Hybrid Recommender Systems for Personalized Government-to-Business e-Services

A Thesis Submitted for the Degree of
Doctor of Philosophy

By

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CERTIFICATE OF AUTHORSHIP/ORIGINALITY

I certify that the work in this thesis has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

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ABSTRACT

As e-Governments around the world face growing pressures to improve the quality of service delivery and become more efficient and cost-effective, their initiatives currently focus on providing users with a seamless service delivery experience. Web-based technologies offer governments more efficient and effective means than traditional physical channels to provide high quality e-Service delivery to their users, which include citizens and businesses. Government-to-Business (G2B) e-Services involve information distribution, transactions, and interactions with businesses in varying ways via e-Government websites and portals. The G2B e-Services aim to reduce burdens on businesses and to provide effective and efficient access to information for business users. One of the most important e-Services of G2B is the promotion of local businesses goods and services to consumers (i.e., local and overseas businesses) by providing online business directories. However, with the rapid growth of information and unreliable search facilities, business users, who are seeking 'one-to-one' e-Services from government in highly competitive markets, struggle with online business directories and increasingly find it difficult to locate business partners according to their needs and interests. How, then, can business users be provided with information and services specific to their needs, rather than an undifferentiated mass of information? An effective solution proposed in this research is the development of personalized G2B e-Services using recommender systems. It is worth mentioning that the adoption of recommender systems in the context of e-Government to provide personalized services has received very limited attention in the literature.

Recommender systems aim to suggest the right items (products, services or information) that best match the needs and interests of particular users based on their explicit and implicit preferences. In current recommender systems, the Collaborative

Filtering (CF) approaches are the most popular and widely adopted recommendation approaches. Regardless of the success of CF-based approaches in various recommendation applications, they still suffer from data uncertainty, data sparsity, cold-start item and cold-start user problems, resulting in poor recommendation accuracy and reduced coverage. An effective solution proposed in this research to alleviate such problems is the development of hybrid and fusion-based recommendation algorithms that exploit and incorporate additional knowledge about users and items. Such knowledge can be extracted from either the users' trust social network or the items' semantic domain knowledge.

This research explores the adoption of recommender systems in an e-Government context for the provision of personalized G2B e-Services. Accordingly, a G2B recommendation framework for providing personalized G2B e-Services (particularly personalized business partner recommendations) for Small-to-Medium Businesses (SMBs) is proposed. Novel hybrid and fusion-based recommendation models and algorithms are also proposed and developed to overcome the limitations of existing CF-based recommendation approaches. Experimental results on real datasets show that our proposed recommendation algorithms significantly outperform existing recommendation algorithms in terms of recommendation accuracy and coverage when dealing with data sparsity, cold-start item and cold-start user limitations inherent in CF-based recommendation approaches.