Social Energy: Emerging Token Economy for Energy Production and Consumption

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WELCOME to the third issue of the IEEE TRANSACTIONS ON COMPUTATIONAL SOCIAL SYSTEMS (TCSS) in 2019. Thanks to the efforts of the editors, reviewers, authors, and readers of TCSS, the influence of TCSS is rapidly increasing. According to the latest statistics released by Elsevier, the CiteScore of TCSS in 2018 reaches 4.00, and ranks eighth out of the 255 journals (top 3%) in the field of social sciences. This is a solid improvement compared with the corresponding data in 2017 (CiteScore: 2.36, Rank: 17/226, and top 8%). Thanks and congratulations to our authors, reviewers, and members of our editorial board. The current issue includes 20 regular papers and a brief discussion on social energy.

Scanning the Issue

1. PersoNet: Friend Recommendation System Based on Big-Five Personality Traits and Hybrid Filtering

Huansheng Ning, Sahraoui Dhelim, and Nyothiri Aung

Homophily-based friend recommendation system (FRS) is accurate when the common feature is a physical or social feature, such as age, race, location, job, or lifestyle. However, it is not the case with personality types. Having a given personality type does not necessarily mean that you are compatible with people that have the same personality type. Targeting to deal with this problem, this paper presents and evaluates an FRS based on the big-five personality traits model and hybrid filtering, in which the friend recommended process is based on personality traits and users' harmony rating. To validate the proposed system's accuracy, a personality-based social network site that uses the proposed FRS named PersoNet is implemented. Users' rating results show that PersoNet performs better than collaborative filtering (CF)-based FRS in terms of precision and recall.

2. COOC: Visual Exploration of Co-Occurrence Mobility Patterns in Urban Scenarios

Xiangjie Kong, Menglin Li, Gaoxing Zhao, Huijie Zhang, and Feng Xia

This paper proposes a framework to mine cooccurrence event data from mobile data and to explore the urban cooccurrence pattern visually. The proposed framework can be divided into two modules: data modeling module, to obtain the cooccurrence event data effectively utilizing frequent itemsets mining algorithm based on traffic GPS records, and visualization module, to explore the cooccurrence pattern in urban scenarios from global, regional, statistical, and location perspectives. The visualization system has been demonstrated using case studies with a real-world data set.

3. An Optimization and Auction-Based Incentive Mechanism to Maximize Social Welfare for Mobile Crowdsourcing

Yingjie Wang, Zhipeng Cai, Zhi-Hui Zhan, Yue-Jiao Gong, and Xiangrong Tong

This paper proposes an incentive mechanism to maximize social welfare for mobile crowdsourcing and investigates worker-centric task selection and platform-centric worker selection. This paper applies an optimization algorithm in task selection for mobile crowdsourcing systems. A discrete particle swarm optimization (DPSO) algorithm for worker-centric task selection is designed to maximize the utilities of workers. In addition, a platform-centric worker selection method, which integrates multiattribute auction and two-stage auction, is proposed to maximize the utility of the platform. The performance of the proposed incentive mechanism is evaluated through experiments. The experimental results show that the proposed incentive mechanism can improve the efficiency and truthfulness of mobile crowdsourcing effectively.

4. LORI: A Learning-to-Rank-Based Integration Method of Location Recommendation

Jian Li, Guanjun Liu, Chungang Yan, and Changjun Jiang

The existing integration policies of the location recommendation method do not learn user preferences in their integration processes so that they cannot make full use of the advantage of each method. In view of this, this paper proposes a novel integration method: learning-to-rank-based integration. In the method, a confidence coefficient is applied for each user in the integration process, and these coefficients can well optimize recommendation performance. A learning-to-rank-based algorithm is designed to train the confidence coefficients. A set of experiments is done on a real large-scale check-in data set, and the results demonstrate that the proposed method outperforms the state-of-the-art ones.

