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PATIENT TREATMENT TIME PREDICTION USING DECISION TREE ALGORITHM

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Abstract –

With the increasing demand of the hospital services and also with the increasing crowd of the patients for their treatment in the hospital, proper management of the crowd with effective time utilization of patients as well as hospital management should be done. Patient queuing is considered as one of the major problem in the hospitals. Patients must wait for long period of time to carry out variety of treatment process unless all previously waiting patients are not done. It can be convenient and preferable if the patient waiting time is predicted before so that the time wasted waiting in the queues can be saved. We proposed a patient time prediction algorithm for hospital queue recommendation and management which will predict waiting time for each patient in the queue on the basis of the average treatment time, which is calculated from previous hospital records. Based on the predicted waiting time, Hospital queuing recommendations (HQR) system can be developed, which will suggest an efficient treatment plan for each patient such that the waiting time is minimum.

Keyword- Hospital Queuing Recommendation, Patient Treatment Time Prediction, Decision Tree.

INTRODUCTION

Currently, most hospitals are overcrowded and inefficient in providing appropriate queue management. Queue management and waiting time prediction is a tedious and challenging as each patient requires different operations such as X-Ray, CT Scan, Blood Test, etc.

Those operations can be referred as *tasks* for the patient. In some cases, more than one task may be suggested for the patient in order to get the treatment done. Some of these operations are independent, such as Blood Test. But some operations are dependent on completion of other operations, for example, for a surgery, it is mandatory to have X-Ray test or CT Scan Test in prior. Patients must have to wait in queues for treatments. In order to complete treatment in shortest duration, waiting time of each task is predicted.

In this paper, we propose a Patient Treatment Time Prediction (PTTP) calculation and a Hospital Queue Recommendation (HQR) framework. The PTTP uses Decision Tree Algorithm for every treatment, and the waiting time of each assignment is expected in view of the prepared PTTP display. At that instance, HQR prescribes an effective treatment for every patient. Patients can see the suggestion and waiting time, hence utilizing the versatile web interface.

The expected waiting time for every patient is the total of all patients' likely treatment times in the current queue. HQR framework, is proposed bearing in mind the expected waiting time. A

treatment suggestion with a well panned treatment format and the minimum sitting tight time is prescribed for every patient.

RELATED WORK

To improve accuracy of the data analysis, various optimization methods of classification and regression algorithms are proposed. A multi-branch decision tree algorithm, based on a correlation-splitting criterion was proposed.

Decision tree algorithm belongs to the family of supervised learning algorithms. Unlike other unsupervised learning algorithms, decision tree algorithm can be used to solve regression and classification problems as well. Decision trees are one of the most widely used classification and prediction tools. The decision tree algorithm is used in many fields such as Business Management, Customer Relationship Management, Healthcare Management and Fraudulent Statement Detection.

Various recommendation algorithms have been presented and applied in related fields. Algorithms such as Keyword-aware service recommendation method on MapReduce for big data applications, travel recommendation algorithm, Bayesian-inference-based recommendation system, multi criterion rating system, etc. There is no effective prediction algorithm for Patient Treatment Time Prediction.

To predict the waiting time for each operation/ treatment, we use decision tree algorithm to train the treatment time consumption based on the characteristics of patient and time to build the PTTP model. Compared to the original RF algorithm, our PTTP algorithm is based on Decision Tree to reduce the complexity and to obtain the same levels of accuracy and performance. We also propose an HQR system based on PTTP model. HQR system suggests an efficient treatment plan with least waiting time for every patient.

PROPOSED SYSTEM

We intend to develop a web interface, through which the user/ patient can know about treatment suggestion and minimum waiting period. Patient can login to the web page, and upload treatment file. The treatment file to be uploaded should be an Excel file. An algorithm is used to convert data in Excel file to datasets or data tables. Later, PTTP Algorithm and HQR System work in order to acknowledge the patient about the treatment recommendation and waiting time.

METHODOLOGY

To predict the treatment time for each operation/ treatment, we use decision tree algorithm to train the treatment time consumption based on the characteristics of patient and time to build the PTTP model. Compared to the original random Forest algorithm, our PTTP algorithm is based on Decision Tree to reduce the complexity and to obtain the same levels of accuracy and performance.

Hospitals produce a large amount of data on daily basis. The data contains massive information such as names of the patients, age, gender, medical history, treatment department and detailed information of treatment tasks. Time required for each treatment task may vary. This time variation depends on various factors such as, age and gender of a patient.

Hospital data from various treatment tasks is gathered. As large number of patients visit hospital each day, say, 5000-8000 patients in a medium-sized hospital. And it keeps decreasing or decreasing, depending on factors like size of the hospital, facilities in the hospital, to name a few.

