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Healthcare Made Smarter: AI-Driven Drug Recommendation Systems

Dr. Radha Krishna Jana[1], Dr. Atanu Kotal[2] , Asit Kumar Nayek[3]

[12] JIS University, [3] Haldia Institute of Technology

radhakrishna.jana@jisuniversity.ac.in,atanukotal78@gmail.com, asit_nayek@ieee.org

***Abstract*—** We are busy in social network today. We posted different tweets on different topics. We can analysis tweets using different techniques. Then the positive sentiments on particular subjects recommended in thw social network.This research work proposed a recommended system on drug tweets. This system help to healthcare providers in decision-making when prescribing medications, analyzing drug review sentiments to determine effectiveness and utilizing a hybrid method to overcome limitations of traditional recommender algorithms, ultimately aiming to improve patient care and digital healthcare pathways.

Keywords*— *Sentiment Analysis, Drug recommendation system,BERT

I. Introduction

The global community is actively engaged on social media, exchanging ideas and sharing diverse perspectives. This research examines the homophily phenomenon in the context of social media sentiment analysis[1]. This research explores and discusses different methods for sentiment analysis of social media posts[2]. Healthcare providers are strained by growing patient numbers and a persistent shortage of clinicians, which heightens the risk of medical errors such as wrong-drug prescriptions. By adapting the personalized-recommendation technology used in e-commerce, such a system can assist clinicians in making safer, more informed prescribing decisions [3]. The proposed system can support healthcare professionals in choose the best medications for patients, reducing the burden of keeping up with the vast array of available drugs and potentially improving treatment outcomes[4]. Opinion mining and sentiment analysis can help extract useful information from patient feedback, determining whether reviews are positive, neutral, or negative, and supporting healthcare professionals in their decision-making[5]. Sentiment analysis on drug reviews helps healthcare professionals understand overall drug effectiveness. However, recommendation systems face challenges like cold start issues and adapting to changing customer preferences [6].

The aim of this study:

- Develop a drug recommendations system.
- Classify drug reviews.
- Create a web-based system .
- Facilitate knowledge sharing among healthcare professionals.

Section II discuss the related work, Methodology expressed in Section III, In Section IV discussed Result and discussion, Conclude all the work in Section V.

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II. Related Work

Various techniques are employed for sentiment analysis, and this research introduces an innovative approach utilizing Genetic Algorithm[7]. This research introduces a hybrid sentiment analysis approach, demonstrating superior performance compared to existing related models[8]. This research explores the Firefly Algorithm and its applications in sentiment analysis[9].This research introduces a model leveraging XAI, demonstrating enhanced confidence compared to existing related models[10]. This review explores current trends in university student stress detection, focusing on machine learning, deep learning, and physiological parameters [11]. This study by Cheng et al. (2016) used SVM and decision trees to predict drug responses based on patient characteristics, including medical history and genetic information [12].This study by Zhang et al. (2020) explored CNNs and RNNs for predicting drug interactions and recommending drugs, leveraging both structured and unstructured patient data [13].

This study discussed a personalized drug recommendation system using collaborative filtering and patient similarity measures, considering factors like medical history, age, and lifestyle [14]. This study by Zhao et al. (2018) incorporated genomic data into drug recommendation systems to personalize treatments based on genetic profiles, aiming to enhance efficacy and reduce adverse reactions [15]. Wu et al. (2017) proposed a graph-based recommendation model for drug-drug interaction prediction. Such systems help healthcare professionals avoid drug combinations that could lead to adverse effects[16]. Khan et al. (2021) used machine learning algorithms to predict drug-drug interactions and recommend alternative drugs. By using historical data and machine learning techniques, these systems offer insights into how drugs interact and suggest safer combinations[17]. Lee et al. (2020) employed NLP techniques to mine vast amounts of medical literature and extract relevant drug information for recommendation. They developed a knowledge graph that links drugs with conditions, side effects, and effectiveness based on textual medical records and research papers[18].

