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ICWE 2021 Workshops

ICWE 2021 International Workshops
BECS and Invited Papers
Biarritz, France, May 18–21, 2021
Revised Selected Papers

 Springer


BECS 2021
1st International Workshop on
Big data driven Edge Cloud Services

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Preface

Edge clouds are becoming an important type of computing infrastructure for collecting and processing big data as low-latency and reliable communication technologies such as 5G and Web of Things (WoT) are developed and deployed. Edge clouds are especially useful for efficient and secure data collection and processing for smart cities and smart factories. In edge cloud environments, it is essential to provide Web services for efficiently collecting and processing various types of big data in real-time. In addition, it is necessary to develop a framework for building big data service applications in a reliable and usable manner.

The first International Workshop on Big data-driven Edge Cloud Services (BECS 2021)¹ was held to provide a venue in which scholars and practitioners could share their experiences and present on-going work on providing value-added Web services for users by utilizing big data in edge cloud environments. The workshop was held in conjunction with the 21st International Conference on Web Engineering (ICWE 2021)², which was held online during May 18–21, 2021.

The first edition of the BECS workshop focused on the following topics: Web services in edge clouds; Web of Things in edge clouds; AI in edge computing (Edge AI); dependable and highly usable big data platforms; distributed data collection, analysis, and prediction; stream data processing in edge clouds; big knowledge graphs for distributed edge cloud environments; modeling and mashup of edge cloud services; micro-service architecture for edge cloud environments; and edge-cloud interaction and collaboration.

The BECS 2021 workshop started with a keynote talk by Domenico Siracusa who is the head of the RiSING Research Unit at Fondazione Bruno Kessler (FBK) in Italy. The title of the talk was Distributing Intelligence in the Cloud-to-Edge Continuum. In the talk, he explained the need to support fine-grained and dynamic management of resources on the Cloud-to-Edge continuum to deal with the increasing complexity of Internet of Things (IoT) and artificial intelligence applications. He also presented the vision to create and deploy cloud-native applications over heterogeneous and distributed computing environments, and discussed the application of the developed technologies in real-world pilot scenarios stemming from smart city and robotic logistics environments, providing insights on outcomes and open challenges.

In the BECS 2021 workshop, five full papers and one short paper were selected for presentation. The first paper, Putting Data Science Pipelines on the Edge (by Ali Akoglu and Genoveva Vargas-Solar), proposes a composable just-in-time architecture for data science pipelines named JITA-4DS and associated resource management techniques for configuring disaggregated data centers. In the second paper, DNN Model Deployment on Distributed Edges, the authors (Eunho Cho, Juyeon Yoon, Daehyeon Back, Dongman Lee, and Doo-Hwan Bae) analyze the characteristics of split points with representative

¹ <https://becs.kaist.ac.kr/iwbecs2021/>.

² <https://icwe2021.webengineering.org/>.

network configurations that need to be considered to design a proper Deep Neural Network (DNN) slicing scheme concentrating more on actual application requirements. The third paper, Towards Proactive Context-Aware IoT Environments by means of Federated Learning (by Rubén Rentero-Trejo, Daniel Flores-Martín, Jaime Galán-Jiménez, José García-Alonso, Juan Manuel Murillo, and Javier Berrocal), proposes a solution based on federated learning to predict behaviors in different environments and improve users' coexistence with IoT devices, avoiding most manual interactions and making use of mobile devices capabilities. The fourth paper, titled Real-time Deep Learning-based Anomaly Detection Approach for Multivariate Data Streams with Apache Flink by Tae Wook Ha, Jung Mo Kang, and Myoung Ho Kim, presents a real-time deep learning-based anomaly detection approach for multivariate data streams with a stream processing framework, Apache Flink. In the fifth paper, A Novel Approach to Dynamic Pricing for Cloud Computing Through Price Band Prediction, the authors (Dheeraj Rane, Vaishali Chourey, and Ishan Indraniya) define a dynamic pricing model for cloud brokers in which instead of fixed pricing, the brokers can provide a price range to their consumers. Finally, the short paper written by Sinwoong Yun, Dongsun Kim, and Jemin Lee, Learning-based Activation of Energy Harvesting Sensors for Fresh Data Acquisition, defines the estimation error of the sensing data at a measuring point, which increases as the distance to the sensor increases and the age of information (AoI) of the data increases. In addition, the authors define the network coverage, which is defined as the area having the estimation errors lower than a target value.

Although the workshop was held online due to the COVID-19 pandemic, the authors and participants had important discussions on the technical issues relating to the collection and processing of big data in an efficient manner in distributed edge cloud environments.

This book is enriched with two invited papers that are tightly related to the main topic area of the BECS workshop. The first invited paper, Exploiting Triangle Patterns for Heterogeneous Graph Attention Network, was selected from the position papers that were submitted to the BECS workshop. Eunjeong Yi and Min-Soo Kim, the authors of this paper, propose a heterogeneous graph attention network called TP-HAN by which graph patterns can be efficiently exploited from large-scale graphs that are build out of big data. Another paper, Towards Seamless IoT Device-Edge-Cloud Continuum: Software Architecture Options of IoT Devices Revisited, was invited from a related research group. In this paper, the authors (Antero Taivalsaari, Tommi Mikkonen, and Cesare Pautasso) discuss the implications of the IoT device architecture choices in light of the new occurrences and make some new predictions about future directions. In addition, they make a case for isomorphic IoT systems in which development complexity is alleviated with consistent use of technologies across the entire system.

We would like to thank all the Program Committee members and reviewers for their efforts in providing high-quality reviews and constructive comments. Our special thanks also goes to Domenico Siracusa who gave a wonderful keynote talk. The BECS 2021 workshop was supported by the Ministry of Science and ICT (MSIT), South Korea, under the Information Technology Research Center (ITRC) support program (IITP-2021-2020-0-01795) supervised by the Institute of Information and Communications Technology Planning Evaluation (IITP). We are grateful for their support. Last but not

least, we would like to thank the authors who submitted and presented their research work for the workshop and all the participants who contributed to make the workshop successful.

October 2021

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