17th International Learning & Technology Conference 2020

Editorial: 5G and Beyond; Paving the way for 6G

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In recent times, 5G has gained prevalence in learning and technology that it will be the game-changer of the coming decade. In the wake of the fourth industrial revolution, governments and businesses worldwide are also beginning to realize the seismic shift towards 5G. The speed of development and growth of 5G has not only gained momentum in the network and application domains but has also increased investment by leading technology companies such as Ericson, Huawei, Google, and AT&T. At a recent summit "AI for the Good of Humanity" Global Artificial Intelligence (AI), held in Riyadh on 21-22 October, and organized by the Saudi Data and AI Authority (SDAIA), Charles Yang, President of Huawei Middle East, said ""Huawei has adopted an ambitious long-term research and development strategy regarding AI, creating unprecedented opportunities through the synergy of AI with 5G connectivity, cloud, computing, and industrial applications".

Introducing 5G technology marks the start of a new age of communication, impacting almost every aspect of everyday life. According to Deloitte, nearly 2,5 billion people are using smartphones, and 1,2 billion are using tablets. During 2017 alone, more than 175 billion applications were downloaded, some with over one billion users, which led to more data communication and interaction of billions of devices. The average download speed went from 8 Mbps on 3G to 32.5 Mbps on 4G and up to 240 Mbps on 5G. By 2021, the video will account for 78% of mobile data traffic, up from 60% in 2016. CISCO predicted that in 2019, and for the first time in history, the mobile network traffic would surpass the fixed network traffic.

The Kingdom of Saudi Arabia Vision 2030 realizes the importance of 5G in the nation's future; the National Digitization Unit (NDU) is striving towards recognizing the Kingdom as a new tech hub for the modern Arab world. Ministry of Communications and Information Technology projections show that 5G will contribute more than $19 billion to Saudi Arabia's GDP and create almost 20,000 new ICT jobs by 2030. To achieve one of the National Transformation Program 2020 objectives in information and communication technology, the Communications and Information Technology Commission (CITC), a Saudi communications authority, and Zain, a mobile network operator in Saudi Arabia, have signed an agreement to launch the first mobile Broadband high-speed project in rural areas. According to Open signal, a London-based mobile analytics company, the Kingdom ranks first in the 5G generation mobile network's average speed reaching 377.2 Mbps, Korea ranked second fastest with 336.1 Mbps.

For almost two decades, Effat University envisioned a timely platform that brings together educators, researchers, and tech enthusiasts under one roof and functions as a fount for creativity and innovation. It was a dream that such a platform bridges the existing gap and becomes a leading hub for innovators across disciplines to share their knowledge

and exchange novel ideas. It was in 2003 that this dream was realized, and the first Learning & Technology symposium was held. Up until today, the Conference has covered a variety of cutting-edge themes such as Digital Literacy, Cyber Citizenship, the Global Learning Environment, MOOCs, Makerspace, IoT, Artificial Intelligence and Machine Learning, 5G and Beyond: Paving the way to 5G, to cite just a few. The Conference has also attracted key, prominent figures in the fields of sciences and technology who addressed large, eager-to-learn audiences and inspired many with unique stories.

Six invited speakers presented the up-to-date research related to the field of 5G, Artificial Intelligence, Machine Learning, and Automation in 5G, Internet of Things and Smart Cities as follows:
- Ayman Ameen Sajini, CEO of Islamic Est. for Private Sector Development, Islamic Development Bank
- Dr. Miltiades Lytras, Research Professor, Deree College , Greece, Visiting Researcher, Effat University
- Mr. Abdulrahman Shiekh, VP, Education E-Solutions, Technology Strategy Advisor, Big Innovation Center
- HH Lubna Althunayan, Educational Technology Consultant, Riyadh International Consulting, KSA
- Dr. El-Hadi Aggoun, Professor and Director of the Sensor Networks and Cellular Systems (SNCS) Research Center, University of Tabuk, Tabuk, Saudi Arabia
- Dr. Mazhar Bari, Senior Vice President Technology and Innovation at Siemens Saudi Arabia and Head of the MindSphere Application Centre (MAC)

This special issue provides a forum for the latest research, innovations, and applications of the field of 5G. Specifically, it examines the modern practices and potential of 5G and the way it affects the digital transformation, innovation, and social, economic, and educational developments, both locally and globally. Additionally, it explores the characteristics of the next communication generation (6G). It discusses related 5G topics including 5G Technologies, Services, and Applications, 5G Vision for Smart Cities Research, 5G Services for Sustainable Development, 5G Network Security, Economy, and Privacy, Artificial Intelligence, Machine Learning, and Automation in 5G, Internet of Things and Smart Cities in 5G, 5G Hardware, 5G Communication, and 5G and Energy Efficiency.

The contribution of our conference to the Digital Transformation in the Kingdom of the Saudi Arabia is multifold:
- It contributes to the body of knowledge in the scientific domain of Learning and Technology by synthesizing robust, progressive, theoretical, and applied knowledge and ideas
- It mobilizes a dynamic, talented community of academics, scholars, researchers, students and industry stakeholders, towards the enhancement of creative thinking, innovation and entrepreneurship
- It provides a testbed for the design, implementation and testing of applications in the domains of Learning technologies towards more effective Learning
- It creates and supports an Innovation incubator and hub in the areas of learning, technology and innovation, by bringing together diverse stakeholders
- It contributes significantly to the research capacity of Effat university by promoting high quality, leading research of its faculty and researchers
- It enhances policy making and crafting of strategies for the digital transformation of Education in Saudi Arabia

The special issue includes twenty, high-quality papers. Among them, seven papers discussed the future of the 5G technologies and their applications internationally and nationally. Seven Papers went through proposed different algorithms and techniques that enhance the efficiency of 5G technologies. The rest of the papers addressed the security issues and beyond in the 5G technologies and how it could be extended for future technologies towards the new 6G generation.

