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EDITORIAL

IEEE ACCESS SPECIAL SECTION EDITORIAL: ADVANCED DATA MINING METHODS FOR SOCIAL COMPUTING

Various kinds of social networks develop explosively, such as online social networks, scientific cooperation networks, athlete networks, airport passage networks, and so on. With the large number of participants and real-time property, social networks increasingly demonstrate their strength in information dissemination. Social computing has become a promising research area and attracts lots of attention. Analyzing and mining human behaviors, topological structure, and information diffusion in social networks can help to understand the essential mechanism of macroscopic phenomena, discover potential public interest, and provide early warnings of collective emergencies.

In the past, to study the characteristics of social networks, questionnaires were usually designed and volunteers in the network were invited to complete the questionnaires. However, the amount of data collected from questionnaires is nowhere near enough to understand the whole perspective and essential mechanism of social events. With the development of mobile sensing, computer networks, and artificial intelligence in recent years, it is possible to collect plenty of data from various social networks. Big data in social networks also bring challenges to processing social data and investigating human behaviors. In addition, new and complex features in social networks occur nowadays, such as heterogeneous human properties, dynamic network structure, and random interpersonal interactions. Therefore, advanced multidisciplinary data collection and data mining methods should be proposed for social computing and developed to study social networks.

This IEEE ACCESS Special Section on advanced data mining methods for social computing aims at bringing together researchers to disseminate their findings in the quickly growing field of social computing. The related theories and methods include machine learning algorithms, information theory, heuristic methods, mathematics, and computational and statistical physics.

The Call for Papers aroused great enthusiasm in the scientific community and received 152 submissions. Out of these, 60 articles were accepted for inclusion in the Special Section after a thorough review process by at least two

independent referees. The accepted articles can be categorized into five groups. The first group, with 16 articles, tackles the issues of natural language processing. The second group, with ten articles, tackles social multimedia mining. The third group, with 12 articles, addresses machine learning for social data. The fourth group, with nine articles, addresses social networking mining and topology analysis. The fifth group, with 13 articles, tackles user behavior modeling and preference analysis.

In the first group, the article “Advanced quantum based neural network classifier and its application for objectionable web content filtering,” by Patel *et al.*, designs a quantum-based neural network classifier as a Firewall to detect malicious Web requests on the Web and forms neural network architecture constructively by adding the hidden layer neuron one by one.

The article by Das *et al.*, “A graph-based clustering approach for relation extraction from crime data,” considers a textual corpus containing information on crimes against women in India and extracts substantial relations between the named entities present in the corpus using a hierarchical graph-based clustering technique. For extracting the relations, different types of entity pairs have been chosen and similarities among them have been measured based on the intermediate context words.

In the article by Ma *et al.*, “Feature-based fusion adversarial recurrent neural networks for text sentiment classification,” the authors propose a Feature-Based Fusion Adversarial Recurrent Neural Networks (FARNN-Att) integrated model with an attention mechanism. The authors extract the long-term dependence of text using the BiLSTM network and put forward a novel contextual feature representation way. A regularization method of adversarial training is used to improve the robustness and generalization ability of the model.

The article by Kim, “A document ranking method with query-related web context,” evaluates and rearranges web pages based on the query-related web context. The approach is based on the retrieved result by a search engine. If a query is given, it retrieves the search results and checks whether

the query is on a burst state or not. If the query is on a burst state (or popular state), the method applies the query-related context to the search results.

The article by Tocoglu *et al.*, “Emotion analysis from Turkish tweets using deep neural networks,” investigates the performance of deep neural networks on emotion analysis from Turkish tweets. The article examines three different deep learning architectures including artificial neural network (ANN), convolutional neural network (CNN), and recurrent neural network (RNN) with long short-term memory (LSTM).

The article by Kumar *et al.*, “Sarcasm detection using multi-head attention based bidirectional LSTM,” introduces a multi-head attention-based bidirectional long-short memory (MHA-BiLSTM) network to detect sarcastic comments in a given corpus.

In the article by Liang *et al.*, “A dynamic Bayesian network approach for analysing topic-sentiment evolution,” the authors propose constructing a Gaussian Process Dynamic Bayesian Network to model the dynamics and interactions of the sentiment of topics on social media such as Twitter. The authors use Dynamic Bayesian Networks to model time series of the sentiment of related topics and learn relationships between them.

