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Detection of Lung Cancer Using Optimized SVM-CNN Model

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Abstract: ***Lung cancer is a leading cause of cancer-related deaths worldwide, and early detection is critical for effective treatment. Artificial Intelligence (AI) has shown great promise in improving the accuracy and speed of lung cancer detection. In this study, we present a review of recent research on lung cancer detection using AI, including the use of deep learning, and image analysis technique. Neural networks have always been several a powerful tool which can be used in different applications that require an accurate model and the complexity of these models exceeds a human's computational capabilities. The objective of this study is to analyze different types of cancer diagnosing methods that have been developed and tested using image processing methods.***

Keywords: Artificial Intelligance, Lung cancer, Neural Networks, SVM

I. INTRODUCTION

Lung cancer is one of the leading causes of cancer-related deaths worldwide, with a five- year survival rate of only 19%. Early detection of lung cancer can improve patient outcomes, as it enables earlier treatment and better chances of survival. However current screening methods for lung cancer, such as low-dose computed tomography (CT)scans, have the limitations in terms of accuracy and efficiency.

Early detection of lung cancer is critical for improving patient outcomes, as it increases the likelihood of successful treatment and recovery. Artificial intelligence (AI) has shown promise in improving the accuracy and efficiency of lung cancer detection.

AI algorithms can analyse medical images such as CT scans, X-rays, and MRI scans to detect abnormalities that may be indicative of lung cancer. These algorithms can identify small nodules and lesions that might be missed by human radiologists, enabling earlier detection and treatment.

In addition to image analysis, AI can also help with risk assessment and prediction. By analysing patient data, such as medical history, age, and smoking status, AI can identify individuals who are at higher risk of developing lung cancer, allowing for earlier screening and intervention.

AI-based lung cancer detection systems have been developed and tested in various clinical settings, and several have shown promising results. However, further research and validation are needed to ensure the safety and efficacy of these systems in routine clinical practice. Overall, AI has the potential to revolutionize lung cancer detection and improve patient outcomes by enabling earlier diagnosis and treatment.

Early detection of lung cancer is critical for improving patient outcomes. According to the American Cancer Society, lung cancer is the leading cause of cancer-related deaths worldwide, with an estimated 1.8 million deaths in 2020 alone. The majority of lung cancer cases are diagnosed at an advanced stage when treatment options are limited and patient survival rates are low. Detecting lung cancer at an earlier stage can significantly improve patient outcomes by increasing the likelihood of successful treatment and recovery. Studies have shown that when lung cancer is detected at an early stage, the five-year survival rate is over 50%, compared to less than 10% for advanced-stage lung cancer.

However, detecting lung cancer at an early stage can be challenging, as symptoms may not appear until the cancer has advanced. This is where AI can play a crucial role. AI algorithms can analyse medical images and patient data to detect lung cancer at an earlier stage, enabling earlier treatment and improving patient outcomes. Moreover, early detection of lung cancer can also reduce healthcare costs.

Late-stage lung cancer requires more intensive and expensive treatments, such as chemotherapy and radiation therapy, whereas early-stage lung cancer can often be treated with less invasive and less expensive procedures, such as surgery or radiation therapy. Overall, the motivation for earlier lung cancer detection using AI is to improve patient outcomes, reduce healthcare costs, and save lives.

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II. LITERATURE SURVEY

In recent years, there has been growing interest in the use of artificial intelligence (AI)for the early detection of lung cancer.AI based approaches have the potential to improve the accuracy and efficiency of lung cancer screening, by analysing large amounts of imaging data and identifying early signs of cancer that may be missed by human observers.

Various AI based methods have been proposed for lung cancer detection, including deep learning algorithms that can analyse CT scans and identify lung nodules, as well as machine learning models that can integrate multiple imaging modalities and clinical data to predict the likelihood of lung cancer.

In this literature survey, we will review some of the recent studies that have investigated. The use of AI for early lung cancer detection, highlighting the strengths and limitations of Different approaches, as well as the potential implications for clinical practice.

1) Lung Cancer Incidence Prediction Using Machine Learning Algorithms

The cancer is called malignant tumor caused by an irregular division of tissue or organ in cells. Although many types of cancer in both male and female. It is based on Statistical analysis of its data and neural-based models . The goal of the Back propagation algorithm is used for multi-layer perceptron to update the weight of the neurons with the gradient descent algorithm. Generally Initial weight are assigned randomly and it starts the input in its feeding to net and calculating its total potential by their corresponding weights following the hidden layer. The output produced by its Activation function of each neuron and the calculations are repeated till output layer. At that layer the output is compared with target and error. It is used in real-life applications, optimized problems and prediction. The Long Short term Memory Network (LSTM) is effective of recurrent network and used for the classification method and prediction analysis. The major components are cell, input gate, output gate and forget gate. Forget gate is used for the irrelevant data and input gate removal and accepts the forget gate. Output of LSTM uses the sigmoid activation function. It uses weights, it remembers the previous errors and minimization of network. The Support Vector Regression is kind of support vector machine to accept the real value in the binary format Prediction problem is used effectively. It creates the sub-class of training data known as. support vectors and minimizes the observed data and predicted data distance to improve its performance.

