

Global Station for Big Data and Cybersecurity
Global Institution for Collaborative Research and Education(GI-CoRE)
Hokkaido University

Final Evaluation Report



北海道大学 国際連携研究教育局
ビッグデータ・サイバーセキュリティグローバルステーション

外部評価報告書

July 2021
2021年7月

**Final Evaluation Report
(brief version in Japanese)**

外部評価報告書（日本語・概要版）

もくじ（日本語版）

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はじめに

国際連携研究教育局（GI-CoRE）は、北海道大学の強みや特色を活かした国際連携研究教育の推進と、部局が独自に進める国際連携研究教育の支援を目的とし、世界トップレベルの教員を国内外及び学内から結集した総長直轄の教員組織です。

GI-CoRE 内には研究領域ごとの活動拠点である「グローバルステーション（GS）」を置き、各 GS において、原則 5 年間の設置期間内に重点的に研究教育活動を進めています。これまでに、延べ 8 つの GS（下記※を参照）を設置し、研究活動を推進するとともに、最先端の研究成果を大学院教育などに還元してきました。

GI-CoRE では、GS の設置期間満了を迎える年度に、各 GS でのこれまでの活動を振り返るとともに、今後、より強固かつ持続可能な研究教育体制を確立していくため、国内外の有識者により構成される外部評価委員会において、評価を実施することとしています。

この外部評価報告書は、2020 年 7 月に実施したビッグデータ・サイバーセキュリティ GS（GSB）の自己点検成果報告書及び外部評価結果を一冊に収録した、いわば GSB の研究教育活動の集大成です。

なお、ビッグデータ・サイバーセキュリティ GS は設置期間満了に伴い、情報科学研究院に定着化し、新たに「GI-CoRE 協力拠点」として認定を受けたビッグデータと IoT に関する協同センターとして、2021 年 4 月以降も GI-CoRE と連携しながら研究教育活動を継続しています。

本学では、外部評価結果を踏まえ、より充実した研究教育活動を実践していくことにより、世界の課題解決に貢献していきたいと考えております。

北海道大学 国際連携研究教育局長
寶 金 清 博

※これまでに設置したグローバルステーション（GS）

GS 名	設置期間 (年度)	主な学内連携部局等
量子医理工学	2014～2019	医学研究院、大学病院ほか
人獣共通感染症	2014～2019	人獣共通感染症国際共同研究所、 獣医学研究院
食水土資源	2015～2019	農学研究院ほか
ソフトマター	2016～2020	先端生命科学研究院ほか
ビッグデータ・サイバーセキュリティ	2016～2020	情報科学研究院ほか
北極域研究	2016～2020	北極域研究センターほか
バイオサーフィス創薬	2019～2023	薬学研究院ほか
先住民・文化的多様性研究	2021～2025	アイヌ・先住民研究センターほか

国際連携研究教育局 (GI-CoRE)
ビッグデータ・サイバーセキュリティグローバルステーション
外部評価委員

*国立情報学研究所 コンテンツ科学研究系 高野 明彦 教授

オーストラリア ニューサウスウェールズ州政府データ解析研究所
イアン・オPPERマン CEO

アメリカ合衆国 南カリフォルニア大学 スヴェン・ケーニヒ 教授

*委員長

国際連携研究教育局 (GI-CoRE)
ビッグデータ・サイバーセキュリティ
グローバルステーション
外部評価委員会実地調査要領

1. 調査日程

令和2(2020)年7月7日(火)

2. 詳細スケジュール

7月7日(火) 日本時間				
日本時間	次第	豪州	米国	米国
8:30~8:55	#1 開会宣言(大鐘教授) 参加者紹介(吉岡GS長) 開会挨拶(笠原総長代行・GI-CoRE 局長代行) 記念撮影	9:30~ 9:55	16:30~ 16:55	19:30~ 19:55
8:55~9:50	#2 GSB 全体の活動報告(吉岡GS 長)	9:55~ 10:50	16:55~ 17:50	19:55~ 20:50
9:50~ 10:00	休憩			
10:00~ 10:30	#3 UMass Amherst エットから 活動報告 ^{※注1} (シュロモ シルバースタイン教 授)	11:00~ 11:30	18:00~ 18:30	21:00~ 21:30
10:30~ 10:55	#4 UTS エットから活動報告 (エリック デュエキエウ イッチ教授)	11:30~ 11:55	18:30~ 18:55	21:30~ 21:55
10:55~ 11:05	休憩			
11:05~ 11:40	#5 評価委員ヒアリング	12:05~ 12:40	19:05~ 19:40	22:05~ 22:40
11:40~ 12:25	#6 評価委員ディスカッション	12:40~ 13:25	19:40~ 21:25	22:40~ 23:25
12:25~ 12:35	休憩			
12:35~ 13:00	#7 総括	13:35~ 14:00	21:35~ 22:00	23:35~ 00:00

注1: アメリカ東部との時差の都合により、本セッション終了後 UMass 代表は 10:30(日本時間)で退出予定。

国際連携研究教育局 (GI-CoRE)

ビッグデータ・サイバーセキュリティグローバルステーション

外部評価調書の概要（参考和訳）

総合評価：A

（評価コメント）

重要で時宜を得たトピックに関する国際研究と教育の実現を目指す「ビッグデータ・サイバーセキュリティグローバルステーション（GSB）」の全体的な開発の方向性を高く評価します。GSBの研究課題：ビッグデータ、サイバーセキュリティ、IoTは、学際的な研究を考える上で重要で横断的な視点を与えてくれます。

このGSBの開発の方向性は、日本政府が第5次科学技術基本計画で設定した研究と教育の方向性を十分に配慮したものとなっています。GSBの活動により得られた重要な資産は、人事交流、共同研究プロジェクト、共同での教材制作を通じてGSBの目的を非常に積極的に支援する研究グループとして、マサチューセッツ大学アマースト校とシドニー工科大学という優れた国際パートナー大学を得たことであります。この国際連携の強さは、国際的な研究パートナーシップの質と、個々の研究者が行う連携のための取り組みにより決まります。さまざまな分野でのGSBの研究貢献は、GSBの国際連携が国際レベルに達していることを示しています。

国境を越えた共同研究を成功させるためには、研究プロジェクトのために世界の一流級の専門家を集めることがますます重要になっています。同時に、学生が世界レベルの最高の教師から学ぶことができるのは理想的です。GSBの枠組みは、これらの研究と教育の目的を促進するように設計されています。国際的な研究協力を中心とした研究者と学生の国際交流を促進することは、国際的な研究人材を育成するために重要です。このアプローチを通じて、GSBは学際的な研究分野をカバーする国際的な大学院教育カリキュラムを構築しました。

GSBにおける最も重要な目的は、特定の国際共同研究プロジェクトの質を向上させることよりは、学際的な研究分野をバランスよくカバーする大学院教育の国際化であるように思われます。海外の外部評価委員からのスコアが比較的低いのは、このGSBの目的が明確に伝えられていなかったためと思われます。GSBの活動を通じて、大学院教育のカリキュラムがどのように変化したかについての、より詳細な報告が求められます。

GSBの価値を高めるには、その研究活動を、得られた新しい知識による影響だけでなく、グローバルな課題解決にどのように影響するかを示す「影響力の経路」を示す必要があります。そのために、研究成果を社会的または世界的な影響に変換するためのメカニズムについて考えることが必要です。様々な研究課題の領域を含めることは、GSBの活動を拡大していくためには、潜在的に非常に有力ですが、その研究成果は上記の「影響の経路」を尊重する必要があります。たとえば、世界がデータとデジタル接続にますます依存するようになるにつれて、ますます複雑になるシステムのサイバーセキュリティは重要なトピックになるでしょう。

GI-CoREのGSBプログラムに対する全体的な評価は「Excellent (A)」です。国際的な共同研究と教育を実施するために必要な制度と組織体制の確立に成功し、新しい国際大学院コースのカリキュラムの再設計につながりました。外部評価委員一同は、GSBの継続を心から推奨します。

**Final Evaluation Report
(original version in English)**

外部評価報告書（英語・オリジナル版）

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Foreword

Hokkaido University established the Global Institution for Collaborative Research and Education (GI-CoRE) as a faculty organization under the direct control of the President that brings together world-class researchers from around the world and within the University. It aims to promote international collaborative research and education that leverages the University's strengths and distinctive features as well as to provide support for international collaborative research and education promoted by faculties and centers, respectively.

Under the GI-CoRE system, a research and education hub known as a Global Station (GS) is implemented for each research field. GSs have a finite implementation period of five (5) years in principle to conduct intensive research and education activities. Thus far, eight (8) GSs in total (see * below) have been implemented to further develop research activities and contribute the resulting cutting-edge research outcomes to graduate school education.

In the final year of the GI-CoRE project period, a Final Evaluation is conducted by the External Evaluation Committee composed of global experts outside Hokkaido University for each GS to not only review GS activities from past years but also build a stronger and more sustainable research and education system in the future.

This Final Evaluation Report contains the Research Progress Report of GS for Big Data and Cybersecurity (GSB) conducted in July 2020 and the evaluation results. This report is a compilation of the research and education activities of GSB.

After the implementation period, GSB project was transitioned into Faculty of Information Science and Technology and it was certified as Collaborative Center for Big data and IoT, one of the "GI-CoRE Cooperating Hubs," to continue research and education activities in cooperation with GI-CoRE after April 2021.

Hokkaido University remains committed to continuing its efforts to contribute to resolving global issues by conducting advanced research and education activities based on evaluation results.

Kiyohiro Houkin,
Director,
Global Institution for Collaborative Research and Education (GI-CoRE),
Hokkaido University
(President, Hokkaido University)

*The Global Stations (GSs) implemented thus far.

Name of the GS	Implementation Period (FY)	Main Internal Affiliation
Quantum Medical Science and Engineering	2014–2019	Faculty of Medicine, University Hospital, and others
Zoonosis Control	2014–2019	International Institute for Zoonosis Control and Faculty of Veterinary Medicine
Food, Land and Water Resources	2015–2019	Research Faculty of Agriculture and others
Soft Matter	2016–2020	Faculty of Advanced Life Science and others
Big Data and Cybersecurity	2016–2020	Faculty of Information Science and Technology and others
Arctic Research	2016–2020	Arctic Research Center and others
Biosurfaces and Drug Discovery	2019–2023	Faculty of Pharmaceutical Sciences and others
Indigenous Studies and Cultural Diversity	2021-2025	Center for Ainu and Indigenous Studies and others

Global Station for Big Data and Cybersecurity
Global Institution for Collaborative Research and Education (GI-CoRE)
External Evaluation Committee

*Professor Akihiko Takano,

Digital Content and Media Sciences Research Division, National Institute of Informatics (NII)
(Japan)

Ian Oppermann,

NSW Government Chief Data Scientist and CEO, NSW Data
Analytics Centre (DAC) (Australia)

Professor Sven Koenig,

Computer Science Department, University of Southern California (USC) (United States)

*Chair

令和2年3月31日

国立大学法人北海道大学 国際連携研究教育局
局長職務代理 殿

職員の任命について（回答）

令和2年3月23日付け海大国連第4-2号で依頼のありましたこのことについて、下記のとおり回答します。

記

- 承諾いたします。

職名・氏名 教授・高野 明彦

任命期間 令和2年4月1日～令和3年3月31日

- 承諾いたしかねます。

Letter of Acceptance

25/03/ 2020

To Acting Director Kasahara Masanori of the Global Institution for Collaborative Research and Education (GI-CoRE), the National University Corporation Hokkaido University.

I hereby accept my appointment to serve as a member of the External Evaluation Committee for the Global Station for Big Data and Cybersecurity at the Global Institution for Collaborative Research and Education (GI-CoRE), Hokkaido University.

Period: From 1 April 2020 to 31 March 2021



Signature

Dr. Ian Oppermann

Letter of Acceptance

3/27/2020

To Acting Director Kasahara Masanori of the Global Institution for Collaborative Research and Education (GI-CoRE), the National University Corporation Hokkaido University.

I hereby accept my appointment to serve as a member of the External Evaluation Committee for the Global Station for Big Data and Cybersecurity at the Global Institution for Collaborative Research and Education (GI-CoRE), Hokkaido University.

Period: From 1 April 2020 to 31 March 2021

Signature



Professor Sven Koenig

Global Station for Big Data and Cybersecurity
Global Institution for Collaborative Research and Education(GI-CoRE)
Schedule of the External Evaluation Committee

1. Date of Implementation

Tuesday, July 7, 2020

2. Investigation Schedule

Tuesday, July 7, 2020				
JST	Session	AEST	PST	EST
8:30- 8:55	#1 Opening (Prof. Ogane) Members Introduction (Prof. Yoshioka, GSB Director) Opening Remarks (Acting President, Acting Director of GI-CoRE) Photo Session	9:30- 9:55	16:30- 16:55	19:30- 19:55
8:55- 9:50	#2 Explanation about GSB activities by Prof. Masaharu Yoshioka, GSB Director	09:55- 10:50	16:55- 17:50	19:55- 20:50
9:50- 10:00	Break			
10:00- 10:30	#3 Explanation about GSB activities @UMass by PI * (Prof. Shlomo Zilberstein)	11:00- 11:30	18:00- 18:30	21:00- 21:30
10:30- 10:55	#4 Explanation about GSB activities @UTS by PI (Prof. Eryk Dutkiewicz)	11:30- 11:55	18:30- 18:55	21:30- 21:55
10:55- 11:05	Break			
11:05- 11:40	#5 Interview by Evaluation Committee members	12:05- 12:40	19:05- 19:40	22:05- 22:40
11:40- 12:25	#6 Discussion by Evaluation Committee members	12:40- 13:25	19:40- 21:25	22:40- 23:25
12:25- 12:35	Break			
12:35- 13:00	#7 Wrap-up	13:35- 14:00	21:35- 22:00	23:35- 00:00

Results of the Evaluation Committee

**Evaluation Committee
Global Station for Big Data and Cybersecurity
Global Institution for Collaborative Research and Education (GI-CoRE)
Hokkaido University**

October 2020

Summary Report

Professor Sven Koenig, University of Southern California (United States)

Dr. Ian Oppermann, NSW Data Analytics Centre (Australia)

Professor Akihiko Takano, National Institute of Informatics (Japan)

Comprehensive Evaluation S (A) B / C / D (circle one)

We applaud the overall development direction of the Global Station for Big Data and Cybersecurity (GSB), which pursues multi-national research and education on important and timely topics. GSB's Focus: Big Data, Cybersecurity, and Internet of Things are important orthogonal perspectives for devising interdisciplinary research.

The GSB is well aware of the direction of research and education set by the Japanese government in the 5th Science and Technology Basic Plan. The primary asset of GSB is its excellent international partner universities, the University of Massachusetts at Amherst and the University of Technology Sydney, with research groups that support the objectives of GSB very actively via personnel exchanges, joint research projects, and course material production. The strengths of collaboration are the quality of international research partnerships and the collaboration efforts of individual researchers. GSB's research contributions in various fields have proven to be at the international level.

Bringing together top experts from around the world for research projects is increasingly important for successful cross-border collaborative research. At the same time, it is ideal for students to be able to learn from the best teachers in the world. The GSB scheme is designed to facilitate these research and educational objectives. Promoting international exchange of researchers and students centered on international research collaboration is important for developing international research human resources. Through this approach, GSB has built an international graduate education curriculum that covers cross-disciplinary research areas.

The GSB's priority seems to be the internationalization of graduate education, which covers interdisciplinary research areas in a balanced manner, rather than improving the quality of specific international collaborative research projects. The relatively low score of reviewers from overseas seems to be due to the fact that the aim of this GSB was not clearly communicated. More detailed reports should be given on how the curriculum of graduate education has changed through the activities of GSB.

To increase the value of GSB, we need a pathway of influence to show how research and activities affect global challenges beyond improving the state of global knowledge. Mechanisms need to be

planned to transform research outcomes into social or global impacts. Mixing focal areas is potentially very powerful in order to expand GSB activity, but the outcome must anticipate the above pathway of influence. For example, as the world becomes increasingly dependent on data and digital connectivity, cybersecurity in increasingly complex systems would become an important topic.

The overall evaluation of the GI-CoRE program GSB is excellent (A). It has successfully established the system and framework necessary to conduct international cooperative research and education, and lead to redesigning the new international graduate course curriculum. The reviewers heartfully recommend the continuation of GSB.

Global Station for Big Data and Cybersecurity Global Institution for Collaborative Research and Education (GI-CoRE) Final Evaluation

External Evaluation Committee Member Name: Akihiko Takano

Choose one of the five Evaluation Ratings options below as explained by the Evaluation Explanation for each Evaluation Item on the form.

Evaluation Ratings	Evaluation Explanation
S	Achieved outcomes surpassed the original plan (Outstanding)
A	Good progress has been maintained and expected outcomes have been achieved (Excellent)
B	Most expected outcomes have been achieved with some slight delays (Good)
C	Although certain outcomes were achieved, overall results were insufficient (Satisfactory)
D	No expected outcomes were achieved (Unsatisfactory)

I. Research	<p>1. Has construction of an international research and education center capable of attracting outstanding researchers from around the world (including from HU) been achieved?</p> <p>Evaluation Results and Reasons (Your Evaluation Results) S / <input checked="" type="radio"/> A / B / C / D (circle one)</p> <p>(Reasons) The Global Station for Big Data and Cybersecurity (GSB) has successfully carried out international research and education projects with a focus on key research areas. It is made up of HU's strong research group and its outstanding international partner universities. Many internationally recognized researchers in multiple fields are involved. GSB supports these international cooperation through active exchange of researchers, collaborative research projects, and preparation of course materials.</p> <p>Specific points (Outstanding points) Although the major affiliated universities are limited to the University of Massachusetts Amherst (UMA) and the University of Technology Sydney (UTS), the quality of the joint project is very high and has won numerous publications, patents and awards.</p>
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(Suggestions for improvement)

The collaborations are limited within the research group or within the specific discipline. It would be more productive if the greater collaborations between different research groups or different disciplines happen.

2. Is world-leading cutting-edge international cooperative research underway?

Evaluation Results and Reasons

(Your Evaluation Results)

S A / B / C / D (circle one)

(Reasons)

Collaboration in the field of IoT is underway with the UTS team, known as one of the leading research centers for IoT. Collaboration with UMA on big data is also underway. Many international symposiums were held by GSB to promote new collaborations. Some of them have succeeded in obtaining competitive funding.

These research efforts on hot themes in the field of ICT provide a forum for discussion on the reorganization of HU's Graduate School of Information Science and Technology.

Specific points

(Outstanding points)

HU cross-appointment of UMA and UTS researchers is very effective in deepening research cooperation by exchanging a series of lectures on specific research topics and co-authoring joint treatises through daily discussions.

(Suggestions for improvement)

Under the current threat of COVID-19, it is necessary to devise the new scheme for promoting international research collaboration.

3. Are research outcomes from GI-CoRE being actively utilized to solve social issues?

Evaluation Results and Reasons

(Your Evaluation Results)

S / A (B) / C / D (circle one)

(Reasons)

Most of the collaborations hosted by GSB are still at the academic research level and are not ready to provide solutions to real social problems.

Specific points

(Outstanding points)

A good example is the "Japanese and Australian Wagyu Traceability" project, which is the result of joint research between HU and UTS. However, it is still in the process of "solving" social problems.

(Suggestions for improvement)

Under the current situation with COVID-19, the work on infection modelling is especially relevant to the important social issues.

II. Education

1. Is the educational system and curriculum designed to help develop researchers who possess specialized knowledge and are capable of working internationally?

Evaluation Results and Reasons

(Your Evaluation Results)

S (A) B / C / D (circle one)

(Reasons)

In the focused field of research in GSB, there are many international exchanges of researcher in both directions, and actively organized seminars and symposiums together. It definitely helps to develop human resources for international research activities.

Specific points

(Outstanding points)

By conducting international collaborative research at GSB, students will acquire the scientific communication skills in English that are essential for participating in the international research community.

(Suggestions for improvement)

If all courses in GSB are given in English, it is even more effective for students to be accustomed to communication in English.

2. Is the educational framework designed to develop human resources who possess expert knowledge and capable of working internationally in the fields of big data, IoT and cybersecurity?

Evaluation Results and Reasons

(Your Evaluation Results)

S A / B / C / D (circle one)

(Reasons)

There are many research visits in both directions, and actively organized seminars and symposiums together. The experience of these collaborations is crucial to develop IT professionals in big data science, IoT and cybersecurity.

Specific points

(Outstanding points)

By conducting international collaborative research at GSB, students will acquire scientific communication skills in English that are essential for participating in the international research community.

(Suggestions for improvement)

It is too early to assess whether the proposed educational framework is effective in developing human resources with expertise and abilities in the field. A much longer term evaluation is suitable for it.

III. Establishment of Framework

Are the necessary systems and frameworks being established in order to conduct international cooperative research and education?

Evaluation Results and Reasons

(Your Evaluation Results)

S A / B / C / D (circle one)

(Reasons)

The success of collaborations with UTS and UMA to date seems to be highly dependent on specific researchers. This is unavoidable at first, but in the long run it needs to be transformed into systematic collaboration.

Specific points

(Outstanding points)

Active joint research activities such as joint thesis writing and joint seminars have been reported. It is also recorded that many researchers visited each other and gave lectures to achieve this.

(Suggestions for Improvement)

Look for collaborative research partners other than UTS and UMA and envision long-term collaborative research in a wider range of fields. The long-term interaction of postdoctoral researchers may help strengthen these research relationships.

IV. Overall Evaluation

GSB's focus on big data, IoT and cybersecurity is very timely and relevant. Plans to address this challenge with international collaborative research and a new educational curriculum are also effective.

GSB's foremost assets are its outstanding international partner universities, the University of Massachusetts Amherst and the University of Technology Sydney. Both schools have strong research groups on GSB research themes, and many joint research and symposiums have been organized through cross-appointments and joint research with them.

The GSB's vision of inviting the best researchers from around the world to create the ideal education and research curriculum is worth the effort. It not only promotes the purpose of GSB research and education, but also provides important cultural experiences to those involved.

The quality of collaborative research at GSB has reached the international level in various fields, as evidenced by the list of co-authored papers published and the content of the joint symposium held.

Global Station for Big Data and Cybersecurity Global Institution for Collaborative Research and Education (GI-CoRE) Final Evaluation

External Evaluation Committee Member Name: Ian Oppermann

Choose one of the five Evaluation Ratings options below as explained by the Evaluation Explanation for each Evaluation Item on the form.

Evaluation Ratings	Evaluation Explanation
S	Achieved outcomes surpassed the original plan (Outstanding)
A	Good progress has been maintained and expected outcomes have been achieved (Excellent)
B	Most expected outcomes have been achieved with some slight delays (Good)
C	Although certain outcomes were achieved, overall results were insufficient (Satisfactory)
D	No expected outcomes were achieved (Unsatisfactory)

I. Research	<p>1. Has construction of an international research and education center capable of attracting outstanding researchers from around the world (including from HU) been achieved?</p> <p>Evaluation Results and Reasons (Your Evaluation Results) S / A / (B) / C / D (circle one)</p> <p>(Reasons) The Global Station has identified areas for research focus which are important, aligned to the Nationally and internationally important goals and which are well aligned with the timeframes for meaningful research impact.</p> <p>The researchers involved are internationally recognized and represent multiple disciplines.</p> <p>A minor concern however is that there are only 2 main research partners outside of HU.</p> <p>A greater concern is that the researchers are not working across teams. Rather they remain in their areas of discipline focus.</p> <p>As an example, the inclusion of a hospital and medical researchers in an ICT focused program provides a great deal</p>
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of opportunity to extend the traditional reach of ICT research. There is little evidence of multi-disciplinary research or of teams referring to, or building on, research outputs of other parts of the Global Station.

Specific points

(Outstanding points)

- Interesting and relevant outcomes being addressed in the form of major societal goals.
- High quality and committed partners in the form of UTS and UMA

(Suggestions for improvement)

- Need for greater collaboration between discipline areas and between groups
- Need for broader scope of collaboration beyond existing partners at UTS and UMA
- Need for more multi-disciplinary, collaborative publications in international journals

2. Is world-leading cutting-edge international cooperative research underway?

Evaluation Results and Reasons

(Your Evaluation Results)

S / A / **(B)** / C / D (circle one)

(Reasons)

Collaboration is clearly underway in IoT in particular with the UTS team.

Collaboration is underway with UMA in data.

Specific points

(Outstanding points)

The work with UTS in particular shows research which addresses important, real world problems in a multi-disciplinary manner. The Wagu tagging and extension to seafood shows real promise linking IoT and blockchain to real world needs.

Grants have been awarded and seminars run.

Work on cyber security has not demonstrated the same level of focus.

(Suggestions for improvement)

There is not a great deal of evidence for IoT activity outside of the UTS collaboration.

There is also not a great deal of evidence that the medical / bio informatics research spans more than a limited domain. The infection modelling may draw on population level data but does not seem to connect to the other domains at UMA or at UTS.

The fields of research seem quite narrow. The international journal publications are highly dependent on a modest number of individual contributors from the Global Station.

There is a need for more multi-disciplinary, collaborative publications in international journals spanning more of the scope of the Global Station.

More international journals papers would strengthen this area.

3. Are research outcomes from GI-CoRE being actively utilized to solve social issues?

Evaluation Results and Reasons

(Your Evaluation Results)

S / A / B / C / D (circle one)

(Reasons)

The activity associated with grant writing, holding seminars and publishing papers are all traditional activities of universities and academics. There is little evidence that these “activities” lead to “outcomes”.

Specific points

(Outstanding points)

Work on infection modelling will help governments around the world better understand the spread of disease, but this work must still clearly connect to the goals of the Global Station and would benefit from great cross disciplinary collaboration.

(Suggestions for improvement)

A pathway from a seminar or publication to the advancement of one of the goals of the Global Station must be described and measured. Examples may include that the work of the Global Station has:

- a. influenced government policy,
- b. influenced government legislation,
- c. led to new research initiatives by others outside of the Global Station research partners
- d. created new businesses opportunities (beyond patents)
- e. raised public awareness of issues, or provided high quality information to the general public on these issues
- f. Trained researchers who have then created impact
- g. Development and sharing of infrastructure which can be used by others outside of the Global Station research partners

The success stories for the Global Station need to be clearly described and published. These are the sort of stories which the public or Government Minister's would understand.

