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ML-POWERED EMERGENCY DRUG ASSISTANCE FOR CRITICAL HEALTHCARE NEEDS

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ABSTRACT: In health-related emergencies, timely and accurate medication recommendations are critical for effective treatment and improved patient outcomes. In order to improve decision-making and automate medicine selection, an ML-Powered Emergency medicine Assistance for Critical Healthcare system that makes use of machine learning techniques was introduced. To provide personalized and trustworthy pharmaceutical recommendations, the system examines patient data, such as symptoms, medical history, and health indicators. The framework guarantees excellent accuracy in forecasting the optimal course of action by using machine learning techniques like Naive Bayes, Random Forest, Decision Tree, Gradient Boosting, and Logistic Regression. In order to deliver a holistic solution that encourages preventative healthcare by recognizing potential dangers and providing customized lifestyle and medication suggestions, the system integrates predictive analytics and classification techniques in addition to emergency treatment. This proactive approach reduces medical errors, bridges gaps, and enhances healthcare delivery in resource-constrained environments. By automating prescription suggestions, the framework lowers human involvement, streamlines decision-making, and supports healthcare practitioners in making decisions.

Keywords: Machine Learning, Emergency Drug Assistance, Healthcare Decision Support, Personalized Medication Recommendations, Predictive Analytics, Naive Bayes, Random Forest, Logistic Regression, Gradient Boosting.

I. INTRODUCTION

The Machine Learning Based, a Drug or medicine Recommendation System is a cutting-edge strategy designed to help people manage their health and wellbeing. Healthcare solutions are changing to offer more individualized and accessible medical help as a result of the quick developments in artificial intelligence and data analytics. For those who might not have instant access to medical specialists or resources, this method is especially helpful since it empowers them to make data-driven, well-informed health decisions.

After safely registering users, the technology lets them access a customized dashboard where they may enter their symptoms. It provides useful information, such as potential causes and related symptoms, and employs machine learning algorithms to reliably forecast potential diseases based on the symptoms that are presented. Early disease identification and prevention are made possible by this predictive power, which gives people a better grasp of their health issues. In addition to predicting diseases, the system uses user input to suggest suitable drugs while taking safety measures and possible adverse effects into account.

The system makes sure that the recommended drugs are in line with the most recent healthcare standards and best practices by examining enormous datasets of patient reviews and medical literature. This improves treatment regimens' overall efficacy and lowers the possibility of self-medication errors. The method offers advice for illness management, including food programs, exercise regimens, and lifestyle changes based on specific medical problems, in addition to prescription recommendations. Users are empowered to take proactive measures to enhance their health and avoid issues in the future thanks to this all-encompassing strategy. The system continuously improves the accuracy and dependability of its recommendations by combining sentiment analysis, natural language processing, and artificial intelligence.

By bridging the gap between technology and healthcare, the Drug Recommendation System increases the number of people who can obtain individualised medical support. Future improvements could incorporate multimodal data analysis, real-time symptom tracking, and deep learning approaches as the system develops further to increase the precision and effectiveness of recommendations. The ultimate goal of this intelligent healthcare solution is to assist people in making educated decisions, which will improve health outcomes and make the healthcare system more effective.

II. LITERATURE REVIEW

GV Lavanya, Praveen KS [1], "Drug Recommender System Using Machine Learning for Sentiment Analysis", The Drug Recommender System helps patients and healthcare providers make well-informed drug prescription decisions by using machine learning for sentiment analysis. In order to provide insights into medicine effectiveness, side effects, and patient happiness, the system analyses user sentiments in medication evaluations using vectorisation techniques such as BoW, TF-IDF, and Word2Vec. The report emphasises how crucial automation is to the healthcare industry, especially in tackling the scarcity of medical experts and reducing the hazards associated with self-medication. With its 93% accuracy rate, the Linear SVC classifier—which uses TF-IDF vectorization—optimizes medication selection and enhances patient outcomes. In order to provide individualised and efficient treatments, the recommender engine ranks drugs according to good sentiment ratings while taking into account negative reviews to avoid side effects. This sentiment-aware technology promotes a patient-centric, data-driven healthcare strategy by improving decision-making for both physicians and patients. Future developments, such as multimodal sentiment analysis and deep learning approaches, may enhance medication recommendations even more, revolutionising medical decision-making and raising the bar for healthcare worldwide.