5. Temporal Sequence of Retweets Help to Detect Influential Nodes in Social Networks

Ayan Kumar Bhowmick, Martin Gueuning, Jean-Charles Delvenne, Renaud Lambiotte, and Bivas Mitra

This paper proposes a fast, efficient, and unsupervised algorithm SmartInf to detect a set of influential users by identifying anchor nodes from a temporal sequence of retweets in Twitter cascades. The set of influential nodes identified by SmartInf has the capacity to expose the tweet to a large and diverse population. Experimental evaluation of empirical data sets from Twitter shows the superiority of SmartInf

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over state-of-the-art baselines in terms of infecting larger population. The authors also investigate the key factors behind the improved performance of SmartInf by testing the proposed algorithm on a synthetic network. The results reveal the effectiveness of SmartInf in identifying a diverse set of influential users who facilitate faster diffusion of tweets to a larger population.

6. N2VSCDNNR: A Local Recommender System Based on Node2vec and Rich Information Network

Jinyin Chen, Yangyang Wu, Lu Fan, Xiang Lin, Haibin Zheng, Shanqing Yu, and Qi Xuan

This paper proposes a novel clustering recommender system based on node2vec technology and rich information network, namely, N2VSCDNNR, to solve challenges of data sparsity and efficiency. A series of experiments validates the performance of the proposed N2VSCDNNR over several advanced embedding and side information-based recommendation algorithms. Meanwhile, N2VSCDNNR seems to have lower time complexity than the baseline methods in online recommendations, indicating its potential to be widely applied in large-scale systems.

7. Competition and Cooperation: Dynamical Interplay Diffusion Between Social Topic Multiple Messages in Multiplex Networks

Qian Li, Zheng Wang, Bin Wu, and Yunpeng Xiao

Given the interaction among multiple messages involved in a diffusion process and the rich intertwined effects, a diffusion model based on multiple messages and multiplex network space is proposed. The proposed model attempts to explore the internal mechanism related to concurrent diffusion of multiple messages relative to social topics. A unified framework of multiple messages coupled dynamic processes is constructed using a discrete-time microscopic Markov chain approach (MMCA). Experimental results indicate that the framework can reveal the mechanism of multiple message interaction in social topics more realistically.

8. Marginal Gains to Maximize Content Spread in Social Networks

Wenguo Yang, Jianmin Ma, Yi Li, Ruidong Yan, Jing Yuan, Weili Wu, and Deying Li

The existing work shows content spread maximization problem to be NP-hard. One of the difficulties in designing an effective and efficient algorithm for the content spread maximization problem lies in which the objective function to maximize the lack of submodularity. In this paper, the authors formulate the maximized content spread problem from an incremental marginal gain perspective. They apply the sandwich framework and devise a marginal increment-based algorithm (MIS) that guarantees a data-dependent factor. Furthermore, a novel scalable content spread maximization algorithm influence ranking and fast adjustment (IRFA), which is based on the influence ranking of a single node and fast adjustment with each boosting step in the network, is proposed. Through extensive experiments, they demonstrate that both MIS and IRFA algorithms are effective and outperform other edge selection strategies.

9. GA-Based Q-Attack on Community Detection

Jinyin Chen, Lihong Chen, Yixian Chen, Minghao Zhao, Shanqing Yu, Qi Xuan, and Xiaoniu Yang

This paper introduces and formalizes the problem of community detection attack and develops efficient strategies to attack community detection algorithms by rewiring a small number of connections, leading to privacy protection. They first provide two heuristic attack strategies and then propose an attack strategy called "Genetic Algorithm (GA)-Based Q-Attack." They launch a community detection attack based on the above three strategies against six community detection algorithms on several social networks. By comparison, their Q-Attack method achieves much better attack effects than these two heuristic attack strategies. Furthermore, they take transferability tests and find that adversarial networks obtained by Q-Attack on a specific community detection algorithm also show considerable attack effects while generalized to other algorithms.

10. An Overview of Unsupervised Deep Feature Representation for Text Categorization

Shiping Wang, Jinyu Cai, Qihao Lin, and Wenzhong Guo

This paper provides a comprehensive overview of unsupervised deep learning methods and compares their performances in text categorization. They start with the autoencoder and its representative variants, including sparse autoencoder, stacked autoencoder, contractive autoencoder, denoising autoencoder, variational autoencoder, graph autoencoder, convolutional autoencoder, adversarial autoencoder, and residual autoencoder. Aside from autoencoders, deconvolutional networks, restricted Boltzmann machines, and deep belief nets are introduced. Then, the reviewed unsupervised feature representation methods are compared in terms of text clustering. Extensive experiments in eight publicly available data sets of text documents are conducted to provide a fair test bed for the compared methods.