II. Education

1. Is the educational system and curriculum designed to help develop researchers who possess specialized knowledge and are capable of working internationally?

Evaluation Results and Reasons

(Your Evaluation Results)

S / A B / C / D (circle one)

(Reasons)

There is good evidence of exchange research visits, seminars and joint publications. Travel restrictions make collaboration more difficult. The Global Station was clearly active before COVID impacted travel.

Specific points

(Outstanding points)

Topical seminars, research visits, joint publications, patents applications are all evidence of creating frameworks or contributing to the current state of global knowledge.

(Suggestions for improvement)

Greater mixing of disciplines is required. In particular, the opportunity to take advantage of IoT, big data and health represents a powerful opportunity.

Greater exposure to international conferences and seminars in English may also help with the internationalization of graduates.

2. Is the educational framework designed to develop human resources who possess expert knowledge and capable of working internationally in the fields of big data, IoT and cybersecurity?

Evaluation Results and Reasons

(Your Evaluation Results)

S / A B / C / D (circle one)

(Reasons)

There is clear evidence of international contributions to Big Data, IoT through publications, seminars, lectures.

There is less evidence of contributions to Cyber security. Whilst there are public seminars and lectures, the high-quality international journals for cybersecurity are missing. Even conference papers are less prominent than the other domains.

Specific points

(Outstanding points)

Evidence of activity which builds and shares expert knowledge

The collaborative project with UTS on Wagu beef tracking is a good example of addressing a real world problem using multiple skills and discipline areas.

(Suggestions for improvement)

More evidence of expert contributions to the state of world knowledge (journal papers, patents, major awards) would improve the results in this area.

Whilst not helpful for the assessment in 2020, the longer-term ability to follow the careers of graduates of the Global Station would provide a very good indicator if assessed 5 or 10 years from now.

III. Establishment of Framework

Are the necessary systems and frameworks being established in order to conduct international cooperative research and education?

Evaluation Results and Reasons

(Your Evaluation Results)

S / A / B / C / D (circle one)

(Reasons)

Collaboration with UTS and UMA has clearly been established. This collaboration does seem dependent on individual researchers. Whilst this is understandable, it represents a possible weakness to longer term or more systematic collaboration. Longer term post-doctoral study periods may help cement these research relationships.

Specific points

(Outstanding points)

Clear evidence of joint publications and seminars.

Evidence of multiple research visits and of individuals visiting multiple times.

(Suggestions for Improvement)

Developing plans for longer term collaboration, greater mixing of discipline areas and bringing more partners together (beyond UTS and UMA).

IV. Overall Evaluation

The Global Station has clearly demonstrated evidence of collaboration in the target areas.

The focus of the Global station is good, and the topics are relevant for society.

The strength of the collaboration is the quality of the international research partnerships and the commitment to collaborate from individual researchers. There is evidence of contributions at an international level in a diverse number of areas.

The areas for improvement of the collaboration include:

- The need for impact pathways to show how the research and activities will impact the global challenges beyond improving the state of global knowledge. The mechanisms to translate research outputs into societal or global impact need to be mapped out. There are many ways this could be demonstrated, but clear impact pathways need to be described. Existing research activities and any new research activities can then be tested against these impact pathways.
- Limited collaboration between disciplines. Mixing the area of focus is potentially very powerful. Incentives should be developed to encourage multi-disciplinary activities. These should be aligned with the impact pathways / impact mapping described above.
- The focus of the research areas. Research challenges addressed by the Global Station should be chosen as clear problems / sub-problems which need to be overcome to achieve societal impact. Taking the UN Sustainable Development Goals as an example of outcomes to be achieved by 2030, sub-problems are described which must be addressed in order to achieve the goals, as are measurable indicators of progress. A version of these outcomes frameworks could be described for Japan and the research of the Global Station aligned against them.
- Limited focus on Cyber security. The relatively low focus on cyber security represents an opportunity for future activity. As the world becomes increasingly dependent on data and digital connectivity, cyber security of increasingly complex systems becomes ever more important.
- Increasing the level of partnership. Going beyond the existing key research collaborators will help to extend the longevity of international collaboration. Developing plans for longer term collaboration, greater mixing of discipline areas and bringing more partners together (beyond those within UTS and UMA) would all potentially strengthen the quality of the work of the global station.
- Limited number of success stories. Capturing successes in a way which is meaningful for the general public, politicians and administrators will help build the reputation of the Global Station as a successful activity.

Global Station for Big Data and Cybersecurity Global Institution for Collaborative Research and Education (GI-CoRE) Final Evaluation

External Evaluation Committee Member Name: Sven Koenig

Choose one of the five Evaluation Ratings options below as explained by the Evaluation Explanation for each Evaluation Item on the form.

Evaluation Ratings	Evaluation Explanation
S	Achieved outcomes surpassed the original plan (Outstanding)
A	Good progress has been maintained and expected outcomes have been achieved (Excellent)
B	Most expected outcomes have been achieved with some slight delays (Good)
C	Although certain outcomes were achieved, overall results were insufficient (Satisfactory)
D	No expected outcomes were achieved (Unsatisfactory)

I. Research	<p>1. Has construction of an international research and education center capable of attracting outstanding researchers from around the world (including from HU) been achieved?</p> <p>Evaluation Results and Reasons (Your Evaluation Results) S / <input checked="" type="radio"/> A / B / C / D (circle one)</p> <p>(Reasons)</p> <p>Specific points (Outstanding points) Strengths: GSB consists of strong research groups at Hokkaido University and its excellent international partner universities that support the objectives of GSB very actively via personnel exchanges, joint research projects, and course material production. The research strengths of GSB are reflected in quantitative indicators, such as many publications, awards, and patents as well as an increasing number of joint publications. The presentation of research results in the GSB-organized international symposia helps to advertise the research results.</p> <p>(Suggestions for improvement)</p>
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Weaknesses: The research topics could be more focused, the international collaborations could be intensified (for example, via systematic student exchanges on a larger scale), the number of joint publications between research groups at Hokkaido University and at least one international partner university of GSB could be increased, and the joint supervision of students by faculty members from different universities still needs to be institutionalized. Student and faculty surveys could help with future evaluations.

2. Is world-leading cutting-edge international cooperative research underway?

Evaluation Results and Reasons

(Your Evaluation Results)

S / A / B / C / D (circle one)

(Reasons)

Specific points

(Outstanding points)

Strengths: GSB got a good start with interesting projects on Big Data and the Internet of Things. It remained unclear to which degree the available data-processing speeds and network throughputs (which resulted in records held by GSB research groups) are utilized by other GSB research groups but they might be enablers for some research on Big Data and the Internet of Things.

(Suggestions for improvement)

Weaknesses: More focus in the tackled research topics might increase the visibility of the research further (which might be difficult to achieve given the breadth of the research interests of the participating researchers, which include several topics more at the periphery of Big Data and the Internet of Things, such as evolutionary biology, genomics, cognitive sciences, geometry/topology, and nanotechnology/materials), the resulting research topics could be linked more tightly, and the fusion of research directions in Big Data, Cybersecurity, and the Internet of Things has yet to be achieved (for example, via large research projects that combine more than two research areas with expertise present in GSB).

3. Are research outcomes from GI-CoRE being actively utilized to solve social issues?
<p>Evaluation Results and Reasons</p> <p>(Your Evaluation Results)</p> <p>S / A / <input checked="" type="radio"/> B / C / D (circle one)</p> <p>(Reasons)</p> <p>Specific points</p> <p>(Outstanding points)</p> <p>Strengths: GSB pursues some research projects with clear societal impact, such as the “detecting bias on news websites” project in conjunction with the University of Massachusetts at Amherst and the “Wagyu beef” project in conjunction with the University of Technology Sydney.</p> <p>(Suggestions for improvement)</p> <p>Weaknesses: The societal impact of the research could be increased further by collaborating more with domestic and overseas industries as well as putting more emphasis on the societal impact of research projects.</p>

II. Education
1. Is the educational system and curriculum designed to help develop researchers who possess specialized knowledge and are capable of working internationally?
<p>Evaluation Results and Reasons</p> <p>(Your Evaluation Results)</p> <p>S / <input checked="" type="radio"/> A / B / C / D (circle one)</p> <p>(Reasons)</p> <p>Specific points</p> <p>(Outstanding points)</p> <p>Strengths: The research and educational activities of GSB have strong international components. The upcoming cotutelle program as well as internships with governmental research institutions and companies are great ideas. E-learning does not only support the international education component but also helps to educate working adults.</p> <p>(Suggestions for improvement)</p> <p>Weaknesses: The contact between students taking an e-learning course and its lecturer could be intensified (to increase the cultural component of the education), and all courses could be offered in English (to help GSB students</p>

to get even more quickly used to communication in English). Student and faculty surveys could help with future evaluations.

2. Is the educational framework designed to develop human resources who possess expert knowledge and capable of working internationally in the fields of big data, IoT and cybersecurity?

Evaluation Results and Reasons

(Your Evaluation Results)

S / A / B / C / D (circle one)

(Reasons)

N/A since the evaluation material was not sufficiently focused on the curricula of the GSB programs on Big Data, Cybersecurity, and the Internet of Things. For example, it remained unclear exactly which topics are taught and to which degree project-based learning is supported.

Specific points

(Outstanding points)

Strengths: The collaborations with the University of Massachusetts at Amherst on Big Data and the University of Technology Sydney on Cybersecurity and the Internet of Things are strong.

(Suggestions for improvement)

Weaknesses: Not all educational tracks are strongly related to Big Data, Cybersecurity, and the Internet of Things. For example, Bioengineering/Bioinformatics provides one of many application areas for research on Big Data, but a whole curriculum on them does not help to develop human resources on Big Data, Cybersecurity, and the Internet of Things.

III. Establishment of Framework

Are the necessary systems and frameworks being established in order to conduct international cooperative research and education?

Evaluation Results and Reasons

(Your Evaluation Results)

S / A / B / C / D (circle one)

(Reasons)

Specific points

(Outstanding points)

Strengths: The faculty members of Hokkaido University can concentrate fully on GSB activities. The international co-operations are supported well, for example, by English-speaking staff members.

(Suggestions for Improvement)

Weaknesses: The school has been restructured although I am not able to sufficiently judge the impact of the reorganization.

IV. Overall Evaluation

I applaud the overall development direction of the Global Station for Big Data and Cybersecurity (GSB), which pursues multi-national research and education on important and timely topics. The name of GSB is slightly misleading since the global station is broader than its name implies, for example, also covers the Internet of Things as well as additional topics (such as Singularity Theory or Bioengineering). I thus recommend that the name be changed to the Global Station for Big Data, Cybersecurity, and the Internet of Things.

GSB is very responsive to the directions for research and education desired by the Japanese government in the Fifth Science and Technology Basic Plan. One asset of GSB is its excellent international partner universities, the University of Massachusetts at Amherst and the University of Technology Sydney, with research groups that support the objectives of GSB very actively via personnel exchanges, joint research projects, and course material production. (The roles of Temple University and some of the many organizational units at Hokkaido University are less clear.) Collaborative research, including across borders, is the future of research since it becomes more and more important to bring top experts from around the world together for research projects. Similarly, students should be able to learn from the best teachers from around the world. The GSB activities do not only further these research and educational objectives of GSB but also provide an important cultural experience for the people involved. The upcoming cotutelle program is also a great idea for these reasons. All current GSB activities have been well thought out and are supported well, for example, by English-speaking staff members.

The breadth of the GSB activities in the past years is impressive (ranging from giving lectures at conferences and to the public to organizing international symposia and “exchange idea” seminars). For example, restructuring a school is not easy and involves a massive amount of effort. The GSB activities have resulted in lots of successes, which are reflected in quantitative indicators, such as a large number of publications, awards, and patents as well as an increasing number of joint publications. Overall, I feel that GSB got off to a very successful start. In the following, I will therefore focus on its future.

The GSB activities and their outcomes have resulted in valuable experience for the GSB leadership on how to achieve the objectives of GSB best. Now is the time for the GSB leadership to evaluate which activities worked

well. This requires comprehensive (quantitative) data, which were sparse in the self- assessment report (for example, in terms of the job placement of graduated students or the number of joint publications between research groups at Hokkaido University and at least one international partner university of GSB) but fortunately more abundant in the slides presented at the meeting with the evaluation committee. Additional data would be valuable for the GSB leadership when making decisions on future GSB activities, such as the results of student surveys (both before and after graduation) about which GSB activities were considered most valuable by them – and similar faculty surveys of GSB personnel at Hokkaido University and the involved research groups at the international partner universities.

Once the GSB leadership has evaluated the various current GSB activities, it might want to concentrate in the future on those activities that provide the most value and link them more tightly. For example, it might be helpful to think about the best way of systematically starting and fostering multi-national research collaborations and provide even more incentives for them, which would also provide a desirable boost in the number of joint publications between research groups at Hokkaido University and at least one international partner university of GSB. Multi-national research collaborations require either longer visits (from faculty members or students) or regular teleconferences. Often, visits of Ph.D. students to other research groups are a good way of starting research collaborations. Thus, it could make sense to start a formal GSB-funded exchange program of Ph.D. students on a larger scale, for example, with visits of 3 months with the possibility of longer stays for those students whose visits resulted in interesting research. Students will tend to join research groups that are similar to the research groups they are part of at their home universities but joining research groups with different but complementary expertise can also result in interesting collaborations. However, the students might not go for such opportunities unless they are incentivized to do so. Attracting students from international partner universities to spend longer periods of time at Hokkaido University needs to be incentivized as well since the different language might be viewed by some students as an obstacle. Furthermore, the joint supervision of students by faculty members from different universities still needs to be institutionalized.

It might be helpful to consider how the contact between students taking an e-learning course and its lecturer can be intensified, both for GSB courses on video that were developed by the international partner universities and for lectures that are given in person by visiting researchers. While listening to international lecturers is helpful for students, additional contact one-on-one or in small groups with them would be desirable, even if it were via zoom (or similar software) for GSB courses on video.

Similarly, the contact between personnel from Hokkaido University and the international partner universities could be increased via joint educational activities, such as co-developing courses or co-teaching their lectures (via recording videos or lecturing live on zoom).

It might be helpful to consider whether more focus in the tackled research topics might increase the visibility of the research further, whether the resulting research topics can be linked more tightly, and how to fuse the research directions in Big Data, Cybersecurity, and the Internet of Things (for example, via large research projects that

combine more than two research areas with expertise present in GSB). Similarly, increasing the collaboration with domestic and overseas industries as well as putting more emphasis on the societal impact of research projects could increase the impact of the research further, as the successful Wagyu beef project of GSB suggests.

It might also make sense to consider how to make GSB stand out even more in Japan, perhaps by pursuing more extreme activities. For example, individual lectures in English are common at Japanese universities but GSB stands out since longer lecture series in English around the same topic are uncommon. Thus, it is commendable that students can satisfy all credit requirements with courses taught in English. I might have misunderstood the self-assessment report, but it appears that some courses are still taught in Japanese. Since it makes sense to offer some lectures in English, one could be more extreme by offering all courses in English (including those given by faculty members from Hokkaido University) to help GSB students to get even more quickly used to communication in English. This change could also attract more foreign students to GSB, including visiting students from the international partner universities, which might result in even more research collaborations with the international partner universities. Similarly, since it makes sense to offer subjects from the humanities (including law) to GSB students, one could be more extreme by offering additional subjects from the humanities (beyond patent law and ethics) or co-teaching subjects with lecturers from the humanities.

All of the activities suggested above require additional funding, part of which should be provided by Hokkaido University (perhaps with some support by the international partner universities) and part of it could result from a desirable expansion of the amount of external funding received for GSB research projects (as well as teaching and student-exchange activities).

**Global Station for Big Data and Cybersecurity
Global Institution for Collaborative Research and Education
(GI-CoRE)
Hokkaido Univeristy**

**Research Progress Report
(Project Period: Academic Year 2016-2020)**

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I. Overview

1. Global station name: Big Data and Cybersecurity

2. Period: FY 2016 – FY 2020 (5 years)

3. Purpose and objective

To promote advanced international collaborative education and research, a new station Global Station for Big Data and Cybersecurity (hereinafter “GSB”) was established in the Global Institution for Collaborative Research and Education (hereinafter “GI-CoRE”) in FY 2016 by bringing together faculty members (mainly from the Graduate School of Information Science and Technology, the Faculty of Science, University Hospital, and the Information Initiative Center) involved in big data science (big data + data science), the Internet of Things (IoT) and cybersecurity and by cooperating with top-class universities around the world. This global station was launched to serve as a basis to reorganize the Graduate School of Information Science and Technology in order to enhance practical education programs related to big data science, IoT and cybersecurity for students that include working adults and to develop IT professionals who can play an active role in a future-oriented world.

4. Necessity and urgency

In this project, an international collaborative research hub for big data science, cybersecurity and IoT has been formed to promote collaborative research on a global level. In addition to international collaboration, the global station also promotes interdisciplinary collaboration to tackle urgent research topics, such as clinical bioinformatics, based on support from different departments. To meet an increasing need for international higher education in these fields, it is important to promptly create a research hub to support such educational programs. Especially in the fields of big data science and cybersecurity, there is a qualitative and quantitative shortage of Japanese researchers and engineers who are active internationally. Accordingly, educators and researchers from overseas are in demand as collaborative partners.

5. Originality and novelty

Big data science, cybersecurity and IoT are recognized as important technologies that support the information society of the future. These technologies are also expected to create new innovation based on interdisciplinary collaboration. Furthermore, there is a strong demand for advanced education and research programs to support such technologies.

Under these circumstances, Hokkaido University has established a research and education hub for big data science, cybersecurity and IoT. Aiming to activate education and research in these three fields, this hub collaborates not only with well-known overseas educational and research institutes but also with domestic companies in these fields.

In FY 2019, the previous Graduate School of Information Science and Technology was reorganized into the Faculty of Information Science and Technology and the new Graduate School of Information Science and Technology. The former is a research organization to which faculty members of the previous Graduate School of Information Science and Technology belong, and the latter is an organization to provide education of information science and technology through collaboration with members from the Faculty of Information Science and Technology and other faculties of the University. At the new Graduate School of Information Science and Technology, an international supervisor system that also envisions a cotutelle program was established, allowing researchers with cross-appointments from the University of Massachusetts Amherst (UMass Amherst) and the University of Technology, Sydney (UTS) to serve as co-supervisors. Researchers with cross-appointments also provide international collaborative informatics subjects. The reorganization was intended to prepare new educational programs and develop global-minded individuals who can be active in the world through international collaboration and cooperation among multiple departments. This has allowed for the formation and globalization of an educational and research hub to create future industries and new values toward social transformation, as described in Japan's Fifth Science and Technology Basic Plan.

II. Budget

Unit: 1,000 JPY

	Category	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020 (projected)	Total
GI-CoRE establishment of framework	Personnel cost (for researchers from overseas)	0	1,509	2,947	6,782	5,000	16,238
	Administrative cost*	11,713	10,528	6,705	9,956*	10,020	48,922
	Travel expenses for invited overseas GSB members for short visit	0	2,624	1,972	4,578	5,650	14,824
	Operating and research cost	40,239	72,291	40,328	30,031	33,094	215,983
Total		51,952	86,952	51,952	51,347	53,764	295,967

*Including rent for invited overseas GSB member

III. Result Details

1. Research

1.1 Objective

To realize “Hokkaido University Contributing Towards the Resolution of Global Issues,” the vision of the Future Strategy for the 150th Anniversary of Hokkaido University proposed in August 2014, several global stations have been established in GI-CoRE under the direct control of the President as global brain circulation centers to develop the next-generation human resources. These global stations aim to promote advanced international collaborative research with first-class education and research units overseas and to establish international graduate schools.

Since its foundation in 1876, Hokkaido University has pursued four basic philosophies: “Frontier Spirit,” which leads to taking on the challenges of the times and paving the way forward; “Global Perspectives,” which help promote cultural and social exchanges with the people of the world; “All-round Education,” with the aim of cultivating a well-rounded character and a high level of intelligence; and “Practical Learning,” which focuses on putting the University’s research results into practice in order to benefit society. These are not just philosophies but have led to specific strengths and achievements, such as the establishment of “Nitobe College” to foster leaders who are aware of themselves as Japanese in the international community and the production of a Nobel Prize winner in chemistry.

However, Japan is facing rapid changes in society, such as the sharply declining birthrate, an aging population, globalization, and the rise of emerging countries. In an age when it is required to make changes aimed at a vibrant society to enable sustainable development, national universities need to carry out university reforms in response to the demands of society, such as the development of individuals who lead change and the creation of innovation. Based on the government’s strategy for Japan’s revitalization and recommendations by the Education Rebuilding Implementation Council, and to transform into a leading national university that meets the needs of society, Hokkaido University has decided to advance reforms aimed at “contributing towards the resolution of global issues.” This will be implemented under the leadership of the President by combining the University’s wisdom and collective effort, utilizing the strengths of practical research and field research and organically driving great development.

To realize the vision, Hokkaido University has plotted five specific strategies as pillars of functional enhancement: (1) promotion of world-class research for the realization of a sustainable society, (2) construction of advanced international collaborative research hubs and development of human resources for the next generation, (3) cultivation of leading and core human resources that contribute to the development of the international community, (4) university-wide educational system reforms for the development of diverse human resources based on the University’s four basic philosophies, (5) contribution to revitalizing communities and society in Japan and elsewhere and to creating new values.

Considering the world situation, technologies advanced by information science, such as big data science, artificial intelligence, and the Internet of Things (IoT), have been introduced in all fields. In the information

science field, a wide range of research and development projects are being carried out toward the realization of a social system that is friendly to people and the environment and an efficient and effective social system.

Meanwhile, the situation regarding recent cyberattacks has been serious, and the damage has been increasing rapidly. This prompted Japan to enact a basic cybersecurity bill on November 6, 2014, which clarified the responsibilities of educational research institutions. In addition, by connecting everything to the Internet (IoT) and acquiring new knowledge and insight from the big data obtained from the IoT devices, research and development for realizing a super smart society is spreading worldwide. The Fifth Science and Technology Basic Plan, which was endorsed by the Cabinet on January 22, 2016, highlights the importance of fundamental technologies involving cybersecurity, IoT system construction, big data science and artificial intelligence in efforts to create new value for the development of future industry and social transformation, which include the enhancement of competitiveness and the strategic consolidation of fundamental technologies in a “super smart society.”

Against this backdrop, Hokkaido University established the GSB in April 2016 to create an international collaborative research hub for big data science, cybersecurity and IoT system construction in the field of information science, and to start research at an international level through global interuniversity collaboration. Since there are pressing needs for international higher education in related fields for future globalization, it is very important to collaborate with the world’s top-level universities, achieve advanced education and promote collaborative research.

GSB aims to achieve international collaboration with prominent overseas education and research institutes related to big data science, cybersecurity and IoT, to also collaborate with domestic companies in these domains and to create new areas by fusing big data science and cybersecurity fields. It also aims to promote practical research related to the security of medical big data and joint research on safe and secure IoT, and to establish an international cybersecurity research and education hub for the next generation (GSB), thereby stimulating research on big data science and cybersecurity.

After its establishment in FY 2016 aimed at collaboration with UMass Amherst in the fields of big data science and cybersecurity, the GSB has expanded its collaboration to start relations with UTS in the IoT and cybersecurity fields. The GSB has promoted multiple collaborative research projects to achieve world-level research. GSB promotes collaborative research with overseas universities, and as a result, actively publishes international co-authored papers. Furthermore, in the fields of big data science, IoT research and cybersecurity technology, GSB actively promotes keynote and invited lectures at international conferences to disseminate the research results achieved in this project to the world, also GSB promotes collaborative research with domestic companies and national research institutes in the related domain, and advances industry-academia-government collaboration.

1.2 Progress and future development

a. Status of research activities

[FY 2016]

On April 1, 2016, GI-CoRE established a new global station, GSB in the field of information science related to big data science, cybersecurity and the Internet of Things (IoT). On May 16 and 17, an opening ceremony for GSB and a forum entitled “Forum for the 21st Century Super Smart City” were held. The forum was attended by Prof. Bruce Croft (Dean, College of Information and Computer Sciences) and two other professors from the University of Massachusetts Amherst (UMass Amherst, USA), as well as Mr. Sadayuki Tsuchiya (MEXT Vice Minister), Dr. Jun’ichi Tsujii (AIST, AIRC Director), and Dr. Richard Johnson (US NAS Board Member), in addition to researchers from Tohoku University, Kyushu University, Keio University, Ohio University, the University of British Columbia and other universities to propose the establishment of a Japan-US computational platform.

Below is an outline of specific efforts in FY 2016, including the opening ceremony.

1. Establishment of the Global Station for Big Data and Cybersecurity (GSB)

- ◆ Improvement of on-campus venture business laboratories and the environment for collaborative research at GSB
- ◆ Organization of the GSB opening ceremony and the Japan-US Academia Business Forum, an international collaborative research conference with UMass Amherst and an international industry-academia collaboration seminar (Hokkaido University, Sapporo)
- ◆ Conclusion of the Memorandum of Agreement between Hokkaido University, GI-CoRE and University of Massachusetts Amherst, College of Information and Computer Sciences (CICS)
- ◆ Researcher with a cross-appointment from UMass Amherst (one associate professor)
- ◆ Employment of GSB researchers (post-doctors, research assistants)

2. Start of international collaborative research on big data science and cybersecurity

- ◆ A visit to UMass Amherst by GSB faculty members (two professors, one associate professor, one assistant professor) for a collaborative research meeting
- ◆ Round-table conference among those involved in industry, academia and government from Japan and the United States toward international industry-academia-government collaboration

3. Investigation and preparation for the establishment of the new Graduate School of Information Science and Technology

- ◆ Examination of collaborative education with overseas universities, development of curricula and preparation for credit transfer
- ◆ Development of undergraduate curricula in collaboration with enPIT2 (educational program for cybersecurity-related field)
- ◆ Overseas dispatch of related faculty members for the development of curricula related to cybersecurity
August: University of Tampere, Finland (one professor)

January: Macquarie University and the University of Technology, Sydney, Australia (2 professors)

March: Temple University, US (one professor, one associate professor)

March: UMass Amherst, US (two professors)

◆ Lectures related to big data science, cybersecurity and IoT

February: University of Technology, Sydney, Australia (two lecturers)

March: University of Technology, Sydney, Australia (three professors)

The above activities in FY 2016 were aimed at the launch of GSB and the start of practical collaborative research with UMass Amherst's College of Information and Computer Sciences (CICS), a partner of GSB. At the same time, it was necessary to improve the environment for the smooth implementation of such activities. As indicated above, GSB was established on April 1 as scheduled and the opening ceremony, related workshops and international conferences were held with the cooperation of related researchers and officers in Japan and overseas. At the same time, an MoA was newly concluded between CICS and GI-CoRE, and based on the MoA, international collaborative research was started mainly by big data science researchers.