Ebin K J, Lisha Kurian, George Joseph K, Gokul Unnikrishnan, Sreelakshmi Jayaraj [2] "Disease Prediction and Medicine Recommendation Systems: A Comparative Analysis on Learning Algorithms", This study investigates the application of cutting-edge machine learning algorithms to create a trustworthy system for recommending medications and predicting diseases. The system seeks to improve medical decision-making and offer tailored therapy suggestions by integrating patient-specific factors like medical history, allergies, and treatment outcomes. Machine learning approaches provide data-driven insights for precise and customised prescriptions, while traditional prescribing methods frequently struggle with patient-specific intricacies, resulting in a one-size-fits-all approach. The study tests a number of algorithms, such as support vector machines, decision trees, and neural networks, and concludes that XGBoost performs better than the others in terms of accuracy and efficiency. The system successfully anticipates ailments and recommends suitable therapies, addressing potential prescription errors made by clinicians, with a reported accuracy of up to 92%. This study supports the expanding use of AI in healthcare, which is consistent with the larger precision medicine movement. In order to provide more precise and individualised healthcare solutions, future enhancements will focus on increasing system productivity and dependability.

Mahima Mohapatra, Mamata Nayak, Saswati Mahapatra [3] "A Machine Learning-Based Drug Recommendation System for Health Care", Making sure that medical advice is accurate is essential given the growing dependence on the internet for health-related information. Medication errors are a major risk to patient safety, which highlights the necessity of efficient drug recommendation systems in the medical field. In order to propose drugs for particular medical problems, this study provides a machine learning-based drug recommendation system that examines user reviews and ratings. To offer individualised medication recommendations, the system uses content-based and collaborative filtering, data mining, visualisation, sentiment analysis, and machine learning algorithms. For data extraction and accuracy evaluation, the model, which was constructed on Google Collab with Python tools, makes use of logistic regression and stemming. Based on user situations, the algorithm can accurately recommend medications and find correlations between comparable ailments, according to experimental data. The study comes to the conclusion that by offering more accurate medication recommendations, such a system can greatly benefit patients and medical professionals. Advanced machine learning algorithms will be included into future developments to improve accuracy and customise recommendations to meet the needs of specific patients, ultimately leading to better healthcare results.

Suvendu Kumar Nayak, Mamata Garanayak, Sangram Keshari Swain, Sandeep Kumar Panda, Deepthi Godavarthi [4] "An Intelligent Disease Prediction and Drug Recommendation System Using Machine Learning", Large volumes of data are found in medical databases, which can be examined using data mining techniques to find important trends and patterns. By using a variety of machine learning techniques, the disease prediction and medication suggestion system shown in this work enables users to obtain precise medical insights by merely entering symptoms. The system analyses user reviews and suggests drugs based on ratings and medical conditions by combining natural language processing (NLP), sentiment analysis with the Vader tool, and probabilistic approaches. The algorithm diagnoses ailments and suggests medications while taking possible adverse effects into account by integrating data from hospital information systems. Three main models are used by the system: one for sentiment analysis, one for illness prediction, and one for medication recommendation. The efficacy of this strategy is supported by experimental data, which show consistent accuracy across all models. According to the study's findings, automating drug recommendation systems can greatly improve healthcare services by lowering medical errors and enhancing treatment results. In order to improve prediction performance, future developments will concentrate on growing the dataset and utilising deep neural networks to increase accuracy.

Satvik Garg [5] "Drug Recommendation System Based on Sentiment Analysis of Drug Reviews Using Machine Learning", There is a lack of physicians, medical personnel, and appropriate pharmaceuticals as a result of the COVID-19 pandemic's severe demand on healthcare resources. Consequently, many people turned to self-medication without seeking expert advice, which made their health issues worse. This study introduces a drug recommendation system that forecasts the efficacy of prescription drugs for particular illnesses by using sentiment analysis on patient feedback. Term Frequency-Inverse Document Frequency (TF-IDF), Word2Vec, Bag of Words (BoW), and Manual Feature Analysis are some of the vectorisation methods used by the system. To assess patient attitudes and suggest the best medication, a variety of classification algorithms are employed, such as Random Forest, Linear SVC, Decision Trees, and Logistic Regression. According to experimental results, the Linear SVC model with TF-IDF vectorisation outperforms other models and reaches the greatest accuracy of 93%. To improve model generalisation, the study also emphasises the need for additional advancements, such as dataset balancing strategies like SMOTE, Adasyn, and Smote Tomek. To improve recommendation accuracy, future research will examine various oversampling strategies, improve hyperparameter optimisation, and apply ensemble learning. By offering data-driven medicine suggestions, decreasing reliance on medical professionals, and minimising prescription errors, the suggested method shows promise in helping patients and healthcare providers.