11. A Social Computing-Based Analysis on Monogamous Marriage Puzzle of Human

Ning Cai, Chen Diao, and Bo-Han Yan

This paper proposes a novel hypothesis, which is a mechanism to explain the monogamous marriage puzzle. They speculate that the defacto monogamy may not be the result of voluntary and rational choice of any group of people; instead, it should be naturally yielded from the sexual selection dynamics of mankind in civilized societies. The key of the mechanism lies in the redistribution of wealth. Compared with relevant studies, the main advantages of the work presented here are threefold: 1) a straightforward hypothesis for the cause of socially imposed monogamy is testified via social computing; 2) the effect of sexually transmitted diseases is analyzed, based on an analytical model being simultaneously compatible with the marriage and mating systems; and 3) the overall study is conducted from a viewpoint of systems dynamics and can be easily reproduced and extended.

12. A Novel Stream Clustering Framework for Spam Detection in Twitter

Hadi Tajalizadeh and Reza Boostani

This paper proposes a novel stream clustering framework, which is able to promote all conventional stream clustering methods by replacing the Euclidean distance, with a set of incremental Naïve Bayes (INB) classifiers in the online phase. These INBs can capture the mean and boundary of microclusters, while the Euclidean distance just considers

the mean of clusters and acts inaccurate for asymmetric big microclusters. In this paper, DenStream was promoted by the proposed framework, called here as INB-DenStream. To show the effectiveness of INB-DenStream, state-of-the-art methods such as DenStream, StreamKM++, and CluStream were applied to the Twitter data sets and their performance was determined in terms of purity, general precision, general recall, F1 measure, parameter sensitivity, and computational complexity. The compared results implied the superiority of our method to the rivals in almost the data sets.

13. User Rating Classification via Deep Belief Network Learning and Sentiment Analysis

Rung-Ching Chen and Hendry

This paper proposes a deep learning model to process user comments and to generate a possible user rating for the recommendation. The proposed system first uses sentiment analysis to create a feature vector as the input nodes. Then, the system implements noise reduction in the data set to improve the classification of user ratings. Finally, a deep belief network and sentiment analysis (DBNSA) achieves data learning for the recommendation. The experimental results indicated that the proposed system has better accuracy than the traditional methods.

14. Forecasting Horticultural Products Price Based on AutoRegressive Integrated Moving Average (ARIMA) Model and Neural Network Based on a Large-Scale Data Set Collected by Web Crawler

Yuchen Weng, Xiujuan Wang, Jing Hua, Haoyu Wang, Mengzhen Kang, and Fei-Yue Wang

This paper uses both ARIMA model and neural network method to forecast the price of agricultural products (cucumber, tomato, and eggplant) in short-term (several days) and long-term (several weeks or months). A large-scale price data of agricultural products were collected from the website based on web crawler technology. The results show that ARIMA can give good performance for average monthly data, but not for daily data, whereas the neural network method can predict well daily, weekly, and monthly trends of price fluctuation. Thus, it is expected that the deep learning method represented by a neural network will become the mainstream method of agricultural product price forecasting.

15. Opinion Formation in Online Social Networks: Exploiting Predisposition, Interaction, and Credibility

Rajkumar Das, Joarder Kamruzzaman, and Gour Karmakar

This paper proposes the concept of relative credibility of the opinion sources and takes into account an agents perceived credibility about others and the relative nature of human judgment when exposed to many opinion sources with a different credibility. In addition, the credibility of sources external to an online social networks (OSNs) is considered in the opinion formation model. The proposed model is validated by analyzing its performance in capturing the real-world opinion formation dynamics using traces collected from an OSN, specifically Twitter.

16. Pedestrian Evacuation With Herding Behavior in the View-Limited Condition

Qi Meng, Min Zhou, Jiali Liu, and Hairong Dong

This paper investigates the pedestrian evacuation in view limited condition by using an extended social force model which considers both visibility distance and herding behavior. Two cases are simulated, which are simulations without and with herding behavior, respectively. The simulation results show that, in a certain range, the larger the visibility distance, the faster the evacuation, and different visibilities lead to different tendencies of density fluctuations. They also find that herding behavior plays a beneficial role in evacuation and group formation appears when herding behavior dominates the selection of directions.