[FY 2017]

To further promote international collaborative research, which began in FY 2016, in addition to UMass Amherst GSB started collaboration with UTS and prepared to expand the globalization of education and research activities. With the aim of reorganizing the Graduate School of Information Science and Technology, in addition to the above-mentioned international collaboration, GSB also promoted interdepartmental collaboration within the University and designed international collaborative subjects with researchers with cross-appointments from UMass Amherst and UTS. Furthermore, GSB conducted research and development on a medical big data system for the creation of clinical bioinformatics aiming at the individualization of medical care.

The specific circumstances for these efforts are as follows:

1. Preparation for forming an international university network and expanding the globalization of educational and research activities

In FY 2017, GSB conducted research and development on big data science in collaboration with UMass Amherst, a partner university of GSB. Also, as part of this activity, two students from the Graduate School of Information Science and Technology were dispatched to UMass Amherst.

Furthermore, in preparation for the formation of an international university network, GSB started research on and the development of IoT networks in collaboration with the University of Technology, Sydney (UTS, Australia). At the same time, GSB started to design collaborative education programs with the UTS and the development of educational programs on clinical bioinformatics in collaboration with Temple University.

2. Formation of interdepartmental and international interuniversity collaboration with the aim of reorganizing the Graduate School of Information Science and Technology

To reorganize the Graduate School of Information Science and Technology into a new system of one division

and multiple courses in April 2019, efforts were made in FY 2017 to strengthen interdepartmental collaboration for interdisciplinary collaborative research and education and international interuniversity collaboration for the internationalization and globalization of research and education. Specifically, the cooperative and support system of the entire graduate school was enhanced, and a new school system was designed with personnel support from other departments in the University (Hokkaido University Hospital, the Faculty of Science, the Information Initiative Center, the Research Institute for Electronic Science, and the Research Center for Integrated Quantum Electronics) and collaboration and cooperation from the humanities fields, including the Graduate School of Law and the Faculty of Humanities and Human Sciences. As a result, GSB developed an interdisciplinary collaborative education program in a broad sense, including integrated education in the humanities and sciences that is required for information science-related fields. At the same time, it designed and developed international graduate education programs together with researchers with cross-appointments from UMass Amherst, UTS and other overseas universities.

3. GSB provided international collaborative subjects in collaboration with UMass Amherst and UTS for the Graduate School of Information Science and Technology to be newly established in FY 2019.

By introducing e-learning, these subjects can be continuously provided for lectures even after the GSB period ends. To develop e-learning materials, preparation was made to use part of the subjects as those for the Hokkaido Summer Institute (HSI) in 2018. This made it possible to develop effective and substantial educational programs for individual themes such as big data science, cybersecurity and IoT. Accordingly, in FY 2017, specific subject contents were set with overseas partner universities (UMass Amherst, UTS), and equipment necessary for e-learning and software development was introduced.

4. Research and development of a medical big data system for the creation of clinical bioinformatics aiming at individualization of medical care

A medical big data system was constructed for the creation of clinical bioinformatics through interdepartmental collaboration between GSB, the Graduate School of Information Science and Technology and Hokkaido University Hospital. In FY 2017, an experimental server (prototype) was constructed to confirm the effectiveness of the system.

Specifically, a hierarchical database was designed in the period from June to September so that different types of information in the information system operated at Hokkaido University Hospital can be used in anonymized and encrypted form for various research projects to create an anonymized database for clinical research (prototype).

5. Organization of international symposiums

July 10 and 11: GI-CoRE GSQ, GSB & IGM JOINT SYMPOSIUM: Quantum, Informatics, Biology & Medicine (co-hosted)

[FY 2018]

Following FY 2017, the collaboration with UMass Amherst and UTS was strengthened, and preparations were made to expand the globalization of education and research activities. To reorganize the existing Graduate School of Information Science and Technology into an interdisciplinary education system comprised of the members of the Faculty of Information Science and Technology, who are teaching staff of the existing graduate school, and teaching staff of new education fields, an application to establish the new system was made and it was approved. In addition, some of the international collaborative subjects by UMass Amherst and UTS researchers with cross-appointments were provided at HSI. International symposiums were held and several research projects that include the acquisition of competitive funds were started.

The specific circumstances for these efforts are as follows:

1. Formation of an international university network with GSB as the hub, together with the University of Massachusetts and the University of Technology, Sydney

- ◆ Regarding the University of Massachusetts, in addition to the College of Information and Computer Sciences (CICS), GSB began to consider research and education collaboration with faculty members in the Department of Mathematics and Statistics.
- ◆ GSB's activities strengthened collaboration with the University of Technology, Sydney, and the Key Technology Partnerships (KTP) agreement was concluded in September between UTS's Faculty of Engineering and Information Technology and HU's Graduate School of Information Science and Technology to promote academic research exchanges and strategic international collaboration. Associate Professor Matteo Convertino, a key member of GSB, made a three-week research stay at the University of Technology, Sydney through KTP's Visiting Fellow program.

2. To establish an interdisciplinary education system beyond the existing research and education framework, preparations were made to reorganize the Graduate School of Information Science and Technology into the new Graduate School of Information Science and Technology with one division and multiple courses and the Faculty of Information Science and Technology.

- ◆ An application was made in April 2018 to establish the new system, and it was approved in September. For practical operation, the internal regulations of the graduate school and the faculty were prepared, and entrance examinations were conducted.
- ◆ To further promote the globalization of education, it was decided to establish the new Graduate School of Information Science and Technology in April 2019 with the aim of expanding cutting-edge technologies, such as big data science, security technology, and IoT technology.
- ◆ Members of the Faculty of Information Science and Technology, which is a research organization comprised of faculty members of the existing Graduate School of Information Science and Technology, as well as members of the Faculty of Science and researchers with cross-appointments participate in education at the new Graduate School of Information Science and Technology.

3. Development of educational programs for international collaborative informatics subjects

- ◆ Development of educational programs for international collaborative informatics subjects provided at the Graduate School of Information Science and Technology (established in FY 2019), and preparation of e-learning materials (4 subjects) as part of the subjects

E-learning materials were prepared as materials for active learning based on multiple assignments from the subject rather than using only slides and videos.

- ◆ Provision of four subjects at the Hokkaido Summer Institute (HSI)

4. Organization of international symposiums

August 7 and 8: The 2nd GI-CoRE GSQ, GSB & IGM Joint Symposium: Quantum, Informatics, Biology & Medicine, Hokkaido University (co-hosted)

September 19: Twelve GSB research assistants gave presentations at a research exchange meeting.

December 20 and 21: 2018 Winter International Symposium on Big-Data, Cybersecurity and IoT (BCI 2018), Sapporo, Japan (hosted)

- Eleven GSB research assistants gave presentations.

5. International collaborative research and competitive funds

- ◆ Professor Yoshikazu Miyanaga applied for the Fund for the Promotion of Joint International Research (Fostering Joint International Research (B)) of the Grants-in-Aid for Scientific Research (for Multi-Media IoT based on Energy Harvest Cognitive Wireless Network, Feb, 2019 – Mar. 2021) with Lecturer Negin Shariati (co-investigator) and Professor Xiaojing Huang (international collaborator) from UTS, and his proposal was adopted, 13,600,000 yen.

- ◆ Professor Masaharu Yoshioka applied for the Grant-in-Aid for Scientific Research (B) (for Research on the analysis and visualization of news websites stance based on the comparison among various news websites, FY 2018 – 2021, 4 years) with Professor James Allan from UMass as a collaborative researcher, and his proposal was adopted, 17,030,000 yen.

[FY 2019]

In 2019, the Graduate School of Information Science and Technology and the Faculty of Information Science and Technology were launched, and an international research and education system, including researchers with cross-appointments with UMass Amherst and UTS, was established. In addition, GSB developed seven international collaborative informatics subjects on big data science, security technology and IoT technology in which researchers with cross-appointments were also involved. GSB continued research exchanges with UMass Amherst and UTS and acquired new competitive funds.

1. Establishment of the Graduate School of Information Science and the Faculty of Information Science and Technology

- ◆ The Faculty of Information Science and Technology was established as a research organization to which faculty members of the existing Graduate School of Information Science and Technology belong, and the

new Graduate School of Information Science and Technology was established as an interdisciplinary education organization that includes UMass Amherst and UTS researchers with cross-appointments and members of the Faculty of Science.

- ◆ At the new Graduate School of Information Science and Technology, UMass Amherst and UTS professors with cross-appointments not only serve as co-supervisors but also provide many subjects in English. As a result, students can satisfy credit requirements using subject provided in English only.

2. Formation of an international university network with GSB as a hub, together with UMass Amherst and UTS

- ◆ Associate Professor Hiroshi Tsutsui, a GSB member, made a two-week research stay at UTS through the KTP Visiting Fellow program.
- ◆ Two “exchange ideas” seminars were held by overseas universities.
 - December 18: Ring Confidential Transaction Protocol for Blockchain, Dr. Joseph Liu, Monash University
 - January 9: Advanced Computing in Data Center Networks, Dr. Hong Shen, the University of Adelaide
- ◆ Workshop
 - May 31 – June 2: Lefschetz Pencils and Low dimensional Topology Host: Professor Toru Ohmoto (Graduate School of Science, Hokkaido University, GSB), Dr. Kenta Hayano (Keio University), Associate Professor R. Inanc Baykur, invited from UMass Amherst

3. Construction of educational programs for international collaborative informatics subjects

- ◆ To further promote the globalization of education, the new Graduate School of Information Science and Technology was established in April with the aim of enhancing cutting-edge technologies, including big data science, security technology and IoT technology. Seven new subjects were newly established as international collaborative informatics subjects.
- ◆ Four HSI subjects were provided in collaboration with faculty members from overseas universities.
- ◆ One subject was provided for the Summer Institute Satellite School in collaboration with a faculty member from an overseas university (Lecturer David Fisher, UMass Amherst).

4. Organization of international symposiums

August 8 and 9: 2019 Summer International Symposium on Big-Data, Cybersecurity and IoT, Sapporo, Japan(hosted)

- Seventeen GSB research assistants gave presentations.

August 19 – 21: International Symposium on Multimedia and Communication Technology (ISMAC 2019), Manila, Philippines (co-hosted)

December 5 and 6: 2019 Winter International Symposium on Big-Data, Cybersecurity and IoT, Sapporo, Japan (hosted)

- A poster session was held by nine GSB research assistants and four students from the Graduate School of Information Science and Technology who are supervised by GSB participating faculty members.

5. International collaborative research and competitive funds

Ongoing Grants-in-Aid for Scientific Research: 2 cases

- Fund for the Promotion of Joint International Research (Fostering Joint International Research (B)) (Multi-Media IoT based on Energy Harvest Cognitive Wireless Network, February 2019 – March 2021), Professor Yoshikazu Miyanaga, Faculty of Information Science and Technology, Hokkaido University (principal investigator), Lecturer Negin Shariati Moghadam (co-investigator) and Professor Xiaojing Huang (international collaborator), University of Technology, Sydney.
- Grant-in-Aid for Scientific Research (B) (Research on analysis and visualization of news websites stance based on the comparison among various news websites, FY 2018 – 2021, 4 years), Professor Masaharu Yoshioka, Faculty of Information Science and Technology, Hokkaido University, Professor James Allan (collaborative researcher), UMass Amherst.

Newly acquired external funds: 1 case

- Lecturer Ying He, University of Technology, Sydney, Australian-Japan Foundation, DFAT, (Promoting Wagyu Beef Traceability between Japan and Australia, September 2019 – June 2021), Associate Professor Hiroshi Tsutsui (research participant), Graduate School of Information Science and Technology, Hokkaido University, 20,000 Australian dollars.

b. Research implementation system

As of 01 April 2020, GSB consists of thirty-seven cross-appointment members as follows.

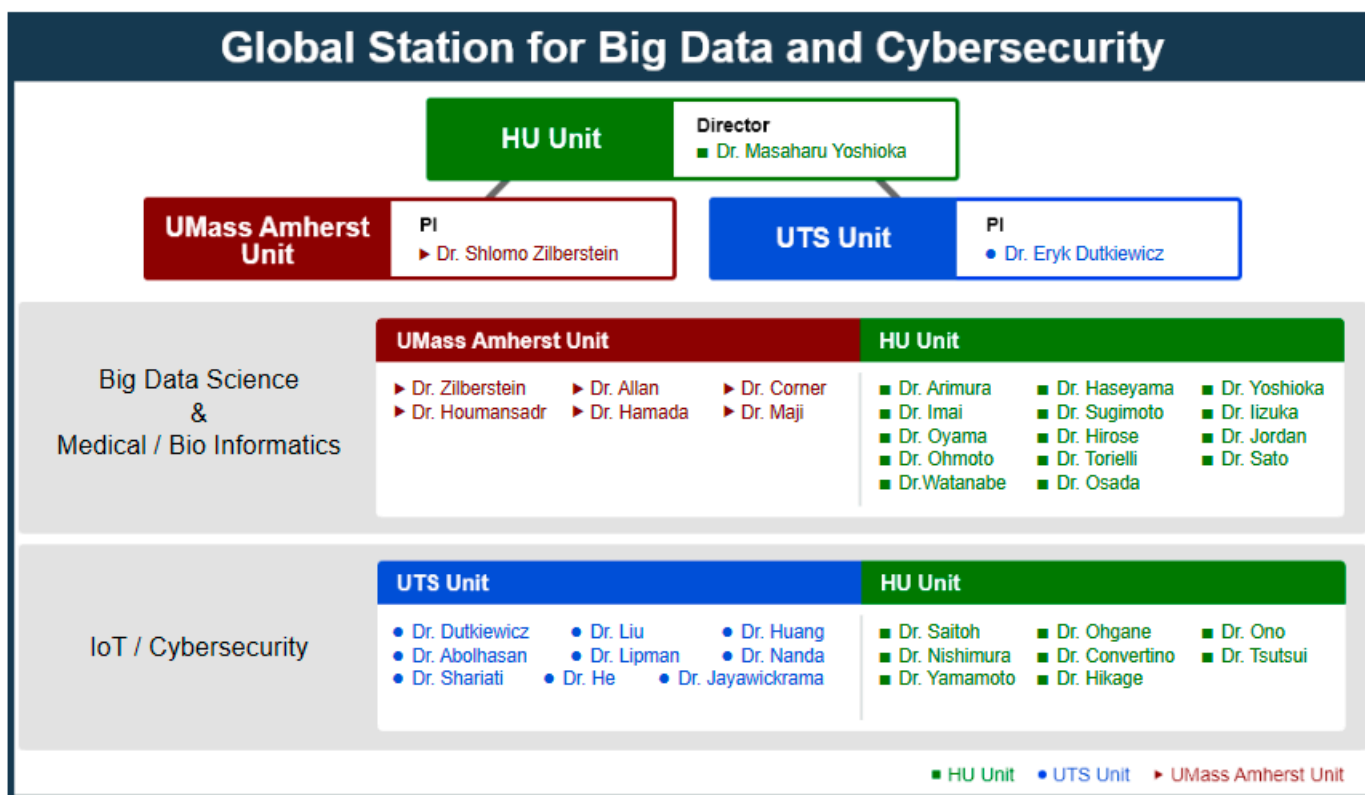
Twenty-two from Hokkaido University, six from University of Massachusetts Amherst, and nine from University of Technology Sydney.

Research Areas	Affiliated Institutions, Departments and Researcher Name	Description of Research
Big Data Science and Medical/Bio Informatics	<p>College of Information and Computer Sciences University of Massachusetts Amherst Professor Shlomo ZILBERSTEIN Professor James ALLAN Associate Professor Mark D. CORNER Associate Professor Amir HOUMANSADR Assistant Professor Subhransu MAJI</p> <p>Department of Mathematics and Statistics University of Massachusetts Amherst Assistant Professor Noriyuki HAMADA</p> <p>Faculty of Information Science and Technology Hokkaido University Professor Hiroki ARIMURA Professor Miki HASEYAMA Professor Masaharu YOSHIOKA Professor Hideyuki IMAI Professor Masanori SUGIMOTO Professor Hidemi WATANABE Associate Professor Naoki OSADA Associate Professor Hiroyuki IIZUKA Associate Professor Satoshi OYAMA Associate Professor Yoshihiro HIROSE Assistant Professor Charles JORDAN</p> <p>Faculty of Science Hokkaido University Professor Toru OHMOTO Assistant Professor Michele TORIELLI</p> <p>Hokkaido University Hospital Professor Norihiro SATO</p>	<ul style="list-style-type: none"> ·Information Retrieval ·Artificial Intelligence ·Machine Learning ·Network Security ·Computer Vision ·Human Computation ·Information Theory ·Data Science ·Data Mining ·Intelligent Informatics ·Design and Analysis of Algorithms ·Statistical Science ·Multimedia Signal Processing ·New Generation Information Access Systems ·Evolutionary Biology ·Systems Genomics ·Biodiversity ·Genomics ·Cognitive Sciences ·Complexity Theory ·Applied Mathematics and Statistics ·Geometry and Topology ·Clinical Researches

IoT/Cybersecurity	<p>School of Electrical and Data Engineering University of Technology Sydney Professor Eryk DUTKIEWICZ Professor Ren Ping LIU Professor Xiaojing HUANG Associate Professor Mehran ABOLHASAN Associate Professor Justin LIPMAN Associate Professor Priyadarsi NANDA Lecturer Negin SHARIATI MOGHADAM Lecturer Ying HE Lecturer Beeshanga ABEWARDANA JAYAWICKRAMA</p> <p>Faculty of Information Science and Technology Hokkaido University Professor Kunimasa SAITOH Professor Takeo OHGANE Professor Tetsuo ONO Associate Professor Toshihiko NISHIMURA Associate Professor Matteo CONVERTINO Associate Professor Hiroshi TSUTSUI Associate Professor Manabu YAMAMOTO Assistant Professor Takashi HIKAGE</p>	<ul style="list-style-type: none"> ·5G Networks ·IoT Networking ·Cyber Security ·IoT Security ·Wireless Communications ·Software-Defined Networks ·Blockchain ·5G and Beyond Wireless Networks ·Communication and Network Engineering ·Nanotechnology/Materials ·Optical Engineering and Photonics ·Electronic Devices and Equipment ·Human Interfaces and Interactions ·Human-Robot Interaction ·Cognitive Science ·Biocomplexity/Applied Complexity ·Environmental System Science ·Information Networks ·Adaptive Array Antenna ·Robot Informatics ·Image Processing and Implementation ·Planar Antenna ·Millimeter-wave Antenna ·Transmission Antenna for a Solar Power Satellite
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Beside of the above, the following two members participated GSB’s activities during the related period. Professor Yoshikazu Miyana (01 April 2018 to 31 March 2020, Director of GSB), he is now Vice-president of Chitose Institute of Science and Technology (CIST). Professor Shin-ichi Minato (01 October 2016 to 31 March 2018), he is now professor of Department of Communications and Computers Engineering, Graduate School of Informatics of Kyoto University currently.

The GSB research organization chart is as below.



<https://gi-core.oia.hokudai.ac.jp/gsb/members/>

c. Hosting of overseas faculty members

[FY 2016]

1. Establishment of the Global Station for Big Data and Cybersecurity (GSB)

In addition to holding the GI-CoRE kick-off symposium and a GSB meeting, the GSB began to consider collaboration with UTS in preparation for expanding the globalization of the station.

2. Promotion of collaborative research and education

A GSB seminar was held as a research exchange to promote collaborative research and education.

3. Number of invitees:

UMass Amherst: 3 professors, 3 assistant professors

UTS: 3 professors, 2 lecturers

[FY 2017]

1. Globalization of education and research activities by forming a GSB international university network

In addition to research exchanges with UMass Amherst, collaboration began with UTS in the IoT field.

2. Promotion of collaborative research and education

In collaboration with UMass Amherst, an educational program was developed on big data science and cybersecurity. Based on the program, an invited professor from UMass Amherst and several GSB faculty members who belong to Hokkaido University gave a course titled “Introduction to Artificial Intelligence, Big Data, and Cybersecurity” at the Hokkaido Summer Institute (participating overseas faculty member: Professor James Allan, UMass Amherst).

With faculty members of Hokkaido University, three assistant professors from UMass Amherst taught pattern recognition at the Summer Institute Satellite School.

3. Number of invitees:

UMass Amherst: 1 professor, 3 assistant professors

UTS: 2 professors, 2 lecturers

[FY 2018]

1. Globalization of education and research activities by forming a GSB international university network

In addition to research exchanges with UMass Amherst, the Key Technology Partnership (KTP) with UTS was launched.

2. Promotion of collaborative research and education

Using the video materials provided by UMass Amherst, several GSB faculty members of Hokkaido University gave an HSI course titled “Introduction to Artificial Intelligence, Big Data, and Cybersecurity” (faculty member who provided the video materials: Lecturer David Fisher, UMass Amherst).

An educational program was developed on cybersecurity and IoT in collaboration with the University of Technology, Sydney. Based on the program, two courses were provided at HSI: “Cyber Security Fundamentals” (participating overseas faculty member: Associate Professor Priyadarsi Nanda, UTS) and “Introduction to Wireless Sensor Networks and IoT” (participating overseas faculty member: Lecturer Negin Shariati, UTS)

3. Number of invitees:

UMass Amherst: None

UTS: 5 professors in total (Professor Eryk Dutkiewicz: 3 times), 2 associate professors, 2 lecturers

Others: 2018 Winter International Symposium on Big-Data, Cybersecurity and IoT (BCI 2018), Sapporo, Japan: 1 associate professor from Chulalongkorn University, 1 professor from De La Salle University

[FY 2019]

1. Globalization of education and research activities by forming a GSB international university network

In addition to the College of Information and Computer Sciences at UMass Amherst, faculty members of the Department of Mathematics and Statistics at UMass Amherst were invited, and collaboration with UTS continued.

2. Promotion of collaborative research and education

A faculty member from UMass Amherst and several GSB faculty members of Hokkaido University provided an HSI course titled “Introduction to Artificial Intelligence, Big Data, and Cybersecurity” (participating overseas faculty member: Assistant Professor Amir Houmansadr, UMass Amherst).

An education program was developed on cybersecurity and IoT in collaboration with the University of Technology, Sydney. Based on the program, three courses were provided at HSI: “Cyber Security” (participating overseas faculty member: Associate Professor Priyadarsi Nanda, UTS), “Software Defined Networks” (participating overseas faculty members: Associate Professor Mehran Abolhasan and Associate Professor Justin Lipman, UTS) and “Blockchain” (participating overseas faculty member: Lecturer Ying He, UTS)

In addition to the above HSI courses, “Wireless Sensor Networks and IoT” (participating overseas faculty members: Associate Professor Justin Lipman and Lecturer Negin Shariati, UTS) was provided as a common subject in the Graduate School of Information Science and Technology. Two subjects for e-learning that were HSI courses in FY 2018, “Cyber Security Fundamentals” (participating overseas faculty member: Associate Professor Priyadarsi Nanda, UTS) and “Introduction to Wireless Sensor Networks and IoT” (participating overseas faculty member: Lecturer Negin Shariati, UTS), were also provided as common subjects in the Graduate School of Information Science and Technology.

In collaboration with an overseas university faculty member (Lecturer David Fisher, UMass Amherst), a subject on information retrieval was taught at the Summer Institute Satellite School.

Assistant Professor Noriyuki Hamada, who belongs to the Department of Mathematics and Statistics at UMass Amherst, stayed at Hokkaido University for about two months for collaborative research with Professor Toru Ohmoto of the GSB.

3. Number of invitees:

UMass Amherst: 1 professor, 1 associate professor, 1 lecturer, 2 assistant professors

UTS: 6 professors in total (Professor Eryk Dutkiewicz: 3 times, Professor Xiaojing Huang: twice), 4 associate professors in total (Associate Professor Justin Lipman: twice), 2 lecturers

Others: 2019 Winter International Symposium on Big-Data, Cybersecurity and IoT (BCI 2019), Sapporo, Japan: 1 professor emeritus and 1 associate professor from Chulalongkorn University

d. Current research achievements (April 2016 – March 2020)

As of March 2020 (As of March 2021)

1. International Collaborative Papers (Peer Reviewed): #49 (#64)	1-1. Featured in International Journals: #37 (#51) 1-2. Featured in International Conference Proceedings: #12 (#13)
2. Other Publications: #353 (#471)	2-1. Featured in International Journals: #144 (#176) 2-2. Featured in International Conference Proceedings: #182 (#258) 2-3. Featured in Domestic Journals (in Japanese): #23 (#32) 2-4. Books published: #4 (#5)
3. Oral Presentations: #483 (#637)	3-1. Keynote Speeches: #9, (International: #8, Japanese: #1) (#10, (International: #9, Japanese: #1)) 3-2. Invited Lectures: #71, (International: #33, Japanese: #38) (#104, (International #56, Japanese #48)) 3-3. Other Presentations: #403 (#523)
4. Patent Applications: #16	Patent Applications (Registered Patents): #16 (#6) (#16 (#7)) Overseas Patents: #4 (#1) (#4 (#1)) Japanese Patents: # 12 (#5) (#12 (#6))
5. Awards Received: #55 (#72)	#55 (Awards at International Conferences: #22, Others: #33) (#72 (Awards at International Conferences: #34, Others: #38))
6. External Grants: #61 (#67)	Collaborative Research between HU and Overseas Members: #3 (#3) Others: #58 (#64)

The numbers in the parentheses show the final research achievement as of March 2021. The additional items are marked with a “ † (dagger)” in the following list.