Prajakta Khairnar, Vamsi Avula, Aditya Hargane, and Pratik Baisware, [6] "Medicine Recommend System Using Machine Learning", present a machine learning-based system designed to assist users in predicting diseases and recommending suitable medicines based on entered symptoms. By providing a quick and convenient substitute when seeing a doctor is not an option, the system seeks to alleviate the hassle that many individuals experience when seeking medical assistance for mild illnesses. The authors used machine learning methods like Random Forest, Decision Tree, and Naïve Bayes to create a model that was trained on a dataset that mapped different symptoms to illnesses. In addition to predicting the illness, the system also categorises its severity and suggests suitable medications. The suggested solution has a user-friendly interface and an average accuracy of roughly 98%, making it accessible to the general public. The system is designed for emergency or short-term use when medical consultation is not accessible, which effectively lessens the strain for healthcare workers even though it cannot replace expert medical advice.

A. Sultan Saleem, R. Reni Hena Helan, S. J. Vivekanandan, Mohammed Zahid Hussain, Shaik Ajid, Ulasa Saketh [7] "Drug Recommendation System in Medical Emergencies", This study proposes a disease prediction and drug recommendation system to assist users in identifying illnesses and receiving appropriate medication suggestions. In emergency situations, visiting hospitals can be time-consuming; this system aims to provide instant and accurate disease predictions along with drug recommendations based on symptoms and severity. The system utilizes a web-based platform to ensure accessibility, especially in remote areas where healthcare services are limited. It leverages machine learning models and sentiment analysis of patient reviews to recommend safe and effective medications. The approach incorporates predictive analytics, symptom-matching databases, and a severity assessment model to enhance the accuracy of recommendations. With increasing reliance on telemedicine and automated healthcare solutions, this system improves patient care by reducing prescription errors and assisting doctors with data-driven medication suggestions. Future improvements include enhanced predictive models, real-time symptom tracking, and personalized drug recommendations based on individual health history and lifestyle.

CH. Srinivas Reddy, E. Navyasri, A. Madhu, N. Lakshya, S. Saikumar, T. Lakshmana [8] "Drug Recommendation System Using Machine Learning", In order to improve the precision and dependability of medicine recommendations in urgent medical situations, this project investigates the creation of an AI-powered drug recommendation system. In order to recommend suitable medications while maintaining privacy and security, the system takes into account the patient's symptoms, blood pressure, diabetes, and other variables. The enhanced model combines Random Forest and Decision Tree classifiers, attaining 100% accuracy on training and test datasets. It was initially based on the Decision Tree classifier, which had 99% accuracy. It improves diagnostic precision by supporting 10 distinct drug categories and increasing the feature set to 30 characteristics. The system's versatility allows it to stay current with changing medical knowledge while still meeting legal and ethical requirements for healthcare applications.

Maryam Bagherian, Elyas Sabeti, Kai Wang, Maureen A. Sartor, Zaneta Nikolovska-Coleska, Kayvan Najarian [9] "Machine Learning Approaches and Databases for Prediction of Drug–Target Interaction: A Survey Paper", The function of machine learning (ML) in forecasting drug–target interactions (DTIs), a critical component of drug discovery, is examined in this survey work. ML-based techniques provide a more effective substitute for expensive and time-consuming experimental methods for determining DTIs. An overview of the key datasets used for DTI prediction is given in the study, along with a thorough comparison of the many databases and machine learning approaches utilised in this field. It emphasises important issues in ML-based DTI prediction and talks about the advantages and disadvantages of various approaches. The article ends by suggesting future lines of inquiry for enhancing the precision, comprehensibility, and effectiveness of DTI prediction models.

