A Personalized Decision Support System for Health Care Applications

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ABSTRACT: We recommend to significantly take a look at encouraged remedy suggestions and compare historic treatment data for selected rare and persistent illnesses. As consultant sicknesses we take a look at Glioblastoma Multiforme (mind cancer) which is classified as an extraordinary disorder, and Diabetes Mellitus, that is a nationally and globally large persistent sickness. A graph model is designed to seize the data bearing on the remedy alternatives and actual treatments administered and in addition analyzed to discover sequential remedy styles based on unique final results class 122 esprimarily based on durability, complications and many others. The belief of ‘Patient Similarity’ might be explored to form cohorts of clinically similar patients. The treatment patterns might be ranked, and noticeably ranked patterns might be ordered depending on anticipated results before being assigned to cohorts of patients. A prototype decision guide machine is planned for recommending remedy alternatives based totally on a patients clinical and possibly genomic data while available.

KEYWORDS: Graph Data, Sequential Pattern Mining, Patient Similarity.

I. INTRODUCTION

In medical science, decision making is a complex task as it depends on variety of interrelated functions. We are concentrating not only on the accuracy and prediction of the result, but also on the interoperability of the result from the physicians who use Decision Support System (DSS). Making the right decision at right time is the most important factor in healthcare systems, especially in medical diagnosis systems. The phenomenal growth of technological development in healthcare systems, forces the knowledge corresponding to the diagnosis and adaptation of treatment flow to be recorded by a variety of methods such as Clinical pathways, DSS, Guideline based DSS and so on.

The decision support system is one of the methods widely used in healthcare systems. Classification plays a vital role in decision making. Decision trees are among the classification techniques that solve large complex problems by providing rules in an understandable form. But the rules generated from decision trees do not work well with continuous attributes. Fuzzy logic system supports uncertain boundaries. The main difficulty arises with a slight change in attribute values, which in turn changes the sensitivity of decision tree. Crisp set comprises a function with 0 (false) and 1 (true), whereas fuzzy set theory contains the elements with unsharp boundaries, that is, it handles uncertain information.

In order to handle the aforementioned issues, it is necessary to move to fuzzy decision trees. Personalized treatment is an important factor in healthcare systems. The term personalization refers to the delivery of right diagnosis and treatment for every individual patient. Traditional healthcare decision support systems do not provide reasoning and mainly focused on integration of data and knowledge. In order to improve knowledge representation and reasoning facility, the ontologies acts as a stepping stone to improve the healthcare systems.

II. BACKGROUND WORKS

Some work has been executed in the vicinity of developing fashions for predicting remedy plans for patients. Research companies have advanced models to are expecting the various drug interventions in addition to tablets coupled with lab interventions that might work nice for a specific ailment. These models do no longer include vital parameters like signs and symptoms, outcomes of investigations, laboratory
take a look at results, and so forth and are simplest constrained to predicting drugs that may be effective [15]. We recall a completely complete definition of a treatment plan and the method outlined formerly would rank the remedy patterns for a given patient, which implies selection of medication/interventions, their dosages, their ordering, etc. Based on the fashions built by way of Kim et al (2004) [7] for continual coronary heart failure (CHF) remedy, considerable factors improving the plasma BNP stages had been determined, which were established by way of massive-scale trials. Similar work has been finished in the location of heart disease analysis reporting fairly appropriate accuracy [19]. Neuvirth et al (2011) [11] present a prototype for a information-pushed chance evaluation machine for Diabetes patients and claim to become aware of physicians who can supply best care to such sufferers and also pick out sufferers requiring emergency care offerings.

The selection support model evolved via Chen et al (2012) for Diabetes [5] makes use of a case primarily based reasoning approach to locate affected person cases similar to the only queried and isn’t always very robust for the reason that approach used by authors to find comparable instances isn’t always very granular and in the end the identical line of treatment which is given to those comparable instances is recommended for the brand new affected person. In our method we will think about all of the cohorts of patients just like the check affected person after which assign weights to the treatment sample in each cohort, which we trust might be greater correct than the case primarily based reasoning technique. We considerably tease out the different remedy styles which might be function of a particular outcome and plan to come up with a significant measure of affected person similarity to construct patient profiles primarily based on scientific and possibly behavioral variables, specifically for diabetes.

Since a well-defined data model is important for the execution of treatment flow and for the success of semantic web technologies in healthcare systems, the ontology is used to construct the decision support systems. The term ontology is taken from philosophy and it is the knowledge of formal explicit specification with sharing facility of aggregation. Ontology is constructed to define properties, attributes and restrictions corresponding to the concepts. Each and every entity can be called a class. An attribute of ontology refers to a characteristic of concept or relationships between concepts. An instance of ontology implies a case of concept.