Papers where “GI-CoRE” is stated as an affiliated institution of a Japanese or overseas researcher, or those mentioning “Hokkaido University” in the acknowledgements, are marked with a “ * (asterisk)” and the applicable author name is underlined.

*i) Papers where “GI-CoRE” is stated as an affiliated institution

*ii) Papers which mention “Hokkaido University” in the acknowledgements.

Journals in English published by Japanese publishers are listed as “International Journals”.

[JP] Japanese Publishers

[OV] Overseas Publishers

[Proc] International Conference Proceedings

Collaborative papers between HU and overseas GI-CoRE members are marked with “@GI-CoRE”.

1. International Collaborative Papers: #64 in total

1-1. Featured in International Journals: #51

2021-2020

- 1) Y. Jung, M. Wada, K. Shibahara, S. Jain, I. A. Davidson, P. Barua, J. R. Hayes, T. Sakamoto, T. Mizuno, Y. Miyamoto, Y. Sasaki, K. Saitoh, K. Nakajima, and D. J. Richardson, “High Spatial Density 6-Mode 7-Core Fiber Amplifier for L-Band Operation”, IEEE/OSA Journal of Lightwave Technology, vol. 38, no. 11, pp. 2938-2943, June 2020. [OV] †
- 2) Naoki Osada, Kazunari Matsudaira, Yuzuru Hamada, Suchinda Malaivijitnond. Testing sex-biased admixture origin of macaque species using autosomal and X-chromosomal genomic sequences. Genome Biol. Evol. in press (2021) [OV] †
- 3) Yue Li, Kazumichi Fujiwara, Naoki Osada, Yosuke Kawai, Toyoyuki Takada, Alexey P. Kryukov, Kuniya Abe, Hiromichi Yonekawa, Toshihiko Shiroishi, Kazuo Moriwaki, Naruya Saitou, Hitoshi Suzuki. House mouse *Mus musculus* dispersal in East Eurasia inferred from 98 newly determined complete mitochondrial genome sequences. Heredity 126: 32–147(2021) [OV] †
- 4) Juliano Rabelo, Mi-Young Kim, Randy Goebel, Masaharu Yoshioka, Yoshinobu Kano, and Ken Satoh : A Summary of the COLIEE 2019 Competition. In New Frontiers in Artificial Intelligence. JSAI-isAI 2019. Lecture Notes in Computer Science, pp. 34-49, Springer International Publishing, Cham, LNCS12331, 2020. [OV]*i) †
- 5) Juliano Rabelo, Mi-Young Kim, Randy Goebel, Masaharu Yoshioka, Yoshinobu Kano and Ken Satoh: COLIEE 2020: Methods for Legal Document Retrieval and Entailment. In Proceedings of the International Workshop on Juris-Informatics 2020 (JURISIN 2020) in association with the 12th JSAI International Symposia on AI (JSAI-isAI 2020), pp. 114-127, The Japanese Society of Artificial Intelligence, 2020. [OV]*i) †
- 6) Jessica R. Deere, Summer Streets, Mark D. Jankowski, Mark Ferrey, Yvette Chenaux-Ibrahim, Matteo Convertino, EJ Isaac, Nicholas B. D. Phelps, Alexander Primus, Joseph L. Servadio, Randall S. Singer, Dominic A. Travis, Seth Moore, Tiffany M. Wolf, (2021), A chemical prioritization process: Applications to contaminants of emerging concern in freshwater ecosystems (Phase I), Science of the Total Environment, [OV] †
- 7) Servadio J, Deere J, Mark D. Jankowski, Mark Ferrey, EJ Isaac, Yvette Chenaux-Ibrahim, Alexander Primus, Convertino M, Nicholas B. D. Phelps, Summer Streets, Dominic A. Travis, Seth Moore, Tiffany M. Wolf, (2021), Anthropogenic factors associated with contaminants of emerging concern detected in inland Minnesota lakes (Phase II), Science of the Total Environment, in press [OV] †
- 8) Li J, Convertino M, (2021), Inferring Ecosystem Networks as Information Flows, Scientific Reports, in press [OV] †
- 9) Li J, Convertino M, (2021), Temperature-driven Organization of Fish Ecosystems and Fishery Implications,

PLoS ONE, doi: <https://doi.org/10.1101/2021.01.18.427097>, PLoS ONE, in press [OV] †

- 10) Louis Yat Hin Chan, Baoyin Yuan, Matteo Convertino, COVID-19 Communication and Systemic Portfolio Risk, *Sci. Report*, in press [OV] †
 - 11) Convertino M, Honore Peggy, Victor J. Del Rio-Vilas, 2020, Portfolio Evaluation and Design of Surveillance Systems, *Ecological Indicators*, in press [OV] †
 - 12) B. Pahlavsay, E. Palezzato and M. Torielli, Domination in latin square graphs. arXiv:1911.10673. To appear in *Graphs and Combinatorics*. [OV] *i)
 - 13) E. Palezzato and M. Torielli, Combinatorially equivalent hyperplane arrangements. arXiv:1906.05463. To appear in *Advances in Applied Mathematics*. [OV] *i)
 - 14) M. Torielli and S. Tsujie, Freeness of hyperplane arrangements between boolean arrangements and Weyl arrangements of type B1. *The Electronic Journal of Combinatorics*, 27(3), 2020. <https://doi.org/10.37236/9341>. [OV]*i)
 - 15) E. Palezzato and M. Torielli, Localization of plus-one generated arrangements. *Communications in Algebra*, vol. 49(1), 301–309, 2021. <https://doi.org/10.1080/00927872.2020.1798976>. [OV] *i)
 - 16) W. Guo and M. Torielli, On the Falk invariant of Shi and Linial arrangements. *Discrete & Computational Geometry*, 2020. <https://doi.org/10.1007/s00454-020-00266-0>. [OV] †
 - 17) Liu Y, Saha S, Hoppe B, Convertino M, “One Size Does Not Fit All: Tailoring Impacts of Ambient Temperature on Children’s Health by Age”, *Lancet Child & Adolescent Health*, 2020, in press, [OV]*i)
 - 18) Cullen CM, Kawalpreet K Aneja, Sinem Beyhan, Clara E. Cho, Stephen Woloszynek, Matteo Convertino, Sophie J. McCoy, Yanyan Zhang, Matthew Z. Anderson, David Alvarez-Ponce, Ekaterina Smirnova, Lisa Karstens, Pieter C. Dorrestein, Hongzhe Li, Ananya Sen Gupta, Kevin Cheung, Jennifer Gloeckner Powers, Zhengqiao Zhao, and Gail Rosen, “Emerging Priorities for Microbiome Research, *Frontiers in Microbiology*”, 2020, [OV]*i)
 - 19) Deere J, Moore S, Ferrey M, Jankowski MD, Primus A, Convertino M, Servadio JL, Phelps NBD, Hamilton MC, Chenaux-Ibrahim Y, Travis DA, Wolf TM, “Characterization of contaminants of emerging concern in aquatic ecosystems utilized by Minnesota tribal communities”, *Science of the Total Environment*, 2020, [OV]*i)
 - 20) Servadio JL, Muñoz-Zanzi C, Fiecas M, Convertino M, “Sensitivity to temporal resolution when characterizing Yellow Fever incidence”, *Science Advances*, 2020, in press [OV]*i)
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- 144) Y. Sasaki, K. Takenaga, S. Matsuo, K. Aikawa, and K. Saitoh, “Few-mode multicore fibers for long-haul transmission line”, *Optical Fiber Technology*, vol. 35, pp. 19-27, Feb. 2017. [OV]

- 145) Takahiro Ogawa, Akira Tanaka, Miki Haseyama: “Wiener-Based Inpainting Quality Prediction”, *IEICE Transactions on Information and Systems*, vol. E100-D, no.10, pp.2614-2626 (2017) [JP]
- 146) Kohei Tateno, Takahiro Ogawa, Miki Haseyama: “Visualizing Web Images Using Fisher Discriminant Locality Preserving Canonical Correlation Analysis”, *IEICE Transactions on Information and Systems*, vol. E100-D, no.9, pp.2005-2016 (2017) [JP]
- 147) Miki Haseyama, Takahiro Ogawa, Sho Takahashi, Shuhei Nomura, Masatsugu Shimomura: “Biomimetics Image Retrieval Platform”, *IEICE Transactions on Information and Systems*, vol. E100-D, no.8, pp.1563-1573 (2017) [JP]
- 148) Sho Takahashi, Miki Haseyama: “A Method of Important Player Extraction Based on Link Analysis in Soccer Videos”, *ITE Transactions on Media Technology and Applications*, vol.5, no.2, pp.42-48 (2017) [JP]
- 149) Takahiro Ogawa, Yoshiaki Yamaguchi, Satoshi Asamizu, Miki Haseyama: “Human-Centered Video Feature Selection via mRMR-SCMMCCA for Preference Extraction”, *IEICE Transactions on Information and Systems*, vol. E100-D, no.2, pp.409-412 (2017) [JP]
- 150) Shota Hamano, Takahiro Ogawa, Miki Haseyama: “A Language-Independent Ontology Construction Method Using Tagged Images in Folksonomy”, *IEEE Access*, vol.6, pp.2930-2942 (2017) [OV]
- 151) Ryosuke Harakawa, Takahiro Ogawa, Miki Haseyama: “Extracting Hierarchical Structure of Web Video Groups Based on Sentiment-Aware Signed Network Analysis”, *IEEE Access*, vol.5, pp.16963-16973 (2017) [OV]
- 152) Daichi Takehara, Ryosuke Harakawa, Takahiro Ogawa, and Miki Haseyama: “Extracting Hierarchical Structure of Content Groups From Different Social Media Platforms Using Multiple Social Metadata”, *Multimedia Tools and Applications*, vol.76, no.19, pp.20249-20272 (2017) [OV]
- 153) Kenta Ishihara, Takahiro Ogawa, Miki Haseyama: “Helicobacter Pylori Infection Detection from Gastric X-ray Images Based on Feature Fusion and Decision Fusion”, *Computers in Biology and Medicine*, vol.84, no.1, pp.69-78 (2017) [OV]
- 154) Keisuke Maeda, Sho Takahashi, Takahiro Ogawa, Miki Haseyama: “Distress Classification of Road Structures via Adaptive Bayesian Network Model Selection”, *ASCE Journal of Computing in Civil Engineering*, vol.31, no.5, pp.04017044-1 - 04017044-13 (2017) [OV]
- 155) Naoki Osada, Ryutaro Miyagi, Aya Takahashi. “Cis- and trans-regulatory effects on gene expression in a natural population of *Drosophila melanogaster*.” *Genetics* 206: 2139-2148 (2017). [OV]
- 156) Yasuaki Takada, Ryutaro Miyagi, Toshinori Endo, Aya Takahashi, Naoki Osada. “A generalized linear model for decomposing genetic, parent-of-origin, and maternal effects on allele-specific gene expression.” *G3* 7: 2227-2234 (2017). [OV]
- 157) Convertino M, “Information Fractal Dimension as Communication Network Stability, *IEICE technical report*, 117 (349), 15-20, 2017 [JP]
- 158) Junko Tanaka and Toru Ohmoto, “GEOMETRIC ALGEBRA AND SINGULARITIES OF RULED AND DEVELOPABLE SURFACES”, accepted for publication in *Journal of Singularities*, special volume for the proceedings of the conference “Geometric and Algebraic Singularity Theory”, held in Bedlewo during

September 10-16, 2017. [OV]*i)

- 159) Yuji Takenobu, Norihito Yasuda, Shunsuke Kawano, Yasuhiro Hayashi, and Shin-ichi Minato: “Evaluation of Annual Energy Loss Reduction Based on Reconfiguration Scheduling,” *IEEE Trans. Smart Grid*, DOI 10.1109/TSG.2016.2604922, 2017 [OV]
- 160) Reona Minoda, Shin-ichi Minato, “Verifying Scenarios of Proximity-Based Federations among Smart Objects through Model Checking and Its Advantages”, *IEICE Transactions on Information and Systems*, Vol. E100-D, No. 6, pp. 1172-1181, June 2017 [JP]
- 161) Jun Kawahara, Takeru Inoue, Hiroaki Iwashita, Shin-ichi Minato, “Frontier-based Search for Enumerating All Constrained Subgraphs with Compressed Representation”, *IEICE Trans. Fundamentals*, Vol. E100-A, No. 9, pp. 1773-1784, Sep. 2017 [JP]
- 162) Fumito Takeuchi, Masaaki Nishino, Norihito Yasuda, Takuya Akiba, Shin-ichi Minato, Masaaki Nagata, “BDD-Constrained A* Search: A Fast Method for Solving Constrained Shortest-Path Problems”, *IEICE Transactions on Information and Systems*, Vol. E100-D, No. 12, pp. 2945-2952, Dec. 2017 [JP]
- 163) Reona MINODA and Shin-ichi MINATO: “Verifying Scenarios of Proximity-based Federations among Smart Objects through Model Checking and Its Advantages,” *IEICE Trans. Inf. & Syst.*, 2017. [JP]
- 2016**
- 164) Iku Ohama, Hiromi Iida, Takuya Kida, and Hiroki Arimura, “The Relevance Dependent Infinite Relation Model for Discovering Co-Cluster Structure from Relationships with Structured Noise”, *IEICE Trans. Inf. and Syst.*, Vol.E99-D, No.4, pp.1139-1152, April 2016. DOI: 10.1587/transinf.2015EDP7329, [JP]
- 165) Shuhei Denzumi, Ryo Yoshinaka, Hiroki Arimura and Shin-ichi Minato: “Sequence Binary Decision Diagram: Minimization, Relation-ship to Acyclic Automata, and Complexities of Boolean Set Operations,” *Journal of Discrete Applied Mathematics*, Vol. 212, pp. 61-80, Oct. 2016. [OV]
- 166) Mayumbo Nyirenda, Ryosuke Omori, Heidi L. Tessmer, Hiroki Arimura, Kimihito Ito, “Estimating the Lineage Dynamics of Human Influenza B Viruses”, *PLoS ONE* 11(11): e0166107, 2016. DOI: 10.1371/journal.pone.0166107, (September 2016) [OV]
- 167) Takuya Takagi, Shunsuke Inenaga and Hiroki Arimura, “Fully-online construction of suffix trees for multiple texts”, *Proc. the 27th Annual Symposium on Combinatorial Pattern Matching (CPM'16)*, *Leibniz International Proceedings in Informatics (LIPIcs)*, Vol.54, pp.22:1--22:13, DROPS, 2016. (DOI: 10.4230/LIPIcs.CPM.2016.22) (Tel Aviv, Israel, June 27-29, 2016) (Also available as: arXiv:1507.07622) [OV]
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- 169) T. Fujisawa and K. Saitoh, “A group delay spread analysis of strongly coupled 3-core fibers: A effect of bending and twisting”, *Optics Express*, vol. 24, no. 9, pp. 9593-9591, May 2016. [OV]
- 170) J. Tu, K. Long, and K. Saitoh, “Design and optimization of 3-mode x 12-core dual-ring structured few-mode multi-core fiber”, *Optics Communications*, vol. 381, pp. 30-36, Dec. 2016. [OV]
- 171) F. Ye, J. Tu, K. Saitoh, K. Takenaga, S. Matsuo, H. Takara, and T. Morioka, “Design of homogeneous

trench-assisted multi-core fibers based on analytical model”, IEEE/OSA Journal of Lightwave Technology, vol. 34, no. 18, pp. 4406-4416, Sep. 2016. [OV]

- 172) J. Tu, K. Long, and K. Saitoh, “An efficient core selection method for heterogeneous trench-assisted multi-core fiber”, IEEE Photonics Technology Letters, vol. 28, no. 7, pp. 810-813, Apr. 2016. [OV]
- 173) Kotoku Omura, Shoichiro Yamasaki, Tomoko K. Matsushima, Hirokazu Tanaka, Miki Haseyama: “Performance Improvement of Error-Resilient 3D DWT Video Transmission Using Invertible Codes”, IEICE Transactions on Fundamentals of Electronics, Communications and Computer Sciences, vol. E99-A, no.12, pp.2256-2265 (2016) [JP]
- 174) Takahiro Ogawa, Akihiro Takahashi, Miki Haseyama: “Classifying Insects from SEM Images Based on Optimal Classifier Selection and D-S Evidence Theory”, IEICE Transactions on Fundamentals of Electronics, Communications and Computer Sciences, vol. E99-A, no.11, pp.1971-1980 (2016) [JP]
- 175) Kenta Ishihara, Takahiro Ogawa, Miki Haseyama: “Classification of Gastric Cancer Risk From X-ray Images Based on Efficient Image Features Related to Serum Hp Antibody Level and Serum PG Levels”, ITE Transactions on Media Technology and Applications, vol.4, no.4, pp.337-348 (2016) [JP]
- 176) Takahiro Ogawa, Miki Haseyama: “Adaptive Subspace-Based Inverse Projections via Division Into Multiple Sub-Problems for Missing Image Data Restoration”, IEEE Transactions on Image Processing, vol.25, no.12, pp.5971-5986 (2016) [OV]
- 177) Ryosuke Harakawa, Takahiro Ogawa, Miki Haseyama: “A Web video retrieval method using hierarchical structure of Web video groups”, Multimedia Tools and Applications, vol.75, no.24, pp.17059-17079 (2016) [OV]
- 178) Ren Togo, Kenta Ishihara, Takahiro Ogawa, Miki Haseyama: “Estimation of salient regions related to chronic gastritis using gastric X-ray images”, Computers in Biology and Medicine, no.77, pp.9-15 (2016) [OV]
- 179) Takeru Inoue, Hiroaki Iwashita, Jun Kawahara, and Shin-ichi Minato: “Graphillion: software library for very large sets of labeled graphs,” International Journal on Software Tools for Technology Transfer (STTT), DOI 10.1007/s10009-014-0352-z, Vol. 18 Issue 1, pp. 57-66, Springer, Feb. 2016. [OV]

2-2. Featured in International Conference Proceedings: (Appendix)

2-3. Featured in Japanese Journals: (Appendix)

2-4. Featured in Books Published: (Appendix)

3. Verbal Presentations: #637 in total

3-1. Keynote Speeches: #10 (International #9, Japanese #1)

-International Conferences

2019

- 1) Masaharu Yoshioka, “GSB Activity Report”, 2021 International Symposium on Big-Data, Cybersecurity and IoT, March 3-4, 2021, Sapporo [International][Keynote] †

- 2) Yoshikazu Miyanaga, “Psycho-acoustic Masking Effect for Robust Speech Communication Robot,” International Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment, and Management (HNICEM), Nov. 2019. [International][Keynote]
- 3) Yoshikazu Miyanaga, “Autonomous ROBOT System with Psycho-acoustic Masking Speech Recognition,” Regional Conference on Computer Information and Engineering (RCCIE), Nov. 2019. [International][Keynote]
- 4) Yoshikazu Miyanaga, “Psychoacoustic Masking Effect for Noise Robust Speech Recognition Robot,” Proceedings of 2019 14-th International Symposium on Signals, Circuits, and Systems, IEEE (ISSCS2019, IEEE), p. 1, Jul. 2019. [doi:10.1109/ISSCS.2019.8801748] [International][Keynote]
- 5) Yoshikazu Miyanaga, “Noise Robust Speech Recognition Robot with Psychoacoustic Effect,” Proceedings of 2019 IEEE International Conference on Consumer Electronics - Asia (ICCE2019-Asia, IEEE), pp. 29-30, Jun. 2019. [International][Keynote]

2018

- 6) Yoshikazu Miyanaga, “Autonomous ROBOT with Noise Robust Speech Recognition”, International Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment, and Management, IEEE (HNICEM2018, IEEE), Nov. 2018. [International][Plenary Keynote]
- 7) Yoshikazu Miyanaga, “Noise Robust Speech Recognition for AI-ROBOT,” International Conference on Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology (ECTI-CON 2018), Jul. 2018. [International][Keynote]
- 8) Convertino M, Optimal Information Networks: from Data Analysis to Design of Complex Systems, ISMAC2018 (International Symposium on Multimedia and Communication Technology) August 29-31, 2018, Tottori, Japan [International] [Invited, Keynote]

2016

- 9) Miki Haseyama: “Realization of Associative Image Search -Development of Image Retrieval Platform for Enhancing Serendipity-”, 2016 IEEE 46th International Symposium on Multiple-Valued Logic, pp.56-59 (2016) [International][Keynote]

-Japanese Conferences

2018

- 10) 長谷山 美紀, “AI・IoT・ビッグデータ解析技術による実社会データからの価値創出”, CEVA TECHNOLOGY SYMPOSIUM SERIES, Tokyo, Nov. 2018 [Japanese][Keynote]

3-2. Invited Lectures: #104 in total (International #56, Japanese #48)

-International Conferences

2021-2020

- 1) Hiroki Arimura, “Interpretable and Explainable Machine Learning for Trustworthy AI”, 2021 International Symposium on Gig-Data, Cybersecurity and IoT, March 3-4, Sapporo [International][Invited] *i) †
- 2) K. Saitoh, “Design of Randomly-Coupled Multicore Fibers”, IEEE Photonics Society Summer Topicals

Meeting Series (SUM), Paper MD3.3, Virtual Conference, July 13-15, 2020. †

- 3) K. Saitoh, T. Fujisawa, and T. Sato, “Control of Group Delay Spread in Randomly-Coupled Multicore Fibers”, Optoelectronics and Communications Conference (OECC), Paper T3-1, Taipei, Taiwan, Oct 4-8, 2020. †
- 4) K. Saitoh, “Reduction of Group Delay Spread in Coupled Multicore Fibers”, Asia Communications and Photonics Conference (ACP), Workshop 10, Beijing, China, Oct. 24-27, 2020. †
- 5) K. Saitoh, “Few-mode Multi-core Fibres: Weakly-coupling and Randomly-coupling”, European Conference on Optical Communications (ECOC), Paper Tu4A-1, Virtual Conference, Dec. 6-10, 2020. †
- 6) Hidemi Watanabe, “Single-cell transcriptomics as big data biology”, 2021 International Symposium on Gig-Data, Cybersecurity and IoT, March 3-4, Sapporo [International][Invited] *i) †
- 7) Takeo Ohgane, “Recent results on GaBP and AMP for large-scale signal detection”, 2021 International Symposium on Gig-Data, Cybersecurity and IoT, March 3-4, Sapporo [International][Invited] *i) †
- 8) Tetsuo Ono, “Intelligent Room using IoT Network and Personal AI Agents”, 2021 International Symposium on Gig-Data, Cybersecurity and IoT, March 3-4, Sapporo [International][Invited] *i) †
- 9) Naoki Osada, Whole genome sequencing analysis of house mice across the Eurasian continent. Genome Concept Centennial Conference. Online international conference, Feb. 17, 2021 †
- 10) Naoki Osada, Inference of East and Northeast Asian Population Histories using Present-day and Ancient Genome Sequence Data, The First Meeting of the Academic Year 2020 Joint Research Project on “Studies in Asian and African Geolinguistics”, ILCAA, Oct.10, 2020(Online) †
- 11) Convertino M, Ecosystem connectome: from discovery to Ecosystem Design, Center for Ecological Research, Kyoto University, April 2020 [INVITED] †
- 12) Convertino M, “Biocomplexity and Data Science: Critical Interactions from Microbes to Populations in Ecosystems”, Environmental Data Science seminar, University of California, Davis, April 2020 (online) [INVITED] †
- 13) Convertino M, Ecosystem Data Science and Design, VinUNI, Vietnam [ONLINE due to COVID-19], June 2020 [INVITED] †
- 14) Convertino M, InTo COVID, Infodemic Tomography: Coupling Covid Social And Epidemiological Media For Systemic Risk Management, WHO/SEARO, [ONLINE], August 2020 [INVITED] †
- 15) Convertino M, InTo COVID, Infodemic Tomography: Coupling Covid Social And Epidemiological Media For Systemic Risk Management, Central University of Tamil Nadu (India), Sept. 2020 [INVITED] †
- 16) Convertino M, Water Networks as Ecological Corridors: Species, Pathogens, and Populations, Water Science Forum, Beijing Normal University, [ONLINE due to COVID-19], Sept. 2020 [INVITED] †
- 17) Convertino M, Critical Interactions: Ecosystem Synthesis and Design (from Pathogens to Populations, Hong Kong Baptist University, Smart Data Society Lab [ONLINE], Sept. 2020 [INVITED] †
- 18) Hiroyuki Iizuka, “Ethogram generation and stereotypy recognition for captive animals using deep learning”, 2021 International Symposium on Gig-Data, Cybersecurity and IoT, March 3-4, Sapporo [International][Invited] *i) †
- 19) Satoshi Oyama, “Machine Learning with Higher-Order Feature Interactions”, 2021 International

Symposium on Gig-Data, Cybersecurity and IoT, March 3-4, Sapporo [International][Invited] *i) †

- 20) Hiroshi Tsutsui, “Evaluation of Low Power Consumption Multimedia IoT System Using Zynq UltraScale+ RFSoc”, 2021 International Symposium on Gig-Data, Cybersecurity and IoT, March 3-4, Sapporo [International][Invited] *i) †
- 21) Toru Ohmoto, “Applied Singularity Theory -- an updated new catastrophe theory”, 2021 International Symposium on Gig-Data, Cybersecurity and IoT, March 3-4, Sapporo [International][Invited] *i) †
- 22) Naomichi Nakajima and Toru Ohmoto, “Dually Flat Structure for Singular Models”, Workshop on Statistical Manifolds and Related Fields (online), Hokkaido University, Dec. 24, 2020. †
- 23) Toru Ohmoto, “Information Geometry from Singularity Theory Viewpoint”, Workshop on Contact Structure, Singularities and Differential Equations (online), Jan. 20, 2021. †
- 24) Convertino M, Disaster Information Systems: a Biocomplexity Perspective and Ecosystem Design, Disaster Prevention Research Institute, Kyoto University, January 2020 [International][Invited]

