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GUEST EDITORIAL

Guest Editorial: Machine learning applied to quality and security in software systems

During the development of software systems, even with advanced planning, problems with quality and security occur. These defects may result in threats to program development and maintenance. Therefore, to control and minimise these defects, machine learning can be used to improve the quality and security of software systems. This special issue focuses on recent advances in architecture, algorithms, optimisation, and models for machine learning applied to quality and security in software systems. After a rigorous review according to relevance, originality, technical novelties, and presentation quality, we selected 4 manuscripts. A summary of these accepted papers is outlined below.

In the first paper entitled "Robust Malware Identification via Deep Temporal Convolutional Network with Symmetric Cross Entropy Learning" by Sun et al., the authors propose a robust Malware identification method using the temporal convolutional network (TCN). Moreover, word embedding techniques are generally utilised to understand the contextual relationship between the input operation code (opcode) and application programming interface (API) function names in many cases. Here, considering the numerous unlabelled samples in practical intelligent environments, the authors pre-train the TCN model on an unlabelled set using a word embedding method, that is, *word2vec*. In the experiments, the proposed method is compared to several traditional statistical methods and more recent neural networks on a synthetic Malware dataset and a real-world dataset. The performance comparisons demonstrate the better performance and noise robustness of the proposed method, that the proposed method can yield the best identification accuracy of 98.75% in real-world scenarios.

In the second paper entitled "Just-In-Time Defect Prediction Enhanced by the Joint Method of Line Label Fusion and File Filtering" by Zhang et al., the authors propose a Just-in-Time defect prediction model enhanced by the joint method of line label Fusion and file Filtering (JIT-FF). First, to distinguish added and removed lines while preserving the original software changes information, the authors represent the code changes as original, added, and removed codes according to line labels. Second, to obtain semantics-enhanced code representation, the authors propose a cross-attention-based line label fusion method to perform complementary feature enhancement. Third, to generate code changes containing fewer defect-irrelevant files, the authors formalise the file filtering as a sequential decision problem and propose a reinforcement learning-based file filtering method. Finally, based on generated code changes, CodeBERT-based commit representation and multi-layer perceptron-based defect prediction are performed to identify the defective software changes. The experiments demonstrate that JIT-FF predicts defective software changes more effectively.

In the third paper entitled "Android Malware Detection via Efficient API Call Sequences Extraction and Machine Learning Classifiers" by Wang et al., the authors propose a novel Android malware detection framework, where the authors contribute an efficient API call sequences extraction algorithm and an investigation of different types of classifiers. In API call sequences extraction, the authors propose an algorithm for transforming the function call graph from a multigraph into a directed simple graph, which successfully avoids unnecessary repetitive path searching. The authors also propose a pruning search, which further reduces the number of paths to be searched. The developed algorithm greatly reduces the time complexity. The authors generate the transition matrix as classification features and investigate three types of machine learning classifiers to complete the malware detection task. The experiments are performed on real-world APKs, and the results demonstrate that the proposed method reduces the running time and produces high detection accuracy.

In the fourth paper entitled "Selecting Reliable Blockchain Peers via Hybrid Blockchain Reliability Prediction" by Zheng et al., the authors propose H-BRP, a Hybrid Blockchain Reliability Prediction model, to extract the blockchain reliability factors and then make the personalised prediction for each user. Connecting to unreliable blockchain peers is prone to resource waste and even loss of cryptocurrencies by repeated transactions. The proposed model primarily aims to select reliable blockchain peers and to evaluate and predict their reliability. Comprehensive experiments conducted on 100 blockchain requesters and 200 blockchain peers demonstrate the effectiveness of the proposed H-BRP model. Furthermore, the implementation and dataset of 2,000,000 test cases are released.

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The Guest Editors would like to express their deep gratitude to all the authors who have submitted their valuable contributions, and to the numerous and highly qualified anonymous reviewers. We think that the selected contributions, which represent the current state of the art in the field, will be of great interest to the community. We also would like to thank the *IET Software* publication staff members for their continuous support and dedication. We particularly appreciate the relentless support and encouragement granted to us by Prof. Hana Chockler, the Editor-in-Chief of *IET Software*.

Honghao Gao[1]
Walayat Hussain[2]
Ramón J. Durán Barroso[3]
Junaid Arshad[4]
Yuyu Yin[5]

[1]*School of Computer Engineering and Science, Shanghai University, Shanghai, China*
[2]*Peter Faber Business School, Australian Catholic University, Sydney, QLD, Australia*
[3]*Department of Theory of Signal and Communications and Telematic Engineering, Universidad de Valladolid, Valladolid, Spain*
[4]*School of Computing and Digital Technology, Birmingham City University, Birmingham, UK*
[5]*School of Computer, Hangzhou Dianzi University, Hangzhou, China*