Farzaneh Firoozbakht, Behnam Yousefi, Benno Schwikowski [10] "An Overview of Machine Learning Methods for Monotherapy Drug Response Prediction", A thorough analysis of machine learning (ML) techniques for forecasting monotherapy medication reactions is provided in this work. As molecular profiles and drug response data become more widely available, machine learning techniques are becoming crucial to the advancement of personalised medicine. Through an analysis of their software availability, evaluation methods, and input-output data formats, the study methodically divides more than 70 machine learning approaches into 13 subclasses. It describes the structure of ML models for drug response prediction and gives ML researchers insights into biological difficulties. By describing basic machine learning concepts and typical datasets for model training and validation, the publication also acts as a resource for biologists and biomedical researchers.

Amir Masoud Rahmani, Efat Yousefpoor, Mohammad Sadegh Yousefpoor, Zahid Mehmood, Amir Haider, Mehdi Hosseinzadeh, Rizwan Ali Naqvi [11] "Machine Learning (ML) in Medicine: Review, Applications, and Challenges", The developments, uses, and difficulties of machine learning (ML) in medicine are examined in this study. As a branch of artificial intelligence (AI), machine learning (ML) looks for patterns in medical data to improve diagnosis and treatment choices. Data pre-processing (cleaning and reduction), learning approaches (supervised, unsupervised, semi-supervised, and reinforcement learning), assessment strategies (simulation vs. real-world implementation), and applications (diagnosis and treatment) are the four main categories into which the paper divides ML-based healthcare schemes. Current research, issues including bias, data privacy, and model interpretability, as well as potential avenues for advancing machine learning in healthcare, are discussed in the research investigation.

Fanglin Zhu, Lizhen Cui, Yonghui Xu, Zhe Qu, and Zhiqi Shen [12] "A Survey of Personalized Medicine Recommendation". This study offers a thorough analysis of personalised medicine suggestion, a new field of study that suggests the best medications for specific patients according to their current health. The study divides current medicine recommendation algorithms into four primary categories: medicine recommendation based on feedback, which integrates external medical knowledge, such as clinical guidelines and biomedical literature, to improve recommendations; medicine recommendation with combination pattern, which focusses on recommending effective medicine combinations rather than single drugs; medicine recommendation based on multi-disease, which addresses patients with multiple conditions and how to optimise medication choices accordingly; and medicine

recommendation based on feedback. As a reference for future research and development in personalised medicine recommendation, the paper also discusses the evaluation of these algorithms based on two important aspects: effectiveness and safety, and highlights several evaluation metrics. Lastly, the study identifies three major challenges and future directions in personalised medicine recommendation: ensuring the safety of recommendations, improving interpretability to enhance trust and transparency, and developing more personalised medicine recommendations.

Francisca Chibugo Udegbe, Ogochukwu Roseline Ebulue, Charles Chukwudalu Ebulue, and Chukwunonso Sylvester Ekesiobi [13] "Machine Learning in Drug Discovery: A Critical Review of Applications and Challenges", This review critically analyses the role of machine learning (ML) in drug discovery, emphasising its applications in key areas like predictive toxicology, target identification, hit discovery, and lead optimisation. ML has the potential to transform drug discovery by increasing efficiency, predictive accuracy, and offering new insights into drug development, but major obstacles stand in the way of its full adoption. These obstacles include concerns about data availability and quality, model interpretability, integration into current drug discovery workflows, and ethical and regulatory considerations. To address these obstacles, the study highlights the necessity of improving interdisciplinary cooperation, developing algorithmic tools, enhancing data-sharing procedures, and changing regulatory frameworks. To optimise the advantages of machine learning in drug discovery, the review urges more study, cooperation, and communication amongst stakeholders, including the pharmaceutical sector, regulatory agencies, and the scientific community. The drug discovery process can be greatly sped by tackling these issues and utilising ML capabilities, which will result in more effective, individualised, and predictive therapeutic development.