2019

- 25) T. Fujisawa, M. Arai, and K. Saitoh, “Epitaxial design of GeSn quantum wells for optoelectronic applications”, 2019 IEEE Photonics Society Summer Topicals Meeting Series, Paper MA4.1, Miami, USA, July 8-10, 2019. (July 8) [International][Invited]
- 26) Masaharu Yoshioka, “Extraction of Knowledge and Information from Documents”, 2019 Summer International Symposium on Big-Data, Cybersecurity and IoT, August 2019, Sapporo [International][Invited] *i)
- 27) Takeo Ohgane, “Large-scale signal detection based on belief propagation with node selection”, 2019 Summer International Symposium on Big-Data, Cybersecurity and IoT, August 2019, Sapporo [International][Invited] *i)
- 28) Naoki Osada, “Big data in biology: perspectives of genomic diversity studies”, 2019 Winter International Symposium on Big-Data, Cybersecurity and IoT, Dec. 2019, Sapporo [International][Invited] *i)
- 29) Convertino M, “Pattern-oriented Metacommunity Modeling: Networks, Uncertainty and Optimal Controls” and “Reverse Modeling: Information, Possibilities, Systemic Risk and Network Inference”, Lectures at the University of Surrey (UK), One Health EJP Summer School (<https://onehealthjep.eu/summer-school-2019/>), August 2019, [International][Invited]
- 30) Convertino M, “Ecocentric Model-Technology Nexus for EcoHealth”, 2019 Summer International Symposium on Big-Data, Cybersecurity and IoT, August 2019, Sapporo [International][Invited] *i)
- 31) Convertino M, “Entropy as a Driver of Optimality: Portfolio Effect and Population Connectome”, Keynote Lecture The 5th Electronic Conference of Entropy, Session “Biological Systems” chaired by Dr. Bill Sherwin [International] [Invited]
- 32) Convertino M, Mapping the Global Earth Microbiome, Hakubi Center, Kyoto June 2019 [International] [Invited]
- 33) Convertino M, Water-Population Nexus for Sustainable Ecosystem Design, School of Civil and Environmental Engineering, Nanyang Technological University, Singapore, May 2019 [International] [Invited]

- 34) Convertino M, Bio-Hydro-Geo Dynamics: Mapping Systemic Earth Risk, AI for Summit, Seattle, USA, May 2019 [International] [Invited by Microsoft AI for Earth Program]
- 35) Convertino M, A, Environmental Dynamics, Syndemics Prediction and Public Health Control, Chatham House (The Royal Institute of International Affairs), London, UK, September 2019 [International] [Invited]
- 36) Convertino M, A, Complex Environmental Dynamics and Population Patterns Prediction, University College London, Civil and Environmental Engineering Department, London, UK, September 2019 [International] [Invited]
- 37) Hiroyuki Iizuka, “Deep Learning and Big Data for Cognitive Modeling”, 2019 Summer International Symposium on Big-Data, Cybersecurity and IoT, August 2019, Sapporo [International] [Invited]*i)
- 38) Satoshi Oyama, “Crowdsourcing for Big Data Analytics”, 2019 Summer International Symposium on Big-Data, Cybersecurity and IoT, August 2019, Sapporo [International][Invited] *i)
- 39) Yoshihiro Hirose, “Geometrical Approach to Data Science”, 2019 Winter International Symposium on Big-Data, Cybersecurity and IoT, December 2019, Sapporo [International][Invited] *i)
- 40) Manabu Yamamoto: “Development of planar-type ultra-wideband array antennas based on leaf-shaped radiating elements,” 2019 Winter International Symposium on Big-Data, Cybersecurity and IoT, Hokkaido University, December 2019. [International][Invited] *i)
- 41) Toru Ohmoto, “Multiple-point formulas revisited” (Feb.13, 2019), International workshop “Kagoshima Algebra-Geometry-Analysis Seminar”, Feb. 11--15, 2019, Kagoshima University, Japan. [International] [Invited, selected]
- 2018**
- 42) T. Sakamoto, K. Saitoh, S. Saitoh, Y. Abe, K. Takenaga, A. Urushibara, M. Wada, T. Matsui, K. Aikawa, K. Nakajima, “120 Spatial Channel Few-mode Multi-core Fibre with Relative Core Multiplicity Factor Exceeding 100”, European Conference on Optical Communications (ECOC 2018), Paper We3E.5, Rome, Italy, Sept. 23-27, 2018.[International]
- 43) T. Fujisawa, T. Sakamoto, T. Matsui, K. Tsujikawa, K. Nakajima, and K. Saitoh, “PLC-based Mode Controlling Devices for Mode-Division-Multiplexing”, OptoElectronics and Communications Conference (OECC), Paper 6E1-2, Jeju, Korea, July 2-6, 2018. [International]
- 44) T. Sakamoto, K. Saitoh, S. Saitoh, K. Shibahara, M. Wada, Y. Abe, A. Urushibara, K. Takenaga, T. Mizuno, T. Matsui, K. Aikawa, Y. Miyamoto, and K. Nakajima, “Mode Dependent Loss Reduced Few-Mode Multi-Core Fiber Design for Repeated Dense SDM Transmission”, OptoElectronics and Communications Conference (OECC), Paper 5C3-2, Jeju, Korea, July 2-6, 2018.[International]
- 45) T. Sakamoto, K. Saitoh, S. Saitoh, K. Shibahara, M. Wada, Y. Abe, A. Urushibara, K. Takenaga, T. Mizuno, T. Matsui, K. Aikawa, Y. Miyamoto, and K. Nakajima, “Few-Mode Multi-Core Fiber Technologies for Repeated Dense SDM Transmission”, IEEE Photonics Society Summer Topicals Meeting Series (SUM), Paper TuF2.2, Waikoloa, Hawaii, USA, July 9-11, 2018.[International]
- 46) Toru Ohmoto, “Multiple-point formulas revisited”(Oct. 5, 2018), International workshop “Singularities and Characteristic classes/RR50”, Oct. 4--6, 2018, University of Geneva, Switzerland. [International][Invited, selected]

2017

- 47) K. Saitoh, T. Fujisawa, and T. Sato, “Weakly-coupled and strongly-coupled multicore fibers”, OptoElectronics and Communications Conference (OECC), Paper Oral 2-3B-2, Singapore, July 31-Aug 4, 2017. [International](Invited) (Aug. 2)
- 48) K. Saitoh, T. Fujisawa, and T. Sato, “Design and analysis of weakly- and strongly-coupled multicore fibers”, OSA Advanced Photonics Congress (APC), Paper NeTu2B.5, New Orleans, USA, July 24-27, 2017. [International](Invited) (July 25)
- 49) T. Fujisawa and K. Saitoh, “Material analysis of GeSn/SiGeSn quantum wells based on many-body theory”, IEEE Photonics Society Summer Topicals Meeting Series (SUM), Paper TuA1.1, San Juan, Puerto Rico, July 10-12, 2017. [International](Invited) (July 11)

2016

- 50) K. Saitoh, “Multicore fibers for high density space division multiplexing”, 11th International Workshop on Optical Signal Processing and Optical Switching (IWOOP), Sapporo, Japan, Nov. 16-17, 2016. [International]
- 51) T. Sakamoto, T. Matsui, K. Saitoh, S. Saitoh, K. Takenaga, and S. Matsuo, Y. Tobita, N. Hanzawa, K. Nakajima, F. Yamamoto, “High spatial density few-mode multi-core fiber for dense space division multiplexing transmission”, Photonic Networks and Devices, Paper NeW2C.3, Vancouver, Canada, July 18-20, 2016.[International]
- 52) K. Aikawa, Y. Sasaki, Y. Amma, K. Takenaga, S. Matsuo, K. Saitoh, T. Morioka, and Y. Miyamoto, “High core count single-mode multicore fiber for dense space division multiplexing”, IEEE Photonics Society Summer Topicals Meeting Series (SUM), Paper WE2.2, Newport Beach, USA, July 11-13, 2016.[International]
- 53) K. Saitoh, “Multicore multimode fibers with high spatial density”, IEEE Photonics Society Summer Topicals Meeting Series (SUM), Paper TuE4.1, Newport Beach, USA, July 11-13, 2016. [International]
- 54) T. Sakamoto, T. Matsui, K. Saitoh, S. Saitoh, K. Takenaga, S. Matsuo, Y. Tobita, N. Hanzawa, K. Nakajima, F. Yamamoto, “High spatial density few-mode multi-core fiber with low differential mode delay characteristics”, OptoElectronics and Communications Conference (OECC), Paper MC2-3, Niigata, Japan, July 3-7, 2016.[International]
- 55) Y. Sasaki, Y. Amma, K. Takenaga, S. Matsuo, K. Aikawa, K. Saitoh, T. Morioka, and Y. Miyamoto, “Single-mode multicore fiber for dense space division multiplexing”, OptoElectronics and Communications Conference (OECC), Paper MC1-4, Niigata, Japan, July 3-7, 2016. [International]
- 56) Shin-ichi Minato: “Power of Enumeration - BDD/ZDD-Based Techniques for Discrete Structure Manipulation,” In Proc. of IEEE 46th International Symposium on Multiple-Valued Logic (ISMVL2016), p. 143, May 2016. [International][Invited]

-Japanese Conferences

2021-2020

- 57) 齊藤晋聖, “大容量空間分割多重伝送用光ファイバーの最新動向,” 第 156 回微小光学研究会「オンライン社会を加速する光通信と微小光学」, オンライン, Oct. 14, 2020. †

- 58) 長谷山 美紀: "データサイエンス教育のフロンティア", NoMaps Conference 2020 (2020) [JP]
- 59) 長谷山 美紀: "データサイエンス基礎から応用", 放送大学講義 (2020) [JP] †
- 60) 長谷山 美紀: "第3次 AI ブームを考える - 情報科学を駆使した実社会データ連携 -", ソフトウェアシンポジウム (2020) [JP] †
- 61) 長田直樹, 日本人のルーツと病気とのかかわり, NHK カルチャーヤマト王権・古代史講座特別編ー日本列島人の起源と歴史, オンライン講座, 2020年9月27日†
- 62) 筒井弘, 無線通信・画像処理ハードウェア IP の設計技, IEEE Sapporo Section YP Invited Talk, Muroran Institute of Technology, December 18, 2020, †
- 63) 日景 隆, 吉江明花, 大宮 学: " [依頼講演] 大規模 FDTD 解析を用いた都市環境モデルの3次元伝搬特性推定", 信学技報, vol. 120, no. 97, AP2020-9, pp. 1-4, 2020年7月. †
- 64) 吉江明花, 佐藤亜衣, 日景 隆: " [依頼講演] 市販レイトレーシングソフトを用いた都市環境伝搬特性シミュレーションの高速化検討", 信学技報, vol. 120, no. 97, AP2020-10, pp. 5-7, 2020年7月. †
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- 66) 日景 隆: "電波と生体安全性-基本的考え方から実際の評価まで-", 第26回 EMC 環境フォーラム, 技術セッション9「電波と生体安全性」, オンライン, 2020年10月. †
- 67) 長谷山 美紀: "AI・ビッグデータ解析に基づいた実観測データからの価値創出"フォトエレクトロニクス研究拠点 第2回研究会 (2020) [JP][Invited]

2019

- 68) 齊藤晋聖, 藤澤 剛, "データセンタ間通信における SDM 技術の適用可能性", 電子情報通信学会ソサイエティ大会, BCI-1-6, 大阪, Sep. 10-13, 2019. (Sep. 11) [JP] [Invited]
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- 70) 高野純矢, 藤澤 剛, 澤田祐甫, 坂本泰志, 松井 隆, 中島和秀, 齊藤晋聖, "シリコンフォトニクスによる高次モードを用いた低損失かつ高トレランス 100/400GbE 用 4 波長合波器", C-3-57, 大阪, Sep. 10-13, 2019. (Sep. 13) [JP][Invited]
- 71) 藤澤剛, 齊藤晋聖, "最適化手法を用いた空間分割多重通信向け光導波路デバイスの研究," 第152回微小光学研究会 "AIで拓げる微小光学", 東京 June 14, 2019.[JP] [Invited]
- 72) 長谷山 美紀: "AIの進化と人間の可能性" 札幌大谷中学校 (2019) [Invited]
- 73) 長谷山 美紀, 小川 貴弘: "生体情報解析を導入した次世代 AI 技術の構築" 電子情報通信学会通信ソサイエティ大会 (2019) [Invited]
- 74) 長谷山 美紀: "AI・IoT・ビッグデータ解析による次世代インフラ維持管理に向けた取り組み" 第29回トンネル工学研究発表会 (2019) [Invited]
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- 76) 長谷山 美紀: "AI・IoT・ビッグデータ解析に基づいたマルチメディア信号処理による実社会データからの価値創出" 映像情報メディア学会 冬季大会 2019 (2019) [Invited]
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- 78) 大鐘 武雄, “ガウス確率伝搬法等繰り返し手法を用いた多数信号検出特性” 無線電信システム研究会 (RCS), 沖縄県宮古島, 2019年6月20日 (招待講演)
- 79) 大鐘 武雄, “スマートアンテナ技術「MIMO」の最新動向”, ワイヤレス・テクノロジー・パーク (WTP)2019, 東京ビッグサイト, 2019年5月31日 (招待講演)

2018

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- 82) 齊藤晋聖, “空間分割多重伝送のためのマルチコア/マルチモードファイバ”, 技術レーザー学会「ファイバーレーザー技術」専門委員会第2回委員会, 千歳市, July 26-27, 2018.
- 83) 齊藤晋聖, “空間分割多重伝送のための光ファイバ技術”, 電子情報通信学会光ファイバ応用技術研究会創立20周年記念シンポジウム, OFT-T1, 東京, May 17, 2018.
- 84) 芝原光樹, 水野隆之, 李 斗煥, 宮本 裕, 小野浩孝, 中島和秀, 齊藤翔太, 竹永勝宏, 齊藤晋聖, “モード間干渉キャンセラを用いた 2500km-12 コア x3 モード多重ファイバ及び 6300km-3 モード多重ファイバのモード分散非マネジメント空間多重伝送”, 電子情報通信学会光通信システム研究会, OCS2018-7, 東京, May 11, 2018.
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- 87) 長谷山 美紀, 住友ゴム工業株式会社にて講演(2018) [Invited]
- 88) 長谷山 美紀, 室蘭工業大学にて講演(2018) [Invited]
- 89) 長田直樹, “ゲノムからたどる人類進化の歴史”, 名古屋大学遺伝子実験施設公開セミナー「ゲノム解析が見える化する生命の成り立ち」, 名古屋大学, 名古屋市 2018年12月10日 招待講演

2017

- 90) 齊藤晋聖, “Multicore Fiber Technology for Space Division Multiplexing (SDM)”, 第31回光通信システムシンポジウム, 三島市, Dec. 19-20, 2017. (Dec. 20)
- 91) 齊藤晋聖, “空間分割多重伝送の現状とモード制御デバイス”, 集積光デバイスと応用技術研究会, IPDA17-2-11, 加賀市, Nov. 9-10, 2017. (Nov. 10)
- 92) 藤澤 剛, 荒井昌和, 齊藤晋聖, “中赤外フォトニクス向け GeSn 系量子構造と光デバイス応用”, 電子情報通信学会ソサイエティ大会, C-4-10, 東京, Sep. 12-15, 2017 (Sep. 13) (依頼講演)
- 93) 石坂雄平, 藤澤 剛, 齊藤晋聖, “屈折率センサの高感度化に向けたプラズモニク導波路構造の検討”, 電子情報通信学会ソサイエティ大会, C-3-8, 東京, Sep. 12-15, 2017 (Sep. 12) (依頼講演)

94) 長谷山 美紀: “ [特別招待講演] ビッグデータからの価値創出を実現する次世代情報検索 ～AI・IoT技術の発想支援型検索への導入～”, 電子情報通信学会技術研究報告, vol.117, no.329, pp.101-106 (2017) [Invited]

95) 長田直樹, “集団遺伝学とゲノム進化学”, 第11回生物学基礎論研究会特別講演, 札幌市北海道医療大学札幌サテライトキャンパス, 2017年9月10日 招待講演

2016

96) 水野隆之, 芝原光樹, 小野浩孝, 阿部宜輝, 宮本 裕, フェイフォン イエ, 盛岡敏夫, 佐々木雄佑, 安間淑通, 竹永勝宏, 松尾昌一郎, 愛川和彦, 齋藤晋聖, ヨンミン ジュン, デイビッド リチャードソン, “32 コアファイバによる高密度空間分割多重 (DSDM) 光伝送技術 ～ OFC2016 ポストデッドライン報告 ～”, 電子情報通信学会光通信システム研究会, OCS-2016-7, 東京, May 13, 2016. (May 13)

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98) 長谷山美紀: “情報科学に基づいた社会インフラメンテナンス高度化の試み”, 第11回産学官CIMGISセミナー (2016) [Invited]

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100) 長谷山 美紀: “ビッグデータ時代の発想支援型画像検索 ～生物の微細構造が有する機能の発見法～”, 日本比較生理生化学学会 東京大会 (2016) [Invited]

101) 高橋 翔, 長谷山 美紀: “サッカー映像における試合内容の理解を促すデータの可視化”, 映像情報メディア学会年次大会, pp.S4-6 (2016) [Invited]

102) 長谷山 美紀: “[招待講演]マルチメディア信号処理と次世代情報検索”, 電子情報通信学会技術報告, vol.116, no.166, pp.33-36 (2016) [Invited]

103) 長谷山 美紀: “気づきを生み出す発想支援型検索 –ビッグデータからの価値創出–”, ITpro EXPO 2016 (2016) [Invited]

104) 長谷山 美紀: “報技術による社会インフラ管理の高度化 –ビッグデータ解析による構造物点検の高精度化の試み–”, CReC シンポジウム (2016) [Invited]

3-3. Other Presentations: #523

4. Patent Applications: #16 (Registered Patents #7) in total

Overseas Patents: # 4 (#1), Japanese Patents: # 12 (#5)

-Overseas Patents

- 1) International Patent, Application No. PCT/JP2018/025024, Information transmission system, Jan. 9, 2020, Hokkaido University, Masanori Sugimoto
- 2) US Patent 9858661B2, Detecting species diversity by image texture analysis, 2018, The Charles Stark

Draper Laboratory, Inc., University of Florida Research Foundation, Inc., Charles Stark Draper, M Convertino and R Mangoubi

- 3) International Patent Application No. PCT/JP2018/003039, (WO2018/150867), Multicore fiber and multicore fiber tape using same, 2018 January, Fujikura Ltd., Hokkaido University, Technical University of Denmark, Yusuke Sasaki, Kunimasa Saitoh, Toshio Morioka et al.
- 4) International Patent Application No. PCT/JP2017/008307, (WO2017/159385), Multicore fiber, 2017 March, Nippon Telegraph and Telephone Corporation, Hokkaido University, Taiji Sakamoto and Kunimasa Saitoh et al.

-Japanese Patents

- 5) Japanese Patent No. 6781432 (P6781432), “A method for producing a radio wave propagation simulation model creation system, creation apparatus and creation program”, 2020 Oct., Hokkaido University and NIPPON TELEGRAPH AND TELEPHONE CORPORATION, Inomata, Kimoto, Nakamura, Takatori, and Hikage
- 6) Japanese Laid-Open Patent Publication No. Tokkai 2020-005233, Phased array antenna system, 2020 January, Takashi Hikage, Manabu Yamamoto
- 7) Japanese Patent No. 6609387, Method, system and program for estimating properties of rubber materials, 2019, Hokkaido University and Sumitomo Rubber Industries, Ltd., Miki Haseyama, Takahiro Ogawa, Hiroaki Yamada, Wakana Ito
- 8) Japanese Patent No. 6609388, Diagnostic device for rubber material deterioration, 2019, Hokkaido University, Sumitomo Rubber Industries, Ltd., Miki Haseyama, Takahiro Ogawa, Hiroaki Yamada, Wakana Ito
- 9) Japanese Patent Application No. Tokugan 2019-201196, Positioning system, positioning method, signal generator, signal receiver and control program, Nov. 6, 2019, Hokkaido University, Masanori Sugimoto
- 10) Japanese Laid-Open Patent Publication No. Tokkai 2020-046623, Few-mode multicore optical fiber, 2018 September, Nippon Telegraph and Telephone Corporation, Hokkaido University, Taiji Sakamoto and Kunimasa Saitoh et al.
- 11) Japanese Laid-Open Patent Publication No. Tokkai 2020-027216, Mode multi/demultiplexer, 2018 August, Nippon Telegraph and Telephone Corporation, Hokkaido University, Taiji Sakamoto and Kunimasa Saitoh et al.
- 12) Japanese Laid-Open Patent Publication No. Tokkai 2019-191224, Mode exchanger, 2018 April, Nippon Telegraph and Telephone Corporation, Hokkaido University, Taiji Sakamoto and Kunimasa Saitoh et al.
- 13) Japanese Laid-Open Patent Publication No. Tokkai 2019-152717, Wavelength multiplexer, 2018 March, Nippon Telegraph and Telephone Corporation, Hokkaido University, Taiji Sakamoto and Kunimasa Saitoh et al.
- 14) Japanese Patent No. 6631848, Mode multi/demultiplexer and mode division multiplexed transmission system, 2017 March, Nippon Telegraph and Telephone Corporation, Hokkaido University, Taiji Sakamoto and Kunimasa Saitoh et al.
- 15) Japanese Patent No. 6699028, Mode exchanger, 2017 March, Nippon Telegraph and Telephone

Corporation, Hokkaido University, Taiji Sakamoto and Kunimasa Saitoh et al.

- 16) Japanese Patent No. 6653886, Mode multi/demultiplexer and mode division multiplexed transmission system, 2016 September, Nippon Telegraph and Telephone Corporation, Hokkaido University, Taiji Sakamoto and Kunimasa Saitoh et al.

5. Awards Received: (Awards at International Conferences are listed in Appendix)

6. External Grants: #67 in total

Collaborative Research between HU and Overseas Members: #3, Others: #64

- 1) Fund for the Promotion of Joint International Research (Fostering Joint International Research (B)) , “Multi-Media IoT based on Energy Harvest Cognitive Wireless Network”, February 2019 – March 2021), Yoshikazu Miyanaga (HU, PI), Manabu Yamamoto (HU, co-investigator), Takashi Hikage (HU, co-investigator), Negin Shariati Moghadam (UTS, co-investigator) and Xiaojing Huang (UTS, international collaborator), 13,600,000 yen. @GI-CoRE
- 2) Grant-in-Aid for Scientific Research (B), “Research on analysis and visualization of news websites stance based on the comparison among various news websites”, FY 2018 – 2021 (4 years), Masaharu Yoshioka (HU, PI), James Allan (UMass Amherst, collaborative researcher), 17,030,000 yen. @GI-CoRE
- 3) Australian-Japan Foundation, DFAT, “Promoting Wagyu Beef Traceability between Japan and Australia”, September 2019 – June 2021, Ying He (UTS, PI), Hiroshi Tsutsui (HU, research participant), 20,000 Australian dollars. @GI-CoRE

(end)

e. Utilization and dissemination of research achievements

1. Organization of international symposiums

- 1) August 31 – September 2, 2016: International Symposium on Multimedia and Communication Technology, ISMAC 2016 (Tokyo City University, Tokyo), cohosted by IEICE and the GSB
 - Dispatch of Lecturer Negin Shariati (a UTS researcher with a cross-appointment) as a keynote speaker
 - Participation of three HU professors (GSB members)
 - Two presentations by students (research assistants)

- 2) August 23 – 25, 2017: 2017 International Symposium on Multimedia and Communication Technology, Ayutthaya, a World Heritage historic city of Thailand, cohosted by IEICE, ECTI and the GSB
 - Tutorial lecture by an HU professor (GSB member)
 - One presentation by a student (research assistant)

- 3) August 29 – 31, 2018: International Symposium on Multimedia and Communication Technology, (ISMAC 2018), Tottori, Japan, cohosted by IEICE, ECTI, APSIPA and GSB
 - Dispatch of Lecturer Negin Shariati (UTS researcher with a cross-appointment) as a plenary speaker
 - Dispatch of Associate Professor Matteo Convertino (GSB HU member) as a keynote speaker
 - Participation of an HU professor (GSB member)
 - Three presentations by students (research assistants)

- 4) August 19 – 21, 2019: International Symposium on Multimedia and Communication Technology, (ISMAC 2019), Manila, Philippines, hosted by IEEE, IEICE, ECTI and the GSB
 - Dispatch of Professor Eryk Dutkiewicz (a UTS researcher with a cross-appointment) as a keynote speaker
 - Participation of an HU professor and a HU associate professor (GSB members)
 - Three presentations by students (research assistants)

2. Extension lectures and exhibition for the general public

- 1) Lecture and exhibition at ITpro Expo Sapporo 2016
- 2) Extension lectures on cybersecurity and big data science for the general public (October – November 2016)
- 3) May 26, 2019: Hokkaido University and Citizen's College of Hokkaido Extension Lecture "Artificial Intelligence and Big Data," cohosted
 - Lecture cohosted by IEEE and the GSB in line with IEEE ISCAS 2019

f. Issues in conducting research, their solutions and future development

Mutual understanding of research is indispensable for conducting specific collaborative research, and this requires close exchanges of opinions over an extended period (at least two weeks to one month). However, it

may be difficult for researchers with cross-appointments who have many students at their own universities to leave their universities even for a short period. As a result, it is hard for them to finish their collaborative research while staying at Hokkaido University.

In addition to overseas researchers with cross-appointments coming to Hokkaido University, the GSB has dispatched associate professors who have relatively few students and doctoral students from Hokkaido University to partner universities for collaborative research.

Some dispatched professors have started researchers from the discussions during their stay at UMass Amherst and UTS. Some doctoral students started research during their stay at an overseas university and continued it after returning to Japan by utilizing various online tools, such as e-mail and tools for co-authoring papers, and have presented a refereed paper at international conferences. This experience showed that dispatched students can experience an international research environment and achieve successful results if themes and faculty members at host universities are appropriately determined. In the future, researchers with cross-appointments may want to serve as a contact point and help to create a framework for matching dispatched students with appropriate faculty members at host universities to provide a better research and education environment for doctoral students.

Meanwhile, the spread of remote conference systems in recent years has facilitated collaboration between overseas researchers with cross-appointments and the faculty of Hokkaido University, reducing the barriers for teaching remotely without leaving their home universities. In the future, the GSB would like to promote practical exchanges while utilizing such technologies.

