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Dr. Query:
A Predictive Mobile-Based Healthcare Tool for Querying Drug

Megha Rathi, Jaypee Institute of Information Technology, Noida, India
https://orcid.org/0000-0002-3738-7291

Vaibhav Grover, Jaypee Institute of Information Technology, Noida, India

Twinkle Kheterpal, Jaypee Institute of Information Technology, Noida, India

ABSTRACT

Drugs can help us to treat disease, but sometimes medication can cause severe side effects. With a little knowledge, one can have drugs that are intended to prevent or avoid adverse outcome. Recognizing potential drugs enhances the quality of the healthcare system and reduces the risk associated with drug intake. Several factors like drug-drug interactions and side effects should be known to us before we intake drugs. So, the authors' motive is to develop a predictive mobile-based healthcare tool that would help drug consumers to find drugs which suit them best. As an outcome, the tool will provide the names of the top 10 medicines that will be best for specified indications and do not cause specified side effects and do not or least interact with mentioned drugs. Proposed mobile-based drug query tool will provide exact query matching drugs as well as close matches by leveraging machine learning in the tool.

KEYWORDS

Android-Based Mobile Technology, Application of Machine Learning, Data Mining, Drug Query System, Healthcare, Machine Learning

1. INTRODUCTION

Drug-Interaction and Drug side Effects are two important factors that need to consider before taking any drug. One drug may cause adverse effect to some drug consumers but provide better results to other. So other factors like age, gender, and other biological problem to patient must also be addressed while suggesting drugs. In order to provide effective drug prediction system, one must consider all the above-mentioned factors while providing the name of drugs because wrong suggestion may lead to disastrous result and even lead to death of any patient. If a patient is taking more than one drug predicting drug-drug interaction initially is very difficult and sometimes cause severe side effect. With more than one prescribed medicine chances of possible drug interaction is quite high. Old age patients and patients suffering from critical disease like cancer (Jurulink et al., 2003) (Van et al., 2010) have high chances of drug interaction and possibility of side effect due to intake of drug. So,

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precaution must be taken while suggesting drug to critical patient. Most of the drug-drug interaction and side effect are discovered accidentally when two or more drugs are prescribed by any healthcare professional to any patient, so clinical trial lead to the discovery of most drug-drug interaction (Percha, 2013). Many methods have been used in the past for discovering drug-drug interaction like finding out the drug interaction from scientific data (Kuhn et al.,2010) (He et al.,2013), dataset of insurance claim (Noren et al., 2008), electronic health records (Duke et al., 2012), and Adverse Event Reporting system (Tatonetti & N.P, 2012) but all the above mentioned methods rely on clinical experience and trial in the marketing of drug. All above methods are not effective in finding out drug-drug interaction and cannot alert any patient about the side effect (Tatonetti et al., 2012). So there is a need of mechanism which can suggest drug with very low error rate. It has been found that machine learning is very effective in healthcare domain especially in disease detection and drug suggestion (Rathi & Gupta, 2014). Medication or drug intake requires lot of knowledge of drug, its side effects, and its interaction with other medicines. We cannot afford to take a risk which is directly connected with people's life as any mistake in diagnosis or treatment of a disease may lead to death of a patient. Globally, it is estimated that 142,000 people died in 2013 from adverse effects of medical treatment; this is an increase from 94,000 in 1990. However, a 2016 study of the number of deaths that were a result of medical error in the U.S. placed the yearly death rate in the U.S. alone at 251,454 deaths (GBD Mortality and Causes of Death, Collaborators, 2013).

In this research, our objective is to develop a mobile based healthcare tool that could be of great help in choosing and identifying drugs according to patient need and health condition. Although our tool cannot replace professional but can help customers as well as professionals to put a check over the prescription with our tool's results. This approach will not only satisfy customer with the prescription but will also help in reducing the rate of error of medical data. A rate of error of medical data is a curable negative effect of care, sometimes harmful of sometimes evident to the patient. To achieve the objective of less rate of medical error, we developed an approach where user can specify indication and our tool will provide top ten drugs that can cure that indication. As indication is not the only criteria for drug prescription, several other factors such as side effect and interaction of a drug with drugs that the patient is already taking can change the prescription result. So along with indication our tool can take input of side effects that user does not want in his/her prescribed medicine and drug interaction. For example, for a patient who notices symptoms like headache and vomiting and wants a drug that do not cause sleepiness and do not interact with aspirin (patient is already having a medication which involves disprin), we can input query like: "Find a drug for headache and vomiting that does not have a side effect - sleepiness and does not interact with aspirin."

Our tool is different from already existing drug query system which gives exact matching results of the query. As generally the drug data is not complete or have noise in it, our approach leverages machine learning algorithms to get exactly matching as well as closely related results. In traditional drug query system there can be a case where we can get zero results but this is not the case with our drug query system. The tool is always going to give results with a score of correctness. Keeping all the details as mentioned above we propose a model which uses the power of heterogeneous graphs and machine learning algorithms to provide better results. Then, we propose a score function to give confidence or how well a query matched with a result. The score function uses likelihood of closeness between two labeled nodes. Drug and its properties are represented by labeled nodes the score function approximate the closeness between medicine and property of medicine.

2. LITERATURE REVIEW

Several researches have proposed ideas for querying medicines over data that contains little bit noise. In the paper (Jin et al., 2014) an efficient algorithm to find the best ranked k replies for a given query is proposed. Matching score is used to find the quality of answer. In order to speed up processing time of query an algorithm is proposed to restrict the matching scores while computation. Using