17. A One-Third Advice Rule Based on a Control-Theoretic Opinion Dynamics Model

Yu Luo, Garud Iyengar, and Venkat Venkatasubramanian

This paper employs a control-theoretic opinion dynamics model to show that the one-third advice ruleładjusting one's decision about 33.3% toward advicełis in fact distributionally robust for a crowd of decision-makers whose decisions also serve as advice for others. Their results imply that the observed egocentric advice discounting might not be a coincidence; instead, when an individual is faced with insufficient information, the distributionally robust optimal decision is to combine one-third of advice with two-thirds of his/her initial decision. Their theory also suggests that knowing the dispersion of decisions can further help decision-makers optimize advice taking.

18. Content Retrieval Based on Vehicular Cloud in Internet of Vehicles

Xiaonan Wang and Yanli Li

This paper combines vehicular cloud (VC) with the Internet of Vehicle (IoV) and proposes a VC-based content retrieval solution in IoV, to reduce content retrieval latency and improve success rates. In this solution, vehicles do not perform handovers, so the content retrieval success rate is improved. Moreover, vehicles can retrieve the content from the nearest VC member in a unicast way, so the content retrieval latency is reduced. This solution is analyzed and evaluated, and the data show that it effectively achieves the above-mentioned objectives.

19. Filtering Instagram Hashtags Through Crowdtagging and the hyperlink-induced topic search (HITS) Algorithm

Stamatios Giannoulakis and Nicolas Tsapatsoulis

This paper presents a methodology based on the principles of collective intelligence to locate the hashtags. They show that the application of a modified version of the well-known HITS algorithm, in a crowdtagging context, can provide an effective and consistent way for finding pairs of Instagram images and hashtags, which lead to representative and noise-free training sets for content-based image retrieval. As a proof of concept, they use the crowdsourcing platform Figure-eight to allow collective intelligence to be gathered in the form of tag selection (crowdtagging) for Instagram hashtags. The crowdtagging data of Figure-eight are used to form bipartite graphs. The HITS algorithm is first used to rank the annotators in terms of their effectiveness in the crowdtagging task and then to identify the right hashtags per image.

20. Extracting Resource Needs and Availabilities From Microblogs for Aiding Postdisaster Relief Operations

Moumita Basu, Anurag Shandilya, Prannay Khosla, Kripabandhu Ghosh, and Saptarshi Ghosh

This paper focuses on a particular application that is critical for efficient management of postdisaster relief

operations—identifying tweets that inform about resource needs and resource availabilities. Two broad types of methodologies, named supervised classification approaches and unsupervised pattern matching and information retrieval (IR) approaches, can be practically applied to identify such tweets during an ongoing disaster event. In this paper, they experiment with several supervised and unsupervised approaches to address the problem and propose two novel neural retrieval models (unsupervised) for the said application, which effectively combine word-level embeddings and character-level embeddings. They conduct experiments on tweets posted during two disaster events and observe that the two approaches perform well in different scenarios.

Social Energy

The inherent nature of energy, i.e., physicality, sociality, and informatization, implies inevitable and intensive interaction between energy systems and social systems. From this perspective, we define "social energy" as a complex sociotechnical system of energy systems, social systems, and their derived artificial virtual systems. The recent advancement in intelligent technology, including artificial intelligence, intelligent sensing and computing, and knowledge engineering, enables the possibility of substantial improvements in sociotechnical system control and management.

We began our discussion on the concept of "social energy" in 2007. Here, we would like to provide an updated discussion on its recent development, including energy system asset management, social computing for energy system analysis, blockchain services for energy market transactions, and energy token economics. These recent developments are examples which extend traditional research areas of energy systems from technical into sociotechnical perspectives.

Social Computing for Energy

Social computing is a novel technology that captures social signals through a variety of software-defined social sensors in the cyber-space. For instance, at Huazhong District of the State Grid of China, a social computing project aims to establish a "power-social-economy" model from open source data utilizing techniques of Big Data extraction, deep neural networks, and probability graph models. This research work aims to provide a much more accurate prediction on the district's electricity consumption with its corresponding spatial-temporal distribution. The prediction from open social data provides much more solid foundation for Huazhong Grid's precision operation planning including its future investment and construction.