Thi Ngoc Trang Tran, Alexander Felfernig, Christoph Trattner, and Andreas Holzinger, [14] "Recommender Systems in the Healthcare Domain: State-of-the-Art and Research Issues." The increased difficulty of sorting through massive volumes of clinical data and medical information dispersed across many web sources is addressed in this study, which provides a methodical overview of recommender systems in the healthcare industry. The study emphasises how these kinds of technologies might help patients and medical professionals make more precise and effective decisions about their health. Food recommendation, medicine recommendation, health status prediction, healthcare service recommendation, and healthcare professional recommendation are among the fields into which it divides healthcare recommender systems. To help readers comprehend different recommendation algorithms and applications, the authors provide real-world examples. The study also highlights the significance of context awareness and user personalisation, privacy and ethical issues when managing sensitive data, and the integration of multi-modal data sources including wearable technology and electronic health records. In order to increase the precision, dependability, and smooth integration of recommender systems into medical workflows, the paper ends by highlighting present issues and urging more research.

José Machado, Carla Rodrigues, Regina Sousa, and Luis Mendes Gomes [15] "Drug–drug interaction extraction-based system: A natural language processing approach present a system designed to extract drug–drug interactions from unstructured text using natural language processing and machine learning techniques. The growing problem of polypharmacy in older patients and the shortcomings of the present recommendation systems such as their inadequate databases and low alert quality are the driving forces behind this. Their suggested architecture transforms unstructured data into structured form (drug1, drug2, label) appropriate for databases by identifying drug entities sentence by sentence and figuring out how they interact. Only two drug names are currently accepted as input by the system, which uses a logistic regression classifier to produce a binary classification output with a promising F1-score of 0.827. The low percentage of sentences with interaction labels (around 30.5%) was one major obstacle. Pre-trained word embeddings, deep learning models such as transformers, and real-time recommendation integration for clinical decision assistance are some of the upcoming enhancements. Scalability to multi-drug and multi-label interactions, Future developments should allow the processing of intricate interactions involving numerous medications and a variety of interaction types, while the current system can only handle two drugs per input. Improved linguistic preprocessing, Accurate extraction can be achieved by strengthening the system's comprehension of intricate biological language and sentence structures.

III. COMPARSION TABLE

Sl.no	Author	Title	Techniques Applied	Key Findings	Future Improvements
1	GV Lavanya, Praveen KS	Drug Recommender System Using Machine Learning for Sentiment Analysis	BoW, TF-IDF, Word2Vec, Linear SVC	Sentiment analysis helps in personalized drug recommendations.	Use deep learning and multimodal sentiment analysis.
2	Ebin K J, Lisha Kurian, George Joseph K, Gokul Unnikrishnan, Sreelakshmi Jayaraj, et al.	Disease Prediction and Medicine Recommendation Systems: A Comparative Analysis on Learning Algorithms	Neural Networks, Decision Trees, SVM, XGBoost	ML improves disease prediction and personalized medication.	Enhance system reliability and efficiency.
3	Mahima Mohapatra, Mamata Nayak, Saswati Mahapatra, et al.	A Machine Learning-Based Drug Recommendation System for Health Care	Data mining, Sentiment Analysis, Logistic Regression	Personalized drug recommendations using user reviews.	Implement advanced ML algorithms for better accuracy.

