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An Analytical Survey on Adverse Drug Reactions Using Data Mining

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Abstract - *Adverse drug reactions denote a major health problem all over the world. It describes any injury caused by taking a drug or overdose of drug or due to combination of two or more drugs. Detection of adverse drug reactions is compulsory because they affect large number of people and can help in raising early warning against adverse effects of drugs and help medical experts in making treatment effective and timely. In today's digital era a huge amount of data correlated to adverse effects of drugs is being collected at hospitals, drug retail stores and by drug producers. This data can be used for finding out the secreted relationships between drugs and their adverse reactions. In the current scenario, our world is being completely deployed by many drugs. Few of them are alcohol, marijuana, cocaine, steroids and tobacco. Due to the maximum addiction to those drugs, many problems are getting worse in our society, and alcohol is the most acutely destructive of other drugs. This research deals about the society problems due to the use of alcohol.*

***Key Words*: Addiction, drug, health, medical, treatment.**

1.INTRODUCTION

Drugs are suggested to patients for curing diseases and improving their health. But sometimes drugs may lead to negative side effects which can degenerate patient's health. A drug allergy is the abnormal reaction of your immune system to a medication. However, a drug allergy is more likely with certain medications. The most common signs and symptoms of drug allergy are hives, rash or fever. A drug allergy may cause serious reactions, including anaphylaxis, a life-threatening condition that affects multiple body systems. A drug is any substance (other than food that provides nutritional support) that, when inhaled, injected, smoked, consumed, absorbed via a patch on the skin, or dissolved under the tongue, causes a physiological change in the body. Drugs may be legal (e.g. alcohol, caffeine and tobacco) or illegal (e.g. cannabis, ecstasy, cocaine and heroin) depends on the law of the country and states. Drug repositioning represents the application of known drugs for new indications and plays an important role in healthcare research and industry. With its increasing value in drug development, multiple approaches have been applied in its exercise, basically classified as drug-based and disease based approaches. In the brain, alcohol interacts with centers responsible for pleasure and other desirable sensations. After prolonged exposure to alcohol, the brain adapts to the changes alcohol makes and becomes dependent on it. For people with alcoholism, drinking becomes the primary medium through which they can deal with people, work, and life. Alcohol dominates their thinking, emotions, and actions. The severity of this disease is influenced by factors such as genetics, psychology, culture, and response to physical pain. Data mining is a powerful new technology to discover information within the large amount of the data. Data mining software is one of a number of analytical tools for analyzing data. Knowledge discovery in databases often called data mining, extracting information and patterns from data in large database, and it is one of the technologies used to find the interesting knowledge from the vast data produced by the health care system and used to analysis the patterns in large sets of data.

2. SURVEY ON ADVERSE DRUG REACTION

2.1 Refining Adverse Drug Reactions using Association Rule Mining for Electronic Healthcare Data

Objective

Side effects of prescribed medications are a common occurrence. Electronic healthcare databases present the opportunity to identify new side effects efficiently but currently the methods are limited due to confounding (i.e. when an association between two variables is identified due to them both being associated to a third variable). In this paper we propose a proof of concept method that learns common associations and uses this knowledge to automatically refine side effect signals (i.e. exposure-outcome associations) by removing instances of the exposure-outcome associations that are caused by confounding. This leaves the signal instances that are most likely to correspond to true side effect occurrences. We then calculate a novel measure termed the confounding-adjusted risk value, a more accurate absolute risk value of a patient experiencing the outcome within 60 days of the exposure. Tentative results suggest that the method works. For the four signals (i.e. exposure-outcome associations) investigated we are able to correctly filter the majority of exposure-outcome instances that were unlikely to correspond to true side effects. The method is likely to improve when tuning the association rule mining parameters for specific health outcomes. This paper shows that it may be possible to

filter signals at a patient level based on association rules learned from considering patients' medical histories. However, additional work is required to develop a way to automate the tuning of the method's parameters. In addition to the proof of concept, tentative results are presented for the automatic refinement when considering four signals that have occurred within The Health Improvement Network database for the quinolone drug family.

Learning Outcome

In this article we observed a proof of concept for a novel efficient ADR signal refinement method that filters instances of a DOI-HOI (Drug of interest-Health outcome of interest) signal and does not require knowledge of possible confounders. The recorded history of a patient experiencing the signal is used to filter instances where the medical event can be explained by alternative causes (other than the drug). The tentative results suggest that the method has the capability to efficiently refine ADR signals but each signal may require specific tuning to determine the optimal support and confidence values to be implemented.

