Proceedings of the Thirtieth AAAI Conference on Artificial Intelligence (AAAI-16)

Productive Aging through Intelligent Personalized Crowdsourcing

Han Yu, Chunyan Miao, Siyuan Liu, Zhengxiang Pan,
N. Syahidah B. Khalid, Zhiqi Shen, Cyril Leung*
Joint NTU-UBC Research Centre of Excellence in Active Living for the Elderly
Nanyang Technological University, Singapore
*Department of Electrical and Computer Engineering, the University of British Columbia, Vancouver, Canada
{han.yu, ascymiao, syliu, panz0012, nurs0027, zqshen}@ntu.edu.sg, cleung@ece.ubc.ca

Abstract

The current generation of senior citizens are enjoying unparalleled levels of good health than previous generations. The need for personal fulfilment after retirement has driven many of them to participate in productive aging activities such as volunteering. This paper outlines the *Silver Productive* (SP) mobile app, a system powered by the RTS-P intelligent personalized task sub-delegation approach with dynamic worker effort pricing functions. It provides an algorithmic crowdsourcing platform to enable seniors to contribute their effort through productive aging activities and help organizations efficiently utilize seniors' collective productivity.

Introduction

In recent years, as global population aging starts to make headlines, many researchers and engineers are shifting their focus towards developing technologies for seniors. As the research works often focus on the physical and psychological frailties as a result of aging, most age-friendly technologies are assistive in nature (Rashidi and Mihailidis 2013).

With good nutrition and medical care, today's retirees enjoy better health in general than previous generations. Many seniors aspire to contribute their effort to meaningful activities. As a result, volunteer organizations are starting to engage an increasing number of senior volunteers to participate in productive aging activities (Tan 2007). Productive aging refers not only to economic engagement (e.g., formal employment), but includes all forms of productivity in old age with consequent meaning, outcome and/or output (Butler 2010). Such activities help seniors keep active and gain a sense of fulfillment which is beneficial for their wellbeing.

In this research, we develop a crowdsourcing based productive aging mobile app - *Silver Productivity (SP)*. Infused with the reputation-aware task sub-delegation approach with dynamic worker effort pricing (RTS-P), SP achieves two main objectives simultaneously: 1) providing seniors with a tool to conveniently contribute their effort in productive aging activities; and 2) help organizations efficiently utilize seniors' collective productivity to achieve their objectives.

The RTS-P Approach

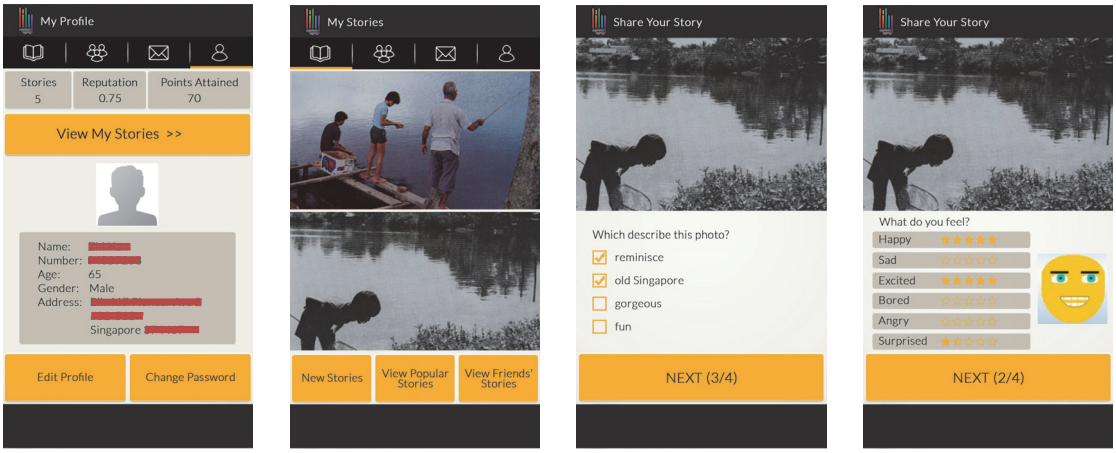
To make efficient quality-time-cost trade-offs in large-scale crowdsourcing networks, intelligent personalized task delegation approaches taking into account factors have been proposed in recent years (Yu et al. 2012; 2013b; 2013a; 2014a; 2014b; 2015b). Existing approaches assume that workers will accept the prices determined by the crowdsourcers and are not able to adjust the prices for their services in response to changing situations.

RTS-P, which extends the work in (Yu et al. 2015a), relaxes this assumption. In SP, RTS-P is implemented as a personal assistant agent. The RTS-P agent intelligently recommends new tasks to its owner based on his personal situations to make efficient quality-time-cost trade-offs. By considering a worker's current reputation, workload, and his trust relationships with others, this technique allows an RTS-P agent to make task acceptance, sub-delegation and pricing decisions for its owner in a distributed manner.

