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A Review on Drug Recommendation System based on Sentiment Analysis of Drug Reviews using Machine Learning

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ABSTRACT : Since the coronavirus emerged, it has been increasingly difficult to get legitimate therapeutic resources, such as the scarcity of specialists and healthcare professionals, appropriate equipment and medications, etc. There are many deaths as a result of the medical profession as a whole being in turmoil. Due to a lack of availability, people began taking medication on their own without the proper consultation, which made their health situation worse than usual. Recently, Machine Learning has proven useful in a variety of applications, and creative work for automation is on the rise. In this research, a drug recommendation system that might significantly lessen the workload of specialists is presented. In this study, we develop a drug recommendation system that makes use of patient reviews to forecast sentiment using a variety of vectorization techniques, including Bow, TF-IDF, Word2Vec, and manual feature analysis, which can support the recommendation of the best medication for a given disease by various classification algorithms. Precision, recall, f1score, accuracy, and AUC score were used to assess the anticipated sentiments. As a result of TF-IDF vectorization, the classifier Linear SVC outperforms all other models with a 91.5 % accuracy rate.

KEYWORDS: Sentiment Analysis, Machine Learning

I. INTRODUCTION

The world is experiencing a doctor shortage due to the exponential increase in coronavirus cases, particularly in rural areas where there are fewer experts than in urban areas. A doctor must complete their education between six and twelve years. Therefore, it is impossible to increase the number of doctors in a short period of time. In this challenging moment, a Telemedicine framework needs to be powered up as much as feasible. Clinical errors occur often today. Every year, medication errors have an impact on over 200 000 people in China and 100,000 people in the USA. Over 40% of the time when prescribing medicine, doctors err since they only have a limited amount of knowledge to base their decisions on [7].

Every day, a new study is published along with additional medications and diagnostic tools that are made available to healthcare professionals. As a result, choosing a treatment or medication for a patient based on indications and past clinical history proves to be ever more difficult for clinicians. Item reviews have grown in importance and importance as a result of the internet's rapid expansion and the growth of the web-based company sector [15]. People all across the world have gotten used to reading reviews and browsing websites before making a purchase decision. While the majority of prior research focused on evaluating expectations and proposals for the E-Commerce industry, the area A medication recommender framework is truly vital with the goal that it can assist specialists and help patients to build their knowledge of drugs on specific health conditions [24]. A recommender framework is a customary system that proposes an item to the user, dependent on their advantage and necessity. These frameworks employ the customers' surveys to break down their sentiment and suggest a recommendation for their exact need. In the drug recommender system, medicine is offered on a specific condition dependent on patient reviews using sentiment analysis and feature engineering. Sentiment analysis is a progression of strategies, methods, and tools for distinguishing and extracting

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emotional data, such as opinion and attitudes, from language [34]. On the other hand, Featuring. engineering is the process of making more features from the existing ones; it improves the performance of models. This examination work separated into five segments: Introduction area which provides a short insight concerning the need of this research, Related works segment gives a concise insight regarding the previous examinations on this area of study, Methodology part includes the methods adopted in this research, The Result segment evaluates applied model results using various metrics, the Discussion section contains limitations of the framework, and lastly, the conclusion section [7].

II. LITERATURE SURVEY

1.Medication Errors: An Overview for clinicians

Authors: Wittich CM, Burkle CM, Lanier WL

Medication error is an important cause of patient morbidity and mortality, yet it can be a confusing and underappreciated concept. This article provides a review for practicing physicians that focuses on medication error terminology and definitions, incidence, risk factors, avoidance strategies, and disclosure and legal consequences. A medication error is any error that occurs at any point in the medication use process. It has been estimated by the Institute of Medicine that medication errors cause 1 of 131 outpatient and 1 of 854 inpatient deaths. Medication factors (eg, similar sounding names, low therapeutic index), patient factors (eg, poor renal or hepatic function, impaired cognition, polypharmacy, and health care professional factors (eg, use of abbreviations in prescriptions and other communications, cognitive biases) can precipitate medication errors. Consequences faced by physicians after medication errors can include loss of patient trust, civil actions, criminal charges, and medical board discipline. Methods to prevent medication errors from occurring (eg, use of information technology, better drug labeling, and medication reconciliation) have been used with varying success. When an error is discovered, patients expect disclosure that is timely, given in person, and accompanied with an apology and communication of efforts to prevent future errors. Learning more about medication errors may enhance health care professionals' ability to provide safe care to their patients [1].