2. Education (International Graduate School)

2.1 Objective

Regarding the social background to the information science field, information science and technology are utilized in all fields of social and economic activities, and social and economic activities themselves are built on the Internet, creating a virtual society (cyber space). This trend is spreading all over the world and is referred to as an IT revolution or an Internet revolution.

The Fifth Science and Technology Basic Plan (decided by the Cabinet on January 22, 2016) highlights weakened fundamentals and the fact that industry-academia collaboration has yet to reach full maturity. It recommends the reinforcement of fundamentals involved in science, technology and innovation, the enhancement of competitiveness in a “super smart society” and the strategic strengthening of fundamental technologies. Cybersecurity, IoT system construction, big data science, AI, devices, robots, sensors, biotechnology, material/nanotechnology, and light/quantum are listed as fundamentals. In addition, support for researchers working overseas, the construction of international research networks, and the mobilization of human resources across fields, organizations and sectors are cited as examples of strategic strengthening. Similarly, at the 10th meeting of the Council on Investments for the Future (June 2017), it was that mathematical and big data science education should be promoted university-wide, in all humanities or science courses. In both of the above cases, the importance of the new information science fields and the role of universities that support them are highlighted.

At the same time, a report on ideal engineering education at universities (interim summary) (June 2017, Study Committee on Ideal Engineering Education at Universities, Ministry of Education, Culture, Sports, Science and Technology) highlights the importance of a drastic review of the vertical division structure of each department, the learning of minor fields in addition to the major field, the strengthening of basic engineering education, the enhancement of common basic education in engineering and information science and technology, the reinforcement of advanced information human resource education, and the establishment of an industry-academia collaborative education system.

Meanwhile, according to data from the New Industrial Structure Subcommittee of the Industrial Structure Council at the Ministry of Economy, Trade and Industry (13th meeting, February 13, 2017), the shortage of human resources in information science is serious, and there is currently a shortage of approximately 171,000 engineers and researchers. It is estimated that there will be shortages of roughly 369,000 in 2020 and 789,000 in 2030.

Accordingly, for higher education to meet the demands of society, it must develop outstanding human resources by reforming the vertical structure of academic disciplines, which has been maintained for many years, and creating an interdisciplinary information science education system that meets the needs of the times. This requires the prompt development of human resources that can adapt to the new age through new education based on e-learning that can support lifelong learning and through a multi-field curriculum (students take subjects provided in their specialized course and other courses.) that can promote interdisciplinary research and development. There seems to be a demand for individuals who can practically utilize IT capabilities from a global perspective beyond the boundaries of education and research fields.

One of the goals of the Future Strategy for the 150th Anniversary of Hokkaido University, which were announced in August 2014, is to promote world-leading research to resolve a variety of issues to create a sustainable society for the next generation. The basis of the plan is to “prepare an environment suitable for cutting-edge international collaborative research that brings together top researchers from around the world, and construct a world-class center for global brain circulation.” To achieve this goal, the GI-CoRE has been established to form international collaboration with top-class overseas universities and to create a research and education hub at Hokkaido University.

In 2016, the GSB was established as a part of GI-CoRE, and the Graduate School of Information Science and Technology functions as the organizing department. The goal of the GSB is to build a global brain circulation center and to develop individuals who can contribute to the resolution of social issues. To achieve this goal, it is necessary to reform graduate school education on the back of international collaboration, and the Graduate School of Information Science and Technology is part of this concept of international collaboration.

In the redefinition of the University’s mission (presented in November 2013), the Graduate School of Information Science and Technology is highly regarded for: 1) further promoting world-leading research in the interdisciplinary research area centered on information, 2) contributing to the development of industrial technology by utilizing its proven track record in commissioned research and collaborative research and by collaborating with domestic and overseas industries, research institutes and other universities, and 3)

contributing to the re-learning and skill improvement of working adults by providing various learning opportunities based on a good record in admitting working adults from Hokkaido and elsewhere in the doctoral program.

Based on these achievements, educational strategies have been plotted to develop industry-ready practical engineers in the short term, and in the long term to cultivate future-oriented innovation leaders (IL) and frontier leaders (FL) who can be active globally.

The development of practical engineers (professional engineer development) means to develop engineers who can provide solutions to the social problems using big data science approach and realization of cybersecurity for the devices and software of the current network.

The cultivation of innovation leaders means to cultivate individuals who can solve such problems through practical experience that leads to create new knowledge, while the cultivation of frontier leaders means to cultivate individuals who study technologies that can respond to ill-defined problem such as unknown cyberattacks and other problems happened in the new network society.

Regarding cybersecurity education, education programs are developed based on the global interuniversity network. At the undergraduate level, with the aim of developing industry-ready practical engineers, short-term education programs are provided utilizing short-term seminars and e-learning suitable for the re-learning of working adults. At the graduate level, in the master's program, students may acquire basic credits from other schools, such as engineering, medicine, science and humanities, and receive project management (PM) lectures that include problem-based learning (PBL). Although focus is placed on practical science, innovation leaders are also developed so that cyber informatics experts can play active roles in various sectors. In the doctoral program, research supporting new fields is promoted centered on a multi-field curriculum in cybersecurity, big data science and information network engineering, to develop frontier leaders suitable for international research activities.

2.2 Progress and future development

a. Education implementation structure (organization)

As stated in the redefinition of the mission in the engineering field of the University, the Graduate School of Information Science and Technology has actively involved in interdisciplinary research and has world-leading track records in big data science, such as the world's fastest data processing record. Moreover, the school has world-class records in information and communication networks that support IoT, such as the research and development of optical fibers that realize the world's largest communication capacity.

Concerning information science education in the University, the Department of Electronics and Information Engineering (180 students) at the School of Engineering has five courses: the Course of Computer Science and Information Technology (50 students), the Course of Electrical and Electronic Engineering (40 students), the Course of Bioengineering and Bioinformatics (33 students), the Course of Media and Network Technologies

(30 students), and the Course of Systems, Control and Electrical Engineering (27 students). In the Graduate School of Information Science and Technology (quota: master's: 177, doctoral: 42), there were the following specialties corresponding to the above five courses when the GSB was established: Computer Science and Information Technology (quota: master's: 48 + doctoral: 12), Electronics for Informatics (quota: master's: 39 + doctoral: 8), Bioengineering and Bioinformatics (quota: master's: 33 + doctoral: 6), Media and Network Technologies (quota: master's: 30 + doctoral: 8) and Systems Science and Informatics (quota: master's: 27 + doctoral: 8). At that time, more students than the quota were often admitted, and students who completed their graduate studies have been employed by more than 200 research institutes and companies in Japan and elsewhere (employment rate: 97% (master's), 91% (doctoral), or more).

In addition, the Information Initiative Center and Hokkaido University Hospital have the most successful track records in the practical use of academic and medical big data in Japan, and have conducted cybersecurity demonstration experiments using the largest academic cloud system in Japan. This project promotes the research, development and practical use of medical big data systems for the creation of clinical bioinformatics aiming to individualize medical care through international and interdepartmental collaboration.

In order to develop various human resources involved in big data science, cybersecurity and IoT, the previous Graduate School of Information Science and Technology has been reorganized into the Faculty of Information Science and Technology, which is a research organization to which faculty members of the previous Graduate School of Information Science belong, and the new Graduate School of Information Science and Technology, which consists of faculty members of other departments, including researchers with cross-appointments.

Thus, a new global station, GSB has been established in the GI-CoRE, an organization under direct control of the President, by merging world-leading education and the research units of overseas universities with the University's researcher group and domestic collaborative institutions.

The Graduate School of Information Science and Technology aims to develop IT professionals in big data science and cybersecurity based on the research results generated by conducting advanced international collaborative research at the GSB, and to function as an international educational organization in the information science-related field, which already has high social needs. Therefore, the Graduate School of Information Science and Technology achieves an interdisciplinary education system not only with members of the Faculty of Information Science and Technology and researchers with cross-appointments but also with personnel support from other departments in the University (the Information Initiative Center and the Faculty of Science) and collaboration and cooperation in curriculum development from the humanities fields, including the Graduate School of Law. Specifically, a graduate school preparatory committee was launched in FY 2017 to begin studies. In 2018, an application for establishing the school was made to the Evaluation Committee for the Chartering of Universities and it was approved. In 2019, the previous graduate school was reorganized into the Faculty of Information Science and Technology and the Graduate School of Information Science and Technology. Coupled with that, a new graduate school was established (quota: master's: 179, doctoral: 43), where a program to develop frontier leaders and innovation leaders has been conducted.

At the new Graduate School of Information Science and Technology, researchers with cross-appointments teach seven international collaborative informatics subjects related to big data science, security technology and IoT technology in English, allowing students to earn credits and develop an international perspective by taking such subjects in English.

The existing Meme Media Laboratory, a Hokkaido University Collaborative Project Center, has world-leading track records in research and development in big data science, and is sharing human resources, hardware and software equipment in this project, which is aimed at interdisciplinary research on big data science and cybersecurity.

b. Education implementation structure (system)

The following is an outline of the newly established Division of Information Science and Technology. The previous Graduate School of Information Science and Technology, which was comprised of five divisions, was reorganized into the new graduate school with one division. In the division, students can acquire broad basic knowledge in relevant fields through expanded common subjects. By preparing international collaborative informatics subjects, the graduate school provides global interdisciplinary collaborative education based on highly specialized knowledge in each field and allows students to acquire practical knowledge corresponding to the needs of society and practical skills as global leaders.

Five courses have been established in the division to cultivate excellent researchers who lead global development using advanced expertise in five information science research fields. This allows the graduate school to provide cutting-edge specialized education in these individual research fields and allows students to acquire world-leading research skills.

Each course provides specialized subjects, and students who belong to the course take the subjects as their major. At the same time, they take subjects of other courses as their minor. Therefore, in the master's program, a multi-field curriculum is employed, where students learn major and minor course subjects. In addition, students in the doctoral program take a third specialized subject in addition to the subjects they have studied in the master's program. However, for a student who wants to engage in international collaborative education, practical education, and integrated education in the humanities and sciences, as well as boundary research, their supervisor will consider the relevance to the student's research theme and discuss with co-supervisors so that the student can study subjects flexibly. In order to realize such a variety of study patterns, international collaborative informatics subjects, practical subjects, and integrated subjects in the humanities and sciences are offered as common subjects.

The Division of Information Science and Technology provides careful and effective research guidance. Students of each course can receive guidance from faculty members who belong to the Faculty of Information Science and Technology, the Faculty of Science and various centers. At the same time, faculty members from different departments, the GSB, centers, and research institutes teach students as co-supervisors. For example, regarding the research "Big Data Analysis of Human-Animal- Ecosystems Using Sustainable IoT Network

Technology for Community Management” as a master's thesis, a supervisor from the media network field teaches the student with GSB members as co-supervisors.

In the master's program, research guidance is provided through collaboration between the supervisor and one or more co-supervisors, and in the doctoral program, a research guidance committee comprised of the supervisor and multiple co-supervisors is formed to provide guidance. Such research guidance is appropriately and flexibly implemented not only by members of the Faculty of Information Science and Technology but also by other researchers according to the research theme of students.

c. Admission of students

The Graduate School of Information Science and Technology admits students who have a strong will to obtain a master's degree or a doctorate in the field of information science, and who aim to study the information science field in a broad sense, including electrical engineering, electronic engineering, system engineering, mathematical science, biological engineering, life science and social science.

The basic concept of admitting new students in the master's and doctoral programs of the new graduate school is as follows:

Master's program: The school admits graduates from universities in Japan and elsewhere (including prospective graduates) who aim to conduct research and development in the information science field in a broad sense as their own career. Specifically, they should be students in Japan and elsewhere who wish to major in the field of information science and obtain a master's degree. By introducing various entrance examination systems, the school actively admits interdisciplinary students who transcend the majors of technical colleges and specialized fields at universities and international students. For the entrance examination of the master's program, a specialized examination is conducted in English or Japanese. The specialized examination consists of a written test (paper) and an oral test to gauge the proficiency level in the basics required for each course in the specialized fields.

Doctoral program: The school admits those who have completed a master's program and want to work on advanced research to acquire a doctorate degree, or working adults who aim to further improve their research ability to acquire a doctorate degree. Specifically, they should be those who have completed a master's program in Japan and elsewhere who wish to obtain a doctoral degree in the information science field or working adults who aim to obtain a doctoral degree. The school actively admits international students and adult students from various fields by introducing various entrance examination systems. For the entrance examination of the doctoral program, a specialized examination is conducted in English or Japanese. The specialized examination consists of a written test (paper) and an oral test to determine whether the applicant's basic skills in the specialized field are sufficient to receive research guidance in each course.

d. Educational content and methods

The Graduate School of Information Science and Technology provides interdisciplinary collaborative education in the fields of information science, social science, mathematics, electrical science, electronics,

communications, system science, biology, life science, and medical science to train leaders contributing to the development of the international community. Its main features are as follows:

- ◆ International collaborative informatics subjects: Realization of new educational programs comprised of course subjects in interdisciplinary fields on the back of advanced international collaborative research and education with multiple overseas universities
- ◆ International collaborative guidance programs: Realization of educational programs in which students can enroll, take courses and obtain a degree in English through international collaboration
- ◆ Re-learning by working adults: Enhancement of educational programs based on proven admission systems and curricula (including e-learning) for working adults
- ◆ Ingenuity in a common curriculum: Realization of a common curriculum that allows students to acquire global perspectives, practical skills and interdisciplinary knowledge by creating international collaborative informatics subjects aimed at interdisciplinary collaborative education in cooperation with faculty members from overseas universities, practical subjects aimed at skills to implement projects, and integrated subjects in the humanities and sciences aimed at the acquisition of extensive knowledge of information-related laws and ethics. This is in addition to specialized subjects aimed at the acquisition of specialized knowledge and skills related to information science
- ◆ Adaptive research guidance system: Realization of a supervisor and co-supervisor system using faculty members of multiple departments by establishing an education system through faculty member collaboration centered on the Faculty of Information Science and Technology to respond to the needs of the times and the wishes of students

The graduate school offers students an option for flexibly taking various subjects. This makes it possible to provide the latest education in advanced research fields.

The graduate school provides a curriculum that can be completed in English through international collaborative informatics subjects with overseas partner universities and English subjects offered by each course. Through these English lectures and international collaborative guidance programs with faculty members of overseas universities, the school aims to develop students with global perspectives.

E-learning (remote education system) is utilized to improve the re-learning of working adults and support international collaborative informatics subjects. In addition to collaborative educational programs with other graduate schools, research institutes and centers within the University, as well as overseas partner universities, the graduate school also introduces unique educational programs such as joint educational programs and internships with governmental research institutions and affiliated companies.

To contribute to the development of an advanced information society and promote a global knowledge-based society under the four basic philosophies of the University (Frontier Spirit, Global Perspectives, All-round Education and Practical Learning), through the succession and creation of information science theory the Graduate School of Information Science and Technology cultivates engineers with extensive, profound

academic knowledge and global perspectives and creative researchers who can independently conduct research and development. With information science as the core, the graduate school creates new research areas from the fusion of various fields and develop individuals who can work globally.

The master's program cultivates innovation leaders (IL) who have advanced knowledge in the basic and specialized fields of information science and excellent research and development capabilities based on practical experience and the creation of new knowledge, and who can play an active role in the international community. The doctoral program cultivates frontier leaders (FL) who can create new research areas from the fusion of various fields, acquire world-class research and development capabilities in specialized fields, and advance research and development in a sophisticated knowledge-based society on the back of international collaboration.

To cultivate the above professionals, the graduate school's students acquire the following knowledge and capabilities:

- ◆ Extensive basic knowledge in various relevant fields centered on information science
- ◆ Practical knowledge that meets the needs of the global community
- ◆ A high level of expertise to study information science and its boundary areas
- ◆ World-class research capabilities based on advanced expertise

The basic concept for the formation and implementation of curriculums in the master's and doctoral programs of the new graduate school to cultivate the above-mentioned innovation and frontier leaders is as follows:

Master's program: A multi-field curriculum is implemented in which students take subjects provided in their specialized course and other courses. Students can also take common subjects (international collaborative informatics subjects, practical subjects and integrated subjects in the humanities and sciences), thereby acquiring extensive basic knowledge, a high level of expertise, global perspectives and an ability to take action, as well as gaining knowledge in border areas and different fields. The quality of education is assured through careful and substantial support for students, including career development, under the supervisor and co-supervisor system. The grade evaluation criteria are disclosed.

Doctoral program: The multi-field curriculum in the master's program is expanded to require students to take subjects in other fields than those they have learned in the master's program. Global perspectives are developed through international collaborative guidance programs. The quality of education is assured through careful and substantial support for students, including career development, under the collaborative education guidance committee system run by a supervisor and multiple co-supervisors. With this, students obtain the highest level of expertise in the world. The grade evaluation criteria are disclosed.

The new graduate school consists of five courses, each of which offers specialized subjects. The core specialized subjects of individual courses correspond to the following specialized areas:

1. Course of Computer Science and Information Technology: A specialized area related to computer science

and information systems, including information and mathematics subjects taught by members involved in mathematics at the Faculty of Science, and big data science subjects by GSB faculty members

2. Course of Electronics for Informatics: A specialized area related to information processing system hardware and next-generation electronics
3. Course of Bioengineering and Bioinformatics: A specialized area related to science and technology connected to life, humans and medicine
4. Course of Media and Network Technologies: A specialized area related to information media and information communication networks dealing with images, videos, audio, music and natural language, including subjects related to complex systems and networks by GSB faculty
5. Course of Systems Science and Informatics: A specialized area related to electrical science, electronics, management, information science, mechanical and system science

In the doctoral program, a doctoral degree in information science or a doctoral degree in engineering is awarded depending on the research content. A doctoral degree in information science is awarded for research themes in the field of information science, such as “Scenario Verification for the Proximity-Based Federation of Smart Objects Using Model Checking” and “Study on Optical Information Processing by Virtual Phase Conjugation Technique using Complex Amplitude Control,” while a doctoral degree in engineering is awarded for research themes in the field of engineering, such as “Study on Mode Control of Random Lasers” and “Study on the Application of Model Order Reduction to Electromagnetic Field Analysis” (these research themes are from titles of dissertations in FY 2017).

e. Outcomes of education

To implement the international education system at the new Graduate School of Information Science and Technology ahead of schedule, the GSB has hired students, mainly doctoral students of the previous Graduate School of Information Science and Technology, as research assistants, and provided opportunities to make presentations at international symposiums attended by researchers with cross-appointments and other internationally renowned researchers.

Table 1 shows the numbers of research assistants hired by the GSB for every half year. In hiring research assistants, the GSB introduced a system in which students are evaluated based on their research activities, including article publication and prize-winning, and their contribution to GSB activities, and in which the evaluation is reflected to their hourly wage to improve research assistants’ motivation for research.

Table 1: Numbers of research assistants hired

The figure in parentheses shows the number of well-evaluated research assistants.

	2016	2017	2018	2019
First half	-	21 (8)	28 (13)	22 (11)
Latter half	14 (5)	22 (9)	23 (9)	17 (9)

In addition, the GSB provided research assistants with opportunities to present their research to overseas researchers, including researchers from different fields, at international symposiums. Table 2 shows the numbers of research assistants who participated in international symposiums.

Table 2: Numbers of presentations by research assistants at international symposiums

The figure in parentheses shows the number of students other than research assistants (included number).

	2017	2018	2019
Summer	13 (3)	16	17
Winter	-	11	13 (4)

Three doctoral students of these research assistants were dispatched to UMass Amherst. Some of these students presented a refereed paper co-authored with faculty members at the host university at an international conference.

A total of 52 students served as research assistants, of whom 24 students have already graduated with a degree.

3. Establishment of Framework

3.1 Operating and administrative structure

Hokkaido University established the Global Institution for Collaborative Research and Education (GI-CoRE) as a faculty organization under the direct control of the President that brings together world-class teaching staff from around the world and within the University. It aims to promote international collaborative research and education that leverages the University's strengths and distinctive features, and to provide support for international collaborative research and education being furthered independently by faculties or schools.

GI-CoRE was launched with three stations which are Global Stations for Quantum Medical Science and Engineering (GSQ) and Zoonosis Control (GSZ) in 2014, Food, Land and Water Resources (GSF) in 2015. In April 2016, three new stations which are Big Data and Cybersecurity (GSB), Soft Matter (GSS), and Arctic Research (GSA) were established. At present, since GSQ, GSZ, GSF closed their project successfully and the new Global Station for Biosurfaces and Drug Discovery (GSD) was established in March 2020, there are four global stations in GI-CoRE. GI-CoRE introduces new personnel and salary systems for its member researchers, and it is positioned as a new education and research organization. President, who also serves as Director of GI-CoRE, will chair a steering committee and sets specific arrangements and packages for GI-CoRE members.

Under the GI-CoRE concept, the GSB was established to collaborate with the College of Information and Computer Sciences (CICS) of UMass Amherst, a research group involved in big data science and data security initially. At the same time, research on the realization of a medical big data system, relevant clinical bioinformatics, and medical informatics started in collaboration with Hokkaido University Hospital. Against the backdrop of these collaborative studies, the GSB has established a structure for conducting intensive lectures, including the development of collaborative educational programs with UMass CICS. Based on these activities,

Under its Director, the GSB promotes research and education through organization-to-organization cooperation with overseas universities, rather than conventional international exchange centered on the activities of individual researchers.

In FY 2017, in order to further promote globalization, the GSB started collaboration with the University of Technology, Sydney (UTS, Australia), which is a world-leading university in IoT technology, and built an international collaborative research group on IoT and cybersecurity. In addition to hosting international symposiums each year, the GSB co-sponsors international conferences with other global stations or IEEE and other international academic societies, and introduces its activities related to international collaborative research and education and improves its presence in various arenas, such as introducing GSB at domestic and overseas events, and offering public lectures for the general public. The GSB also constructs new educational programs centered on overseas researchers with cross-appointments and cooperates with the Summer Institute Program, building a track record suitable for a research and education hub. In order to carry out these various projects promptly and efficiently, the GSB holds a regular project promotion meeting (meeting by the director, vice director and all members of the GSB secretariat, about once a month) and a steering committee meeting (meeting by all GSB faculty members in the University, about once every six months), as well as regular video conferences with overseas faculty members to discuss all important matters related to GSB operations. In this way, activities are smoothly promoted under the faculty-led operating structure.

To establish the Faculty of Information Science and Technology and the new Graduate School of Information Science and Technology, which started in FY 2019, a graduate school preparatory committee that includes core GSB members in Hokkaido University was set up in the previous Graduate School of Information Science and Technology in FY 2018. An application for establishment was made to the Evaluation Committee for the Chartering of Universities in March 2018 and approved in July 2018. With the reorganization into the Faculty of Information Sciences and Technology and the new Graduate School of Information Science and Technology in FY 2019, a system with one division and multiple courses was established and a new human resource development program was created at the new graduate school. Many of the HU members at the GSB belonged to the previous Graduate School of Information Science. The new graduate school introduced international collaborative informatics subjects and co-supervision by overseas faculty members with cross-appointments based on the achievements of GSB's international collaborative research. Through these activities, a discussion of the introduction of a cotutelle program has been started.

In FY 2020, the GSB aims to further revitalize international collaborative research, activate the overseas dispatch of students who belong to the Graduate School of Information Science and Technology, and obtain competitive research funds for research themes conducted by international collaborative research groups, thereby expanding this project.

3.2 Hosting structure, environment improvement and future vision

Education and research support structures:

Utilizing the framework of GI-CoRE led by the President, the GSB invites researchers from overseas top-class universities and research institutes and works with faculty members in relevant fields in the University to promote international collaborative research and education.

The GSB utilizes the cross-appointment system for overseas and HU faculty members as follows:

1. Overseas faculty members

The cross-appointment system with other institutes allows the University to hire researchers from research institutes in Japan and elsewhere and to pay salaries according to their efforts while they remain employees of their home institute. Such researchers are also exempt from administrative operations such as faculty meetings and entrance examinations to secure an environment where they can concentrate on research education. This has led to the invitation of top-class researchers from overseas, who could not normally be invited. It has also led to the strategic acquisition of competitive research funds, such as KAKENHI, by young overseas researchers with cross-appointments through collaboration with GSB members in the University.

2. HU faculty members

The system for appointment to GI-CoRE has also been used for researchers in the University, which promotes international collaborative research and education. This has helped to create opportunities for young researchers with cross-appointments to participate in international collaborative research centered on the themes handled by the GSB. As a result, such researchers have submitted and published many international journal articles and international conference papers.

In addition to institutional aspects, the GSB provides young researchers with an appropriate research environment and educational experience. The departments involved in this project have diversified, which has led the advancement of interdisciplinary collaboration with the Department of Mathematics at the Faculty of Science. These virtuous circles have since spread to relevant departments, and the functions of the University have been further strengthened.

The vision of the GSB for the future is to further deepen, expand and practically operate the following two points that have been pursued since the establishment.

1. Establishment of an international collaborative research hub in the field of information science related to big data science, cybersecurity and IoT system construction, and the launch of international-level research through collaboration between universities worldwide
2. Development of international higher education in relevant fields based on the above developments

The research areas of big data science, cybersecurity and IoT are not independent themes. They are closely integrated with each other to advance research and development. Anticipated basic problems and applied research have become more complicated. Accordingly, it is necessary to substantiate global organizational

collaboration and promote it efficiently. The total number of research and development workers in these areas is very small. There is a need for education programs that systematically provide new knowledge, and it is essential to enhance international higher education programs. The future vision is to deepen, expand and substantiate research and education in these areas.

Furthermore, while maximizing the collaborative research/education networks between the organizations and the research results obtained so far, the GSB will further strengthen the research and education in which the University excels, and practice "global graduate education that organically integrates different fields" in relevant graduate schools. With regard to activity funds, in addition to subsidies for operational expenses from the national government, the GSB aims to obtain various types of funds, such as KAKENHI and other competitive funds, as well as donations.

Global Station's administrative structure:

In order to support the research and education activities at the GSB, it is necessary to strengthen the capability of the administrative section to deal with international affairs. The Global Station Office has bilingual staff members to support international researchers' daily research and education activities. Furthermore, the central administrative section of GI-CoRE also has staff with experience in overseas study to provide support in English for office procedures.