In the article by Granizo *et al.*, “Detection of possible illicit messages using natural language processing and computer vision on Twitter and linked websites,” the authors use natural language processing to identify Twitter messages that could promote illegal services and exploit minors. By applying Support Vector Machine and Convolutional Neural Network, it is possible to recognize gender and age group, even when the face details are blurred, by taking into account torso information and its proportional relationship with the head.

In the article by Xu *et al.*, “A semantic based approach for topic evaluation in information filtering,” the authors propose a model to evaluate the quality of topics by matching concepts in an ontology. In particular, a word embedding technique is applied to dealing with the ambiguity problem by finding similar concept words based on word embedding.

The article by Bi *et al.*, “CODES: Efficient incremental semisupervised classification over drifting and evolving social streams,” addresses the major challenges of social stream classification by proposing an efficient incremental semisupervised classification method named CODES (Classification Over Drifting and Evolving Stream). The method consists of an efficient incremental semisupervised learning module and a dynamic novelty threshold update module.

The article by Kumar *et al.*, “Aspect-based sentiment classification using interactive gated convolutional network,” proposes an interactive gated convolutional network (IGCN) that uses a bidirectional gating mechanism to learn mutual relation between the target and corresponding review context. IGCN also uses positional information of context words with respect to the given target, POS tags, and domain-specific word embeddings, to predict the sentiment of a target.

The article by Wang *et al.*, “The OL-DAWE model: Tweet polarity sentiment analysis with data augmentation,” proposes the OL-DAWE model, which uses a Data Augmentation (DA) technology to generate opposed tweets according to the original tweet. The model extends the training data set and test data set and learns the original and opposed sides of the tweet in the training module.

The article by Dong *et al.*, “A sentiment analysis method of capsule network based on BiLSTM,” proposes a capsule network model with BiLSTM named caps-BiLSTM for sentiment analysis. A convolution layer is used to transform the instance to hide vector, and the capsule module constructs the capsule representation to the n-gram model. The output of the capsule enters into a BiLSTM structure, which is used as a decoder to get the probability representation.

The article by Buenaño-Fernández *et al.*, “Text mining of open-ended questions in self-assessment of university teachers: An LDA topic modeling approach,” evaluates a generic methodology based on topic modeling and text network modeling, that allows researchers to gather valuable information from surveys that use open-ended questions.

The article by Tai *et al.*, “Online social networks and writing styles—A review of the multidisciplinary literature,” attempts to close the gap between the writing styles in pre- and post-Internet periods, as well as provide an in-depth comparison of the writing styles in OSN texts across three major factors: demographics, personality and behavior, and cybersecurity.

The article by Al-Smadi *et al.*, “Leveraging linked open data to automatically answer Arabic questions,” presents an approach that targets Automatic Arabic Questions’ Answering Systems while bypassing many featured challenges in the field. A hybrid approach that evaluates the effectiveness of using LOD to automatically answer Arabic questions is developed.

In the second group, the article by Huang *et al.*, “A multi-view representation framework for micro-expression recognition,” proposes a multiview representation framework based on transfer learning for micro-expression recognition. The framework takes macroexpression as the auxiliary domain and microexpression as the target domain, and assists the identification of microexpressions by transferring the rich information extracted from the auxiliary domain, which effectively addresses the small sample problem of micro-expression recognition.

The article by Lan *et al.*, “Multiple-action transform of quaternion for color images,” proposes a simple yet effective operator, named Multiple-Action Transform of Quaternion for color images, which cascades some basic quaternionic operators to form a multiple architecture such that it can take account of more complicated relationships among color channels.

The article by Ding, “SVM-based feature selection for differential space fusion and its application to diabetic fundus image classification,” presents a feature selection algorithm for differential space fusion. The original data is processed to

obtain differential space data by principal component analysis, and the SVM algorithm is used to classify the dimensionality reduction data.

The article by Han *et al.*, “Automatic segmentation of human placenta images with U-Net,” proposes an automatic segmentation method of human placenta, which reduces manual intervention and greatly speeds up the segmentation, making large-scale segmentation possible.

The article by Su *et al.*, “Prostate MR image segmentation with self-attention adversarial training based on Wasserstein distance,” proposes a segmentation network with self-attention adversarial training based on Wasserstein distance to tackle the problem. A segmentation network with residual connection and attention mechanism is deployed to generate the prostate segmentation prediction. A self-attention discriminator network is added to the segmentation network to discriminate the prediction from ground truth.

