LUNG CANCER DETECTION AND GENERIC DRUG RECOMMENDATION SYSTEM

Ms Farhat Patel[#1], Ms Vaidika Barve[*2], Ms Shruti Darekar[*3] , Mr Varad Mahajan[*4]

[#1]Assistant Professor at Guru Gobind Singh College of Engineering and Research Centre, Nashik

[*2*3*4]Student at Guru Gobind Singh College of Engineering and Research Centre, Nashik.

ABSTRACT

Lung cancer remains one of the leading causes of cancer-related deaths worldwide, making early detection crucial for improving patient outcomes. This project introduces a multifaceted approach to combat lung cancer by combining advanced diagnostic techniques with a personalized drug recommendation system. The goal is to enhance the early detection of lung cancer while also offering more effective and cost-efficient treatment options through the utilization of generic drugs. The first component of the project focuses on lung cancer detection. We employ technologies such as deep learning and image analysis to process medical imaging data, including histopathological images, in order to identify early signs of lung cancer. By leveraging machine learning, we can detect and classify abnormalities in lung images with a high degree of accuracy, thereby enabling timely diagnosis and treatment. The second component of our project addresses the challenge of recommending generic drugs to lung cancer patients. The high cost of cancer medications can place a significant financial burden on patients and healthcare systems. Our recommendation system takes into account the patient's medical history, the stage and type of lung cancer, and the latest medical research. By analysing this information, we provide personalized condition. The integration of these two components creates a holistic solution for addressing lung cancer. Early detection enhances the chances of successful treatment, while generic drug recommendations alleviate the financial burden on patients and healthcare providers. By combining advanced technology with medical expertise, this project aims to improve patient outcomes, reduce the economic strain of treatment, and ultimately contribute to a more efficient and affordable healthcare system for lung cancer patients.

Keywords— Lung cancer, Haralick features, artificial neural network, Convolutional neural networks, Digital pathology, Drug Recommendations, Collaborative filtering

I. INTRODUCTION

Lung cancer remains one of the most prevalent and lethal forms of cancer worldwide, necessitating the development of innovative technologies for early detection and personalized treatment strategies. In recent years, the integration of deep learning techniques, particularly

Convolutional Neural Networks (CNNs), has revolutionized medical image analysis, offering unprecedented accuracy and efficiency in disease diagnosis. Additionally, collaborative filtering methods have emerged as powerful tools for personalized recommendation systems, enabling tailored treatment approaches based on individual patient characteristics and disease profiles.

This proposed system presents a comprehensive exploration of a novel project aimed at lung cancer detection and personalized drug recommendation. Leveraging CNNs, specifically the Inception v3 model, this project focuses on analysing histopathological images to identify cancerous lesions accurately. By utilizing the advanced capabilities of deep learning, the system aims to not only detect lung cancer but also classify its stage and type, providing crucial insights for clinicians to develop precise treatment plans.
Furthermore, the integration of collaborative filtering techniques enhances the project's scope by incorporating personalized drug recommendation functionalities. By analysing patient data, including cancer stage and type, as well as historical treatment responses, the system can generate tailored drug recommendations aligned with individual patient needs. This approach not only streamlines the treatment selection process but also maximizes the likelihood of therapeutic efficacy, ultimately improving patient outcomes and quality of life.

Through this interdisciplinary approach, merging state-of-the- art deep learning with personalized recommendation systems, the project endeavours to address key challenges in lung cancer diagnosis and treatment. By providing accurate detection, comprehensive cancer profiling, and tailored drug recommendations, this initiative holds immense promise in advancing precision medicine and improving patient care in the battle against lung cancer.

II. Related Work

Lung cancer remains a formidable challenge in the field of oncology, necessitating continuous innovation in detection methodologies and treatment strategies. Over the years, researchers have explored various approaches, ranging from traditional image processing techniques to advanced deep learning models, to enhance the accuracy and efficiency of lung cancer detection systems.

Early detection of lung cancer is crucial for improving patient outcomes and survival rates. In the study by [1], a novel methodology leveraging nucleus segmentation-based features was proposed for early lung cancer detection. By labelling sputum samples with Tetrakis Carboxy Phenyl Porphine (TCPP) and employing fluorescent imaging, the researchers achieved promising results. Through the integration of machine learning techniques and nucleus segmentation, the accuracy of lung cancer detection was significantly improved, demonstrating the potential of this approach in enhancing early diagnosis.