For many researchers with cross-appointments, it is very difficult to individually carry out various tasks involved in their stay at Hokkaido University. Accordingly, such administrative support helps to make relatively smooth invitations. In the future, remote guidance is expected to increase, but such support is indispensable when actually inviting overseas researchers.

Appendix: Research Achievements and List of Publications

2. Other Publications

2-2. Other Publications: Featured in International Conference Proceedings: #258

2021-2020

- 1) Kentaro Kanamori, Takuya Takagi, Ken Kobayashi, Hiroki Arimura, “DACE: Distribution-Aware Counterfactual Explanation by Mixed-Integer Linear Optimization”, Proc. the 29th International Joint Conference on Artificial Intelligence and the 17th Pacific Rim International Conference on Artificial Intelligence (IJCAI-PRICAI 2020), January 2021. [Proc] †
- 2) J. Takano, T. Fujisawa, Y. Sawada, and K. Saitoh, “Low-loss silicon $2\times 4\lambda$ multiplexers composed of on-chip polarization-splitter-rotator and 2×2 and 2×1 Mach-Zehnder filters for 400GbE”, Optical Fiber Communication Conference (OFC), Paper M3F.4, San Diego, USA, Mar. 8-12, 2020. [Proc] †
- 3) T. Fujisawa, T. Sakamoto, M. Miyata, T. Matsui, T. Hashimoto, R. Kasahara, K. Nakajima, and K. Saitoh, “Wavefront-matching-method-designed six-mode-exchanger based on grating-like waveguide on silica-PLC platform”, Optical Fiber Communication Conference (OFC), Paper Th1A.5, San Diego, USA, Mar. 8-12, 2020. [Proc] †
- 4) K. Nakamura, T. Fujisawa, T. Sakamoto, T. Matsui, K. Nakajima, and K. Saitoh, “A tunable mode divider based on wavelength insensitive coupler using thermo-optic effect for gain-equalization in MDM network”, Optical Fiber Communication Conference (OFC), Paper Th2A.6, San Diego, USA, Mar. 8-12, 2020. [Proc] †
- 5) Y. Sawada, T. Fujisawa, and K. Saitoh, “Experimental Demonstration of Broadband Silicon Mode Converter Designed by Wavefront-Matching Method”, Conference on Lasers and Electro-Optics (CLEO), Paper SM4J.6, San Jose, USA, May 10-15, 2020. [Proc] †
- 6) Y. Sawada, T. Fujisawa, and K. Saitoh, “Broadband Design of Silicon Photonics Four-Mode (de)Multiplexer by Wavefront Matching Method”, Advanced Photonics Congress (APC), Paper ITh3A.6, Virtual Conference, July 13-16, 2020. [Proc] †
- 7) K. Saitoh, T. Fujisawa, and T. Sato, “Control of Group Delay Spread in Randomly-Coupled Multicore Fibers”, Optoelectronics and Communications Conference (OECC), Paper T3-1, Taipei, Taiwan, Oct 4-8, 2020. [Proc] †
- 8) Y. Wang, T. Fujisawa, T. Sakamoto, T. Matsui, K. Nakajima, and K. Saitoh, “Step index 8-core fiber with 125- μ m cladding diameter for O-band use”, Optoelectronics and Communications Conference (OECC), Paper T3-2.4, Taipei, Taiwan, Oct. 4-8, 2020. [Proc] †
- 9) T. Fujisawa and K. Saitoh, “Ultrasmall two-mode dividers based on mosaic structure designed by direct-binary-search algorithm aided by artificial neural network”, Optoelectronics and Communications Conference (OECC), Paper T5-1.3, Taipei, Taiwan, Oct. 4-8, 2020. [Proc] †

- 10) N. Sugawara, T. Fujisawa, K. Nakamura, Y. Sawada, T. Sakamoto, T. Matsui, K. Nakajima, and K. Saitoh, "Mode Amplitude and Phase Estimation using Multimode NFP by ANN", Optoelectronics and Communications Conference (OECC), Paper T5-2.5, Taipei, Taiwan, Oct. 4-8, 2020. [Proc] †
- 11) K. Saitoh, "Few-mode Multi-core Fibres: Weakly-coupling and Randomly-coupling", European Conference on Optical Communications (ECOC), Paper Tu4A-1, Virtual Conference, Dec. 6-10, 2020. [Proc] †
- 12) N. Sugawara, T. Fujisawa, N. Nakamura, Y. Sawada, T. Sakamoto, T. Matsui, K. Nakajima, and K. Saitoh, "Modal Amplitude and Phase Estimation of NFP of Six-Mode FMF Based on Artificial Neural Network with the Help of Grey-Wolf-Optimizer", European Conference on Optical Communication (ECOC), Paper Tu2A-6, Virtual Conference, Dec. 6-10, 2020. [Proc] †
- 13) Rintaro Yanagi, Ren Togo, Takahiro Ogawa, Miki Haseyama: "Multimedia information retrieval for mixed interaction based on cross-modal retrieval and hand gesture browsing", IEEE International Symposium on Mixed and Augmented Reality (ISMAR 2020) (2020) [Proc] †
- 14) Takuya Inoue, Toshikazu Teshigawara, Yusuke Yamauchi, Sakae Taniguchi, Takahisa Ono, Hiroshi Hamada, Hiroyuki Miyoshi, Fumito Minoura Tomoki Kitashima, Masahito Hashimoto, Masashi Iwaki, Yuka Saito, Keisuke Maeda, Takahiro Ogawa, Miki Haseyama: "Study on Automatic Diagnosis Algorithm for Transmission Equipment Using AI Technology", CIGRE - AORC Technical Meeting, pp.1-7 (2020) [Proc] †
- 15) Guang Li, Ren Togo, Takahiro Ogawa, Miki Haseyama: "Soft-label anonymous gastric X-ray image distillation", 2020 IEEE International Conference on Image Processing (ICIP 2020), pp.305-309 (2020) [Proc] †
- 16) Ren Togo, Takahiro Ogawa, Miki Haseyama: "Multimodal image-to-image translation for generation of gastritis images", IEEE International Conference on Image Processing (ICIP 2020), pp.2466-2470 (2020) [Proc] †
- 17) Rintaro Yanagi, Ren Togo, Takahiro Ogawa, Miki Haseyama: "Image retrieval with lingual and visual paraphrasing via generative models", IEEE International Conference on Image Processing (ICIP 2020), pp.2431-2435 (2020) [Proc] †
- 18) Kaito Hirasawa, Keisuke Maeda, Takahiro Ogawa, Miki Haseyama: "Important scene detection of baseball videos via time-lag aware deep multiset canonical correlation maximization", 2020 IEEE International Conference on Image Processing (ICIP 2020), pp.1236-1240 (2020) [Proc] †
- 19) Saya Takada, Ren Togo, Takahiro Ogawa, Miki Haseyama: "Estimation of visual contents based on question answering from human brain activity", 2020 IEEE International Conference on Image Processing (ICIP 2020), pp.61-65 (2020) [Proc] †
- 20) Keisuke Maeda, Sho Takahashi, Takahiro Ogawa, Miki Haseyama: "Feature integration via geometrical supervised multi-view multi-label canonical correlation for incomplete label assignment", 2020 IEEE International Conference on Image Processing (ICIP 2020), pp.46-50 (2020) [Proc] †
- 21) Saya Takada, Ren Togo, Takahiro Ogawa, Miki Haseyama: "Generation of viewed image captions from human brain activity via unsupervised text latent space", 2020 IEEE International Conference on Image Processing

- (ICIP 2020), pp.2521-2525 (2020) [Proc] †
- 22) Zongyao Li, Ren Togo, Takahiro Ogawa, Miki Haseyama: "Variational autoencoder based unsupervised domain adaptation for semantic segmentation", 2020 IEEE International Conference on Image Processing (ICIP 2020), pp.2426-2430 (2020) [Proc] †
 - 23) Yun Liang, Keisuke Maeda, Takahiro Ogawa, Miki Haseyama: "Estimation of images matched with audio-induced brain activity via modified DGCCA", 2020 IEEE 9th Global Conference on Consumer Electronics (GCCE 2020) (2020) [Proc] †
 - 24) Keigo Sakurai, Ren Togo, Takahiro Ogawa, Miki Haseyama: "Music playlist generation based on reinforcement learning using acoustic feature map", 2020 IEEE 9th Global Conference on Consumer Electronics (GCCE 2020), pp.556-557 (2020) [Proc] †
 - 25) Kyohei Kamikawa, Keisuke Maeda, Takahiro Ogawa, Miki Haseyama: "Interest level estimation based on feature integration considering distribution of partially paired user's behavior, videos and posters", 2020 IEEE 9th Global Conference on Consumer Electronics (GCCE 2020), pp.558-559 (2020) [Proc] †
 - 26) Yuya Moroto, Keisuke Maeda, Takahiro Ogawa, Miki Haseyama: "Estimation of user-specific visual attention considering individual tendency toward gazed objects", 2020 IEEE 9th Global Conference on Consumer Electronics (GCCE 2020), pp.554-555 (2020) [Proc] †
 - 27) Guang Li, Ren Togo, Takahiro Ogawa, Miki Haseyama: "Complexity evaluation of medical image data for classification problem based on spectral clustering", 2020 IEEE 9th Global Conference on Consumer Electronics (GCCE 2020), pp.667-669 (2020) [Proc] †
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- 234) Masaharu Yoshioka, “Analysis of COLIEE Information Retrieval Task Data”, The Proceedings of the 11th International Workshop on Juris-Informatics (JURISIN2017), pp. 156-167, The Japanese Society of Artificial Intelligence, 2017 [International Conference]
- 235) Shan Gao, Masakazu Ishihata, Shin-ichi Minato, “Fast Message Passing Algorithm Using ZDD-Based Local Structure Compilation”, Proceedings of Machine Learning Research vol 73, pp. 117-128, 2017 [OV][Proc]
- 236) Reona Minoda, Shin-ichi Minato, “Efficient Scenario Verification of Proximity-based Federations among Smart Objects through Symbolic Model Checking”, Proceedings of the 7th International Joint Conference on Pervasive and Embedded Computing and Communication Systems (PECCS 2017), pages 13-

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- 237) Reona Minoda, Masakazu Ishihata, Shin-ichi Minato, “Probabilistic CCRN: Reliability Analysis of Ubiquitous Computing Scenarios Using Probabilistic Model Checking”, The Eleventh International Conference on Mobile Ubiquitous Computing, Systems, Services and Technologies, pp. 85-91 [OV][Proc]
- 238) Teruji Sugaya, Masaaki Nishino, Norihito Yasuda, Shin-ichi Minato, “Fast Compilation of s-t Paths on a Graph for Counting and Enumeration”, Proc. of the Third Workshop on Advanced Methodologies for Bayesian Networks (AMBN 2017), pp. 129-140. Sep. 2017. [OV][Proc]
- 239) Masaaki Nishino, Norihito Yasuda, Shin-ichi Minato and Masaaki Nagata: “Dancing with Decision Diagrams: A Combined Approach to Exact Cover,” In Proc. of the 31st AAAI Conference on Artificial Intelligence (AAAI2017), Feb. 2017. [OV][Proc]
- 240) Fumito Takeuchi, Masaaki Nishino, Norihito Yasuda, Takuya Akiba, Shin-Ichi Minato and Masaaki Nagata: “BDD-Constrained A* Search: A Fast Method for Solving Constrained DAG Shortest-Path Problems,” In Proc. of AAAI-17 Workshop on Symbolic Inference and Optimization (SymInfOpt-2017), Feb. 2017. [OV][Proc]
- 241) Jun Kawahara, Takashi Horiyama, Keisuke Hotta, and Shin-ichi Minato: “Generating All Patterns of Graph Partitions within a Disparity Bound,” In Proc. of the 11th International Workshop of Algorithms and Computation (WALCOM2017), Mar. 2017. [OV][Proc]

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- 242) Takuya Takagi, Shunsuke Inenaga, Kunihiko Sadakane, Hiroki Arimura, “Packed Compact Tries: A Fast and Efficient Data Structure for Online String Processing”, Proc. 27th International Workshop on Combinatorial Algorithm (IWOCA 2016), LNCS, Vol.9843, 213-225, Springer, 2016. (DOI: 10.1007/978-3-319-44543-4_17) (Helsinki, Finland, August 17-19, 2016) (Also available as: CoRR abs/1602.00422, arXiv, 2016) [OV] [Proc]
- 243) Kazuhiro Kurita, Kunihiro Wasa, Takeaki Uno, Hiroki Arimura, “Efficient Enumeration of Induced Matchings in Graphs without Short Cycles”, Japan Conference on Discrete and Computational Geometry, Graphs, and Games 2016 (JCDCG³ 2016), Tokyo, Japan, September 2016. [JP, International Conference] [Proc]
- 244) Mayumbo Nyirenda, Hiroki Arimura, Kimihito Ito, “Relaxing the data access bottleneck of geographic big-data analytics applications using distributed quad trees”, Proc. 5th International Conference on Multimedia Computing and Systems (ICMCS'16), ID-111, IEEE, 2016. (Palm Plaza Hotel, Marrakech, Morocco, 29 September - 1 October 2016) [OV] [Proc]
- 245) Kunihiro Wasa, Katsuhisa Yamanaka, Hiroki Arimura, “The Complexity of Induced Tree Reconfiguration Problems”, Proc. 10th International Conference on Language and Automata Theory and Applications (LATA 2016), Lecture Notes in Computer Science, Vol.9618, Springer, 330-342, 2016. DOI: 10.1007/978-3-319-30000-9_26, (Prague, Czech Republic, March 14-18, 2016) [OV] [Proc]
- 246) Ryosuke Harakawa, Takahiro Ogawa, Miki Haseyama: “Tracking Hierarchical Structure of Web Video Groups Based on Salient Keyword Matching Including Semantic Broadness Estimation”, IEEE Global Conference on Signal and Information Processing (GlobalSIP 2016), pp.1238-1242 (2016)

- 247) Keisuke Maeda, Sho Takahashi, Takahiro Ogawa and Miki Haseyama: “Distress Classification of Road Structures via Decision Level Fusion”, 2016 IEEE International Conference on Digital Signal Processing (DSP), pp.589-593 (2016)
- 248) Sho Takahashi, Takahiro Ogawa, Miki Haseyama: “Retrieval Method of Similar Inspection Records based on Distance Metric Learning in Expressway Maintenance”, International Conference on Sustainable Infrastructure (2016)
- 249) Yuma Sasaka, Takahiro Ogawa, Miki Haseyama: “Multimodal Interest Level Estimation via Variational Bayesian Mixture of Robust CCA”, 2016 ACM on Multimedia Conference, pp.387-391 (2016)
- 250) Yoshiki Ito, Takahiro Ogawa, Miki Haseyama: “Novel Video Feature-based Favorite Video Estimation Using Users' Viewing Behavior and Evaluation”, 2016 IEEE 5th Global Conference on Consumer Electronics (GCCE), pp.224-225 (2016)
- 251) Naoki Saito, Takahiro Ogawa, Satoshi Asamizu, Miki Haseyama: “A Tourism Category Classification Method Based on Estimation of Reliable Decision”, 2016 IEEE 5th Global Conference on Consumer Electronics (GCCE2016), pp.52-53 (2016)
- 252) Kento Sugata, Takahiro Ogawa, Miki Haseyama: “Estimating Human Emotion Evoked by Visual Stimuli Using fMRI Data”, 2016 IEEE 5th Global Conference on Consumer Electronics (GCCE), pp.38-39 (2016)
- 253) Shota Hamano, Takahiro Ogawa, Miki Haseyama: “Different Language Association Using Mutual Information Between Tags and Visual Features”, 2016 IEEE 5th Global Conference on Consumer Electronics (GCCE), pp.46-47 (2016)
- 254) Susumu Genma, Takahiro Ogawa, Miki Haseyama: “Image Retrieval for Identification of Insects Based on Saliency Map and Distance Metric Learning”, 2016 IEEE 5th Global Conference on Consumer Electronics (GCCE), pp.50-51 (2016)
- 255) Ryota Saito, Sho Takahashi, Takahiro Ogawa, Miki Haseyama: “Retrieval of Similar Inspection Records Based on Metric Learning Using Experienced Inspectors' Evaluation”, 2016 IEEE 5th Global Conference on Consumer Electronics (GCCE), pp.48-49 (2016)
- 256) Genki Suzuki, Sho Takahashi, Takahiro Ogawa, Miki Haseyama: “Decision Level Fusion-based Team Tactics Estimation in Soccer Videos”, 2016 IEEE 5th Global Conference on Consumer Electronics (GCCE2016), pp.58-59 (2016)
- 257) Daichi Takehara, Ryosuke Harakawa, Takahiro Ogawa, and Miki Haseyama: “Hierarchical Content Group Detection From Different Social Media Platforms Using Web Link Structure”, 2016 IEEE International Conference on Image Processing (ICIP), pp.479-483 (2016)
- 258) Soh Yoshida, Takahiro Ogawa and Miki Haseyama: “Graph-based web video search reranking through consistency analysis using spectral clustering”, 2016 IEEE International Conference on Multimedia and Expo (ICME), pp.1-6 (2016)
- 259) Robert Wille, Nils Quetschlich, Yuma Inoue, Norihito Yasuda, and Shin-ichi Minato: “Using PiDDs for Nearest Neighbor Optimization of Quantum Circuits,” In Proc. of the 8th International Conference on Reversible Computation (RC 2016), (LNCS 9720, Springer), pp. 181-196, Jul. 2016. [OV][Proc]
- 260) Hirofumi Suzuki, Sun Hao, and Shin-ichi Minato: “Generating All Solutions of Minesweeper Problem

Using Degree Constrained Subgraph Model,” In Proc. of the 2016 International Conference on Parallel & Distributed Processing Techniques & Applications (PDPTA'16), a Workshop session of Mathematical Modeling and Problem Solving, pp. 356-362, Jul. 2016. [OV][Proc]

- 261) Reona Minoda, Yuzuru Tanaka, and Shin-ichi Minato: “Verifying Scenarios of Proximity-based Federations among Smart Objects through Model Checking,” In Proc. of the Tenth International Conference on Mobile Ubiquitous Computing, Systems, Services and Technologies (UBICOMM 2016), pp. 65-71, Oct. 2016. (Best paper awarded) [OV][Proc]

2-3. Other Publications: Featured in Domestic Journals (in Japanese): #32

2021-2020

- 1) Sato, T., Shimada, S., Murakami, H., Watanabe, H., Hashizume, H., Sugimoto, M.: Visible Light Positioning using Smartphone Ambient Light Sensor, IPJS Journal, Vol.62 (in Japanese, to appear in 2021). †
- 2) Shimada, S., Hashizume, H., Sugimoto, M.: Visible Light Positioning System for Smartphone using Floor-reflected LED Light, IEICE Transactions on Fundamentals of Electronics, Communications and Computer Sciences, Vol.J104-A, (in Japanese, to appear in 2021). *ii) †
- 3) Mitake, H., Watanabe, H., Sugimoto, M.: A Method for Recognizing Road Surface Condition based on Footsteps and Inertial Data, IPJS Journal, Vol.61, No.10, pp.1578-1590 (2020, in Japanese). †
- 4) Amesaka, T., Watanabe, H., Sugimoto, M.: Ear Canal Transfer Function-based Facial Expression Recognition, IPJS Journal, Vol.61, No.8, pp. 1333-1342 (2020, in Japanese). †
- 5) 前田圭介, 齊藤僚汰, 高橋翔, 小川貴弘, 長谷山美紀: "視線データと点検データの正準相関に基づく道路橋点検のための類似データ検索", 土木学会論文集 F3(土木情報学), vol.76, no.1, pp.74-86 (2020)[JP] †
- 6) 狩野芳伸, 吉岡真治, ラベロ ジュリアーノ, キム ミュン, ゴーベル ランディ, 佐藤健: COLIEE : 法律文書の情報抽出および含意関係認識を行う国際コンペティション. 人工知能学会誌, Vol. 35, No. 3, pp. 377-384, 2020. (解説論文)*i) †
- 7) 岡田友哉, 坂本大介, 小野哲雄 (2021). スキーポールによる携帯端末操作に向けた ユーザ定義型ジェスチャの設計と認識, 情報処理学会論文誌, Vol. 62, No. 2 (2021/2/15 発行予定) †
- 8) 秋葉 翔太, 崔 明根, 坂本 大介, 小野 哲雄, 選択ターゲット候補の半円状再配置によるスマートフォンでの片手選択操作手法の提案, 情報処理学会論文誌 Vol.62, No.2 (2021/2/15 発行予定) †
- 9) 崔明根, 坂本大介, 小野哲雄, Bubble Gaze Lens : バブルレンズ法の視線操作への適用, 方法処理学会論文誌 Vol.62, No.2, (2021/2/15 発行予定) †

2019

- 10) 宇野 耕平, 平野 新, 嶋田 祥太, 渡邊 拓貴, 橋爪 宏達, 杉本 雅則, “変調光照明を用いた違法写真撮影判定手法の提案とその評価”, 情報処理学会論文誌, Vol.61, No.3, 2020 (to appear). [JP]
- 11) 齊藤晋聖, “空間分割多重伝送用光ファイバによる光通信の大容量化”, 電子情報通信学会通信ソサイエティマガジン, no. 51, Winter, pp. 166-176, 2019. [JP]
- 12) 藤後 廉, 間部 克裕, 山道信毅, 大泉晴史, 小川 貴弘, 長谷山 美紀, 加藤 元嗣, 坂本 直哉: “胃バリ

ウム検査における AI による Helicobacter pylori 診断”, Helicobacter Research, vol.23, no.2, pp.133-137(2019) [JP]

- 13) 長谷山 美紀, 小川 貴弘, 高橋 翔, 原川 良介: “センサから得られる視聴行動データを活用したユーザの関心推定の高度化”画像ラボ, vol.30, no.7, pp.8-12(2019) [JP]
- 14) 長谷山 美紀: “AI って何だろう?”2020 高校入試 合格データ特集 道新受験情報, pp.19-22(2019) [JP]
- 15) 平田 健司, 藤後 廉, 小川 貴弘, 長谷山 美紀, 志賀 哲: “核医学におけるディープラーニングを用いた画像診断”画像処理 INNERVISION (2019) [JP]
- 16) 栗原 聡, 長谷山 美紀: “人と共生する AI 革命 活用事例から見る生活・産業・社会の未来展望”pp.21-29(2019) [JP]
- 17) 齊藤 僚汰, 高橋 翔, 小川 貴弘, 長谷山 美紀: “熟練技術者の判定に基づいた道路橋における類似点検データの検索”, 土木学会論文集 F3(土木情報学), vol.74, no.1, pp.67-77 (2018)[JP]
- 18) 山口歌奈子, 東中雅嗣, 佐野裕康, 岡村敦, 大鐘武雄, 西村寿彦, “包絡線変動量を抑圧する位相回転送信ダイバーシチを適用した狭帯域パイロットレス同期検波 FSK 方式”, 電子情報通信学会論文誌, 早期公開論文 (早期公開日:2019/10/28) . [JP]
- 19) 村上 弘晃, 中村 将成, 橋爪 宏達, 杉本 雅則, “鏡像スピーカを用いたスマートフォン高精度 3 次元測位手法”, 情報処理学会論文誌, Vol.60, No.12, pp.2314-2324, 2019. [JP]
- 20) 嶋田 祥太, 橋爪 宏達, 杉本 雅則, “CMOS イメージセンサを用いた OFDM 高速可視光通信”, 電子情報通信学会論文誌, Vol. J102-B, No. 8, pp.605-613, 2019. [JP] *ii
- 21) 長田直樹, “ヤポネシア人の歴史の解明が医学にもたらすもの”. 実験医学 37: 926-929 (2019). [JP]
- 22) 山岸 誠知, 日景 隆, 久野 伸晃, 中村 光貴, 山田 渉, 鷹取 泰司: “数値シミュレーションを用いた 26 GHz 帯屋内伝搬における人体遮蔽特性推定法についての一検討,” 電子情報通信学会論文誌 C, Vol.J102-C, No.5, pp.131-138, May 2019. [JP]

2018

- 23) 長谷山 美紀: “バイオミメティクス画像検索:情報科学が繋ぐ博物学とナノテクノロジー”, 持続可能社会を拓くバイオミメティクス--生物学と工学が築く材料科学, pp.38-45 (2018) [JP]
- 24) 長谷山美紀, 川村圭, 多良島周平, 新井啓之: “メディア工学の研究動向”, 映像情報メディア学会誌, vol.72, no.2, pp.241-246 (2018) [JP]
- 25) 齋藤 剣聖, 小川 恭孝, 西村 寿彦, 大鐘 武雄, “MIMO SC-FDE における受信ウェイトの補間精度の劣化とその軽減法,” 電子情報通信学会論文誌 B, Vol. J101.B, No. 7, pp.570-573, Jul. 2018. doi: 10.14923/transcomj.2017WFL0001 [JP]
- 26) 大鐘武雄, 西村寿彦, 小川恭孝, “5G を実現する MIMO 技術,” 電子情報通信学会誌, Vol.101, No.11, pp.1117-1122, 2018. ISSN: 0913-5693 (Print) / ISSN: 2188-2355 (Online)[JP]

2017

- 27) 長谷山美紀: “農業ビッグデータ解析基盤の構築 -発想支援型検索による害虫同定支援の試み-”, 情報処理, vol.58, no.9, pp.798-801 (2017) [JP]
- 28) 長谷山 美紀: “ビッグデータ解析による新しいインフラ維持管理 - 画像解析による河川管理施設の点検効率化に関する研究 -”, 開発こうほう, no.646, pp.36-39 (2017) [JP]

2016

- 29) 高橋 翔, 長谷山 美紀: “サッカー映像における試合内容の理解を促すデータの可視化”, 映像情報メディア学会誌, vol.70, no.5, pp.722-724 (2016) [JP]
- 30) 齊藤直輝, 小川貴弘, 浅水仁, 長谷山美紀: “画像共有サービスに投稿される画像の観光名所に関するカテゴリー分類”, 電子情報通信学会論文誌 D, vol.J99-D, no.9, pp.848-860 (2016) [JP]
- 31) 長谷山 美紀: “発想支援型検索と異分野連携がもたらす可能性”, 化学経済, vol.63, no.11, pp.42-46 (2016) [JP]
- 32) 湊真一, “私は何がしたかったのか, そしてどのように進んできたのか (レクチャーシリーズ「つながりが創発するイノベーション」第 7 回), ” 人工知能学会誌 ,Vol. 31, No. 3, pp. 452-463, May. 2016. [JP]