In the article by Liu *et al.*, “Optimized coefficient vector and sparse representation-based classification method for face recognition,” the authors propose a method in which the test sample is closely involved in the solution procedure of optimal coefficient vector. The classification of the proposed method is performed by checking the minimal residual between the test sample and the collaborative representation with respect to the test sample of the selected class.

The article by Jian, “Multimedia teaching quality evaluation system in colleges based on genetic algorithm and social computing approach,” establishes the multimedia teaching quality evaluation system of colleges and universities. Combined with genetic algorithm, through the investigation, the evaluation process of multimedia teaching in colleges and the status quo of multimedia teaching were analyzed.

The article by Liu *et al.*, “Multiple characteristics similarity metric method for hyperspectral image classification,” presents a classification method termed multiple characteristics similarity metric. A spatial similarity probability relationship, a sparse similarity relationship, and a collaborative similarity relationship are integrated to use the multiple information of hyperspectral imagery.

The article by Zhao *et al.*, “Exploring deep spectrum representations via attention-based recurrent and convolutional neural networks for speech emotion recognition,” develops a model which leverages a parallel combination of attention-based bidirectional long short-term memory recurrent neural networks, with attention-based fully convolutional networks.

The article by Zhang *et al.*, “Image denoising using hybrid singular value thresholding operators,” presents a hybrid thresholding strategy that combines a hard thresholding operator and a soft one. The former is directly reused the thresholding derived from TSVD, the latter is derived by minimum variance estimator.

In the third group, the article by Yang and Ma, “Parallel heuristics for balanced graph partitioning based on richness of implicit knowledge,” proposes a parallel balanced graph partitioning framework called JA-BE-JA-RIK, which improves the original heuristic JA-BE-JA algorithm by

evaluating RIK such that parallel BGP can be more efficiently made under the condition of obtaining the good edge-cut value and high knowledge cohesion.

The article by Zhuang *et al.*, “Performance prediction model based on multi-task learning and co-evolutionary strategy for ground source heat pump system,” proposes an algorithm to predict the performance data of ground source heat pump system by inputting the time series of system performance and 12 variables including seven drilling parameters, two u-pipe parameters, two ground parameters, and one circulating liquid parameter.

The article by Gong and Zhu, “Person re-identification based on two-stream network with attention and pose features,” combines the advantages of pose estimation and attention mechanism to better solve these problems with better performance, which combines pose and attention with a two-stream network. The method mainly consists of two parts: spatial features with fusion multilayer features and attention, and aggregation attention stream and pose estimation stream features.

The article by Hong *et al.*, “Neural tensor network for multi-label classification,” proposes a new approach to multi-label classification, which employs a neural tensor network to explore the relations among the labels of neighbors and classify the query instance with these correlations. This method utilizes the correlations and interdependencies between labels and leverages the potential of data.

The article by Ma *et al.*, “MsCoa: Multi-step co-attention model for multi-label classification,” proposes an improved multistep multiclassification model to mitigate the phenomenon of error prediction, label repetition, and error accumulation. The model uses multistep and multiclassification task to complete multilabel prediction. It uses the leading label and the original text as input, and the next to-be-predicted label as output.

The article by Liu *et al.*, “hpGAT: High-order proximity informed graph attention network,” proposes an approach to appropriately define a variable receptive field for GNNs by incorporating high-order proximity information extracted from the hierarchical topological structure of the input graph. Multiscale groups obtained from trainable hierarchical semi-nonnegative matrix factorization are used for adjusting the weights when aggregating one-hop neighbors.

The article by Zhong *et al.*, “Clustering geospatial data for multiple reference points,” proposes a novel geospatial data clustering method for multiple reference points. The multi-reference clustering method finds a subset reference points from a candidate set, which defines the minimum global travel distance, and hence the data are grouped into clusters.

The article by Wang *et al.*, “Stock volatility prediction by hybrid neural network,” proposes a hybrid time-series predictive neural network (HTPNN) that combines the effect of the news. According to the timeliness of stocks, the daily K-line data are combined with the news. HTPNN captures the potential law of stock price fluctuation by learning the fusion feature of news and time series, which not only retains

the effective information of news and stock data but also eliminates the redundant information of the text.

The article by Zhou *et al.*, “Precious metal price prediction based on deep regularization self-attention regression,” proposes a Regularization Self-Attention Regression Model for precious metal price prediction. In particular, the proposed RSAR model consists of a convolutional neural network (CNN) component and long short-term memory neural network (LSTM) component.

