

Guest Editorial: SAUPEC/RobMech/PRASA 2020

THIS is a Special Issue of the SAIEE Africa Research Journal (ARJ) comprising re-worked articles that were initially presented at the SAUPEC/RobMech/PRASA 2020 conference. This is a flagship regional conference sponsored by the SAIEE that incorporated the 29th Southern African Universities Power Engineering Conference, the 13th Robotics and Mechatronics Conference of South Africa and the 31th Annual Symposium of the Pattern Recognition Association of South Africa. It was held in Cape Town hosted by the University of Cape Town in January 2020. It is a unique conference in the subcontinent where expert researchers in the electric power sector interact with experts in robotics and mechatronics together with scholars in pattern recognition. The cross-fertilization of knowledge and skills across the three specialized frontiers becomes a major source of knowledge fusion needed to drive the technological advancement in the subcontinent and beyond.

Thirteen best papers were selected from a total of 151 that had been accepted and presented as peer-reviewed papers at the 2020 SAUPEC/PRASA/ROBMEch conference. The selected papers had to be reworked and further enriched by the respective authors followed by a rigorous peer-review process. Each article was reviewed by at least two experts. Consequently, out of the 13 selected best articles, 5 were successfully accepted in this Special Issue. The rest of this editors' note is a preamble to these articles.

Renewable electrical energy technologies as well as artificial intelligence (AI) in information technology are among the major worldwide disruptive technology frontiers with profound impact on many aspects of our lives, and this is the context of the articles in this Special Issue.

South Africa has been experiencing an unprecedented crisis in electric power and energy supply reliability since 2008. Coal has been the main source of electricity and yet is now common knowledge that this has become unsustainable; a situation not unique to South Africa. The electrical energy sector in the country is therefore characterized by intensified research and developments into more sustainable electrical energy technologies. It is in this context that 2 articles in the present Special Issue are on research solutions towards advancing renewable electrical energy technology.

The article by Solan Perumal et al. presents an innovation on supercapacitor design. They achieved remarkable energy densities and specific capacitances through innovatively using graphene oxide (GO) as electrode material. Such a development opens up opportunities for using supercapacitors in improving sustainability of renewable energy sources such as wind and solar.

At a power system level, the integration of renewable energy sources on the national power grids has challenges that need to be addressed through research. In that regard the article by Erick Arwa and Komla Folly presents a technique of optimizing the scheduling of electric vehicles in a grid-tied micro-grid

comprising of PV solar energy source and storage batteries. Through simulations in which they use their improved Q-learning algorithm, they demonstrate achievement of a 14% lower global cost and higher total rewards than the conventional Q-learning method.

In AI techniques, pattern recognition and the use of biometrics still remains a 'hot' research field. There is still a demand for improvement in the authentication system accuracy. Three papers were submitted on advancement of the algorithms and techniques for pattern recognition systems and technologies.

The paper by Kohlakala and Coetzer, presents a novel semi-automated ear-based biometric authentication system. This work makes use of the convoluted neural network (CNN) and morphological post processing for the automatic detection of the region of interest (ROC). The features are matched by implementing a Euclidean distance measure. Experimental work was conducted on two independent ear databases. Accuracies of 99.20% and 96.06% were reported respectively.

Recognizing visual relationships in images has proven to be a challenging task. The second paper by Josias and Brink, proposes three strategies to address this challenge. A multitask learning strategy is investigated and a class selective mini-batch construction strategy is used. This resulted in the development of a novel evaluation approach for visual relationship recognition.

The paper by Coetzer et al. addresses the challenges associated with optimal fusion of human and machine decisions for cost sensitive biometric authentication. The paper proposes an elegant and robust protocol that address the optimization challenge. The results show that when a reasonable number of experts are kept in the loop, there is a lower cost associated with the workforce/machine as compared to the unaided machine.

We wish you a informative engagement with this Special Issue.

Guest Editors



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