Digital Asset Management for Energy

We propose a coordinative blockchain-edge-cloud computing architecture, which is a new type of data platform aiming at acquiring data efficiently and making possible profiting from them autonomously. Edge-computing transforms the ubiquitous sensing data into high-value density knowledge, meanwhile reducing unnecessary data transmission and storage costs.

With this technical development, digital asset management is made possible on a secure and private, while open and sharing, data platform. This platform is able to confirm ownership, specify values, and back-trace the usage of asset data sets. By this way, energy system assets in the physical or virtual form are able to be digitized, evaluated, traded, and shared in a trustable yet flexible platform. After assets are digitized, and the generated data are accessible with a business model, assets are truly connected to the whole society.

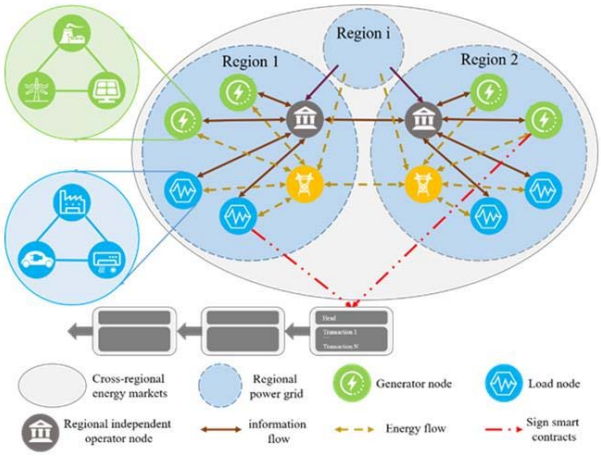

Fig. 1. Cross-regional electricity market structure.

Taking power transmission and transformation asset management as an example, at Hubei Power Grid of China, digital asset models are built by using multisource heterogeneous data, and data fusion and mining techniques. The resulting digital asset management scheme enables data-driven asset management level of the power system.

Blockchain for Energy Market Transactions

With the development of distributed and renewable energy, energy market transactions among diverse participants across different regions become much more common and frequent. In this situation, conventional centralized transaction management systems face the difficulties caused by incomplete information revealed from social stakeholders due to privacy considerations, and a massive amount of small-scale distributed generators existing in the grid, resulting in new, security constrained economic dispatch (SCED) problems. As a result, a centralized market transaction system is no longer suitable for the cross-region energy market with a massive number of stakeholders, and instead, a new form of secure and distributed energy trading market needs to be considered for the emerging distributed energy system for the near future.

Blockchain, as one of the emerging information and communication technologies in recent years, has characteristics of transparency, decentralization, collaborative autonomy, and smart contracts. Naturally, it is a suitable tool for managing decentralized energy market transactions. The application of blockchain in the energy market has been verified to have enormous practical potency to solve the so-called SCED problem, leading to secure yet flexible transaction scenarios shown in Fig. 1.

Energy Token Economics

With blockchain establishing decentralized cross-region energy transaction market, the corresponding token economy

is inherently introduced into the market. A token economy is a systematic approach which adopts interventions to guide market participants' behaviors. The combination of blockchain and token economy is able to achieve the "value transformation and transfer" among different economic systems, and further substantially enhance productivity due to swift token circulation. In the energy market, the token economy can be used to encourage market participants to perform "good behaviors," such as producing and consuming clean energy and answering demand response. The implementation of token economy with incentive mechanisms in the energy market is potentially a major player in the future low-carbon electrical industry.

In this paper, we introduced a number of concepts and practices in progress on social energy, including social computing for energy, energy system digital asset management, blockchain-based energy market, and token economics for energy system behavioral adjustment. Once incorporating these technologies into social energy systems, significant breakthroughs will be made for tackling energy-related social complexity and enabling new token economic form for energy production and consumption.

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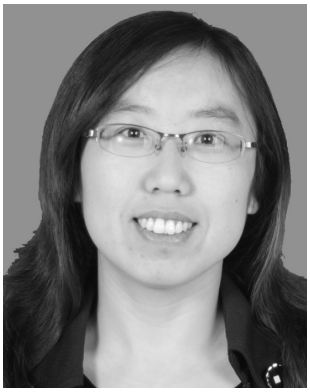

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