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# Guest editorial: Cognitive applications on device architectures and algorithms

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The problem of integrated cognition circuits belongs to a multi-disciplinary area of cognitive engineering. The multi-disciplinary focus on cognitive models and real-time embedded systems, such as system architectures, computing techniques, computation intelligence algorithms, mobile devices and robots, helps to reveal a broader and deeper understanding of system architecture and signal processing that are part of everyday life and society. Over the past decades, many cognitive architectures have been proposed and steadily developed, based on different approaches and computational intelligence methodologies, but still current cognitive architectures are far from the goal of covering the requirements for general intelligence in the area of system architectures and signal processing. Recent research in evolutionary computational algorithms and genetic programming is used in this study as an inspiration for developing a new version of integrated cognitive architecture devices. The knowledge of signal processing and communication devices is also applied to the architecture for Industry 4.0 requirements.

A cognitive architecture specifies the underlying infrastructure for an intelligent system. Briefly, architecture includes those aspects of a cognitive architecture, computing algorithms and computational intelligent techniques that are constant over time and across different application domains like very large scale integrated circuits (VLSI) hardware architectures, communication devices and signal processing. These typically include the short-term and long-term memories that store content about the user's information, nodes information, computational evolutionary algorithms and knowledge about data transmission. The functional processes that operate on system architectures and computational algorithms include the performance mechanisms and the learning mechanisms that alter them.

This special issue aims to address the various issues on cognitive architectures, computational intelligence algorithms like hardware description languages, signal processing, communication devices, artificial intelligence (AI) algorithms on communication, image processing techniques for data transmission, and the papers contributed high quality theoretical and practical works.

## Papers in the special issue

The special issue is composed of seven outstanding contributions.

Venkataravana Nayak *et al.* analyzed that the multi-media content is being applied in various real-time computer vision applications. In multi-media content, digital images constitute a significant part. The representation of digital images interpreted by humans is subjective in nature and complex. Hence, searching for relevant images from the archives is

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The authors would like to thank and congratulate all the authors of the selected papers in this special issue of *International Journal of Intelligent Unmanned Systems* (Emerald Publisher) for their contributions of great value in terms of quality and innovation.

The authors would also like to thank the reviewers for their contribution to the selection and improvement process of the publications in this special issue. Our hope is that this special issue will stimulate researchers in both academia and industry to undertake further research in this challenging field. The authors are also grateful to the *International Journal of Intelligent Unmanned Systems* Editor-in-Chief and the Editorial office for their support throughout the editorial process.



International Journal of Intelligent  
Unmanned Systems  
Vol. 11 No. 1, 2023  
pp. 1-4  
© Emerald Publishing Limited  
2049-6427  
DOI 10.1108/IJUIS-01-2023-141

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difficult. Thus, electronic image analysis strategies have become effective tools in the process of image interpretation.

Shobha Y.K. *et al.* proposed the research work to examine the latest developments such as the techniques employed for allocation of power, browser techniques, modern analysis and bandwidth efficiency of nonorthogonal multiple accesses (NOMA) in the network of 5G. Furthermore, the proposed work also illustrates the performance of NOMA when it is combined with various techniques of wireless communication, namely network coding, multiple-input multiple-output (MIMO), space-time coding, collective communications, as well as many more. In the case of the MIMO system, the proposed research work specifically deals with a less complex recursive linear minimum mean square error (LMMSE) multi-user detector along with NOMA (MIMO-NOMA); here the multiple-antenna base station (BS) and multiple single-antenna users interact with each other instantaneously. Although LMMSE is a linear detector with a low intricacy, it performs poorly in multi-user identification because of the incompatibility between LMMSE identification and multi-user decoding. Thus, to obtain a desirable iterative identification rate, the proposed research work presents matching constraints among the decoders and identifiers of MIMO-NOMA.

Reyana *et al.* proposed a research work on traffic monitoring system, the detection of stirring vehicles is monitored by fitting static cameras in the traffic scenarios. Background subtraction, a commonly used method, detaches poignant objects in the foreground from the background. The method applies a Gaussian mixture model, which can effortlessly be contaminated through slow-moving or momentarily stopped vehicles.

Vamsee Krishna *et al.* attempted a novel approach for system-level modeling and simulation of sigma-delta modulator for low-frequency CMOS integrated analog to digital interfaces. A comparative analysis of various architecture topologies and circuit implementation techniques is described with an analytical procedure for effective selection of topologies for targeted specifications.

Vijaya Saradhi *et al.* explore a huge variety of devices that accumulate as well distribute a large quantity of data either with the help of wired networks or wireless networks to implement a wide variety of application scenarios. The spectrum resources, on the other hand, become extremely unavailable with the development of communication devices and thereby making it difficult to transmit data on time.

Shailesh Khapre *et al.* aim to use the concept of machine learning to enable people and machines to interact more certainly to extend and expand human expertise and cognition. Intelligent code reuse recommendations based on code big data analysis, mining and learning can effectively improve the efficiency and quality of software reuse, including common code units in a specific field and common code units that are not related to the field.

Thirumalaiah G *et al.* describe that space-time variants algorithm will not give good results in practical scenarios; when no tubes increase, these techniques will not give the results. It is challenging to reduce the energy of the output synopsis videos. In this paper, a new optimized technique has been implemented that models and covers every frame in the output video.

Upendra Raju K *et al.* propose that steganography is a data hiding technique used in the data security; while transmitting data through channels, there is no guarantee that the data are transmitted safely. Variety of data security techniques exists such as patch work, low bit rate data hiding, lossy compression etc. This paper aims to increase the security and robustness.