The authors of the paper titled "Efficient Combination of RSA Cryptography, Lossy and Lossless Compression Steganography Techniques to Hide Data", discussed a combination of RSA and Huffman coding, RLE, or DWT has been carefully proposed as a way of securing and compressing messages, even concealing the messages in a cover image, aimed at producing a high-quality stego-image. The authors have evaluated and discussed three distinct algorithms that can be used in image compression. The experimental results indicate that the proposed mechanism has an efficient visual quality and larger storage capacity than the existing techniques.

In the paper entitled "A DDoS Attack Mitigation Framework for IoT Networks using Fog Computing," a DDoS attack mitigation framework using fog computing is proposed to ensure fast and accurate detection. The framework employs an anomaly-based mitigation method that utilizes a k-NN classification algorithm alongside a database. The results demonstrate that the k-NN classifier will be able to detect DDoS attacks with high accuracy.

In the paper, entitled "Design and Simulation of Millimeter-Wave Broadband Modified Ankh-Key Antenna for 5G and Beyond Technologies Applications", a modified Pharaonic Ankh Key antenna of dimensions 12.75 mm x 18.7 mm x 0.787 mm is simulated using HFSS and CST simulators resulting in a great improvement in the antenna efficiency and a huge bandwidth extending from 26.6 GHz till beyond 140 GHz with few band notches having a peak gain 10.2 dBi which can be used in various applications of 5G, 6G and maybe 7G technologies.

In the paper, entitled "An Improving position method using Extended Kalman filter", authors proposed a method to predict the location of mobile nodes in VANETs using an EKF allowing for elementary analysis of location data with technical analysis.

The authors of the paper titled "Survey on Network Slice Isolation in 5G Networks: Fundamental Challenges" conducted a state-of-the-art 5G network slice, addressing a number of network slicing architecture issues, and highlighting the main challenge related to isolating the network slices and defining what levels and types of isolation are required. The author prosed a network simulations such as OMNET++ to analyze the future 5G network slicing architecture in different mobility scenarios.

The authors of "5G-Wireless Sensor Networks for Smart Grid- Accelerating technology's progress and innovation in the Kingdom of Saudi Arabia" presented a comprehensive summary of the new 5G technologies. They also suggested a strategy consisting of several tools and mechanisms to resolve the vulnerabilities of potential components, identify malicious operations, strengthen network communication security, and protect the privacy of the customer.

The authors of "Solving optimization problems in the fifth generation of cellular networks by using meta-heuristics approaches" discussed and highlighted the main concepts of the 5G technology by presenting the meta-heuristic techniques for resources management in 5G.

The paper titled "Location Closeness Model for VANETs with Integration of 5G" presents a model for measuring "location closeness", through two main blocks (Trust Model & Decision Model) for executing and transmits the messages between the nodes. The model further has been implemented and validated using four cases. The results represented the model validation was performed by measuring the trust value and taking the decision based on the pre-defined threshold.

The authors of "The impact of the soft errors in convolutional neural network on GPUs: Alexnet as case study" analyzed the error resilience of Alexnet, a well-known CNN model, from the perspective of architecture-level instructions. Their analysis showed that Alexnet is more prone to SDC than DUE errors, which are more crucial because they modify model's final output. Accordingly, they found that FADD and LD are the top vulnerable instructions against soft errors for Alexnet model, both instructions generate at least 84% of injected faults as SDC errors.

The paper entitled "Fast Auto-Correction algorithm for Digital VLSI Circuits" proposed an efficient auto-correction algorithm (EAC) which improves performance of design bug correction in digital VLSI circuits such as: extra inverters, missing inverters and gate replacements. The proposed EAC algorithm is dependent on sorting of design bugs in an ascending order according to its priority to avoid injection of additional circuits, duplication processes and calling of SAT engines in case of the highest priority bugs.

The authors of the paper entitled "Appliance Identification Based on Smart Meter Data and Event-Driven Processing in the 5G Framework" presented a new proposed for automatically identifying the major household appliances. It is focused on the analysis of events and the extraction and classification of pertinent features in time-domain without using the computationally complex frequency domain transformations. It is demonstrated that the suggested approach attains a 3.7 times compression gain over the conventional counterparts. It aptitudes a valuable diminishing in the system processing and post transmission activities.

In the paper titled "Sub-Nyquist Wideband Spectrum Sensing Based on Analog to Information Converter for Cognitive Radio", A Simulink model of the random demodulator based spectrum sensing architecture is built and simulated on MATLAB to prove the system functionality. Implementation of an efficient high speed chipping sequence for the random demodulator is presented. The proposed chipping sequence architecture can operate at 2.27 GHz clock frequency in targeted technology of 130 nm with a speed up of 13.5% compared to recently published work.

Finally, the authors of the paper titled "Design of PWM-Based Digital Receiver for 5G" presented a PWM-based all digital receiver that is suitable for cognitive radio and software defined radio. A system level simulation of the pulse-width modulator is performed using cadence software. A high-speed two-stage dynamic CMOS-latched comparator is proposed.

We want to thank all the great L&T Conference' community for making possible for one more time this event. We are looking forward to welcome you again in our Effat University in Jeddah. We wish you all to be safe and well during the COVID-19 pandemic.

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