2.2 Biclustering of Adverse Drug Events in the FDA's Spontaneous Reporting System

Objective

In this article, we present a new pharmacovigilance data mining technique based on the biclustering paradigm, which is designed to identify drug groups that share a common set of adverse events (AEs) in the spontaneous reporting system (SRS) of the US Food and Drug Administration (FDA). Taxonomy of biclusters is developed, revealing that a significant number of bona fide adverse drug event (ADE) biclusters have been identified. Statistical tests indicate that it is extremely unlikely that the bicluster structures thus discovered, as well as their content, could have arisen by mere chance. In addition, we demonstrate the potential importance of the proposed methodology in several important aspects of pharmacovigilance such as providing insight into the etiology of ADEs, facilitating the identification of novel ADEs, suggesting methods and a rationale for aggregating terminologies, highlighting areas of focus, and providing an exploratory tool for data mining. The objective of this article is to describe a novel pharmacovigilance data mining technique designed to identify drug groups that share a common set of AEs, with which potential ADEs are analyzed and previously unrecognized ADEs may be identified.

Learning Outcome

In summary, the findings demonstrate the importance and utility of this biclustering methodology for many important aspects of pharmacovigilance noted in several prominent studies. Biclustering provides insight into the etiology of known ADEs and facilitates the identification of novel ADEs. It suggests methods and provides a rationale for aggregating terminologies used to describe ADEs. In addition, biclustering can be used to identify AEs of drug classes. It highlights areas of focus and provides an opportunity for enhanced targeting of novel ADEs. Finally, it provides an exploratory tool for data mining in pharmacovigilance with which the underlying large and complex database can be summarized and described in a big-picture manner, capturing important patterns as well as highlighting data quality issues, which can then be used to improve the signal-detection process.

2.3 Detecting Signals of Adverse Drug Reactions from Health Consumer Contributed Content in Social Media

Objective

Adverse drug reactions are causing a substantial amount of hospital admissions and deaths, which cannot be underestimated. Although a great effort has been put on the pre-marketing review during pharmaceutical product development, it cannot identify all possible adverse drug reactions. Many of this online discussion involve adverse drug reactions. In this work, we propose to mine the associations between drugs and adverse reactions from the user contributed content in social media. We have conducted an experiment using five drugs and five adverse drug reactions. The FDA alerts are used as the gold standard to test the performance of the proposed techniques. The result shows that the proposed technique is promising to detect the adverse drug reactions reported by FDA, such as diarrhea, heart condition, depression, and suicidal thoughts. However, adverse drug reaction such as cancer cannot be detected effectively. In this work, in order to explore the potential of detecting ADRs using online healthcare communities, we proposed to employ association rule mining to extract interesting associations of drugs and adverse reactions. When people talk about the ADRs of a specific drug, the co-occurrence of the drug and its ADR in the posts or comments of an online healthcare social media could be regarded as an association rule, and its interestingness and impressiveness can be measured by investigating such metrics as support, confidence and leverage. Association rule mining was first utilized in the field of data mining. Also, in the area of ADRs detection, this method was employed by several researchers to identify potential casual relationships between drugs and adverse reactions from electronic health data. This study is trying to initially test the effectiveness of using association rule mining to extract accurate adverse reactions caused by certain drugs from online healthcare communities.

Learning Outcome

Nowadays, with the booming of online healthcare communities, more and more patients find it convenient to discuss their health conditions, treatment experience, drug they are taking and adverse reactions of them through these online social media platforms. Since these data are available and accessible to public, if we can make good use of them, ADRs might be detected much earlier and more accurately than using either spontaneous FDA reports or electronic health data. However, very few related studies have focused on social media to identify ADRs, so there is a huge potential in this research area. This study collected posts and comments data of 5 drugs from an online healthcare community – MedHelp, used as grounded truth 5 FDA alerted adverse reactions of these drugs, and employ association rule mining to detect drug adverse reaction of interest. The proposed technique is promising to detect the adverse drug reactions reported by FDA, such as diarrhea, heart condition, depression, and suicidal thoughts. However, adverse drug reaction such as cancer cannot be detected effectively. In the experiment, we calculated the values of support, confidence and leverage for each pair and the results show that our method is able to effectively detect FDA alerted adverse reactions. We also believe that our approach is promising in discovering other potential ADRs.