2. The reason and prevention of Hospital Medication errors

Authors: CHEN, M. R., & WANG, H. F

The main Objective is to analyze the Medication Errors (ME) of doctors, nurses, pharmacists and patients and discuss the measures for reducing the errors. Methods The medication error cases in a hospital during the period from 2009 to 2011 were collected, and error types and causes were analyzed. Results Sixty-seven ME cases(42.95%)were caused by doctors,46 cases(29.49%)by nurses,25 cases(16.02%)by pharmacists and 18 cases(11.54%)by patients. The most of medication errors were B,C and D class. The off-label drug uses were mostly in E and F class. Conclusion The medication errors can be effectively reduced by establishing a safe medication reporting system, an intelligent prescription screening system, an implementation of PDCA circulation management, a bar-code scanning technology and an enhanced patient medication education [2].

3.Practice guidelines for the management of community-acquired pneumonia in adults

AUTHORS: Bartlett JG, Dowell SF, Mandell LA, File TM Jr, Musher DM, Fine MJ

Diagnosis and Management of Community-Acquired Pneumonia in Adults. For outpatients with comorbidities or who have used antibiotics within the previous three months, **a** respiratory fluoroquinolone (levofloxacin, gemifloxacin, or moxifloxacin)**, or an** oral beta-lactam antibiotic plus a macrolide should be used [3].

4.Probabilistic aspect mining approach for interpretation and evaluation of Drug Reviews
AUTHORS: T. N. Tekade and M. Emmanuel

Evidence Based Medicine (EBM) is the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients. Extracting Information from considerable bodies of text is useful & challenging. A generative probabilistic aspect mining model is used here to study the collection. Frequency based approach in aspect based opinion mining extracts high frequency noun phrases and relation based approach identifies aspects based on the aspect-sentiment relation in reviews. However for drug reviews the aspects are not indicated

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explicitly by authors and description of side effects and people's experience is diverse. Topic Modeling identifies aspects based on the co-occurrence of words in reviews. Here in this research Topic Modeling Based on Probabilistic Approach a more fine grained aspect level opinion mining is used. It is interesting to apply the model to find aspects relating to different segmentation of data such as different age groups or other attributes. It is also interesting to work with aspect interpretation as aspects are now represented by a list of keywords. If a few sentences can be extracted or generated automatically to summarize the keywords, interpretation & understanding will be improved [5].

III. EXISTING SYSTEM

In Existing system, with the exponential development of the web and the web-based business industry, item reviews have become an imperative and integral factor for acquiring items worldwide. Individuals worldwide become adjusted to analyze reviews and websites first before settling on a choice to buy a thing [15]. While most of past exploration zeroed in on rating expectation and proposals on the E-Commerce field, the territory of medical care or clinical therapies has been infrequently taken care of. There has been an expansion in the number of individuals worried about their well-being and finding a diagnosis online. As demonstrated in a Pew American Research center survey directed in 2013 ,roughly 61% of grown-ups searched online for health-related subjects, and around 36% of users looked for diagnosing health conditions on the web. A medication recommender framework is truly vital with the goal that it can assist specialists and help patients to build their knowledge of drugs on specific health conditions [24].

DISADVANTAGES OF EXISTING SYSTEM:

1. These frameworks employ the customers' surveys to break down their sentiment and suggest a recommendation for their exact need.
2. There has been an expansion in the number of individuals worried about their well-being and finding a diagnosis online.

Algorithm: Support Vector Machine (SVM).

