Reliable and Scalable Big-Data Applications in Edge Cloud Environments

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The international workshop on big-data-driven edge cloud services (BECS) is a venue where scholars and practitioners can share their experiences and present ongoing work on developing data-driven applications and services in a distributed computing environment so-called edge cloud. The second edition of the workshop (BECS 2022)[1] was held in conjunction with the 22nd International Conference on Web Engineering (ICWE 2022),[2] which was held in Bari, Italy on 5–8 July, 2022.

This special issue of the Journal of Web Engineering is oriented toward discussing the issues of developing more reliable and scalable big-data applications in edge cloud environments. For this issue, we selected BECS 2022 papers that deal with such issues in practical application domains.

Edge-cloud systems are highly distributed and complex systems and it is usually difficult to verify the reliability of such systems using limited computing resources. In the article titled "Pre-trained Model-based Software

[1]https://becs.kaist.ac.kr/iwbecs2022/
[2]https://icwe2022.webengineering.org/

Defect Prediction for Edge-cloud Systems", Sunjae Kwon et al. suggest a function level just-in-time (JIT) software defect prediction (SDP) model based on a pre-trained model to efficiently test edge-cloud systems by prioritizing the limited testing resources for the defect-prone functions. They compare the prediction performance of their proposed approach on four edge-cloud systems in within-project defect prediction and cross-project defect prediction environments to confirm the best pre-trained model for SDP.

Edge devices like wireless sensor network (WSN) nodes are often dispersed over large areas and an accurate localisation of these nodes is imperative. This is especially so when the WSN is deployed for critical applications like fire detection. In the article by Rupendra Pratap Singh Hada et al. titled "A Study and Analysis of a New Hybrid Approach for Localization in Wireless Sensor Networks", the authors harness an approach that is a combination of machine learning and the more conventional multilateration to accurately localise WSN nodes. Localisation by machine learning is accurate but does not scale easily and is therefore used in the first few localisation iterations; multilateration can easily scale but is not very accurate and is thus of greater utility for subsequent rounds of localisation. The authors demonstrate the efficacy of the hybrid approach through pilot WSN deployments over a small area.

Self-driving systems that run in edge-cloud environments become more complicated and it is crucial to prevent accidents caused by software defects of such complex systems. Jiwon Choi et al. propose in their article, "Just-in-Time Defect Prediction for Self-driving Software via a Deep Learning Model", a JIT defect prediction model via deep learning for edge computing applications, called JIT4EA. The JIT4EA model processes both commit messages in a natural language and code changes in programming languages using pre-trained unified cross-modal pre-training for code presentation, called UniXCoder. To evaluate the performance of the proposed method, they conduct experiments with four traditional machine learning classifiers and four state-of-the-art JIT models.

In the article entitled "Sharing Knowledge to Promote Proactive Multi-environments in the WoT", Daniel Flores-Martin et al. contribute to the automation of IoT device activity, through an original knowledge distillation process based on modelling users' behaviour. The distillation process extracts relevant fragments of knowledge from complex, heavily trained models (referred to as teacher models), and transfers them into new, simpler models that will fit other users' needs (referred to as student models). The paper convincingly explains how the distillation process saves training time and

resources and enables IoT devices to quickly learn users' models based on the previously trained models that they receive from the teacher models.

The article titled "Generating Automated Layout Design using a Multi-population Genetic Algorithm" by Arun Kumar et al., discusses a typical example of the use of edge devices in unconventional domains. Here, a multi-population genetic algorithm implementation over an edge device provides optimal layout designs for living spaces. The device is able to dynamically capture the map of the space in question and provides suggestions on the placement of various components like furniture for the optimal usage of space whilst catering to standard architectural norms.

The articles, as stated earlier, range across a plethora of application domains harnessing edge cloud environments and collectively constitute an interesting and useful compendium on the subject.

Acknowledgment

The BECS 2022 workshop was supported by the Ministry of Science and ICT (MSIT), Korea, under the Information Technology Research Center (ITRC) support program (IITP-2023-2020-0-01795) supervised by the Institute of Information & Communications Technology Planning Evaluation (IITP).

Michael Mrissa gratefully acknowledges the European Commission for funding the InnoRenew CoE project (Grant Agreement #739574) under the Horizon2020 Widespread-Teaming program and the Republic of Slovenia (Investment funding of the Republic of Slovenia and the European Regional Development Fund).