Liu et al. (2018) integrated clinical text data from Electronic Health Records (EHR) with drug recommendation **syste**ms, enabling the system to understand free-text notes from healthcare professionals [19]. Sahni et al. (2017) developed a real-time drug recommendation system that integrates directly with hospital EHR systems [20]. **I**n Mochizuki et al. (2021), a CDSS was designed to integrate drug recommendations with clinical workflows[21]. One of the primary challenges identified in Nayak et al. (2022) is the quality and availability of data. Incomplete or inconsistent patient data can significantly affect the accuracy of drug recommendations [22]. **S**aini et al. (2020) emphasized the difficulty in predicting ADRs accurately. Although drug recommendation systems can reduce these risks, they must incorporate continuous feedback loops from patient outcomes and health monitoring devices to improve the prediction of potential side effects[23]. Chowdhury et al. (2020) proposed a new evaluation metric specific to drug recommendation systems, taking into account the medical relevance of drug suggestions rather than just statistical performance[24]. **J**ones et al. (2021) highlighted the importance of explainability in drug recommendation systems[25].

III. Methodology

The system's architecture, illustrated in Fig. 1, follows a three-layer design and caters to two primary user groups: healthcare professionals and administrators. The frontend is built using React JS, a popular JavaScript library, in conjunction with the MUI library.

For building the user interface, we utilized React's component-based architecture, virtual DOM, and responsive design, which make it well-suited for frontend development. Material UI Library provided prebuilt components following material design guidelines, streamlining UI development by eliminating the need for custom component creation. The seamless integration of React and Material UI enabled us to tailor components to our specific UI needs. Additionally, we used TypeScript, a JavaScript superset, as the programming language for frontend development.

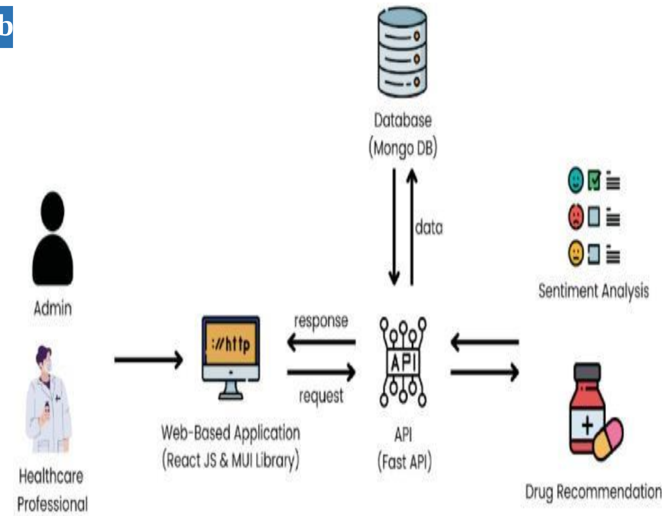

Fig. 1 The Proposed System Architecture.

FastAPI was chosen to handle the web application's API functionalities and integrate machine learning models, serving as the backend implementation for the system's features. For data storage, we utilized MongoDB, a NoSQL database that stores data in BSON format. FastAPI serves as a bridge between the frontend, machine learning models, and database, handling API requests from users and facilitating communication between these components.

The proposed system comprises four primary modules:

1. User Management
2. Drug Review Analytics
3. Recommendation
4. Drug Management.

The system has four key components: user management, analytics of drug reviews, drug recommendation, and drug management.

Administrators oversee the system's functionality, and registration is mandatory for all users, including healthcare professionals and admins. The user management module plays a crucial role in gathering user behavior data, which informs the drug recommendation module.

In the drug review analytics module, sentiment analysis categorizes patient reviews as positive, neutral, or negative based on sentence polarity. This process involves extracting key features from reviews and determining their orientation to assess overall sentiment. By identifying feature orientation, reviews are classified as having a positive or negative polarity, enabling accurate sentiment analysis.