The article by Hu, “Integrating hierarchical attentions for future subevent prediction,” presents a novel hierarchical attention-based end-to-end model for future subevent prediction using large-scale historical events. The model automatically produces a short text which describes a possible future subevent after consuming the texts describing previous subevents.

In the article by Jin *et al.*, “Searching correlated patterns from graph streams,” the authors propose a Hoe-PGPL algorithm to handle the top-k correlated patterns searching from a dynamic perspective. The algorithm applies Hoeffding bound and two-level (Sliding window level and local batch level) candidate inspection to discover potential graph candidates and determine the similarity of these candidates without double-checking the previous stream.

The article by Fan *et al.*, “AEDmts: An attention-based encoder-decoder framework for multi-sensory time series analytic,” proposes an attention-based encoder-decoder framework for multisensory time-series analytics. It consists of four parts: data collection, data mining, time-series analytic part, and user interaction. A temporal-attention-based encoder-decoder model is proposed to make a long-term prediction of multiple time series to realize the real-time user interaction.

In the fourth group, the article by Gao *et al.*, “Discriminating topical influencers based on the user relative emotion,” addresses discriminating topical influencers of social networks. The proposed emotional matching and emotional transforming algorithms are leveraged to obtain the relative emotion of users. The rank of influencers is calculated by the quantified user behavior characteristics and the multicentrality algorithm.

In the article by Talukder *et al.*, “Threshold estimation models for linear threshold-based influential user mining in social networks,” the authors comprehensively survey the different threshold values used in various IM models. The authors develop a system model and propose four threshold estimation models based on influence-weight and degree distribution.

The article by Liu *et al.*, “Link prediction in evolving networks based on information propagation,” proposes a new model, Common Influence Set, to calculate node similarities. The proposed link prediction algorithm uses the common influence set of two unconnected nodes to calculate a similarity score between the two nodes.

The article by Mandaglio and Tagarelli, “Generalized preference learning for trust network inference,” proposes a

principled approach based on a preference learning paradigm, under a preference-based racing formulation. The approach is suitable for addressing several challenges; moreover, it is versatile and flexible with regard to the use of topological and content-based information.

The article by Zhou *et al.*, “Detecting overlapping community structure with node influence,” designs a posterior probabilistic prediction model under the Mixed-Membership Stochastic Blockmodel framework to accurately detect the overlapping community structure that exists in the network. The article develops a nonconjugated stochastic variational inference to deduce the link probability prediction model with node influence.

The article by Li *et al.*, “MV-GCN: Multi-view graph convolutional networks for link prediction,” proposes a novel multiview graph convolutional neural network (MV-GCN) model based on the Matrix Completion method by simultaneously exploiting the interactive relationship and the content information of different objects. Unlike existing approaches, which directly concatenate the interactive and content information as a single view, MV-GCN restricts the consistencies on the graph embedding from multiple views.

The article by Zhou *et al.*, “Parallel heuristic community detection method based on node similarity,” proposes a heuristic community detection method based on node similarities that are computed by assigning different edge weight influence factors based on different neighbor types of nodes. A hash table based data storage and retrieval strategy with a lower conflict rate is introduced to hash the edge information into a ternary bucket structure that can be merged according to the same starting node.

The article by Zhang *et al.*, “Semi-supervised community detection via constraint matrix construction and active node selection,” presents a novel semisupervised and active learning method for community detection to integrate these two types of information in a network so as to increase the accuracy of community identification.

The article by Chen *et al.*, “Dynamic network community detection with coherent neighborhood propinquity,” proposes an incremental algorithm with Coherent Neighborhood Propinquity in dynamic networks. The algorithm considers the direct and indirect effects of changing nodes in their previous communities and also considers the coherent neighborhood propinquity.

In the fifth group, the article “Modeling and analyzing the influence of multi-information coexistence on attention,” by Zhao *et al.*, proposes a multiple information coexistence attention model, which does not depend on the network topology and the information of participants’ neighbors. The model is adopted to study the changes of various types of information attention in the case of multi-information coexistence.

The article by Dai *et al.*, “Data-driven intelligent diagnostics for Parkinson’s disease,” applies several preprocessing methods to image data such as gray-level transformation, histogram equalization, improved wavelet soft-threshold

denoising, and image enhancement, and proposes a deep learning model based on the U-Net architecture with deformable convolution kernels.

The article by Qian *et al.*, “Enhancing user experience of task assignment in spatial crowdsourcing: A self-adaptive batching approach,” proposes a self-adaptive batching mechanism to enhance user experience in spatial crowdsourcing. With appropriate start-up timestamps, previous matching methods can perform better. Multiarmed bandit algorithm in reinforcement learning is adopted to split the batch dynamically according to historical current states.