The SWRL is one of the standard rule languages of semantic web, which contributes to the ability to write Horn-like rules with respect to Web Ontology Language (OWL) concepts. SWRL rules make three-fold use of the vocabulary of ontology syntactically, semantically and inferentially. SWRL is a combination of RuleML OWL ontology and at present it is one of the specifications of W3C. The rules are used to derive new knowledge from OWL knowledge bases by using inference engine. The Java Expert System Shell (JESS) is a forward chaining inference engine developed under Java language at Sandia National Laboratories, New Mexico. JESS uses the very efficient Rete algorithm to match the SWRL rules.

### III. PROPOSED WORK

A prototype of the tool is being developed for GBM patients using clinical and genomic data from a public portal called ‘The Cancer Genome Atlas Portal’ [10] and cBioPortal [3]. The clinical domain includes demographic information about the patient along with some basic clinical features, e.g. Karnofsky performance score, histological type, survival duration, prior glioma information and most importantly the vital status of the patient (Living / Dead). Studies show that GBM patients can be classified into four subtypes namely Classical, Mesenchymal, Proneural and Neural based on the expression levels of a particular set of genes [6, 22]. For our study we considered these set of genes and used their mRNA expression levels, copy number variation data and methylation status. Additional information includes drugs prescribed along with their dosage, therapy type, radiation type, radiation dosage, and start and end dates for the treatment. We model this data as a graph where nodes are of two types: ‘patient node’ & ‘treatment type node’ and edges are also of two types: ‘prescription edge’ & ‘sequence edge’.

A graph offers a much richer picture of a network, and relationships of several types. The majority of
path-based graph database operations are highly aligned with the way in which the data is laid out hence increasing the efficiency [16]. Figure 1 shows a graph consisting of two patients just for illustrative purposes. In the graph patient nodes have properties such as ‘patientid’, ‘age’, etc. Drugs and radiation prescribed are represented as treatment typenodes with properties such as ‘drug name’ and ‘radiation type’ respectively. The ‘prescription edge’ signifies the prescription of treatment with properties such as ‘start date of prescription’, ‘end date of prescription’, ‘dosage’, etc. The ‘sequence edge’ signifies the sequence in which drugs or radiation were prescribed. E.g., The edge labeled ‘Prescribed’ between the patient node with ‘id = Patient 1’ and the drug node with ‘drugName = Drug A’ signifies that ‘Patient 1’ was prescribed 200 mg/day of ‘Drug A’ on 05/21/2007 till 06/22/2007. The other type of edge labeled ‘Followed by’ would always be between two drugs or two types of radiation or between a radiation type and a drug signifying the sequence of the prescription. E.g., the ‘Followed by’ edge between source node ‘Drug A’ and target node ‘Drug B’ with properties ‘patient’ and ‘overlap’ signifies that for ‘Patient 1’, Drug A was followed by Drug B and there was an overlap of 24 days. The graph shown in the above figure is based on the data available for GBM patients.

The objective is to upsurge the survival period of the patient as much as possible. For GBM patients we analyze the treatment data of patients and recognize treatment patterns, which are characteristic of survival for a certain range of time (e.g., 6-12 months). The perception of ‘affected person similarity’ would be explored to both use present similarity measures or develop a brand new metric for the motive of figuring out similar patients, which would play a significant position in recommending remedy for a cohort of patients. Significant work has been carried out on the Healthcare Systems and Analytics Research department of IBM inside the region of affected person similarity regarding doctor comments as an critical parameter to organization similar patients [21].

Chan et al. (2010) [4] have proposed a new affected person similarity set of rules named SimSVM, which does a binary type and outputs the expected class that is survival more than twelve months or much less than one year and diploma of similarity or dissimilarity. Their method only considers a single outcome and a few similarity measures as arrive. We consider that our technique could bea substantial development because we plan to recollect multiple outcomes collectively as we believe that a single outcome based totally technique will be misleading. Forevery man or woman affected person we would rank the treatment styles primarily based on ancient revel in with comparable patients. Heuristics would be evolved to do the ranking.

IV. CONCLUSION

Most of the paintings stated underneath will feed into the prototype improvement paintings. In the paper we supplied the first step in mining massive sequential treatment patterns and correlating the styles with survival length of patients. From a clinical angle, it offers an insight to the scientific practitioner about the importance of prescribing a hard and fast of drugs in a specific series. The contribution of the thesis will be the following like the treatment selection problem would be modeled the use of a graph formalism. Enhancements could be made to sequential mining set of rules/

REFERENCES

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