Similarly, Author [2] introduced a comprehensive system for lung cancer detection from CT images, integrating image processing techniques and neural network algorithms. By employing a multi-stage process encompassing image preprocessing, segmentation, feature extraction, and neural network detection, the system achieved impressive accuracy rates. This

Ms Farhat Patel, Vaidika Barve, Shruti Darekar And Varad Mahajan

underscores the importance of combining advanced image analysis methodologies with machine learning algorithms to enhance lung cancer detection efficacy.

In parallel, efforts have been directed towards developing intelligent medicine recommender systems to optimize treatment selection and reduce medication errors. Addressing the issue of medication errors due to limited clinical experience, [3] proposed a universal medicine recommender system framework utilizing data mining technologies. By analysing diagnosis history records and employing machine learning algorithms such as SVM, BP neural network, and ID3 decision tree, the system demonstrated robust performance in medication recommendation, highlighting its potential in improving healthcare delivery and patient safety.

Moreover, advancements in object detection methodologies have facilitated the recognition and analysis of cancer cells in medical imaging data. [4] presented an improved Faster R- CNN algorithm tailored for colorectal cancer cell detection. By incorporating multi-scale detection and a multi-loss function, the algorithm exhibited superior accuracy compared to traditional approaches, showcasing the efficacy of deep learning techniques in medical image analysis.

Furthermore, with the advent of sentiment analysis and machine learning, researchers have explored innovative approaches for drug recommendation systems. Amidst challenges such as the shortage of medical resources exacerbated by events like the COVID-19 pandemic, [5] proposed a drug recommendation system based on sentiment analysis of patient reviews. By leveraging various vectorization processes and classification algorithms, the system achieved high accuracy in predicting drug sentiments, offering a potential solution to alleviate the burden on healthcare professionals and improve patient access to appropriate medication.

Collectively, these studies underscore the diverse methodologies and technologies employed in the domain of lung cancer detection and drug recommendation systems. From nucleus segmentation-based features to advanced deep learning models and sentiment analysis techniques, researchers continue to innovate, striving towards more accurate, efficient, and personalized approaches for combating lung cancer and improving patient care.

PROPOSED METHODOLOGY

1. Data Collection:

Lung Cancer Data: Acquisition of datasets containing patient information, medical history, imaging scans (CT scans, histopathological images), and biopsy results from reputable sources such as medical institutions or repositories like The Cancer Genome Atlas (TCGA), National Institutes of Health (NIH), or similar databases. Selection criteria based on confirmed cases of lung cancer, including diverse demographics, stages of cancer, and treatment histories.

Ms Farhat Patel, Vaidika Barve, Shruti Darekar And Varad Mahajan

Drug Information: Gathering data on generic drugs used in lung cancer treatment, including their chemical compositions, efficacy, side effects, and patient response from pharmaceutical databases, clinical trials, and medical literature.

2. Preprocessing and Feature Selection:

Lung Cancer Data: Cleaning the datasets to remove duplicates, missing values, and inconsistencies. Feature engineering: Extracting relevant features from medical records, such as tumour size, stage, histological type, genetic mutations, and patient demographics. Normalization and standardization of data to ensure compatibility across different data types and sources.

Drug Information: Preprocessing drug information to categorize drugs based on their chemical properties, mechanisms of action, and potential interactions. Feature selection to identify the most relevant drug attributes for recommendation purposes.

3. Development of Lung Cancer Detection Model:

Machine Learning Models: Implementing various machine learning algorithms such as Support Vector Machines (SVM), Random Forest, Convolutional Neural Networks (CNN), or deep learning architectures to create a predictive model for lung cancer detection. Training the model using the pre- processed and curated lung cancer dataset. Hyperparameter tuning and cross-validation techniques to enhance model accuracy and generalization.

4. Generic Drug Recommendation System:

Recommendation Algorithm: Utilizing collaborative filtering, content-based filtering, or hybrid recommendation systems to suggest generic drugs based on patient-specific characteristics, cancer stage, genetic markers, and treatment history. Integration of the drug dataset with patient profiles to generate personalized recommendations.

5. Evaluation and Validation:
Lung Cancer Detection Model: Assessing the performance of the lung cancer detection model using metrics like accuracy, precision, recall, F1- score, and area under the curve (AUC) through cross-validation and independent test datasets. Validation of the model's predictions against known clinical outcomes and expert evaluations.

