

Welcome Message

It is my great pleasure to welcome to the *Joint 2020 9th International Conference on Informatics, Electronics & Vision (ICIEV)*, and *4th International Conference on Imaging, Vision & Pattern Recognition (IVPR)*, along with the *2nd International Conference on Activity and Behavior Computing (ABC)* to be held in Kokura, Kitakyushu, Japan. Earlier, ICIEV was held in Bangladesh (four times) and Japan (three times), and USA (in 2019) with very good success. The IVPR was organized in Bangladesh, Japan, and USA.

IEEE, IEEE Computer Society, IEEE TCPAMI, etc. are part of the success of ICIEV/IVPR. ABC papers are published in Springer as book chapter (to be archived in SCOPUS index and others). There is a Cooking Activity Challenge and accepted submissions are published as book chapters in Springer (to be archived in SCOPUS and others). Both books are in press now. We thank IEEE, IEEE CS, IEEE TCPAMI, IEEE CS Bangladesh chapter, Center for Natural Science & Engineering Research (CNSER), Kitakyushu International Conference Center, 6 sponsors (Mamezou Co., Ltd; Innovation Plus Co., Ltd.; Fusic Co., Ltd.; SMART Co., Ltd.; Liful Co., Ltd.; and CARECOM Co., Ltd.), the committee members, reviewers, excellent & dynamic volunteers for their efforts. We are very grateful for the extensive efforts of many individuals who worked diligently to ensure a successful, high quality conference. Without the hard work and dedication of all these volunteers, the conference could not be successful. We would like to thank the 4 distinguished keynote speakers for their supports and participations.

This list of co-sponsors indicates the broad involvement and support for the conference. We wholeheartedly thank the committee members, especially the Sozo Inoue, Mazakazu Morimoto, Daniel Roggen, Kaori Fujinami, MAS Kamal, Upal Mahbub, Atsushi Inoue, and others. We would like to specially thank the Secretaries – Ahsan Habib (MBSTU), and Sozo Lab. members of Kyushu Institute of Technology, for their tremendous commitment and supports for a long period for these conferences. Most importantly, we wish to thank all of the authors who are sharing research results at the conference and who are collectively pushing forward the state of the art in these important areas.

Due to covid-19, we could not have all participants (from more than 25 countries). In 2021, we will organize the 10th ICIEV and 5th IVPR in the green city – the Kitakyushu, Japan. The 3rd ABC is planned to be in Thailand in 2021. We wholeheartedly welcome you all to attend the conferences and be a dedicated part of the them. 10th year of ICIEV should be a great gathering with high-quality papers. Please inform others to submit quality papers in these conferences. We invite the attendees to actively participate in the conference activities, and to enjoy the opportunity to learn from one another (on-site or online). We hope to have your cordial support and participation in future conferences.

Honorary General Chair of 9th ICIEV:

Toshio Fukuda, *IEEE President 2020, IEEE Life Fellow, Meijo University, Japan; Beijing Institute of Technology, China*

General Chair of 9th ICIEV:

Michihiko Minoh, *Executive Director, RIKEN; Kyoto University, Japan*

Matthew Turk, *Fellow-IEEE, IAPR, President, Toyota Technological Institute at Chicago, USA*

Md Atiqur Rahman Ahad, *SMIEEE, University of Dhaka, Bangladesh; Osaka University, Japan*

General Co-chair:

Atsushi Inoue, *Eastern Washington University, USA*

General Chair of 4th IVPR:

Toshio Fukuda, *IEEE President 2020, IEEE Life Fellow, Meijo University, Japan; Beijing Institute of Technology, China*

Md Atiqur Rahman Ahad, *SMIEEE, University of Dhaka, Bangladesh; Osaka University, Japan*

General Chair of 2nd ABC:

Sozo Inoue, *Kyushu Institute of Technology, Japan; RIKEN, Japan*

Md Atiqur Rahman Ahad, *SMIEEE, University of Dhaka, Bangladesh; Osaka University, Japan*

Welcome Message from Program Chairs (ICIEV-IVPR 2020)

Welcome to the Joint 9th International Conference on Informatics, Electronics & Vision (ICIEV) and the 4th International Conference on Imaging, Vision & Pattern Recognition (IVPR), 2020 in the wonderful city of Kitakyushu, Fukuoka, Japan. We consider ourselves very fortunate to be able to organize these conferences with provisions for both onsite and online participation during the COVID-19 pandemic. The program contains 4 Keynote Talks, 13 paper sessions and one industry session. We truly believe that this conference will provide the participants a great opportunity to share the research ideas and outcomes, and enhance the networking for future collaboration at the international level.

