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# Modeling information dissemination and evolution in time-varying online social network based on thermal diffusion motion

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## HIGHLIGHTS

- Thermal diffusion motion theory and information entropy are applied in the time-varying social network information dissemination for the first time.
- The network structure is divided into four types: regular network, small-world network, random network and scale-free network. These four network topologies are researched in the OSN information dissemination.
- A new social network information dissemination model is proposed.
- The evolution mechanism of social network information state access nodes is proposed. It reveals that the essence of information dissemination is an irreversible process that evolves toward the increase of energy entropy.
- The concept of external force to do work is introduced in the process of information dissemination.

**ABSTRACT:** Due to the traditional information dissemination model can not accurately simulate information dissemination process in the real world, this paper proposes an information diffusion mathematical model and information state node evolution mechanism by using thermodynamic molecular thermal diffusion motion theory, combined with epidemic infection model. Four different network topologies (regular network, small-world network, random network and scale-free network) are applied in the time-varying online social network (OSN) of information dissemination process. Information entropy is also introduced in the information dissemination of OSN. Information is essentially a special form of matter; the propagation process is a process in which the system transitions from one stable state to another. A transfer function is built by some information parameters such as information energy, information temperature, and energy entropy. It reveals the relationship between the state of microscopic network nodes and the macro iterative evolution rules, and carries out simulation experiments and empirical comparative experiments in a variety of networks with different topological structures. The proposed model is trained and evaluating using truth experimental data collected in Baidu network. The experimental results show that the similarity between the simulation results and the real data is greater than 0.96, the correlation is greater than 0.95, and the peak value of the local error is less than 0.2. The mathematical model accurately describes the internal laws and mechanisms of the information dissemination behavior and proves the proposed mathematical propagation model. The transfer function and evolution mechanism are reasonable and effective; the proposed information propagation model not only has strong extensibility, but also provides theoretical support for research in related fields.

**Keywords:** Social Network, Information Propagation, Information energy, Thermal Diffusion

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