Faculty of Engineering and Information Technology
University of Technology Sydney

Learning and satisfying customer needs for financial adviser

A thesis submitted in partial fulfillment of
the requirements for the degree of
Doctor of Philosophy

by

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CERTIFICATE OF ORIGINAL AUTHORSHIP

I, Charles Yu-Chia Chu, declare that this thesis, is submitted in fulfilment of the requirements for the award of Doctor of Philosophy, in the Faculty of Engineering and Information Technology at the University of Technology Sydney.

This thesis is wholly my own work unless otherwise referenced or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

This document has not been submitted for qualifications at any other academic institution.

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Signature of Candidate: Production Note: Signature removed prior to publication.

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Papers published/under review

- Chu, C., Brownlow, J., and Meng, Q., et al. Combining heterogeneous features for time series prediction. In proceeding of the 2017 International Conference on Behavioral, Economic, Socio-cultural Computing (BESC). 2017.

- Chu, C., Xu, G., and Brownlow, J. et al. Deployment of churn prediction model in financial services industry. In proceedings of the 2016 International Conference on Behavioral, Economic and Socio-cultural Computing (BESC). 2016.

- Chu, C., Xu, G., and Brownlow, J.. Inferring customer's financial needs by multi-label learning. expert Systems with Applications. (Under review)

- Chu, C., Xu, G., and Brownlow, J.. Predicting changing of adviser by bipartite ranking. (Under review)

- Chu, C., Xu, G., and Brownlow, J.. Adviser recommendation based on heterogeneous graph. (To be submitted)

- Brownlow, J., Chu, C., and Xu, G., et al. A multiple source based transfer learning framework for marketing campaigns. In proceedings of the 2018 International Conference on Neural Networks (IJCNN). 2018.

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Abstract

Nowadays, people tend to seek help from professional financial advisers to manage investment and prepare for retirement. People in different financial situations usually have different financial objectives and needs when choosing the advisers they want to see. Therefore, understanding and satisfying customer needs are critical to financial planning services and financial businesses, due to the huge impact on people's financial wellness and retirement readiness.

Traditionally, several tools such as questionnaires, surveys, and statistical analysis, etc., have been employed in practice to manually collect feedback and reviews from a group of customers to understand their needs. However, with a growing number of customers and the emergence of big data, those tools are prohibitively time-consuming or even infeasible, especially when people are overwhelmed with complex customer data. To address this big data challenge, data mining techniques that could learn underlying patterns from big data effectively have been investigated and applied extensively in various fields. Inspired by that, this thesis focus on applying existing or designing new data mining methods to address challenges in inferring and satisfying customers' needs and expectations for financial advisers. Specifically, the main contributions of this thesis are listed as follows.

(1) An automatic end-to-end framework that follows the typical data mining process is designed and implemented to learn the multiple needs of every individual customer.at scale. To begin with, three possible needs are defined using domain knowledge and extracted from data for a selective group

of customers. Based on the labeled dataset, multi-label learning is then applied to build predictive models that could predictive multiple needs of other customers. The advantage of this framework is that it could exploit heterogeneous data sources and predict the personalized needs of individual customers without involving any manual work. Experimental results also verify its effectiveness in learning customer needs.

(2) A novel learning method is proposed for early detection of customers who are likely to stop engaging their current advisers, i.e., the customer churn prediction problem. Specifically, this problem is dealt with as a bipartite ranking problem, and a model is trained which can rank possible churners before those who are less likely to churners. Furthermore, to address the issue of extremely imbalanced data, i.e., there are few churners during a particular time, an instance-based transfer learning strategy is adopted to take advantage of auxiliary data that might of different distribution. In this way, only weights of those data that could improve model performance are increased iteratively, so they could be fully exploited to alleviate the issue of imbalanced data. Furthermore, a novel ranking-based measure is incorporated into the learning process to guide the process towards learning good rankings. Experimental results validate our method's effectiveness in improving model performance by utilizing only useful auxiliary data.

(3) Research on recommending financial advisers to customers is also investigated. To our knowledge, they are little research on this topic. To cope with the issue of a lack of explicit customers' preferences over advisers, a graph-based method is applied to organize customers and advisers in a heterogeneous network. Specifically, their connections are determined by similarities between them in terms of demographic and behavioral features. Furthermore, a random walk with restart process is run to identify advisers who are more preferable for a particular customer.

The effectiveness of these proposed methods has been validated through extensive experiments. In doing so, this research advances the understanding of customer needs for financial advisers, thus provide financial businesses

better chances to satisfy and retain their customers. In summary, this thesis has proposed several effective methods that learn and satisfy customer needs for financial advisers from different perspectives, and their effectiveness has been validated by experiments. These achievements lay a good foundation for further research and applications.