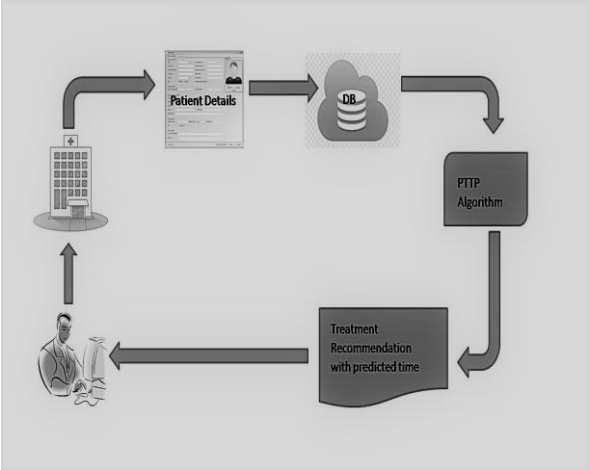

Fig: Block Diagram of PTTP

The patient information collected by the hospitals contains various features. These features help determine the waiting time as well as treatment plan. Not all the features are taken into consideration in PTTP, as these may not provide sufficient information or these may be garbage values. We use some features of the data, like, patient information, treatment information and time in PTTP algorithm. Features which are not related to predicting treatment time are not taken into consideration, such as, phone number, address, etc.

The patient treatment time for each patient is estimated by the proposed PTTP model. The waiting time of each task at the current time can be predicted, such as {*Task-A*:35(*min*); *Task-B:*30(*min*); *Task-C:* 70(*min*); *Tasl-D:*24(*min*); *Task-E:* 87(*min*)}. Finally, the tasks of each patient are sorted in an ascending order according to the waiting time, except for the dependent tasks.

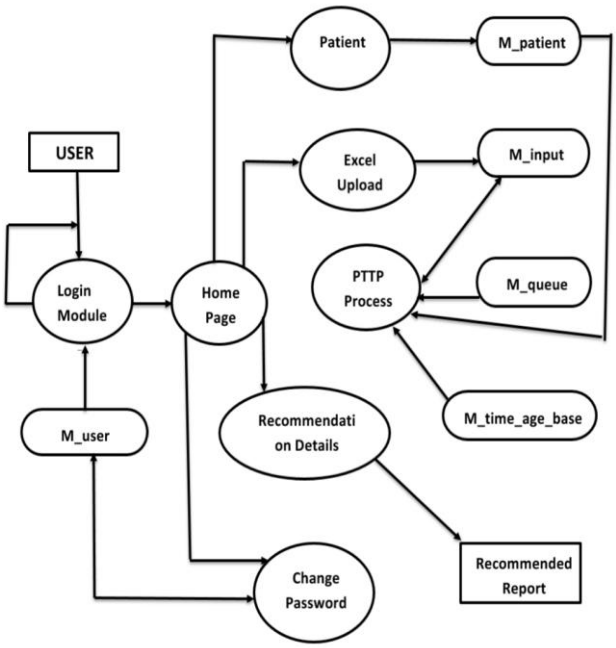

Fig: System Flowchart

The recommendation is processed for each patient, such as the treatment suggestion as{*B*;*D*;*A*} for *Patient*1, {*B*;*C*;*E*} for *Patient*2, and {*D*;*C*;*E*} for *Patient*3. To complete all of the required treatment tasks in the shortest waiting time, the waiting time of each task is predicted in real-time.

A PTTP based Hospital Queuing Recommendation (HQR) System is developed. HQR suggests an efficient and well planned treatment plan for every patient such that all the tasks can be completed in minimum time.

All treatment tasks of the patients are sorted in ascending order according to the waiting time. The task, which is dependent on another task, if any, should be sorted based on their dependencies rather than waiting time.

Finally, a recommendation with sorted treatment tasks is performed for each patient. Each patient is given a suggestion such that he/she can complete the treatment tasks in the most convenient way with least waiting time.

Modules Description

1. Patient Module

List of Treatments and respective average treatment time should be added in the database. Assign the priorities to the treatments. Because, some treatments are depending upon the previous treatment results. List of Treatments and respective average treatment time, based on the age and gender should be added in the database. Because treatment time is also dependent on the gender and the age of the patients. Patient data will be added to the data base through GUI, which includes the patient name, age, gender and treatments.

2. Excel Data Process Module

Excel sheet data has to be prepared, which contains patient id, age, gender and the treatments. The prepared excel sheet is the input for the Parallel Treatment Time Prediction (PTTP) process. Excel sheet should be uploaded from the application, Excel data has to read row by row and it has to be inserted in to the database for the further process.

3. PTTP Process Module

From the input data, which has been inserted from the excel sheet, patient assigned treatments will be taken in to consideration. Based on the priority of the treatment, and the average treatment time and the gender of the patient, new treatment slot will be recommended.

RESULT AND DISCUSSION

PTTP algorithm using decision tree for calculating effective treatment planning in the hospital has been presented. The patient's details such as patient's age, gender etc. are taken into major consideration as the treatment time may be affected by these factors. Also we provide the priority to the treatments such that the major treatment gets major priority. With the provision of all these facts with the help of database, the algorithm performs the calculation for each patient with their respective treatments. This majorly helps in the minimization of hospitals queuing and overcrowd with the effective way of treatment planning for each individual. In future work, Patient's secured user interface through mobile app will be taken into consideration so that patients will be notified with their treatment planning through their own phone. We have taken the inspiration from some other patient treatment planning for designing this approach. The Results shows that the proposed algorithm can perform well for predicting and planning treatment plan for patients in hospital. To summarize, effective and efficient way of Treatment planning is presented as an approach for analyzing the average waiting time for the patients and minimizing the over-crowd in the hospital and also.

CONCLUSION

In this paper, a PTTP algorithm is proposed. A Decision Tree Algorithm is performed for PTTP model. The waiting time for each treatment is predicted based on the PTTP model. Recommendation system is developed for suggesting an efficient treatment plan for each patient.

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