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EDITORIAL

Guest editorial: Machine Learning in Wireless Networks

This dedicated Special Section on Machine Learning in Wireless Networks aims to provide improved knowledge for state-of-the-art worldwide R&D communities in wireless networks and machine learning (ML) techniques. It aims to do so by calling for novel formulations, innovative techniques, and optimised solutions to highlight the key issues related to these problems in a forum for shared research and ideas. At present, ML-based systems or techniques are providing solutions for complex problems in all the domains, providing novel products and services or showing paths to new ways in research across many different fields. A new revolution has started to find solutions by combining the ML and wireless communication networks (WCN's) that could change our lives both directly or indirectly. The integration of these technologies gives advantages in other areas such as Industry 4.0, Internet of Things, mobile networks, smart grids, e-health services, automated factories, mobile data streaming and data analytics etc. Furthermore, WCNs are widely used to share information in mobile networks, sensor networks, data transformations, telemedicine, computing techniques, and vehicles, where ML techniques are used as a decision-making mechanism. Novel algorithms in ML are required to find solutions for real time problems, as well as various strategies needed to embed these algorithms in WCN devices. Novel deep learning techniques, fuzzy logic-based systems and algorithms, intelligent systems, clustering and reinforcement learning methods, data transmission approaches, data security mechanisms are required to get solution for real time problems in the academia or industry.

This Special Section calls for novel and innovative research work which explores new frontiers and challenges in the field of applying ML algorithms to WCNs. As mentioned above, this work will include novel deep learning techniques, machine learning models, AI proposals, hybrid systems etc. on WCNs, as well as case studies or reviews of the state-of-the-art.

1 | PAPERS IN THE SPECIAL SECTION

The Special Section is composed of three outstanding contributions.

In 'Content-based image retrieval using Gaussian–Hermite moments and firefly and grey wolf optimization', Tadepalli *et al.* propose that the rapid growth in the transfer of multimedia information over the Internet requires algorithms to retrieve a query image from image databases containing large repositories. The proposed content-based image retrieval (CBIR) uses Gaussian-Hermite moments (GHMs) as the low-level features. Later these features are compressed with principle component analysis (PCA). The compressed feature set is multiplied with the weight matrix array, which is the same size as that of feature vector. Hybrid firefly and grey wolf optimisation (FAGWO) is used to prevent the premature convergence of optimisation in Firefly Algorithm (FA). The retrieval of images in CBIR is carried in an OpenCV python environment with k-nearest neighbour (KNN) and random forest algorithms (RF) classifiers. The fitness function for the FAGWO is the accuracy of the classifier. The FAGWO algorithm derives the optimum weights from a randomly generated initial population. When these optimised weights are applied, the proposed algorithm shows better precision/recall and efficiency than some of the literature's existing works.

In 'Resource scheduling approach in cloud Testing as a Service using deep reinforcement learning algorithms', Karthik & Sekhar investigate the many organisations all over the world that use cloud computing Testing as a Service (TaaS) for their services. Cloud computing is principally based on the idea of on-demand delivery of computations, storage, applications, and additional resources. It depends upon delivering users services through Internet connectivity. In addition, it uses a pay-as-you-go business design to take care of users' services. It offers some essential characteristics including on-demand service, resource pooling, rapid elasticity, virtualisation, and measured services. Simultaneously, there are various kinds of virtualisation in use, such as full virtualisation, para-virtualisation, emulation, OS virtualisation, and application virtualisation. Resource scheduling in TaaS is among the most challenging tasks, as resources need to be allocated to the mandatory tasks/jobs based on the needed quality of application and projects, but because of the cloud environment, the uncertainty, and perhaps also heterogeneity, resource allocation can't be addressed with the prevailing policies. These problems are still a significant concern of the

majority of cloud providers where they face troubles in selecting the correct resource scheduling algorithm for a particular workload. In this paper, the authors use AI emergent algorithms Deep RM2, Deep Reinforcement Learning, and Deep Reinforcement Learning for TaaS Cloud Scheduling (DRLTCS), to resolve the issue of resource scheduling in cloud TaaS.

In 'Performance analysis of machine learning algorithms on automated sleep staging feature sets', Satapathy *et al*. describe how the speeding up of social activities, rapid changes in lifestyles, and an increase in the pressure in professional fields, lead to people suffering from several types of sleep-related disorders. It is very tedious task for clinicians for monitoring entire sleep durations of the subjects and analyse the sleep staging in traditional and manual lab environments. For the purpose of accurate diagnosis of different sleep disorder, we have considered the automated analysis of sleep epochs, which was collected from the subjects during sleep time. The complete process of automated approach of sleep stages classification is executed through four steps: pre-processing the raw signals; feature extraction; feature selection; and classification. In this study, the authors have extracted twelve statistical properties from input signals. The proposed models are tested in three different combinations of features sets. In the first experiment, the feature set contained all the twelve features. The second and third experiments are conducted with the nine and five best features. The patient records come from the ISRUC-Sleep database. The highest classification accuracy achieved for sleep staging through combinations of five features set. From both categories of subjects, the reported accuracy results exceeded 90%. As per outcome from the proposed system the random forest classification techniques achieved best accuracy incomparable to the other two classifiers.

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We would also like to thank all 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. We are also grateful to the *CAAI Transactions on Intelligence Technology* Editor-in-Chief and the Editorial office for their support throughout the editorial process.

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