The system extracts features from reviews using TF-IDF and Bio Bert, and leverages multiple algorithms, including perceptron, logistic regression, and long short-term memory networks, to determine sentiment. The No Free Lunch Theorem is applied to evaluate these models and select the best-performing one based on metrics. The resulting sentiment analysis assigns an effectiveness score to each medicine, influencing its ranking in search results. Drugs with higher scores are prioritized, aiding healthcare professionals in selecting the most effective treatments. While sentiment analysis may not be essential for patients, it provides valuable insights for healthcare professionals making informed prescription decisions.

The drug recommendation module uses a hybrid approach combining content-based and collaborative filtering . Content-based filtering recommends drugs based on similarities, while collaborative filtering enhances preferences by grouping similar users. This hybrid approach provides reliable recommendations as more healthcare professionals use the system. The drug management module enables users to search for drugs by disease, view drug details, and access features like drug comparison, wish lists, and a forum page.

IV. Results and Discussion

There are different steps to develop a model like data retrieval and preprocessing.

The dataset is then labeled based on ratings, with scores above 7 classified as positive, below 4 as negative, and between 4-7 as neutral. After downsizing the dataset to 60,000 balanced rows, it is split into training and testing sets.
Feature extraction is performed using TF-IDF and Bio BERT, and three machine learning algorithms (Logistic Regression, Perceptron, and LSTM) are trained. The TF-IDF-based Logistic Regression model achieves the highest performance, with an accuracy of 0.7441, F1-score of 0.7449, and precision of 0.7444, outperforming Bio BERT-based models.

V. Conclusion

This study aimed to develop a unique drug recommendation system for healthcare professionals. Our proposed model become the good result.A bottom-up approach was employed, dividing the system into smaller modules that were built, tested and debugged independently before integration.This method ensure effective management of complexity, reduced errors and allowed for flexibility in refining individual

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components.The systems development involved thorough testing and evaluation, resulting in a functional and user-friendly application that meets the required performance and usability standards.

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Authors Profile

Author A : Dr**.** Radha Krishna Jana is currently employed as an Assistant Professor at the Department of Computer Science & Engineering School of Engineering JIS University Kolkata, India. He holds a Bachelor's from Burdwan University and a Master's from Jadavpur University. He obtained his Ph.D. in Computer Science & Engineering from JIS University, India. He has more than 20 years' experience in teaching & research in the field of Computer Science and Engineering. The research interest of the authors is in the area of AI in Medicine and Healthcare, AI & ML in Disease Prediction, Big Data Analytics in Healthcare. He has published more than 50 research papers and 3 Books. He has served as reviewer in different international conferences.

Author B: Dr. Atanu Kotal has 15 years of rich academic and administrative experience. He carried out his research at the Indian Association of Cultivation of Science (IACS) and

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obtained Ph.D. from Jadavpur University in 2008. After that he pursued his postdoctoral research at Kyoto University, Japan and IACS, Kolkata. Presently he has been working as Assistant Professor and HoD of the Department of Chemistry, JIS University, Kolkata since 2015. His present thrust areas of research include interface of Polymer Chemistry, Materials Chemistry and Computation. He has published more than 15 research papers in reputed international journals.

Author C: Mr. Asit Kumar Nayek received his M.Tech from Jadavpur University, Kolkata, India and pursuing his Ph.D. at Maharaja Sriram Chandra Bhanjadeo University (erstwhile North Odisha University), Baripada, India. Presently, he is working as Assistant Professor in the department of Computer Science & Engineering (AI&ML) at Haldia Institute of Technology, Haldia, India. He has more than 10 years of teaching experience and 4 years of administrative experiences at different organizations. His area of interests include computer hardware development, IoT design for different applications and Artificial Intelligence. He is a senior member of IEEE.