A Parallel Patient Treatment Time Prediction Algorithm and Its Applications in Hospital Queuing-Recommendation in a Big Data Environment

Effective patient queue management to minimize patient wait delays and patient overcrowding is one of the major challenges faced by hospitals. Unnecessary and annoying waits for long periods result in substantial human resource and time wastage and increase the frustration endured by patients. For each patient in the queue, the total treatment time of all the patients before him is the time that he must wait. It would be convenient and preferable if the patients could receive the most efficient treatment plan and know the predicted waiting time through a mobile application that updates in real time. Therefore, we propose a Patient Treatment Time Prediction (PTTP) algorithm to predict the waiting time for each treatment task for a patient. We use realistic patient data from various hospitals to obtain a patient treatment time model for each task. Based on this large-scale, realistic dataset, the treatment time for each patient in the current queue of each task is predicted. Based on the predicted waiting time, a Hospital Queuing-Recommendation (HQR) system is developed. HQR calculates and predicts an efficient and convenient treatment plan recommended for the patient. Because of the large-scale, realistic dataset and the requirement for real-time response, the PTTP algorithm and HQR system mandate efficiency and low-latency response. We use an Apache Spark-based cloud implementation at the National Supercomputing Center in Changsha to achieve the aforementioned goals. Extensive experimentation and simulation results demonstrate the effectiveness and applicability of our proposed model to recommend an effective treatment plan for patients to minimize their wait times in hospitals.

In this paper, we propose a Patient Treatment Time Prediction (PTTP) algorithm and a Hospital Queuing-Recommendation (HQR) system. Considering the real-time requirements, enormous data, and complexity of the system, we employ big data and cloud computing models for efficiency and scalability. The PTTP algorithm is trained based on an improved Random Forest (RF) algorithm for each treatment task, and the waiting time of each task is predicted based on the trained PTTP model. Then, HQR recommends an efficient and convenient treatment plan for each patient. Patients can see the recommended plan and predicted waiting time in real-time using a mobile application. Extensive experimentation and application results show that the PTTP algorithm achieves high precision and performance.