This joint conference has attracted a total of 225 paper submissions - 133 in the IVPR track and 92 in the ICIEV track. After several stages of rigorous reviews, only 56 papers (IVPR - 35, IEV - 21) have been included in the technical program for presentation and publication in the conference proceedings. The review process was conducted by our expert technical committee members and the other qualified reviewers. Each paper was reviewed by at least two reviewers (even by 8 reviewers!), and some papers were reviewed in two stages to ensure the quality (average review per paper is 3+). Furthermore, all papers were checked by IEEE's plagiarism checker for originality a couple of times. We have received papers from various institutes and universities in 25 different countries from all over the world - most notably from Japan, Australia, Bangladesh, China, India, Germany, USA, Mongolia, Netherlands, Malaysia, Sweden, Thailand, Italy, Tunisia, Turkey, and UK.

We would again like to emphasize on the challenges that we faced due to the worldwide pandemic when organizing these conferences. For us, a driving force was the tremendous enthusiasm and support from the authors, volunteers, committee members and participants towards organizing and attending the conferences in-person or online. Our heartiest gratitude goes to the reviewers who put extraordinary efforts to complete the reviews despite their busy schedule and hardship due to COVID-19. The reviews played an instrumental role in selecting high quality papers and, thereby, maintaining the standards for the conference program. We are also thankful to the honorable keynote speakers for sharing their vast expertise with all the participants of the conference. That the participants will undoubtedly benefit from the insightful talks and stimulating discussion sessions. Finally, we would like to thank all the authors, organizing committee members, and volunteers for their great unconditional support all along.

For Best Paper Award, we have engaged about 100 experts (including IEEE Fellows) after several screening to short-list some papers. Then based on the scores, we selected the best papers. A few papers have been selected for the *International Journal of Computer Vision and Pattern Recognition (IJCVSP)* and book chapters, to be published in Springer. A few papers are selected as non-archival / work-in-progress (WIP). We hope that this joint conferences will be a wonderful learning and networking experience for all of us and will be cherished as a lasting pleasant memory amidst the dreadful pandemic.

Program Chairs of ICIEV & IVPR, 2020

Sozo Inoue, Kyushu Institute of Technology, Japan

MAS Kamal, Gunma University, Japan

Anca L. Ralescu, University of Cincinnati, USA

Upal Mahbub, Qualcomm Technologies Inc., USA

Message on 2nd ABC

The second edition of the International Conference on Activity and Behavior Computing (ABC'2020) will be held in a virtual format (and partially onsite for those who will be able to attend), given the unprecedented circumstances in this year 2020. This year's edition also has a novel proceedings format, whereby the papers selected for publication appear as chapters within this book.

The Activity and Behavior Computing conference aims to be a venue to discuss the many facets of computing systems which are able to sense, recognize and eventually understand human activities, behaviors, and the context within which they occur. This in turn enables a wide range of applications in a large variety of disciplines. As such, this conference reflects a broad range of topics, which will be reflected in the following pages. In particular, the contributions received this year reflect *Algorithms and Methods*, *Devices and Systems* and *Applications*, and the organization of this volume reflects this.

Despite the challenging worldwide situation, we are extremely pleased to have received 30 submissions, of which 18 were selected for publication. Every submission was peer reviewed in a double-blind format and received at least 3 reviews. The program chairs along with the general chairs had rigorous meeting to decide the fate of the papers at the 1st round. After the rebuttals, another meeting was arranged and the final decisions are made. Even after the final decision, the program committee did a few stages of minor editing for some papers to enrich the quality of the chapters. The resulting selection of papers reflects the broad interests of this nascent community and is important to take stock of the state of the art and continued research challenges in the field.

We wish to thank the contributions of all the authors to this conference, and also all the reviewers. It is thanks to the passion for research of our authors and the dedication of reviewers that we could put together this volume.

Finally, we would like to thank all the remaining people involved in the process of setting up this conference and publishing this book: besides the General Chairs and Program Chairs, this includes as well our publicity chair Brahim Benaissa, our publication chair Paula Lago, the secretaries at Kyushu Institute of Technology (Tahera Hossain, Moe Matsuki, Nattaya Mairittha, and Tittaya Mairittha), the members of the advisory board and the program committee.

Finally, we hope you will find this volume as interesting to read as it was for us to put it together. We hope that you will find the content stimulating, highlighting areas of progress as well as outlining areas that are still in need of further research. We hope that we may see the fruits of your own work, informed by this book, in future editions of ABC.

Program Chairs

Daniel Roggen, *University of Sussex, UK*

Kaori Fujinami, *Tokyo University of Agriculture and Technology, Japan*

General Chairs

Sozo Inoue, *Kyushu Institute of Technology, Japan*

M.A.R. Ahad, *University of Dhaka, Bangladesh; Osaka University, Japan*