2.4 Fine-grained Mining of Illicit Drug Use Patterns Using Social Multimedia Data from Instagram

Objective

According to NSDUH (National Survey on Drug Use and Health), 20 million Americans consumed drugs in the past few 30 days. Combating illicit drug use is of great interest to public health and law enforcement agencies. Despite of the importance, most of the existing studies on drug uses rely on surveys. Surveys on sensitive topics such as drug use may not be answered truthfully by the people taking them. Selecting a representative sample to survey is another major challenge. In this paper, we explore the possibility of using big multimedia data, including both images and text, from social media in order to discover drug use patterns at fine granularity with respect to demographics. Instagram posts are searched and collected by drug related terms by analyzing the hashtags supplied with each post. A large and dynamic dictionary of frequent drug related slangs is used to find these posts. User demographics are extracted using robust face image analysis algorithms. These posts are then mined to find common trends with regard to the time and location they are posted, and further in terms of age and gender of the drug users. Furthermore, by studying the accounts followed by the users of drug related posts, we extract common interests shared by drug users.

Learning Outcome

Instead of using the traditional methods such as surveys, we propose to leverage social media to fetch posts from drug users with significantly less time and labor cost, while achieving decent scalability, timeliness, and accuracy. First, by using hashtags-based search to find time patterns of drug consumption, we have uncovered interesting trends in the consumption of various classes of drugs. Then, by location endpoint search, we have found interesting geographical patterns and visualized the locations by drawing bubbles on the map. Moreover, in order to keep updating our database of drug-related hashtags, we applied Frequent Itemset Mining to the hashtags in drug users' posts we found by using recent media searching. Finally, relationship endpoint gives us a way to find potential network among drug users and drug-related pages on Instagram.
An important innovation of this study is in multimedia data analysis, and especially faces image analysis. We employ the state-of-the-art Face API of Project Oxford by Microsoft to study the age and gender patterns of drug users. Such fine-grained demographics at a large scale are quite consistent with the findings of National Survey on Drug Use and Health (NSDUH), demonstrating the potential of image-based data analytics for studying drug use and other risky behaviors such as underage drinking. In addition to age and gender, race related patterns can be discovered in a similar fashion, again facilitated by face image analysis. Meanwhile, we have produced potentially significant results that can be utilized in areas including linguistics and psychology.

2.5 Detecting Adverse Drug Effects Using Link Classification on Twitter Data

Objective

Adverse drug events (ADEs) are among the leading causes of death in the United States. Although many ADEs are detected during pharmaceutical drug development and the FDA approval process, all of the possible reactions cannot be identified during this period. Currently, post-consumer drug surveillance relies on voluntary reporting systems, such as the FDA's Adverse Event Reporting System (AERS). With an increase in availability of medical resources and health related data online, interest in medical data mining has grown rapidly. This information coupled with online conversations of people which involve discussions about their health provides a substantial resource for the identification of ADEs. In this work, we propose a method to identify adverse drug effects from tweets by modeling it as a link classification

problem in graphs. Drug and symptom mentions are extracted from the tweet history of each user and a drug symptom graph is built, where nodes represent either drugs or symptoms and edges are labelled positive or negative, for desired or adverse drug effects respectively. A link classification model is then used to identify negative edges i.e. adverse drug effects. We test our model on 864 users using lO-fold cross validation with Sider's dataset as ground truth. Our model was able to achieve an F-Score of 0.77 compared to the best baseline model with an F -Score of 0.58.

Learning Outcome

From this article, we observed a methodology to derive an ADE detection model to detect ADEs from publicly available twitter data. This model also provides a way to build a medical profile of users from their tweet history. We have shown that building a medical profile of a user helps to detect ADEs more accurately than the baseline model. However, the main problem with extracting medical information from social media messages is that most of the users are not domain experts and often use general terminology to describe their medical conditions. This leads to ambiguity and inaccurate representation of information. This problem can be alleviated by generating a better lexicon or by mapping medical ontologies to better map text terms to formal concepts used the medical literature. Another possible extension to this work is to use three labels: normal interaction, ADE and no interaction. This may also open a way to study the long-term effects of ADEs that are labelled as normal interactions within the current time duration.

