ITU Journal

Future and evolving technologies

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Volume 5, Issue 1, March 2024

ISSN: 2616-8375

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ITU Journal on Future and Evolving Technologies, Volume 5, Issue 1, March 2024

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Special issue on "Next generation computer communications and networks"

Introduction

This special issue aims to examine various complementary aspects of cutting-edge trends and creative approaches in communications and network research. The goal is to showcase selected pioneering technologies, methods, and principles that will support the development of the next generation of interconnected communication systems and facilitate their integration into smart society, industry, and economy.

The rapid expansion and transformation of the communication and networking industries require creative solutions to ensure efficient performance and the delivery of advanced services to users. These innovative approaches can be beneficial not only in the operation of existing networks but also in the design of future network architectures, whether it be evolutionary or disruptive.

This special issue started as an effort to expand some of the best papers presented in the IEEE International Symposium on Computers and Communications (ISCC) 2022 and 2023 editions. It also includes several other papers that were accepted through an open call after a rigorous reviewing process. The addressed topics highlighted the dynamics of the field and provided ideas for the future. The traditional issues of optimal scheduling are addressed in innovative ways that consider the current size of the networks and the interplay and synergies between software and hardware when designing appropriate algorithms. The long-established neural networks and artificial intelligence approaches are now seen from a different perspective due to the availability of the appropriate hardware and software both at the provided and the malicious user sides. The need for security is expressed in various forms and different environments and uses innovative solutions from the tools that the current AI landscape provides.

The paper "*Minimum collisions assignment in interdependent networked systems via defective colorings*" by Maria Diamanti, Nikolaos Fryganiotis, Symeon Papavassiliou, Christos Pelekis, and Eirini Eleni Tsiropoulou investigates scheduling in a resource-constrained networked system, where the number of resources is less than or equal to the maximum degree of the underlying graph. Two distributed, randomized algorithms are introduced that converge in a logarithmic number of rounds to an assignment of resources over the network for which every node has at most a certain number of collisions.

Antonio Caruso, Stefano Chessa, Soledad Escolar, Fernando Rincón, and Juan Carlos López in their paper "*A dynamic programming schedule trading off quality and stability in task allocation for energy-neutral Internet of Things devices harvesting solar energy*" study the problem of energy neutrality in an energy harvesting Internet of Things (IoT) device to ensure its continuous operation by trading performance with energy consumption. A novel scheduling algorithm, which takes into account the stability of the device, is shown to greatly improve the stability of the device concerning the state-of-the-art algorithms, with a marginal worsening of the overall quality of the tasks executed.

The paper "*MultiTASC++: A continuously adaptive scheduler for edge-based multi-device cascade inference*" by Sokratis Nikolaidis, Stylianos I. Venieris, and Iakovos S. Venieris addresses scheduling in a different manner. It looks at the multi-device cascade setting, where multiple diverse devices simultaneously utilize a shared heavy model hosted on a server, often situated within or close to the consumer environment. MultiTASC++, a continuously adaptive multi-tenancy-aware scheduler, is introduced. Through extensive experimentation, its scalability and efficiency in addressing the unique challenges of collaborative DNN inference in dynamic and diverse IoT environments are shown.

Etienne Le Louët, Antoine Blin, Julien Sopena, Kamel Haddadou, and Ahmed Amaou in their paper "*Effects of secured DNS transport on resolver performance*" look at DNS, which is still a core component of the Internet, comparing various traffic profiles over different Domain Name System (DNS) transports. They observe that switching from the legacy protocol to a more secure one can lead to an important performance penalty.

The paper "*On autoregressive and neural methods for massive-MIMO channel de-noising*" by Dmitry Artemasov, Alexander Blagodarnyi, Alexander Sherstobitov, and Vladimir Lyashev looks at how the Multiple-Input Multiple-Output (MIMO) can be used effectively in 5G Time Division Duplex (TDD) systems. Various methods are described for the massive-MIMO channel estimation de-noising problem. Extensive simulation results demonstrate the robustness of the developed methods to the dynamic channel conditions.

Anestis Papakotoulas, Theodoros Mylonas, Kakia Panagidi, and Stathes Hadjiefthymiades in "*Optimizing IoT security via TPM integration: An energy efficiency case study for node authentication*" study certain vulnerabilities in Internet of Things (IoT) applications. In particular, by leveraging the Trusted Platform Module (TPM), they investigate its capability to enhance node authentication with a focus on energy efficiency.

The paper "*Automated Wi-Fi intrusion detection tool on 802.11 networks*", by Dimitris Koutras, Panos Dimitrellos, Panayiotis Kotzanikolaou, and Christos Douligeris, looks at vulnerabilities in Wi-Fi implementations that may allow nearby adversaries to gain an initial foothold into a network, and proposes a methodology for the detection of attacks originating from Wi-Fi networks, along with a Wi-Fi Network Intrusion Detection (Wi-Fi-NID) tool.

Dimitris Koutras, Panayiotis Kotzanikolaou, Evangelos Paklatzis, Christos Grigoriadis, and Christos Douligeris in their paper "*A framework for automating environmental vulnerability analysis of network services*" introduce a framework designed to automate the assessment of the environmental vulnerability status of communication protocols and networked services, within operational contexts.

In their paper "*Unsupervised representation learning for BGP anomaly detection using graph auto-encoders*", Kevin Hoarau, Pierre Ugo Tournoux, and Tahiry Razafindralambo propose a method to learn the representations of normal BGP behaviour in an unsupervised manner using a Graph Auto-Encoder (GAE), thus ensuring that the representations are not limited to the specific set of anomalies included in the training set.

The paper "*On the extraction of RF fingerprints from LSTM hidden-state values for robust open-set detection*", by Luke Puppo, Weng-Keen Wong, Bechir Hamdaoui, Abdurrahman Elmaghbub, and Lucy Lin, explores the capabilities of deep learning in wireless network security. They introduce a novel open-set detection approach for RF data-driven device identification that extracts its neural network features from patterns of the hidden-state values within a Convolutional Neural Network Long Short-Term Memory (CNN+LSTM) model.

The special issue's Guest Editors would like to thank all the reviewers for their thorough job that has resulted in very well-written and in-dept papers, and the authors who trusted their work in this special issue. Special thanks to the Editor in Chief of the ITU Journal on Future and Evolving Technologies who trusted us with this endeavour and supported and encouraged us through the process. The impeccable and professional support of Alessia Magliarditi, ITU Journal's Manager, and Erica Campilongo, Publishing Editor, in all the lengthy stages of this special issue are greatly appreciated.

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