

## Editorial

### Complex communication networks

Because of the rapid progress of network and communication technologies, a vast of social services is required eagerly these years. With the popularity of complex communication networks, this multidiscipline research issue on social services over complex communication networks poses great challenges. The content of this special issue can be clustered into three categories: Social networks, wireless networks, and data center networks.

#### 1. SOCIAL NETWORKS

The first paper entitled ‘Modeling and performance analysis of information diffusion under information overload in Facebook-like social networks’ [1] by Li and Sun focuses on social networks because an increasing number of people use them to broadcast information and stay connected with their friends. However, because of the information overload in social networks, it becomes increasingly difficult for users to find useful information. This paper takes Facebook-like social networks into account and proposes the models to capture the characters of the network, the user behaviors, and the process of information diffusion under information overload. On the basis of these models, the term type influence is introduced to characterize the information diffusion efficiency for users of a given type, which can be analyzed theoretically. Having noticed the inaccuracy of using type influence to estimate the information diffusion efficiency for a given user, the authors further introduce the term individual influence and propose a scalable approach to estimate it. Simulation results are consistent with the analysis results perfectly, and the average value of deviations for the proposed approach is about 1% if considering at least one-hop neighbors.

The second paper entitled ‘Sampling from social network to maintain community structure’ [2] by Tong *et al.* proposes an improved forest fires algorithm, which can not only decrease the scale of network data but also maintain the previous network community structure well. The authors define two concepts, namely ‘community degree’ and ‘center of community’ in the algorithm. The algorithm was applied on five datasets. In order to make it convenient for the comparison between the sampling algorithm and the other six sampling algorithms under different parameters, the network community profile and Kolmogorov–Smirnov D statistics are used to judge the consistency between the sample and the previous graph. Experiment results reveal that the improved algorithm is better than the other six sampling algorithms under most of the parameters. The efficiency and feasibility of the modified algorithm are also validated.

The next paper entitled ‘Risk computing based on capacity of risk-absorbing in virtual community environment’ [3] by Liu *et al.* pays attention to security issues in the virtual community (VC) environment because of the uncertainties. Many works use trust mechanisms as the enhancement. However, trust has flaws in some aspects as discussed in this paper. Under the analysis of the properties of VC, a risk computing model of individuals with numerical solution is proposed. A new concept, capacity of risk absorbing, is introduced to make the model more reasonable for usual scenario. Then, in order to compute the capacity of risk absorbing, Shapley-value approach is utilized to equalize the risk of individuals who join the game in series. The evaluation result can provide VC computed evidence to control the individual’s behavior.

## 2. WIRELESS NETWORKS

The first paper entitled 'The effect of hexagonal grid topology on wireless communication networks based on network coding' [4] by Shang *et al.* studies the effects of topology structure on the performance benefit of network coding based on a highly structured wireless communication network with hexagonal grid topology and proposes a new concept called 'network intensity'. A comparative analysis demonstrates that the network intensity affects the performance benefit of network coding in terms of the interference and the coding number. These findings will contribute to the design of network topology and the analysis of the bound on performance benefit of network coding in wireless communication networks.

The second paper entitled 'DAMORD: an aggregation algorithm for mobile point source using rate-distortion theory in wireless sensor networks' [5] by Aminian *et al.* proposes a new method for aggregating the data received from the mobile point source in a sensor network. In this method called DAMORD (Data Aggregation for Mobile Object using Rate-Distortion), based on Rate-Distortion theory and considering spatial and temporal correlation, the load of data being transmitted to base station is reduced by virtue of considering the maximum distortion that can be tolerated by the user. A mathematical model followed by the detailed model verification demonstrated the efficiency of the proposed method under different conditions.

Another paper entitled 'EEMHR: Energy-efficient multilevel heterogeneous routing protocol for wireless sensor networks' [6] by Tanwar *et al.* proposes a new Energy Efficient Multi-levels Heterogeneous Routing (EEMHR) protocol for wireless sensor networks, which considers the  $k$  level node heterogeneity. Based upon the initial energy to the respective level of the sensor nodes, they are divided into  $k$  level hierarchy. A variable threshold, which includes the ratio of the number of alive nodes for the current round to the total number of nodes, is also proposed for the selection of cluster heads in an optimized manner. The performance of the proposed approach is evaluated with respect to different energy levels of the sensor nodes by varying various parameters of the networks in comparison with the most of the prominent heterogeneous routing protocols in this category such as stable election protocol and multi-hop communication routing. Simulation results demonstrate that by varying the initial energy and node heterogeneity parameters, the network lifetime of EEMHR is improved to 17% in comparison with these protocols. Also EEMHR provides better stability and distribution of cluster heads in comparison with these protocols.

The final paper in wireless networks category entitled 'Optimal epidemic broadcasting for vehicular ad hoc networks' [7] by Tian *et al.* discusses the problem of optimal epidemic broadcasting control in vehicular ad hoc networks and builds optimal message dissemination under variable beaconing rate. Built upon this model, the authors investigate the optimization problem of the beaconing control for epidemic routing with the constraints different from other research achievements and obtain the solution of this optimization problem. The experimental results prove that the optimal beaconing policy derived from the proposed optimal model is more efficient than the traditional broadcasting method.

## 3. DATA CENTER NETWORKS

The first paper in the category of data center networks entitled 'An exploration of cache collaboration in information-centric network' [8] by Feng *et al.* aims to look insight into such an issue and proposes a way of cache collaboration not only for the on-path routers but also for the off-path routers. The authors firstly introduce an interest counter, on one hand, to rank different contents within a period. In this way, they make use of the advantage of the least frequently used (LFU) as well as avoid its cache pollution problem. On the other hand, to reduce the rate of content replacement and to maintain a relative stability in forwarding plane, the cached content can be easily managed by the control plane. Secondly, the authors utilize the interest-prune and the steady content advertisement mechanism in the control plane based on the interest counter in order to eliminate the duplicated cached content along en-route routers and cache neighbors. As a result, more cache capacity for different contents can be stored, and efficient cache collaboration can be obtained. The performance of proposed scheme is evaluated in both line and tree-like topology

scenarios. The simulation results show that the proposed scheme performs well compared with the perfect-LFU, the LFU, the random, and least recently used replacement policies.

The second paper entitled 'A weighted kernel possibilistic c-means algorithm based on cloud computing for clustering big data' [9] by Zhang and Chen introduces weights to define the relative importance of each object in the kernel clustering solution, which reduces the corruption caused by noisy data. In order to improve the real time of the proposed algorithm, cloud computing technology is used to optimize wkPCM to propose a distributed wkPCM algorithm based on MapReduce, which can provide significant computation speed. Experiment demonstrates that the proposed possibilistic clustering algorithms can cluster big data in appropriate groups in real time.

#### ACKNOWLEDGEMENTS

It is our great honor and pleasure to receive the great support from the Editor-in-Chief, Prof. Mohammad S. Obaidat, and the kind help from all editorial staff for the preparation and publication of this special issue. We would like to thank all authors for their contributions to this special issue. We also thank the professional reviewers for their patience and for distinguishing excellent papers for the special issue.

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