

Cognitive Science and Artificial Intelligence for Human Cognition and Communication

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■ **COGNITIVE COMPUTING HAS** broad horizons, which covers different characteristics of cognition. Moreover, cognitive science is an interdisciplinary, scientific study of human reasoning, emotions, language, perception, attention, and memory. However, artificial intelligence (AI) explores the design of computers and software that would be capable of intelligent behavior. The integration of cognitive science and AI offers a deep understanding of human cognition and communication. In addition, the creative and technical skills apply the knowledge in AI solutions and applications in engineering psychology. This special section guest editorial illustrates the connections between cognitive science and AI that examines human performance and design of engineering psychology. The earlier studies have revealed powerful principles, methodologies, and algorithms prompting in human self-examination and perception for building AI systems that better match human performance. Thus, this special section mainly focuses on the convergence of cognitive science

and AI principles and methods that would be helpful to improve the thinking ability skills of the humans in engineering psychology. Finally, the special section shows the state-of-the-art research advances in cognitive science and AI for human cognition and communication.

The article “ImCAPTCHA: Imperceptible CAPTCHA Based on Cursor Trajectories,” by Yu *et al.*, proposed a novel machine learning model for CAPTCHA based on the cursor trajectory created during mouse operation. This work has adopted ensemble learning algorithm model based on sliding sampling to classify and recognize cursor trajectory data. Experiments show that the classification performance of the model is reliable for recognition based on human-machine cursor trajectories, which is a new concept for CAPTCHA. Further, the article has highlighted that the need of proposed method can reduce the manual procedure and improve the user interactive experience.

The article “Cognitive Science-Based Security Framework for Social Networking in Consumer Electronics Marketing,” by Rathore and Park, provided a novel approach, inspired by cognitive science, to identify malicious users

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who can tamper with the algorithms used to determine consumer purchasing decisions on social networking services (SNSs). This study proposed a cognitive identification framework that relies on the concept of cognitive science to distinguish malicious user from legitimate user on SNSs. The framework takes benefit of social sensing and data processing competency of apache sparks to analyze the real-time SNSs data and make identification decision using machine-learning techniques.

The article “Human Arthritis Analysis in Fog Computing Environment Using Bayesian Network Classifier and Thread Protocol,” by Tanwar *et al.*, presented architecture to analyze real-time health monitoring of patients with arthritis-related problems, using accelerometer and thread protocol (TP) on fog servers. The article presented that whether a limb is prone to the arthritis or not. Numerous health camps can be orchestrated without abundant physical or human resources. This work used TP in observatory scenarios for the arthritis patients. It gives adaptive, complete connectivity while fog computing provides delocalized, distributive structure, with both maintaining a cost-effective solution. The performance evaluation results obtained clearly indicate that Fog computing with TP is a more effective approach for the doctors to efficiently monitor the arthritis patients compared to the traditional core-based centric care infrastructure.

The article “Hand Gesture Recognition Using 3D-CNN Model,” by Muneer Al-Hammadi *et al.*, proposed an efficient system for automatic hand gesture recognition based on deep learning. The proposed system is based on a deep convolutional neural network (CNN). It employs a transfer

learning of 3D-CNN for hand gesture recognition. Three different datasets are used in this article to evaluate the proposed system in signer dependent and signer independent modes, and accuracy is well proven.

The article “Empowering Citizens’ Cognition and Decision Making in Smart Sustainable Cities,” by J. Beneicke *et al.*, addressed from the perspective of human cognition and decision making. This study has identified some of the main challenges and open research lines related to smart sustainable cities with the area of data analytics. Moreover, this article discusses how smart cities can become sustainable by taking advantage of Internet, big data, and advanced analytical methods in sectors such as freight logistics and citizens’ transportation.

As guest editors of this special section, we thank all the authors for their contributions. Moreover, we express our sincere gratitude to the dozens of reviewers from around the world, who spent their valuable time for the review process. Finally, we also thank the Editor-in-Chief of IEEE Consumer Electronics Magazine (MCE) for the opportunity and for supporting us in the publication process. We are sure that this selection of research papers can contribute to the scientific advancements in the involved research communities.

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