IV. PROPOSED WORK

In the proposed, the study is based on the fact that the recommended drug should depend upon the patient's capacity. For example, if the patient's immunity is low, at that point, reliable medicines ought to be recommended. Proposed a risk level classification method to identify the patient's immunity [54]. For example, in excess of 60 risk factors, hypertension, liquor addiction, and so forth have been adopted, which decide the patient's capacity to shield himself from infection. A web-based prototype system was also created, which uses a decision support system that helps doctors select first-line drugs. examined three distinct algorithms, decision tree algorithm, support vector machine (SVM), and back propagation neural network on treatment data. SVM was picked for the medication proposal module as it performed truly well in each of the three unique boundaries - model exactness, model proficiency, model versatility. Additionally, proposed the mistake check system to ensure analysis, precision and administration quality [73].

ADVANTAGES OF PROPOSED SYSTEM:

- The results exhibit that RNN with 95.34% outperformed Naive Bayes, 77.21% .
- the proposed model used to build a medicine recommender system. It contains four stages, specifically, Data preparation, classification, evaluation, and Recommendation.

Algorithm: Recommender System, Machine Learning, NLP, Smote, Bow, TF-IDF, Word2Vec, Sentiment analysis.

V. IMPLEMENTAION

User:

The User can register the first. While registering he required a valid user email and mobile for further communications. Once the user register then admin can activate the user. Once admin activated the user then user can login into our system. User can upload the dataset based on our dataset column matched. For algorithm execution data must be in

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float format. Here we took Drug Recommendation System dataset. User can also add the new data for existing dataset based on our Django application. User can click the Classification in the web page so that the data calculated Accuracy, Precision, Recall and F1-Score based on the algorithms. User can display the Algorithms results along with EDA (Exploratory Data Analysis) [54].

Admin:

Admin can login with his login details. Admin can activate the registered users. Once he activate then only the user can login into our system. Admin can view the overall data in the browser. Admin can click the Results in the web page so calculated Accuracy, Precision, Recall and F1-Score based on the algorithms is displayed. All algorithms execution complete then admin can see the overall accuracy in web page [76].

Data Pre-processing:

Applied standard Data preparation techniques like checking null values, duplicate rows, removing unnecessary values, and text from rows in this research. Subsequently, removed all 1200 null values rows in the conditions column. We make sure that a unique id should be unique to remove duplicacy. the top 20 conditions that have a maximum number of drugs available. One thing to notice in this figure is that there are two green-colored columns, which shows the conditions that have no meaning. The removal of all these sorts of conditions from final dataset makes the total row count equals to 212141.the visualization of value counts of the 10-star rating system. The rating beneath or equivalent to five featured with cyan tone otherwise blue tone [82]. The vast majority pick four qualities; 10, 9, 1, 8, and 10 are more than twice the same number. It shows that the positive level is higher than the negative, and people's responses are polar. The condition and drug column were joined with review text because the condition and medication words also have predictive power. Before proceeding to the feature extraction part, it is critical to clean up the review text before vectorization. This process is also known as text preprocessing. We first cleaned the reviews after removing HTML tags, punctuations, quotes, URLs, etc. The cleaned reviews were lowercased to avoid duplication, and tokenization was performed for converting the texts into small pieces called tokens. Additionally, stopwords, Fig. 4. Bar plot of count of rating values versus 10 rating number for example, "a, to, all, we, with, etc.," were removed from the corpus. The tokens were gotten back to their foundations by performing lemmatization on all tokens. For sentiment analysis, labeled every single review as positive and negative based on its user rating. If the user rating range between 6 to 10, then the review is positive else negative [82].

Machine Learning Results:

Based on the split criterion, the cleansed data is split into 60% training and 40% test, then the dataset is subjected to five machine learning classifiers such as Decision Tree (DT), Random Forest (RF), Light Gradient Boosting Machine (LGBM), CatBoost, Naive Bayes (NB). The accuracy of the classifiers was calculated and displayed in my results. The classifier which bags up the highest accuracy could be determined as the best classifier [97].

