Guest Editorial Advanced Machine Learning on Cognitive Computing for Human Behavior Analysis

THIS special section of IEEE TRANSACTIONS ON COMPUTATIONAL SOCIAL SYSTEMS is a selection of nine articles presented in the Special Issue on "Advanced Machine Learning on Cognitive Computing for Human Behavior Analysis." This special issue aims to provide a forum for researchers from the perspective of cognitive computing to present recent progress on state-of-the-art methods and applications to human behavior analysis. Our purpose is to review the new progress and achievements on deep learning, transfer learning, and their applications on cognitive computing for human behavior analysis in recent years.

Out of 24 submissions to the special issue, based on the review comments from peer-reviewers, nine articles were accepted. We provide a brief summary of these articles as follows.

The article "Diversified and scalable service recommendation with accuracy guarantee" by Wang *et al.* presents a diversified and scalable recommendation method (called DR_LT) based on locality-sensitive hashing and cover tree in this article, where the item topic information is used to optimize the final recommended list. The experimental results on MovieLens dataset clearly show that the feasibility of our proposal in terms of item recommendation accuracy, diversity, and scalability.

The article "Advanced machine learning on cognitive computing for human behavior analysis" by Lv *et al.* presents a classification and regression tree (CART) algorithm, and the proposed CART method is used in the data computing layer of the cognitive model. In addition, the clustering effectiveness index based on frequent patterns optimizes the K-means clustering method. The performance of the algorithm is analyzed through simulation experiments. The results show that the CART algorithm requires fewer training datasets while guaranteeing classification accuracy.

The article "Fuzzy clustering based on automated feature pattern-driven similarity matrix reduction" by Zhang and Cai presents a medoid-based fuzzy clustering algorithm feature pattern-driven similarity-matrices-reduction-based fuzzy clustering (FP-SMR-FC) which is different from the existing ones in the following two aspects. First, multiple similarity matrices are constructed to represent the similarity between objects. In addition, feature pattern-driven Shannon entropy which combines nondeterminacy information contained in the similarity matrices and statistical information contained in the features together is used to learn the weight of each similarity matrix. Second, during the clustering processes of FP-SMR-FC, a new schema for eliminating some of the similarity matrices with very few contributions is developed for similarity matrices reduction. The comparison studies in terms of time complexity and clustering accuracy for FP-SMR-FC with various medoid-based clustering algorithms on real-life datasets are done. In addition, FP-SMR-FC is applied to head pose estimation of human behavior analysis. Comparisons, indeed, demonstrate the promising performance of FP-SMR-FC in practice.

The article "Transfer model collaborating metric learning and dictionary learning for cross-domain facial expression recognition" by Ni *et al.* presents a transfer model collaborating metric learning and dictionary learning called TMMLDL to address the transfer facial expression recognition problem. To reduce the impact of cross-domain distribution variation, the information of global structure and pairwise constraints are utilized among training images in different domains. In particular, a discriminative metric space is learned into the dictionary learning procedure such that the dictionary items can well present the discriminative information of different facial expression classes in the metric subspace. The proposed model tunes dictionary and metric space in an alternative optimization algorithm, which is guaranteed to obtain the optimal model parameters simultaneously. The experimental results on nine cross-domain facial expression classification tasks show that the proposed model achieves satisfactory recognition performance.

The article "A partition-based partial personalized model for points of interest recommendations" by Naserian *et al.* presents an intermediate solution to address all of these problems by fragmenting the model into several partial models, where each partial model is responsible for a few features. An additive strategy is also implemented to support the development of personalized partial models. Furthermore, a partition-based approach is introduced to explore the hidden patterns from the geographically clustered check-in data. The performance of the approaches is evaluated by using the datasets from Foursquare, and it demonstrates that the proposed approach outperforms the state-of-the-art approaches.

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The article "Linked data processing for human-in-the-loop in cyber–physical systems" by Zheng *et al.* presents a computing device-aware HITL CPS data processing framework named Barge, aiming to map the regular code to the different hardware without any change. In Barge, a semantic model, an architecture-driven programming model, and a graph partition scheme are included. The semantic model is used to express the user-defined graph algorithms using the domain-specific language. The architecture-driven programming model will execute the graph algorithms on a different device in parallel. Furthermore, the graph partition scheme will partition the large-scale graphs into suitable partitions by aware of the topology to make the partitioned data is suitable for kinds of smart devices. The authors believe that their work will open a wide range of opportunities to improve the performance of large-scale graph processing for HITL systems.

The article "Mixing patterns in social trust networks: A social identity theory perspective" by Liu *et al.* investigates the mixing patterns (MPs) in social trust networks (STNs) from the standpoint of social identity theory (SIT). The user trust networks (UTNs) are modeled by a directed multigraph (DMG). Then, the structural properties of homogeneous trust networks and heterogeneous trust networks are explored via measures that include degree centrality, the correlation coefficient (CC), the cumulative distribution of the ratio of trust degree to distrust degree (CDRTD), and the assortativity coefficient. The MPs of homogeneous trust networks and heterogeneous trust networks are explained from the perspective of SIT. An experiential evaluation is conducted in the constructed homogeneous trust networks and heterogeneous trust networks using a real-world dataset crawled from Epinions. The research findings indicate that the MPs in homogeneous trust networks tend toward assortative mixing (AM), and those in heterogeneous trust networks tend toward disassortative mixing (DM). The experimental results show that the performance of the proposed approach is superior to that of the state-of-the-art approach to influential user identification.

The article "Learning influential cognitive links in social networks by a new hybrid model for opinion dynamics" by Nematollahzadeh *et al.* presents a novel mathematical formulation of the proposed opinion dynamics model and proves its stability as well. The new model is also extended to support multiple dimensions. In the multidimensional approach, opinions about two or more subjects are considered separately. The rationale behind this is to describe the evolution of agents' opinions on several topics. To study how the model performs in reality, some real-world experiments are conducted and the influence matrix is learned in each case. In addition, a method is introduced to extract the parameters of the model from the experimental data. It is shown that the new model predictions, after it is trained, chase the real behaviors of participants very well and result in less error compared with the previous models.

The article "Person reidentification based on pose-invariant feature and B-KNN reranking" by Zhong *et al.* presents a reranking method based on bidirectional K-nearest neighbors, presented to optimize the ranking list. Experimentally, the proposed method is implemented on three datasets VIPeR, CUHK03, and Market1501. The results demonstrate that the authors' method outperforms the other methods, as a result of both the representation of a more discriminative feature descriptor and the introduction of a reranking method.

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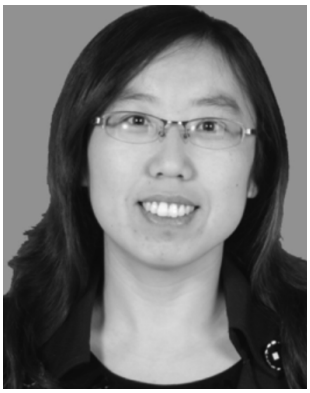

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