RTS-P continues to grow a virtual queue if there are tasks in worker's pending task queue which have not been serviced so as to determine the exact time for sub-delegation. The joint task acceptance and worker effort pricing strategy of RTS-P suggests its owner to increase the price it charges for new tasks if either his current workload is high or his current reputation is low. The rationale is that if its owner's reputation is low, it is less likely to receive a large amount of task requests. Thus, whenever there are crowdsourcers willing to solicit its owner's service, the RTS-P agent recommends him to charge a higher price in order to capitalize on these opportunities. The resulting task allocation maximizes the expected income while minimizes potential congestions of activities for each worker, thereby efficiently utilizes crowdsourcing workers' collective productivity.

The Silver Productivity Mobile App

The SP mobile app is incorporated with the RTS-P approach to support productive aging through intelligent personalized crowdsourcing. It is the result of a collaboration with a local senior care community volunteer organization in Singapore. The objective of the app is to help organizations with a large volume of historical photos (e.g., the Singapore National Archive has over 50,000 historical photos) to elicit the help from seniors who lived through those eras to share their personal experience and stories in relation to the given



(a) User Profile (b) Recommended Photos (c) Providing tags to a Photo (d) Sharing feelings for a Photo

Figure 1: Screenshots of the Silver Productivity mobile app.

photos. Currently, a point-based system instead of money is used in the app to price workers' effort (Figure 1(a)).

Figure 1 shows screenshots from the app demonstrating its main functionalities. These include: 1) understanding user characteristics based on their profile information (Figure 1(a), with private information censored), 2) the RTS-P agent recommending photos to a user automatically (Figure 1(b)), 3) the interface for a user to provide tags about various aspects of the contents depicted by a selected photo (Figure 1(c)), and 4) the interface for a user to share feelings evoked by the contents of a selected photo (Figure 1(d)). The emoticon in the app to collect user contributed feelings is derived from the *AffectButton* (Broekens 2014). Based on the learning models derived from a large-scale user study (Yu, Salmon, and Leung 2015), the app can automatically convert the users choice of the smiley face to composite emotions. Functions to collect user contributed text and audio descriptions about a given photo are also available.

Discussions and Future Work

With RTS-P, SP helps workers determine the amount of new tasks they should accept at any given time. In addition, SP supports two important decisions: 1) the price for one's effort, and 2) when and how much of one's pending workload should be sub-delegated at a given time and to whom, which are not supported by existing crowdsourcing systems. In future research, we will investigate how workers respond to the RTS-P agents' suggestions through user studies.

Acknowledgements

This research is supported, in part, by the National Research Foundation, Prime Minister's Office, Singapore under its IDM Futures Funding Initiative and administered by the Interactive and Digital Media Programme Office; and the Lee Kuan Yew Post-Doctoral Fellowship Grant.

References

Broekens, J. 2014. The affectbutton: a digital self-report tool for emotion. In *CHISparks'14*, 158–159.

Butler, R. O. 2010. *The Longevity Prescription: The 8 Proven Keys to a Long, Healthy Life*. Avery, New York.

Rashidi, P., and Mihailidis, A. 2013. A survey on ambient-assisted living tools for older adults. *IEEE Journal of Biomedical and Health Informatics* 17(3):579–590.

Tan, C. K. 2007. Engaging senior volunteers: A guide for non-profit organisations. Technical report, National Volunteer and Philanthropy Centre, Singapore.

Yu, H.; Shen, Z.; Miao, C.; and An, B. 2012. Challenges and opportunities for trust management in crowdsourcing. In *IAT'12*, 486–493.

Yu, H.; Miao, C.; An, B.; Leung, C.; and Lesser, V. R. 2013a. A reputation management model for resource constrained trustee agents. In *IJCAI'13*, 418–424.

Yu, H.; Shen, Z.; Miao, C.; and An, B. 2013b. A reputation-aware decision-making approach for improving the efficiency of crowdsourcing systems. In *AAMAS'13*, 1315–1316.

Yu, H.; Miao, C.; An, B.; Shen, Z.; and Leung, C. 2014a. Reputation-aware task allocation for human trustees. In *AAMAS'14*, 357–364.

Yu, H.; Yu, X.; Lim, S. F.; Lin, J.; Shen, Z.; and Miao, C. 2014b. A multi-agent game for studying human decision-making. In *AAMAS'14*, 1661–1662.

Yu, H.; Miao, C.; Shen, Z.; Leung, C.; Chen, Y.; and Yang, Q. 2015a. Efficient task sub-delegation for crowdsourcing. In *AAAI-15*, 1305–1311.

Yu, H.; Miao, C.; Shen, Z.; and Leung, C. 2015b. Quality and budget aware task allocation for spatial crowdsourcing. In *AAMAS'15*, 1689–1690.

Yu, X.; Salmon, C. T.; and Leung, C. 2015. Emotional interactions between artificial companion agents and the elderly. In *AAMAS'15*, 1991–1992.