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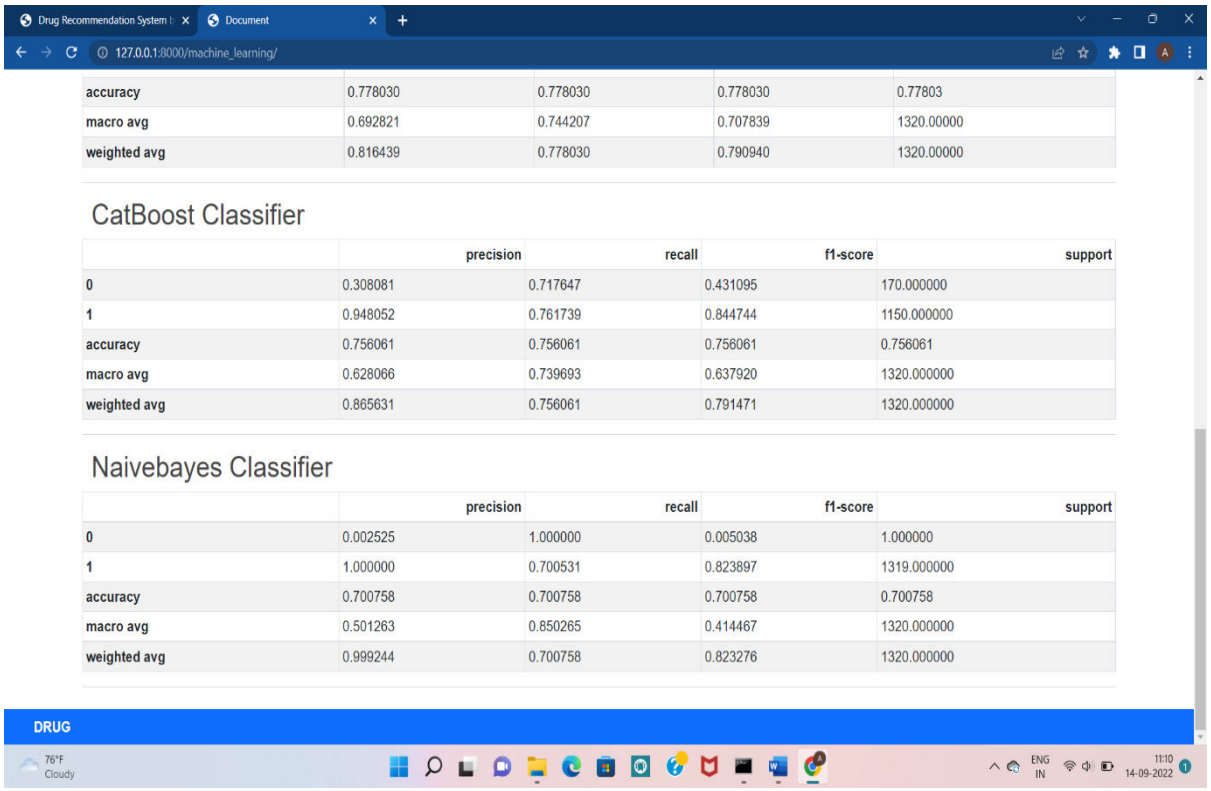

Fig. 1 – Machine Learning Algorithm of CatBoost Classifier

VI. CONCLUSION AND FUTURE WORK

Reviews are becoming an essential part of our daily lives; before going shopping, making an online purchase, or visiting a restaurant, we first read reviews to help us make the best choices. A recommender system was developed using a variety of machine learning classifiers, including Logistic Regression, Perceptron, Multinomial Naive Bayes, Ridge classifier, Stochastic gradient descent, Linear SVC, applied on Bow, TF-IDF, and classifiers like Decision Tree, Random Forest, Lgbm, and Catboost, applied on Word2Vec and the manual features method. This research was motivated by this. Our evaluation of them using five metrics precision, recall, f1score, accuracy, and AUC score shows that the Linear SVC on TF-IDF performs best, with an accuracy rate of 91.5%, eclipsing all other models. Future work involves comparison of different over sampling techniques, using different values of n-grams, and optimization of algorithms to improve the performance of the recommender system [115].

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