Krishna Mohan A *et al.* explore the community of visual tracking or object tracking, and a discriminatively learned correlation filter (DCF) has gained more importance. When it comes to speed, DCF gives the best performance. The main objective of this study is to anticipate the object visually. For tracking the object visually, the authors proposed a new model based on the convolutional regression technique. Features like HOG and Harris are used for the process of feature extraction. The proposed method will give the best results when compared to other existing methods.

Naveen Kilari D *et al.* aim to provide a permanent magnet synchronous generator (PMSG) wind turbine, which feeds electric power (AC) to the power grid. The converter, located on the machine side, is used to produce the full amount of wind power. Research on wind energy conversion system (WECS) is carried out in this study using a direct wind turbine in MATLAB with constant and variable speeds.

Srinivas Talasila *et al.* propose extraction of leaf region from the plant leaf images is a prerequisite process for species recognition, disease detection and classification and so on, which are required for crop management. Several approaches were developed to implement the process of leaf region segmentation from the background. However, most of the methods were applied to the images taken under laboratory setups or plain background, but the application of leaf segmentation methods is vital to be used on real-time cultivation field images that contain complex backgrounds. So far, the efficient method that automatically segments leaf region from the complex background exclusively for black gram plant leaf images has not been developed.

Devisasi Kala D.D *et al.* describe that optimization involves changing the input parameters of a process that is experimented with different conditions to obtain the maximum or minimum result. Increasing interest is shown by antenna researchers in finding the optimum solution for designing complex antenna arrays which are possible by optimization techniques.

Satyender Jaglan *et al.* proposed for automated classification of epilepsy signals. In the first stage, a tertiary wavelet model uses the orthonormal M-band wavelet transform. This model decomposes EEG signals into three bands of different frequencies. In the second stage, the decomposed EEG signals are analyzed to find novel statistical features. The statistical values of the features are demonstrated using multi-parameters graph comparing normal and epileptic signals. In the last stage, the features are inputted to different conventional classifiers that classify pre-ictal, inter-ictal (epileptic with seizure-free interval) and ictal (seizure) EEG segments.

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Budati Anil Kumar is a postdoctoral researcher at ICSDI, UCSI University, Malaysia. He has 13 years of teaching and research experience. His research interests mainly focus on wireless communications, signal processing and cognitive radio networks. He has published more than 50 peer-reviewed international journal and conferences papers, delivered guest lectures and acted as various committee chairs in national and international conferences. He acts as guest editor for various highly indexed and high impact factor journals. He was the editor for the book of *Cognitive Radio and Blockchain Technology for Wireless Communications and IoT*, Taylor and Francis Publisher (CRC

Press) and Scrivener and Wiley Publisher, respectively. He is a member of IEEE, IEI and Fellow of IETE from 2018, and has served as a reviewer for various international journals. He has received a BTech degree from (VYCET) JNTU, Hyderabad, in 2007 and Master of Technology from (LBRCE) JNTUK, Kakinada University in 2010 and a PhD degree from GITAM (Deemed to be University), India, in 2019, respectively.



George Ghinea is professor in the Department of Computer Science at Brunel University London. George obtained his BSc in computer science and mathematics majors from the University of the Witwatersrand, South Africa and later went on to obtain BSc (Hons.) and MSc degrees, both in computer science, from the same university. George was awarded a PhD degree – Quality of Perception: An Essential Facet of Multi-media Communications – from the University of Reading, UK, in 2000. In it, George proposed the Quality of Perception metric, a precursor of the Quality of Experience (QoE) concept now widely known. However, whilst QoE is still a concept, QoP is a concrete metric. Thus, recognizing the infotainment duality of multi-media, QoP not only characterizes the subjective enjoyment associated with experiencing multi-media presentations, but also how such presentations aid a person's ability to assimilate informational content.



Dr S.B. Goyal had completed PhD in computer science and engineering from Banasthali University, Rajasthan, INDIA in 2012 from India and served many institutions in many different academic and administrative positions. He is holding 19+ years of experience at the national and international levels. He has peerless inquisitiveness and enthusiasm to get abreast with the latest development in the IT field. He has a good command over Industry Revolution (IR) 4.0 technologies like big data, data science, artificial intelligence and blockchain, deep learning etc. He is the first one to introduce IR 4.0 including blockchain technology in the academic curriculum in Malaysian universities. He had participated as a speaker in the Bloconomic 2019 event on Blockchain. He had participated in many panel discussions on IR 4.0 technologies at academia as well as industry platforms. He is serving as a reviewer or guest editor in many journals published by Inderscience, IGI Global and Springer. He is contributing as a co-editor in many Scopus books. He is an IEEE senior member since 2013. He had contributed to many Scopus/ SCI journals/ conferences. He had applied/ received Patent Grants of 8 years from Australia and India in the domain of blockchain, IoT, image processing. Currently, Dr. Goyal is associated as a Director, Faculty of Information Technology, City University, Malaysia.



Dr Krishna Kant Singh is professor at the Faculty of Engineering and Technology, Jain (deemed-to-be university), Bengaluru, India. He has wide teaching and research experience. Dr. Singh has acquired a BTech, MTech, and PhD (IIT Roorkee) in the area of image processing and machine learning. He has authored more than 90 research papers in Scopus and SCIE indexed journals of repute. He is also an associate editor of IEEE ACCESS (SCIE Indexed) and a member of the Editorial Board of Applied Computing and Geoscience. Dr. Singh is an active researcher in the field of machine learning, cognitive computing, 6G and beyond networks.



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