2.6 Effective Algorithm For Mining Adverse Drug Reactions

Objective

One of the most important issues in the assessment of drug safety is Adverse Drug Reactions (ADR). In premarketing clinical trials, most of the ADRs are not discovered because of the limitations in size. But that are discovered in post-marketing surveillance that is, the impacts of medicines are monitored when they have been delivered to the user. Nowadays, many data mining techniques and methodologies have been developed to motivate the mining and detection of ADRs. These methods are inconvenient and inefficient for users and time consuming. This problem can be alleviated by generating a better lexicon or by mapping medical ontologies to better map text terms to formal concepts used the medical literature. We proposed a combined system platform for the detection of ADRs. This system platform proposed a new data mining algorithm, named as NM-Algorithm. It is based on the genetic algorithm with supervised learning. This proposed algorithm is completely different from the association rule mining. This proposed algorithm covers both similarity and non-similarity between the elements so that it is much more efficient than others. In this proposed system, we try to employ an interactive approach to capture the adverse drug reactions between drugs and their reactions. To capture the relationship drugs and symptoms, first we concentrated on generating the initial population named as medical datasets. Based on genetic algorithm with supervised learning, we generate the training tuple. The fitness function that is NM ratio is calculated by comparing the initial population with the training instances. From the fitness function results, the adverse drug reactions are effectively mined.

Learning Outcome

A system framework has been developed to achieve better postmarketing surveillance. In this framework, we have developed NM algorithm and it is based on the genetic algorithm. This provides the information that can help people to discover the causality of a type of events and avoid its potential adverse effects. Users can interact this platform to examine various forms of ADR signals from different viewpoints, by selecting and readjusting parameters of measures of interest. One of the main problems is that the pharmocovigilance using computer systems is a lack of standard measures for signal detection. This paper presents a preliminary development of ADR detection and analysis and there is much scope for extending research, such as this system only discovers drug-ADR and multiADRs. The algorithms will be improved to consider about unsupervised learning methods. It is planned to include more iterations after finding the fitness functions because iterations reduces some unwanted measure from the results.

3. PROPOSED METHOD

Data mining based clustering algorithm is used in this paper. Cluster analysis is one of the important data analysis methods in data mining research. The process of grouping a set of physical or abstract objects into classes of similar object is called clustering. In clustering technique was used for exploring knowledge from the data set of children and women who has been affected by an alcohol addicted people. Alcohol causes a number of adverse reactions and problems in society. Main attributes are used for clustering are child age, age when adverse reaction occur etc. This paper uses k-means clustering technique for finding out the characteristics of children and women who has affected due to alcohol addicted people. In this study we use the k-means algorithm to survey results on adverse reactions on alcohol in society. The clusters which are formed as a result gives information about the adverse reactions which are caused due to alcohol.

In this paper, we are about to see the social problems arising due to alcohol addiction. Here, three major problems are explained. They are child abuse, violence against women and divorces. Because of alcohol addiction children and women are mostly affected. Divorce rates are increasing at a higher level.

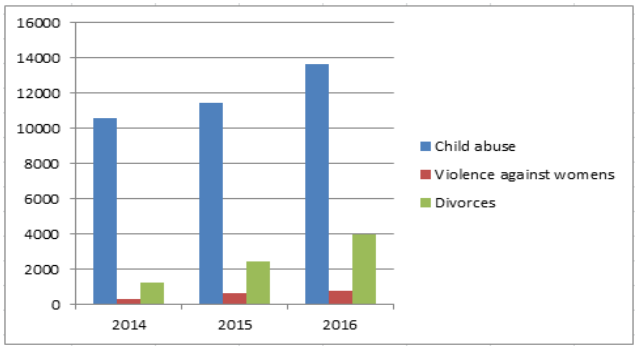

Fig 1. Impact of alcoholism in social life

The above graph shows the Tamilnadu statistics of child abuse, violence against women and divorces that happens due to alcohol addiction during the years 2014, 2015 and 2016.

4. CONCLUSION

Drug addiction, also called substance use disorder, is a dependence on a legal or illegal drug or medication. Keep in mind that alcohol and nicotine are legal substances, but are also considered drugs. Alcohol is the most acutely destructive of other drugs. In this paper, we have explained about the problems of women and children occur due to alcohol addiction using clustering technique. In future work we will discuss about other problems like murders, riots etc., that are also the converse effects of alcohol addiction.

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