Drug Recommendation System: Evaluating the effectiveness of the drug recommendation system through metrics like precision, recall, and user satisfaction surveys.

66

Ms Farhat Patel, Vaidika Barve, Shruti Darekar And Varad Mahajan

Validating recommendations by comparing them with established treatment guidelines and medical expert opinions

6.Ethical Considerations:

Ensuring compliance with ethical guidelines and patient privacy laws in handling sensitive medical data. Obtaining necessary permissions and consents for data usage and ensuring anonymization of patient information.

7.Statistical Analysis:

Conducting statistical analyses to identify correlations between specific patient attributes, cancer characteristics, and recommended drugs. Employing statistical significance tests to validate the robustness of the findings

IV.CONCLUSIONS

In conclusion, the proposed system represents a transformative healthcare solution, addressing the critical challenges of early lung cancer detection and cost-effective drug recommendations. By harnessing advanced technology, this project offers the potential to significantly improve patient outcomes and reduce the financial burden of cancer care. The integration of cutting-edge medical imaging analysis and personalized drug recommendations provides a holistic approach that empowers healthcare providers and patients with the tools needed to combat lung cancer. Furthermore, the commitment to data privacy and security ensures the ethical handling of sensitive patient information, while scalability and interoperability allow for future adaptability. As a beacon of innovation in healthcare, this system holds the promise of revolutionizing lung cancer care, ultimately contributing to more efficient and accessible healthcare solutions

V.REFERENCES

[1] Kancherla, K., Mukkamala, S. (2013). Early lung cancer detection using nucleus segmentation based features. 2013 IEEE Symposium on Computational Intelligence in Bioinformatics and Computational Biology (CIBCB). doi:10.1109/cibcb.2013.6595393.

[2] Miah, M. B. A., Yousuf, M. A. (2015). Detection of lung cancer from CT image using image processing and neural network. 2015 International Conference on Electrical Engineering and Information Communication Technology (ICEEICT). doi:10.1109/iceeict.2015.7307530.

[3] Bao, Y., Jiang, X. (2016). An intelligent medicine recommender system framework. 2016

Ms Farhat Patel, Vaidika Barve, Shruti Darekar And Varad Mahajan

IEEE 11th Conference on Industrial Electronics and Applications (ICIEA). doi:10.1109/iciea.2016.7603801

[4] Vas, M., Dessai, A. (2017). Lung cancer detection system using lung CT image processing. 2017 International Conference on Computing, Communication, Control and Automation (ICCUBEA). doi:10.1109/iccubea.2017.8463851.

[5] Saric, M., Russo, M., Stella, M., Sikora, M. (2019). CNN- based Method for Lung Cancer Detection in Whole Slide Histopathology Images. 2019 4th International Conference on Smart and Sustainable Technologies (SpliTech). doi:10.23919/splitech.2019.8783041.

[6] Yu, Y., Yang, Q., Shaohan, L. (2020). An Improved Faster R- CNN for Colorectal Cancer Cell Detection. 2020 IEEE 3rd International Conference on Electronics and Communication Engineering (ICECE). doi:10.1109/icece51594.2020.93530.

[7] Kommineni, M., Alekhya, P., Vyshnavi, T. M., Aparna, V., Swetha, K., Mounika, V. (2020). Machine Learning based Efficient Recommendation System for Book Selection using User based Collaborative Filtering Algorithm. 2020 Fourth International Conference on Inventive Systems and Control (ICISC). doi:10.1109/icisc47916.2020.91712.

[8] Singh, J. (2020). Collaborative Filtering based Hybrid Music Recommendation System. 2020 3rd International Conference on Intelligent Sustainable Systems (ICISS). doi:10.1109/iciss49785.2020.93159.

[9] Garg, S. (2021). Drug Recommendation System based on Sentiment Analysis of Drug Reviews using Machine Learning. 2021 11th International Conference on Cloud Computing, Data Science and Engineering (Confluence). doi:10.1109/confluence51648.2021.

[10] C K, R., and Srikantaiah, K. C. (2021). Similarity Based Collaborative Filtering Model for Movie Recommendation Systems. 2021 5th International Conference on Intelligent Computing and Control Systems (ICICCS). doi:10.1109/iciccs51141.2021.9432.

Ms Farhat Patel, Vaidika Barve, Shruti Darekar And Varad Mahajan