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Editorial: smart technologies for improving the quality of mobile health care

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1 Background

Smart technologies are technologies that use electronic devices or systems that can be connected to the Internet, used interactively, and are to some extent intelligent [1]. Smart technologies have been widely applied to mobile health care. Some major trends are summarized as follows. Mobile recommendation systems (or apps) recommend patients to the most suitable clinics or health care facilities by considering their preferences [2]. Smart watches have full mobile phone capability and are equipped with sensors such as thermometer and heart rate monitor. The sensors monitor and help maintain users' physical conditions that can be conveyed to the backend server for further diagnosis [3]. In a smart hospital, wireless sensors are attached to patients on the move to collect real-time information such as their pulses and oxygen saturation readings [4]. For a similar purpose, smart clothes are increasingly popular for monitoring health care conditions due to the miniaturization of sensors [5]. An advance in hardware is three-dimensional printers that can be applied to print a patient's implants and organs wherever he/she goes [6]. To assist such operations, the medical record of a patient can be put on a cloud to be accessed from anywhere [7]. Some smart technologies can even overcome the limitations of existing technologies. For example, smart glasses use video cameras and light-emitting diode arrays to assist people with extremely bad vision [8]. Obviously, the applications of smart technologies have improved the quality of mobile health care [9].

2 HCMS special issue

For the aforementioned reasons, this special issue is intended to provide technical details of smart technologies for improving the quality of mobile health care, with special emphases on the quantification of the quality of mobile health care, the effects of a smart technology application, and the relationship between them. These details will hold great interest for researchers in health care, smart technology, quality technology, quantitative management, ambient intelligence, mobile commerce, operations research, system science, and information management, as well as for practicing managers and engineers. This special issue features a balance between state-of-the-art research and practical applications. This special issue also provides a forum for researchers and practitioners to review and disseminate quality research work on smart technologies for improving the quality of mobile health care and the critical issues for further development. After a strict review, eight articles from researchers around the world were finally accepted.

In the first paper, Chen and Chiu established a ubiquitous clinic recommendation system by mining the unknown preferences of patients. Patients' preferences were represented with the weights that they assigned to various clinic attributes, which were unknown to the system administrator. To estimate the values of weights, an integer nonlinear programming problem was formulated and solved. Subsequently, the estimated

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weights were tuned on a rolling basis. In addition, the back propagation network-response surface method was applied to approximate the asymptotic values of weights.

In the second paper, Agnihothri, Cui, Delasay, and Rajan found out the relationship between several factors and the effectiveness of mobile health innovations. Factors considered by them included the current health condition of a patient, the pattern of disease progression, the frequency of measurement and intervention, the effectiveness of intervention, and the cost of measuring. The relationship was fitted with a discrete-time Markov chain model.

Nasir and Dang formulated a mixed-integer linear programming (MILP) model for solving the scheduling and routing problem in a home health care system. Subsequently, the thresholds for some parameters in the MILP model were identified using two methods – Bender's method and the receiver operating characteristic curve method. After validating the results with a new data set, both the two method achieved high accuracy.

Bettiga, Lamberti, and Lettieri established a conceptual framework, grounded on the technology acceptance model, to find out the determinants of users' willingness to adopt and pay for a mobile health care application. The collected data were analyzed using the structural equation modeling method. According to the analysis results, usefulness and the ease of use determined both the intention to accept and the willingness to pay for a mobile health smart technology.

Ubiquitous clinic recommendation systems mine the historical data of patients to learn their preferences, and apply an algorithm to adjust the recommendation algorithm after receiving new patients' data. However, whether such an adjustment mechanism is sustainable is a question. To address this issue, Chiu and Chen modeled the improvement in the successful recommendation rate of a ubiquitous clinic recommendation system using an adjustment mechanism as a learning process. Both the asymptotic value and learning speed of the learning process provided valuable information regarding the long-term effectiveness of the adjustment mechanism.

Chaieb, Jemai, and Mellouli built a hierarchical optimization model (HOM) for a home health care scheduling problem. The HOM was composed of three interconnected subproblems namely the grouping, assignment, and routing subproblems. The complexities of the subproblems were weaker than the original problem. In addition, the subproblems were easier to solve.

Lin and Chou studied the operating room scheduling problem of assigning a set of surgeries to several multifunctional operating rooms. Four easy-to-implement heuristics were proposed to find feasible solutions to the problem efficiently. Subsequently, four local search procedures were also established to improve the solutions. Finally, a hybrid genetic algorithm that incorporated the initial solutions, local search procedures, and an elite search procedure was designed to optimize the solutions.

Yousaf, Mehmood, Awan, Saba, Alharbey, Qadah, and Alrige conducted a comprehensive review of smart technologies for the mobile health of patients with dementia and Alzheimer's disease (ADL). The results showed that smart technologies are helpful to ADL-based cognitive training, monitoring, dementia screening, reminiscence and socialization, tracking, and caregiver guiding. In addition, existing apps for similar purposes were also compared.

3 Concluding remarks

From the accepted papers, it is obvious that reasoning is still the most critical task to the effectiveness of a mobile health care application. We would like to thank the HCMS Editor-in-Chief Yasar Ozcan for providing full support in bringing out this special issue. We are thankful to the paper contributors who shared their research as well as the reviewers who spared their valuable time in paper review. We would also like to thank the Journal staff. Without their support and professional assistance, the prepublication process would not be possible.

References

1. van Doorn M (2015) What does SMART technology actually mean? http://labs.sogeti.com/wat-smart-technology-actually-mean/. Accessed 12 April 2016
2. Chen T (2016) Ubiquitous multicriteria clinic recommendation system. J Med Syst 40(5):113
3. Reeder B, David A (2016) Health at hand: a systematic review of smart watch uses for health and wellness. J Biomed Inform 63:269–276
4. Al-Refaie A, Chen T, Judeh M (2018) Optimal operating room scheduling for normal and unexpected events in a smart hospital. Oper Res 18(3):579–602
5. Schneegass S, Amft O (2017) Smart Textiles. Springer, Cham
6. Chen T, Tsai HR (2017) Ubiquitous manufacturing: current practices, challenges, and opportunities. Robot Comput Integr Manuf 45:126–132
7. Li ZR, Chang EC, Huang KH, Lai F (2011) A secure electronic medical record sharing mechanism in the cloud computing platform. 15th IEEE International Symposium on Consumer Electronics, pp. 98–103
8. Jordan M (2011) What is 'smart' technology? http://knowit.co.nz/2011/08/what-is-smart-technology. Accessed 16 April 2016
9. Chen T, Chiu MC (2018) Smart technologies for assisting the life quality of persons in a mobile environment: a review. J Ambient Intell Humaniz Comput 9(2):319–327