Correspondence
Honghao Gao.
Email: gaohonghao@shu.edu.cn

AUTHOR BIOGRAPHIES

Honghao Gao is currently with the School of Computer Engineering and Science, Shanghai University, China. He is also a Professor at the College of Future Industry, Gachon University, Korea. His research interests include Software Intelligence, Cloud/Edge Computing, and AI4Healthcare. He has publications in IEEE TII, IEEE T-ITS, IEEE TNNLS, IEEE TMM, IEEE TSC, IEEE TCC, IEEE TFS, IEEE TNSE, IEEE TNSM, IEEE TCCN, IEEE TGCN, IEEE TCSS, IEEE TETCI, IEEE TCE, IEEE/ACM TCBB etc. He has broad working experience in cooperative industry-university-research. He is a European Union Institutions-appointed external expert for reviewing and monitoring EU Project, is a member of the EPSRC Peer Review Associate College for UK Research and Innovation in the UK, and a founding member of the IEEE Computer Society Smart Manufacturing Standards Committee. Prof. Gao is a Fellow of the Institution of Engineering and Technology (IET), a Fellow of the British Computer Society (BCS), and a Member of the European Academy of Sciences and Arts (EASA).

Dr. Walayat Hussain is a Visiting Fellow at the School of Computer Science. Currently he is a Senior Lecturer and the Head of Discipline-IT at the Australian Catholic University, Australia. He served as a Lecturer and Postdoctoral Research Fellow at the Victoria University, Melbourne, School of Information, Systems and Modelling, University of Technology Sydney Australia for several years. Prior to joining UTS, he worked as an Assistant Professor and the Postgraduate program coordinator at BUITEMS University for many years. Walayat's research areas are Distributed Systems, AI, Information Systems, Computational Intelligence, Machine Learning, Business Intelligence, Decision Support Systems, and Usability Engineering. His work has been published in different top-ranked reputable ERA-A*, A, Q1 journals and conferences such as IEEE Transactions on Fuzzy Systems, IEEE Transactions on Service Computing, Future Generation Computer Systems, Information Sciences, International Journal of Intelligent Systems, Information Systems, Journal of Ambient Intelligence and Humanized Computing, Neural Computing and Applications, The Computer Journal (Oxford University Press), Computer & Industrial Engineering, IEEE Access, ACM TOMM, IEEE TGCN, IEEE TETCI, International Journal of Communication Systems, Mobile Networks and Applications, GJFSM, FUZZ-IEEE, ICONIP, and many others.

Ramón J. Durán Barroso received the degree in telecommunication engineering and the Ph.D. degree from the University of Valladolid, Spain, in 2002 and 2008 respectively. He currently works as an Associate Professor with the University of Valladolid. He is also the Coordinator of the Spanish Research Thematic Network "Go2Edge: Engineering Future Secure Edge Computing Networks, Systems and Services" composed of 15 entities and the H2020 IoTalentum Project. He has authored more than 150 papers in international journals and conferences. His current research interests include the use of artificial intelligence techniques for the design, optimisation, and operation of future heterogeneous networks, multi-access edge computing, and network function virtualisation.

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Dr. Junaid Arshad has 14 years of research experience and expertise in investigating and addressing cybersecurity challenges for diverse computing paradigms such as Grid computing, Cloud computing, IoT, and blockchain. He is actively engaged in cutting-edge R&D distributed ledger technologies including blockchains, Tangle and Hashgraphs, investigating novel challenges to improve state of the art for such technologies as well as their use to solve real-world challenges. Junaid is an alumnus of the Innovate UK & DCMS funded CyberASAP programme, commercially prototyping the CyMonD system for effective monitoring and defence of IoT-based systems against cyber-threats. Junaid has successfully achieved research funding from UK and overseas funding agencies, and has worked as a security specialist for a number of EU funded projects with experience of developing bespoke security solutions. He is also actively involved in research surrounding analysis of malware for mobile and IoT devices focusing on profiling malicious behavior to achieve runtime detection and defense. Junaid has successfully published high quality research within cybersecurity and has more than 50 publications at high quality venues including journals, book chapters, conferences and workshops. He is an Associate Editor for the Cluster Computing and IEEE Access journals and regularly serves on program and review committees of several journals and conferences.

Yuyu Yin received the Ph.D. degree in computer science from Zhejiang University in 2010. He is currently a Professor with the College of Computer, Hangzhou Dianzi University, Hangzhou, China. He is also a Supervisor of master's students with the School of Computer Engineering and Science, Shanghai University, Shanghai, China. He has authored or coauthored more than 40 articles in journals and refereed conferences, such as Sensors, Entropy, IJSEKE, Mobile Information Systems, ICWS, and SEKE. His research interests include service computing, cloud computing, and business process management. Dr. Yin is also a member of the China Computer Federation (CCF) and the CCF Service Computing Technical Committee. He has organised more than ten international conferences and workshops, such as FMSC 2011–2017 and DISA 2012 and 2017–2018. He has served as a Guest Editor for the Journal of Information Science and Engineering and International Journal of Software Engineering and Knowledge Engineering and a Reviewer for the IEEE Transaction on Industry Informatics, Journal of Database Management, and Future Generation Computer Systems.

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