Fusion of Health Care Architecture for Predicting Vulnerable Diseases Using Automated Decision Support Systems

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ABSTRACT

The healthcare industry is a stage which is presented with tremendous innovative headways consistently. With the perfect learning of foundation data, writing, and proposed calculation, the proposition conveys engineering for supporting computerized choices to medicinal services organizations. Electronic records are constantly gathered and sorted out to give a point by point history of patients, their sicknesses and determination plans. From the acquired data, the virtual doctoring engine (VDE) endeavors to break down the discernible attributes from the datasets utilizing the known-yet-predict (KYP) calculation to propose an ideal finding plan. This treatment plan will later be directed by a specialist for treating the patients. The exhibition of VDE framework is tried against patients experiencing cardiovascular infections. This methodology has been examined against different component extraction calculations and observed to be 18.2% progressively exact in anticipating the ideal treatment plan.

KEYWORDS

Automated Systems, Business Intelligence, Decision Support Systems in Healthcare, Feature Extraction, Healthcare Informatics

1. INTRODUCTION

Organizations rely on processing and acquiring meaningful information from raw data and challenge arises when amount of data exceeds the nominal level that could be processed by a human expert (Forbes, 2017). This limitation led to the development of an interesting domain in Computer Science and Engineering namely business intelligence (BI) (Teixeira, Afonso, Oliveira et al., 2015). Data warehousing optimizes the storage and retrieval of voluminous data, with the support of powerful business analysis tools, these data warehouses extends its functionality to a wider domain. The heterogeneous data are classified and clustered for easier processing by online analytical processing tools to aid in efficient decision-making processes. Yet in medical industries, types of tests and reports possess a great diversity which makes the condition more challenging. The tools implied will also face the difficulty of extracting the required information from multiple data fields. Possibilities of
misguidance and misjudgments always yield potential harm to the patients’ health and reputation of the medical institutions. The decision support systems cannot always rely on training data and a common pattern analysis (Peng, 2005) as the observable characteristics are represented to be referral. Proofs from the reports may seem similar to a pattern tested during investigative stages but response of the particular patient to a drug may differ from representative diagnosis by a great extent. This case is best understood with the probability of diabetes when it possesses a family history. The children of hereditary patients affected with diabetes need to be tested in earlier years when compared to children of healthier patients. The same scenario applies to patients of breast cancer. Hence this system should be able to decide the age and interval of mandated tests based on family history and other risk factors (Richmond, 2008). Even the diagnosis prescribed by qualified doctors are wrong sometimes and account to nearly 10% of mortality rates, which questions the development of a business intelligent architecture for decision support on prescription and diagnosis (Bennett, 2013).

This proposal intends to develop a medically intelligent tool backed by sufficient learning algorithms to demonstrate and justify the need of a clinical decision support system (CDSS) (Berner, 2007) and diagnosis decision support system (Çomak, 2007) in hospitals. Patients’ information is maintained electronically as electronic health records (EHR) (Berner, 2007). These records are constituted with the details of patients’ details apart from name and address including their demographics, age, allergic reactions, previous medications, progress and regress of previous treatments, dosage and so on. This abundant information provides an additional opportunity to understand the physique and mental stages of patients. These details will assist in a customized diagnosis plan by eliminating the odds. The intelligent business model is already trained with similar patients, their treatment plans and counter actions (Shortliffe, 2013). Yet this tested result may not be the right plan for a new patient with similar characteristics. The objective is to derive the distinguishing factors present in the current patient and compare with the treatment plans which are already tested to be efficient. This step of the model is to preserve the computation cost and time to ensure an efficient product for the clients. Comparative study over the existing metrics will delay the overall processing and result in poorly performing software solution. The adaptability of the system to new conditions and parameters will also be reduced when the number of patients is more than the testing environments. This is coined as the Perception Factor of the proposed algorithm which concentrates more on distinguishing parameters in a large patient health record.

Followed by the construction of a data warehouse for storing EHRs, a virtual doctoring engine is established to identify the uncommon factors apart from the similarities of the current patient with existing patients. This engine derives a tree from the root, which indicates the origin of the disease. The symptoms are mapped as the branches and as each branch progresses, the learning feature of this proposed model extends the search for uncommon factors. Achieving this breaking point, with the similarities in above structures will derive the new diagnosis plan. This uncommon factor is denoted by the action plan which doesn’t proceed as planned. Breaking point will identify where the current patient failed to respond as desired and obtained in the existing records. Dissimilarities from patients of the same categorization will add a new learning step and is updated to the model for future cases. The contextual information along with observations will categorize the patient to a specific sector by eliminating other possible diagnosis to improve performance of the approach. This method has proved that previous machine learning algorithms (Tiwari, 2017) are outperformed in clinical and diagnosis decision making stages after introducing this new learning ability. The existing systems do not possess the information of recommended diagnosis plans by the automated systems and information about observations after treatments. Preference of alternative medications and their response are also missing in the training sets. The learning capability of the proposed system depends on the availability of all related information to be compared before a treatment is predicted. A huge dataset about the patients, their diseases, levels, impact of successful medications, observed outcomes, significant features in every patient, types of tests and reports obtained and decision of a medical expert are stated in the methodology. This approach introduces a new scheme to facilitate the learning ability by including the outcomes of failed and successful diagnosis plan to assist in the next treatment.
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