The article by Li *et al.*, “Matrix factorization for personalized recommendation with implicit feedback and temporal information in social ecommerce networks,” proposes a smart model named TimeMF by incorporating implicit feedback and temporal information into social ecommerce recommendation. The weighting scheme is based on the dynamic popularity of an item.

The article by Huang *et al.*, “Modeling for professional athletes’ social networks based on statistical machine learning,” proposes a framework to analyze athletes’ social networks. Based on the characteristics of athletes’ social network structure and social support theory, the matrix distribution is introduced to describe the network structure. The observation model of the Bayesian network is established, and then, the Gaussian process analysis model of a sparse matrix is used to investigate the network.

The article by Xiong *et al.*, “A clickthrough rate prediction algorithm based on users’ behaviors,” proposes a downsampling algorithm based on the K-means model to classify large samples, and then divide them into some sensible and rational features using heuristic methods. To further improve the feature representation, the article selects and combines features by the Gradient Boosting Decision Tree model and processes high-dimensional features by the logistic regression method.

The article by Talukder and Hong, “CM2D: Cost minimization under the competitive market in dynamic social networks,” introduces an epidemic Cost Minimization model under the Competitive Market in Dynamic social networks. In the model, the authors modify the Susceptible-Infected-Recovered (SIR) technique as the Reverse SIR model to employ in the node activation process.

The article by Wang *et al.*, “Failure-aware mobile crowd sensing: A social relationship-based transfer approach,” proposes and studies a problem, namely failure-aware mobile crowdsensing. With the goal of enhancing task completion ratio, the article proposes an indeterminate fitness proportionate based task allocation approach FPSAll, and a utility evaluation-based task transfer approach FTASKTraf.

The article by Zhong *et al.*, “Continuous blood pressure measurement platform: A wearable system based on multidimensional perception data,” presents the design principle of a human-machine fusion system based on CrowdOS, a mobile crowdsensing platform. The system establishes the correlation between blood pressure and exercise, and verifies the

feasibility of calibrating continuous cuffless blood pressure measurement based on exercise information.

The article by Jiang *et al.*, “Factorization meets neural networks: A scalable and efficient recommender for solving the new user problem,” proposes a scalable and efficient recommender to solve the new user problem by filling the gap between factorization models and neural networks. The scalable part is a neural network that can jointly encode, compress, and fuse various types of contexts.

The article by Hao *et al.*, “Urban area function zoning based on user relationships in location-based social networks,” proposes a Prestige Density-Based Spatial Clustering of Applications with a noise algorithm by improving the existing DBSCAN algorithm. After clustering, the result of urban area function zoning can be achieved.

The article by Li *et al.*, “Mining heterogeneous influence and indirect trust for recommendation,” studies the process of trust propagation and proposes a novel recommendation algorithm that incorporates multiple information sources into matrix factorization. Explicit and implicit information of user trust and ratings are incorporated into matrix factorization, and the influence of indirect trust is considered in the recommendation process.

The article by Zhao *et al.*, “Dtree2vec: A high-accuracy and dynamic scheme for real-time book recommendation by serialized chapters and local fine-grained partitioning,” proposes a dynamic DTree2Vec scheme for serialized books that models text of varying degrees of completion to achieve unified semantic feature representation to measure the semantic relevance of books.

In conclusion, we would like to thank all the authors who submitted their research articles to our Special Section. We highly appreciate the contributions of the reviewers for their constructive comments and suggestions. We also would like to acknowledge the guidance from IEEE ACCESS Editor-in-Chief and staff members.

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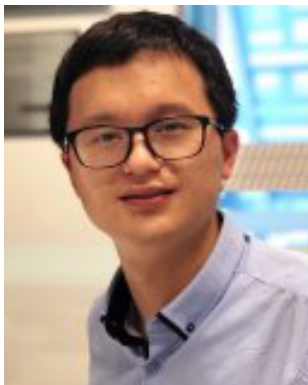
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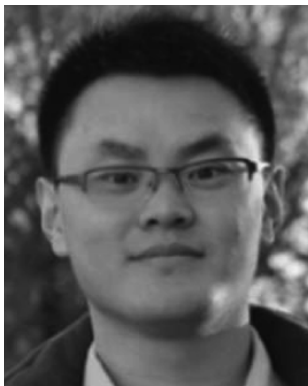
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