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Title(English)	Data-driven Study on Two Dynamic Evolution Phenomena of Social Networks: Rumor Diffusion in Online Social Media and Bankruptcy Evolution Among Firms
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THESIS SUMMARY

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The fast growth of computational technologies and unprecedented volume of data have revolutionized the way we understand our society. While the social network structure is commonly used to conceptualize and describe individuals and collectives in the highly connected world, social network analysis becomes an important means of exploring insights behind this social structure. However, when facing external influences, the social networks can evolve dramatically. Such dynamic evolution phenomenon raised new challenges for scholars in understanding the complex social problems.

In the thesis, driven by real big data, we concentrate on the evolving phenomena of social networks caused by external factors in two levels. From the individual perspective, we explore the rumor diffusion process in the social media network, by proposing a mechanism for identifying early rumor related patterns in the streaming Twitter data. From the organizational perspective, the evolution of bankruptcy among firms is analyzed, modeled and simulated using an agent-based model based on millions of Japanese firm data. The study of two computational social phenomena in this thesis enhances the understanding of dynamic independent and interactive behaviors in complex social problems, and provides a good perspective for seeking future solutions.

The thesis is organized as follows:

Chapter 1 Introduction. This chapter introduces the basic definition of social networks and indicates the important role of social network structure on understanding complex social problems. With this motivation, the main contributions and overall structure of this thesis are also outlined in this chapter.

Chapter 2 Background. This chapter reviews the literature in the field of dynamic evolution of social networks. Starting from the social network evolution phenomena, we address the related research work from both technology and application perspectives. Then, by discussing new challenges in various dynamic social phenomena, two social problems, rumor diffusion in online social media and bankruptcy diffusion among firms, and their importance are explained and argued.

Chapter 3 Rumor Diffusion in Online Social Media. This chapter concentrates on the study of rumor diffusion phenomenon in online social media. With the extremely fast and wide spread of information, online rumor causes devastating socioeconomic damage before being effectively identified and corrected. To fix the gap in real-time situation, we propose a method for monitoring and detecting rumors in the online streaming social media (Twitter) as early as possible. First, the rumor-related pattern combining features of user's attitude and structure in the propagation social network is defined. A pattern matching algorithm tracking these patterns in streaming data is also proposed. Based on the sliding window mechanism, we overcome the streaming challenge by only analyzing the snapshots of data stream and detecting matched patterns automatically. The experiments in two different real datasets show that our approach captures early signal patterns of rumor (that trending in online social media), and have a good potential to be used in real-time rumor discovery. In a nutshell, this chapter presents the work from the following parts: research statement, research review, pattern design, methodology, experiments on real data and concluding remarks of research contribution.

Chapter 4 Bankruptcy Evolution among Firms. In this chapter, we explore the dynamic evolution phenomenon of inter-firm network emerging by bankruptcy. When the bankruptcy transfers as a chain among trade partners (i.e. firms), it causes serious socioeconomic concerns. Beyond previous studies in statistical analysis and propagation modeling, we focus on one underlying human-related factor, the social network among senior executives of firms, and investigate its effects on this social phenomenon. Based on empirical analysis of real Japanese firms' data in ten years, an agent-based model is particularly proposed to understand the role of this human factor in two perspectives. Firstly, the beneficial effects of number of social partners are well examined in various simulated scenarios from both micro and macro levels. Secondly, the local interaction mechanism among firms (i.e. triangle structure in inter-firm social network) is studied in a series of simulations using the real network of one industry. Both results indicate the important role of this inter-firm social network, which enhances our understanding of the inter-firm bankruptcy evolution phenomenon. Overall, this chapter presents the work from the following parts: research question, research review, empirical data analysis, agent-based modeling, simulations and results, and discussion of research contribution.

Chapter 5 Discussion and Implication. This chapter summarizes the correlations within two research problems and discusses the significance of studying those data-driven complex social phenomena. Moreover, we argue the good perspectives of expanding the study on other computational social problems.

Chapter 6 Conclusion. The final chapter concludes this thesis and reemphasizes the contributions. The future research directions are also addressed and explained in this part.