2-4. Other Publications: Books Published: #5

International

2020

- 1) Guang Li, Ren Togo, Takahiro Ogawa, Miki Haseyama: "How to Make Artificial Intelligence More Democratic", SCIENTIFIC AMERICAN (2021) †
- 2) Masaharu Yoshioka and Hideo Joho : Temporal Information Access. In Evaluating Information Retrieval and Access Tasks: NTCIR's Legacy of Research Impact, Tetsuya Sakai, Douglas W. Oard, and Noriko Kando (eds), pp. 127-141, Springer Singapore, Singapore, 2020. [OV]*i) †

2018

- 3) Convertino M and Valverde JL, “Critical Values: Collective Information and Decision Analytics”, 2019, proposed to Springer Series “Risk Governance and Society”, in review [OV] [Books in review]
*Not accepted and excluded from the final counts.
- 4) Travis D., Convertino M., Shaffer C., Gillespie T., Alpern J., Stauffer W., Robertson C., Kennedy S., Craft M., “Biodiversity and Health, Engineering Ecosystem Health via Science and Technology”, in “Beyond One Health”, Editors: Herrmann JA and Johnson-Walker YJ, John Wiley Sons, 2018 [OV]

Japanese

2019

- 5) 長田直樹, “進化で読み解く バイオインフォマティクス入門” 森北出版 (2019). [Books]

2017

- 6) 有村 博紀, “系列マイニング”, 人工知能学大事典, 人工知能学会編, 6 章-99 節, pp. 469-472, 共立出版, Jul. 2017. [Books]

5. Awards Received: #55 in total

Awards at International Conferences: #34

2021-2020

- 1) Guang Li, Ren Togo, Takahiro Ogawa, Miki Haseyama: "Complexity evaluation of medical image data for classification problem based on spectral clustering", 2020 IEEE 9th Global Conference on Consumer

- Electronics (GCCE 2020), pp.112-114 (2020) †
- 2) Kaito Hirasawa, Keisuke Maeda, Takahiro Ogawa, Miki Haseyama: "Important scene prediction of baseball videos using twitter and video analysis based on LSTM", 2020 IEEE 9th Global Conference on Consumer Electronics (GCCE 2020), pp.85-86 (2020) †
 - 3) Saya Takada, Ren Togo, Takahiro Ogawa, Miki Haseyama: "Question answering for estimation of seen image contents from multi-subject fMRI responses", 2020 IEEE 9th Global Conference on Consumer Electronics (GCCE 2020), pp.763-764 (2020) †
 - 4) Nao Nakagawa, Ren Togo, Takahiro Ogawa, Miki Haseyama: "Face synthesis via user manipulation of disentangled latent representation", 2020 IEEE 9th Global Conference on Consumer Electronics (GCCE 2020), pp.1-2 (2020) †
 - 5) Kyohei Kamikawa, Keisuke Maeda, Takahiro Ogawa, Miki Haseyama: "Interest level estimation based on feature integration considering distribution of partially paired user's behavior, videos and posters", 2020 IEEE 9th Global Conference on Consumer Electronics (GCCE 2020), pp.558-559 (2020) †
 - 6) Kaito Hirasawa, Keisuke Maeda, Takahiro Ogawa, Miki Haseyama: "Important scene detection based on anomaly detection using long short-term memory for baseball highlight generation", 2020 IEEE International Conference on Consumer Electronics-Taiwan (ICCE-TW 2020) (2020) †
 - 7) Takahiro Ogawa, Kento Sugata, Ren Togo, Miki Haseyama: "Multi-classifier Decision: Integration of Multiple Brain Activity-based Classifications", ITE Transactions on Media Technology and Applications, vol.7, no.1, pp.36-44 (2020) †
 - 8) Rintaro Yanagi, Ren Togo, Takahiro Ogawa, Miki Haseyama: "Query is GAN: scene retrieval with attentional text-to-image generative adversarial network", IEEE Access. The 2020 IEEE Section Best Paper Award (2021) †
 - 9) Genki Suzuki, Sho Takahashi, Takahiro Ogawa, Miki Haseyama: "Team tactics estimation in soccer videos based on a deep extreme learning machine and characteristics of the tactics ", IEEE Access. The 2020 IEEE Sapporo Section Encouragement Award (2021) †
 - 10) Yuya Moroto, Keisuke Maeda, Takahiro Ogawa, Miki Haseyama: "Human emotion estimation using multi-modal variational autoencoder with time changes", 2021 IEEE 3rd Global Conference on Life Sciences and Technologies (LifeTech 2021), Excellent Poster (On-site) Award Winner: Bronze Prize (2021) †
 - 11) Rintaro Yanagi, Ren Togo, Takahiro Ogawa, Miki Haseyama: "Interactive re-ranking for cross-modal retrieval based on object-wise question answering ", ACM International Conference on Multimedia in Asia. Best Paper Runner-Up Award (2021) †
 - 12) Nakamura, M., Hashizume, H., Sugimoto, M., SENSORDEVICES 2020 Best Paper Award, "Simultaneous Localization and Communication Methods using Short-time and Narrow-band Acoustic Signals" November, 2020. †
 - 13) Matteo Convertino, Hult Prize Hokudai Campus challenge (second place and invitation to the Tokyo regional competition); Team SEA2SEE with students Galbraith E. (IST), Li J. (IST), Garcon EJ (Agric.), & Chebbi N (Chem Eng), December 2020.
 - 14) Matteo Convertino, Reviewer Award for MDPI Journals Sustainability, Symmetry, and Climate, Jan 2020.

2019

- 15) Rintaro Yanagi, Ren Togo, Takahiro Ogawa, Miki Haseyama: Outstanding Prize IEEE GCCE 2019 Excelent Demo! Award, "Voice-input multimedia information retrieval system based on text-to-image GAN" 2019 IEEE 8th Global Conference on Consumer Electronics (GCCE 2019), pp.967-968(2019)
- 16) Megumi Kotera, Ren Togo, Takahiro Ogawa, Miki Haseyama: Silver Prize IEEE GCCE 2019 Excelent Poster Award, "Aesthetic style transfer through text-to-image synthesis and image-to-image translation 2019" IEEE 8th Global Conference on Consumer Electronics (GCCE 2019), pp.492-493(2019)
- 17) Yusuke Akamatsu, Ryosuke Harakawa, Takahiro Ogawa, Miki Haseyama: Silver Prize IEEE GCCE 2019 Excelent Paper Award, "Estimating viewed image categories from fMRI activity via multi-view bayesian generative model" 2019 IEEE 8th Global Conference on Consumer Electronics (GCCE 2019), pp.129-130(2019)
- 18) Yuya Moroto, Keisuke Maeda, Takahiro Ogawa and Miki Haseyama: 2nd Prize IEEE Lifetech 2019 Excellent Paper Award, "Estimation of Visual Attention via Canonical Correlation between Visual and Gaze-based Features", 2019 IEEE 1st Global Conference on Life Sciences and Technologies (LifeTech 2019), pp.229-230 (2019)
- 19) Keisuke Maeda, Sho Takahashi, Takahiro Ogawa, Miki Haseyama: The 2018 IEEE Sapporo Section Encouragement Award, "Automatic Estimation of Deterioration Level on Transmission Towers via Deep Extreme Learning Machine Based on Local Receptive Field", IEEE International Conference on Image Processing (ICIP 2017), pp.2379-2383 (2019)
- 20) Akira Toyoda, Takahiro Ogawa, Miki Haseyama, The 2018 IEEE Sapporo Section Encouragement Award, "MvLFDA-based Video Preference Estimation Using Complementary Properties of Features", The 2018 IEEE Sapporo Section Encouragement Award (2019)
- 21) Naoki Saito, Takahiro Ogawa, Satoshi Asamizu, Miki Haseyama: Best Paper Award, "Classification of Tourism Categories Based on Heterogeneous Features Considering Existence of Reliable Results", The 2019 joint International Workshop on Advanced Image Technology & International Forum on Medical Imaging in Asia (2019)
- 22) Masanori Sugimoto, Best Paper Award in IEEE KST 2019 (January 23-26, 2019, Phuket, Thailand) "Detecting Text in Manga using Stroke Width Transform"
- 23) Yoshihiro Hirose, "Outstanding Poster Award 1st Prize", Data Science Statistics & Visualisation (DSSV2019), Kyoto. (2019 August)
- 24) Takashi Hikage, Distinguished Contributions Award, IEICE Communication Society (2019.9.11)
- 25) Takashi Hikage, The Best Poster Presentation Award, PJWWRAT2019 (2019.12.5)

2018

- 26) Tomoki Haruyama, Sho Takahashi, Takahiro Ogawa, Miki Haseyama, 1st Prize IEEE GCCE 2018 Excellent Poster Award, "Estimation of Important Scenes in Soccer Videos Based on Collaborative Use of Audio-Visual CNN Features", 2018 IEEE 7th Global Conference on Consumer Electronics (GCCE 2018), pp.675-676 (2018)
- 27) Yuya Moroto, Keisuke Maeda, Takahiro Ogawa and Miki Haseyama: IEEE GCCE 2018 Outstanding Paper

Award, “User-centric Visual Attention Estimation Based on Relationship Between Image and Eye Gaze Data”, 2018 IEEE 7th Global Conference on Consumer Electronics (GCCE 2018), pp.44-45 (2018)

- 28) Keisuke Maeda, Sho Takahashi, Takahiro Ogawa, Miki Haseyama: “Distress Classification of Road Structures via Decision Level Fusion”, 2016 IEEE International Conference on Digital Signal Processing (DSP), pp.589-593 (2018)

2017

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(end)

References

Global Institution for Collaborative Research and Education (GI-CoRE)

Final Evaluation for the Global Station for Big Data and Cybersecurity projects

1. Aims

The Global Institution for Collaborative Research and Education (GI-CoRE) shall implement an external evaluation of the research, education and organizational framework of the Global Station for Big Data and Cybersecurity projects which started on April 1, 2016. As the projects have welcomed the final (fifth) year of the implementation period upon the Fiscal Year 2020, the feedback of this evaluation shall be used to improve the future project.

2. Evaluation Structure

A "Hokkaido University Global Institution for Collaborative Research and Education External Evaluation Committee" shall be established in Big Data and Cybersecurity Global Station in accordance with the External Evaluation Implementation Guidelines for the Hokkaido University Global Institution for Collaborative Research and Education Global Station (Document 2). All evaluations and reports shall be undertaken in English.

Global Station for Big Data and Cybersecurity External Evaluation Committee

Candidates from Big Data and Cybersecurity GS: 2 foreign members, 1 Japanese member

*When the evaluation is completed, the GI-CoRE Steering Committee shall receive a report from the Committee chair.

3. Evaluation Method

The External Evaluation Committee shall check the contents of the Research Progress Report (Document 3) sent in advance from HU before implementing the investigation, and shall evaluate the evaluation items prescribed in Document 4.

A 5-level evaluation ratings (S to D) and comments shall be obtained for each "Evaluation Item".

Evaluation Ratings	Evaluation Explanation
S	Achieved outcomes surpassed the original plan (Outstanding)
A	Good progress has been maintained and expected outcomes have been achieved (Excellent)
B	Most expected outcomes have been achieved with some slight delays (Good)
C	Although certain outcomes were achieved, overall results were insufficient (Satisfactory)
D	No expected outcomes were achieved (Unsatisfactory)

4. Required Expenses

Travel expenses (only when applicable) and honoraria shall be provided to the Committee Members in accordance with HU regulations. It will be arranged and covered by Global Station for Big Data and Cybersecurity, Hokkaido University depending on the situation of COVID-19.

5. Publishing of Evaluation Results

Evaluation of this project shall be broadly announced, with the results both published on the relevant HU websites and published as booklets which are sent to external organizations such as the Japanese Ministry of Education, Culture, Sports, Science and Technology.

GI-CoRE Global Station External Evaluation Schedule

Year and Month	Agenda
Fiscal Year 2019 (2019-2020)	
November	Selection/Arrangement of the Evaluation Committee Members *Criteria: 2 foreign and 1 Japanese members (candidates who can conduct evaluation in English) *Confirmation of affiliation, main achievements, contact details, etc.
December	GI-CoRE Steering Committee #23 *Fixing overviews of evaluation items, evaluation structure, schedule, etc. *Fixing the Evaluation Committee Members
January to March	*Starting to create 2020 Research Progress Report (in English) *Official appointment request (letters from the GI-CoRE Director) *Fixing evaluation forms
Fiscal Year 2020 (2020-2021)	
April	Commission of Evaluation Committee Members
May	Preparation of On-site Investigation
June	Distribution of Research Progress Report to Committee Members Document screening by Committee Members
July	Online meeting via Zoom July 7th Online investigation based on the document screening
August	Submission of Results of the Evaluation from each Committee to the Chair Each Evaluation Committee Member shall forward their evaluation reports, based on the document screening and on-line meeting
September to November	Submission of Summary Report and Results of the Evaluation Committee The Chair shall summarize the Evaluation from each Committee and make a report
December	GI-CoRE Steering Committee #27 *Report of the results of the Evaluation from the External Evaluation Committee Members
March	Expiration of the GSB project under the GI-CoRE System
Fiscal Year 2021 (2021-2022)	
April	Internalization of the GSB project into the affiliated faculty
July	Publication of the Final Evaluation Report

Hokkaido University

Global Institution for Collaborative Research and Education (GI-CoRE)

External Evaluation Implementation Guidelines for the Global Stations

December 15, 2015

Establishment of the Global Institution for Collaborative Research and Education Steering Committee

1. Purpose

These implementation guidelines shall provide the necessary matters for the implementation of evaluation of the Global Station by non-University affiliated persons (hereinafter the “GS External Evaluation”) of the Hokkaido University Global Institution for Collaborative Research and Education (GI-CoRE).

2. Committee

(1) The "Hokkaido University Global Institution for Collaborative Research and Education External Evaluation Committee (hereinafter the "Committee")" shall be established by GI-CoRE in order to perform the matters prescribed in each of the following items.

(i) Implementation of GS External Evaluation

(ii) Matters related to the creation and publishing of the report pertaining to the GS External Evaluation

(2) A Committee shall be established for each Global Station that is target for external evaluation.

3. Composition

(1) The Committee shall be composed of third parties other than constituent members of Hokkaido University, and designated by the Director of GI-CoRE from persons prescribed in each of the following items.

(i) Person designated by the Director of GI-CoRE who is an expert both within and outside Japan in the research field of the Global Station to be externally evaluated

(ii) Persons whom the Director of GI-CoRE deems necessary

(2) The Committee members prescribed in the preceding paragraph shall be commissioned by the Director of GI-CoRE after approval by the GI-CoRE Steering Committee.

4. Term of Office

(1) The term of office for Committee Members shall be 1 year. However, if a Committee Member vacancy occurs, the term of office of the successor shall be the remaining term of the predecessor.

(2) Committee Members may be reappointed.

5. Committee Chair

(1) A Committee Chair shall be appointed and selected through mutual election by the Committee members.

(2) The Committee Chair shall call a Committee meeting as required, and shall chair the said meeting.

6. Proceedings

- (1) A Committee meeting may not be held unless a majority of the members are present.
- (2) Committee meeting proceedings shall be decided by a majority of the attending members.
In case of a tie, the Committee Chair shall decide the issue.

7. Implementation of GS External Evaluation

- (1) The Committee shall implement the GS External Evaluation as prescribed in the following Article.
- (2) The Committee may hear the opinions of persons concerned and implement firsthand investigations related to the implementation of the GS External Evaluation.

8. Evaluation Items

The Committee shall evaluate the items prescribed by GI-CoRE in each of the following items.

- (1) Items related to research
- (2) Items related to education
- (3) Items related to the structure of the research and education center
- (4) Other items deemed necessary by the Committee

9. Creation and Publishing of the Report

The Committee shall collate the evaluation results prescribed in the preceding paragraph and publish the results in a report.

10. Response to Evaluation Results

The Director of GI-CoRE shall promptly work to implement improvements in view of the report prescribed in the previous paragraph for items in which improvements are deemed necessary.

11. General Affairs

General affairs for the Committee shall be processed by the Division of International Planning, International Affairs Department.

12. Miscellaneous Provisions

Necessary matters concerning GS External Evaluation other than those prescribed within these implementation guidelines shall be prescribed separately by the GI-CoRE Steering Committee.

Supplementary Provisions

These guidelines shall come in force on 12 December 2017.

Supplementary Provisions

These guidelines shall come into force on March 7, 2019 and shall be applied from July 1, 2018.

REGULATIONS FOR THE HOKKAIDO UNIVERSITY
GLOBAL INSTITUTION FOR COLLABORATIVE RESEARCH AND EDUCATION

HU Doc. No.151
April 1, 2014

(Purpose)

Article 1 These *Regulations* shall prescribe the organization and administration of the Hokkaido University Global Institution for Collaborative Research and Education (hereinafter referred to as "the Institution for Research and Education"), based upon the *Rules Concerning the Organization of Hokkaido University* (HU Doc. No. 31 of 2004), Article 37(4).

(Objectives)

Article 2 The objectives of the Institution for Research and Education shall be to invite teaching staff from Japan and overseas with world-class education and research results, to promote international collaborative research and international collaborative education (hereinafter referred to as "international collaborative research and education") that capitalizes upon the distinctive characteristics of Hokkaido University (hereinafter referred to as the "University"), and to provide support for international collaborative research being furthered independently by faculties or schools.

(Employees)

Article 3 A Director and other necessary teaching staff shall be placed in the Institution for Research and Education.

(The Director)

Article 4 The President shall be appointed as the Director of the Institution for Research and Education.

2. The Director shall supervise the work of the Institution for Research and Education.

(The assistant director)

Article 5 An assistant director shall be placed in the Institution for Research and Education.

2. A vice president designated by the President shall be appointed as the assistant director.

3. The assistant director shall assist the Director in his or her duties and shall take over those duties in the event of the latter being incapacitated.

(Global stations)

Article 6 The following global stations shall be placed in the Institution for Research and Education to promote international collaborative research and education that capitalizes upon the distinctive characteristics of the University.

(1) The Global Station for Soft Matter

(2) The Global Station for Big Data and Cybersecurity

(3) The Global Station for Arctic Research

(4) The Global Station for Biosurfaces and Drug Discovery

2. Full-time teaching staff from the University (including specially appointed academic staff who come under each item of Article 3 of the *Hokkaido University Specially Appointed Academic Staff Regulations* (HU Doc. No. 35 of 2006). The same applies to Article 7(2) below.) and teaching staff invited from Japan and overseas shall be placed in the Institution

for Research and Education.

3. The period for which a global station is established shall be five years. However, this period can be extended within five years if the steering committee provided for in Article 8 deems it necessary.

(Global station leaders)

Article 7 A global station leader shall be placed in each of the global stations referred to in the items of Article 6(1).

2. The global station leader shall be one of the teaching staff of the said global station who has been designated by the Director.
3. The global station leader shall supervise the work of the said global station under the orders of the Director.
4. The term of office of the global station leaders shall be three years or less, and they can be reappointed.

(Steering Committee)

Article 8 A steering committee shall be placed in the Institution for Research and Education to deliberate important matters concerning the said institution.

2. The organization and administration of the steering committee shall be prescribed separately.

(Administration)

Article 9 The administrative work of the Institution for Research and Education shall be processed in the Division of International Planning, the International Affairs Department.

(Miscellaneous provisions)

Article 10 In addition to what is prescribed in these *Regulations*, necessary matters regarding the operation of the Institution for Research and Education shall be prescribed separately by the President after approval by the steering committee.

Supplementary Provisions

These *Regulations* come into force on April 1, 2014.

Supplementary Provisions

These *Regulations* come into force on April 1, 2015.

Supplementary Provisions

These *Regulations* come into force on April 1, 2016.

Supplementary Provisions

These *Regulations* come into force on July 1, 2018.

Supplementary Provisions

These *Regulations* come into force on March 1, 2020.

Supplementary Provisions

These *Regulations* come into force on April 1, 2020.

REGULATIONS FOR THE GLOBAL INSTITUTION FOR COLLABORATIVE RESEARCH AND EDUCATION STEERING COMMITTEE

HU Doc. No. 152
April 1, 2014

(Purpose)

Article 1 These *regulations* shall provide for the necessary matters concerning the organization and administration of the Global Institution for Collaborative Research and Education Steering Committee (hereinafter referred to as "the committee"), based upon Article 8(2) of the *Regulations for the Global Institution for Collaborative Research and Education* (HU Doc. No. 151 of 2014, "*Regulations for the Institution for Education and Research*" in Article 3).

(Topics for Deliberation)

Article 2 The committee shall deliberate on the issues set forth in item (6) through item (10) of Article 2 of the *National University Corporation Hokkaido University Agenda for Hearing with Faculty Council Rules* (HU Doc. No. 42 of 2015, referred to as "*Hearing Rules*" in the following paragraph) and deliver opinions to the President.

2. In addition to the matters specified in the preceding paragraph, the committee shall deliberate the following matters pertaining to the Hokkaido University Global Institution for Collaborative Research and Education (hereinafter referred to as "the Institution for Research and Education" in (5) below).
 - (1) Matters regarding personnel affairs of the faculty (excluding matters set forth in item (6) through item (10) of Article 2 of the *Hearing Rules*).
 - (2) Matters regarding the establishment, reform or termination of global stations.
 - (3) Matters regarding the evaluation of the educational and research activities of global stations.
 - (4) Matters regarding budgets.
 - (5) Other important matters pertaining to the administration of the Institution for Research and Education.

(Structure)

Article 3 The committee shall consist of the following members:

- (1) The director of the Global Institution for Collaborative Research and Education (referred to as "the director" in Article 5)
- (2) The assistant director of the Global Institution for Collaborative Research and Education (referred to as "the assistant director" in Article 5)
- (3) One vice president designated by the President (excluding the person mentioned in the previous item)
- (4) One dean or director from each of the following categories (a-d), each of whom shall be designated by the President
 - a) The Graduate School of Law, the Faculty of Education, the Research Faculty of Media and Communication, the Faculty of Economics and Business, the Faculty of Humanities and Human Sciences, the Faculty of Public Policy

- b) The Faculty of Fisheries Sciences, the Faculty of Environmental Earth Science, the Faculty of Science, the Research Faculty of Agriculture, the Faculty of Advanced Life Science, the Faculty of Engineering, the Faculty of Veterinary Medicine, the Faculty of Information Science and Technology
 - c) The Faculty of Pharmaceutical Sciences, the Faculty of Health Sciences, the Faculty of Medicine, the Faculty of Dental Medicine, Hokkaido University Hospital
 - d) Each affiliated research institute, each research center, the Field Science Center for Northern Biosphere
- (5) Each global station leader as prescribed in Article 7 of the *Regulations* for the Institution for Education and Research
- (6) Other persons whom the President deems appropriate
2. The President shall appoint the committee members mentioned in the preceding item (6)

(Term of Office)

- Article 4** The terms of office of the committee members indicated in paragraph 1(4) and paragraph 1(6) of the previous article shall be two years. However, the term of office of substitute committee members shall be the remaining term of office of the previous committee member.
2. The committee members indicated in the preceding paragraph may be reappointed.

(Committee Chair)

- Article 5** The director shall be appointed as the committee chair.
2. The committee chair shall call committee meetings and preside over the said meetings.
3. The assistant director shall take over the director's duties in the event of the latter being incapacitated.

(Proceedings)

- Article 6** The committee cannot validly convene unless at least two-thirds of the committee members are present.
2. Committee proceedings, other than those prescribed separately, shall be decided by the majority vote of the attending committee members.

(Attendance of Persons Other Than Committee Members)

- Article 7** In cases deemed necessary by the committee, persons other than committee members may be permitted to attend committee meetings, and explanations or opinions of the said persons may be heard.

(Committees on Special Issues)

- Article 8** Committees on special issues may be established within the committee when necessary in order to deliberate specialized matters.

(General Affairs)

- Article 9** The administrative affairs of the committee shall be processed in the Division of International Planning, the International Affairs Department.

(Miscellaneous Provisions)

- Article 10** In addition to what is prescribed in these *regulations*, necessary matters regarding the operation of the committee shall be prescribed by the said committee.

Supplementary Provisions

These *regulations* come into force on April 1, 2014.

Supplementary Provisions (HU Doc. No. 196 of April 1, 2015)

These *regulations* come into force on April 1, 2015.

Supplementary Provisions (HU Doc. No. 191 of October 1, 2016)

These *regulations* come into force on October 1, 2016.

Supplementary Provisions (HU Doc. No. 163 of April 1, 2017)

1. These *regulations* come into force on April 1, 2017.
2. The dean of the Graduate School of Dental Medicine who was specified as a committee member in c) of paragraph 1(4) of Article 3 prior to the revision (hereinafter referred to as “the former committee member” in this paragraph) shall be deemed to have been appointed as a committee member under the revised *regulations* in c) of paragraph 1(4) of Article 3 on the enforcement date of these regulations. The term of office of the said member shall be the remaining term of office of the former committee member on the enforcement date, notwithstanding the revised provisions of Article 4(1).

Supplementary Provisions (HU Doc. No. 182 of June 20, 2017)

These *regulations* come into force on June 20, 2017 and apply retroactively from April 1, 2017.

Supplementary Provisions (HU Doc. No. 98 of July 1, 2018)

These *regulations* come into force on July 1, 2018.

Supplementary Provisions (HU Doc. No. 134 of April 1, 2019)

1. These *regulations* come into force on April 1, 2019.
2. The dean of the Graduate School of Letters who was specified as a committee member in c) of paragraph 1(4) of Article 3 prior to the revision (hereinafter referred to as “the former committee member” in this paragraph) shall be deemed to have been appointed as a committee member under the revised *regulations* in c) of paragraph 1(4) of Article 3 on the enforcement date of these regulations. The term of office of the said member shall be the remaining term of office of the former committee member on the enforcement date, notwithstanding the revised provisions of Article 4(1).



Final Evaluation Report

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