4	Suvendu Kumar Nayak, Mamata Garanayak, Sangram Keshari Swain, Sandeep Kumar Panda, Deepthi Godavarthi, et al.	An Intelligent Disease Prediction and Drug Recommendation System Using Machine Learning	NLP, Vader Sentiment Analysis, Probabilistic Methods	Uses symptom-based input for disease prediction and prescription.	Leverage deep neural networks and expand datasets.
5	Satvik Garg	Drug Recommendation System Based on Sentiment Analysis of Drug Reviews Using Machine Learning	BoW, TF-IDF, Word2Vec, Linear SVC, Logistic Regression	Sentiment-based ML enhances medication recommendations.	Improve generalization with dataset balancing & ensemble learning.
6	Prajakta Khairnar, Vamsi Avula, Aditya Hargane, and Pratik Baisware, et al.	Medicine Recommend System Using Machine Learning	Web-Based Platform, Sentiment Analysis, ML Models	Assists users in medical emergencies via symptom-matching.	Add real-time symptom tracking and personalized suggestions.
7	A. Sultan Saleem, R. Reni Hena Helan, S. J. Vivekanandan, Mohammed Zahid Hussain, Shaik Ajid, Ulasa Saketh, et al.	Drug Recommendation System in Medical Emergencies	Decision Tree, Random Forest	High accuracy using expanded feature set & multiple classifiers.	Ensure adaptability with evolving medical data.
8	CH. Srinivas Reddy, E. Navyasri, A. Madhu, N. Lakshya, S. Saikumar, T. Lakshmana, et al.	Drug Recommendation System Using Machine Learning	ML-Based DTI Prediction	ML reduces time and cost in drug discovery.	Improve model interpretability and efficiency.
9	Maryam Bagherian, Elyas Sabeti, Kai Wang, Maureen A. Sartor, Zaneta Nikolovska-Coleska, Kayvan Najarian, et al.	Machine Learning Approaches and Databases for Prediction of Drug–Target Interaction: A Survey Paper	ML-Based Drug Response Prediction	Categorizes ML methods for drug response prediction.	Enhance dataset availability and model reliability.
10	Farzaneh Firoozbakht, Behnam Yousefi, Benno Schwikowski	An Overview of Machine Learning Methods for Monotherapy Drug Response Prediction	BoW, TF-IDF, Word2Vec, Manual Feature Engineering	Automated sentiment-based drug recommendations.	Improve model tuning, oversampling, and ensemble learning.
11	Amir Masoud Rahmani, Efat Yousefpoor, Mohammad Sadegh Yousefpoor, Zahid Mehmood, Amir Haider, Mehdi Hosseinzadeh, Rizwan Ali Naqvi, et al.	Machine Learning (ML) in Medicine: Review, Applications, and Challenges	Supervised, Unsupervised, Semi-Supervised, Reinforcement Learning	Categorizes ML applications in healthcare and highlights challenges.	Address bias, interpretability, and data privacy concerns.

12	Fanglin Zhu, Lizhen Cui, Yonghui Xu, Zhe Qu, and Zhiqi Shen	A Survey of Personalized Medicine Recommendation	Electronic Health Records Utilization, Deep Learning (DL) Techniques, Drug-Drug Interaction (DDI) Mitigation, Multi-disease Medicine Recommendation, Clinical Decision Support System.	Categorizes medicine recommendation algorithms, evaluates effectiveness and safety, highlights key challenges	Ensuring safety, improving interpretability, achieving refined personalization
13	Francisca Chibugo Udegbe, Ogochukwu Roseline Ebulue, Charles Chukwudalu Ebulue, and Chukwunonso Sylvester Ekesiobi	Machine Learning in Drug Discovery: A Critical Review of Applications and Challenges	Predictive Toxicology, Target Identification, Lead Optimization	Highlights ML's role in drug discovery, discusses challenges like data quality, model interpretability, and regulatory concerns	Enhancing data sharing, interdisciplinary collaboration, refining ML algorithms, updating regulatory frameworks
14	Thi Ngoc Trang Tran, Alexander Felfernig, Christoph Trattner, and Andreas Holzinger	Recommender Systems in the Healthcare Domain: State-of-the-Art and Research Issues	Food Recommendation, Drug Recommendation, Health Status Prediction, Healthcare Service Recommendation, Healthcare Professional Recommendation	Provides an overview of healthcare recommender systems, categorizes applications, discusses real-world challenges	Improving accuracy, reliability, and integration into medical workflows
15	Mahima Mohapatra, Mamata Nayak, Saswati Mahapatra	A Machine Learning-Based Drug Recommendation System for Health Care	Sentiment Analysis, Data Mining, Visualization, Content-Based Filtering, Collaborative Filtering	Develops a drug recommendation system based on user reviews and ratings, improving medication selection	Enhancing precision, effectiveness, and trustworthiness of recommendations

IV. CONCLUSION

By enabling precise, data-driven, and customised medicine recommendations, the use of machine learning into drug recommendation systems has greatly enhanced healthcare. Numerous machine learning techniques, such as sentiment analysis, classification models, and hybrid approaches, have shown great accuracy in identifying diseases and suggesting suitable therapies, as evidenced by the papers that were evaluated. While classification-based methods perform well in structured clinical applications, sentiment analysis-based algorithms efficiently assess patient experiences and drug efficacy. Comparing several studies reveals that models like Decision Trees, XGBoost, and Linear SVC are very effective at maximising medication selection and reducing prescription errors. Data imbalance, model interpretability, and privacy issues are still important issues that require careful thought, nevertheless. Despite these obstacles, machine learning-based medication recommendation systems keep improving medical judgement, treatment results, and patient and healthcare provider in making the correct decision.

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