2) Multistage Lung Cancer Prediction And Detection Us Ing Multiclass Svm Classifier

Lung cancer using Image Enhancement technique of better-quality impression pictures. Images used for this purpose masking is subjected to a selective median filter. More dependable for preparing and identification of more dependable to consolidate the versatile edge to its own commotion recognition that is used. The Image Segmentation and Detection of canmcerin CT images to gain its own better recognition of the image. The watershed lines depend to compare the edges of the marker and it is not influenced to its lower-constract edges to problem that needs to be solved in neighborhood minima. The Feature Extraction and Detection involves in huge arrangement of information that needs to be arranged in decreased. Feature Extraction of the normality or variation of normal picture. Feature Extraction arrange a large combination of pixels. Classification of cancer nodule of utilized SVM classifier of the machine learning algorithm. SVM uses the effective tool for hyper plane classifier that expands the edges, Cancer stage classification of the affected lung area and the total affected area.

3) Sex And Smoking Status Effects On The Early Detection Of Lung Cancer In High Ris K S Mokers Us Ing An Electronic Nose

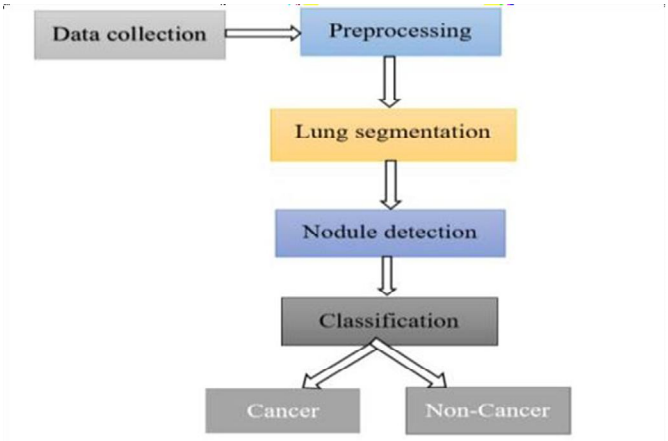
Respiratory diseases like asthma, chronic pulmonary disease is identified by breath odor. This is because of the equilibrium of the air and pulmonary blood gas in the breath analysis of diagnostic disease in the lung cancer. An electronic nose (e-nose) is VOC in that array of the sensors with overlapping the digital VOCs. They also detect with the chemical reaction and can generate an electrical impulse. These are the sensors coated with reactive compound depends mainly on chemical constituents, an electrical sensor causing measurable resistance change. Data that it needs to be obtained in the form of pattern recognition technique to obtain the specific odor. E- nose which is capable of measuring a non- invasive breadth sample in the real time analysis of chemicals. The e-nose system which contains 32 polymer sensors with some unique pattern of electrical resistance's-nose for lung cancer patients used to facilitate the lung cancer in advanced stage, effects due to smoking comparison of high-risk current. To study its majority and design in a cross-sectional case control for the lung cancer patients for detected cancer. It has been ranged from 45-79 years of male or female from the history of past years. The "High risk Smoker" and "Lung cancer" in terms of sex. It is based on the LDCT lung cancer detection.

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III. METHODOLOGY

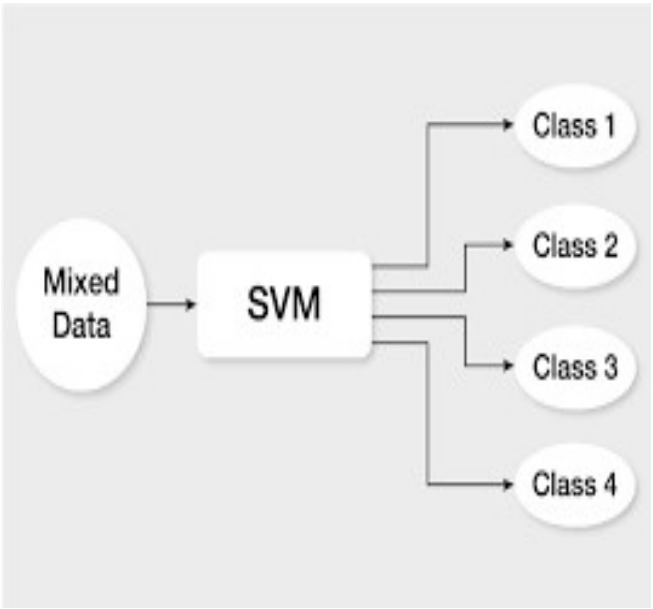
The methodology used in this work can be given as



The Algorithms used in the work are CNN in combination with SVM

Support Vector Regression Algorithm

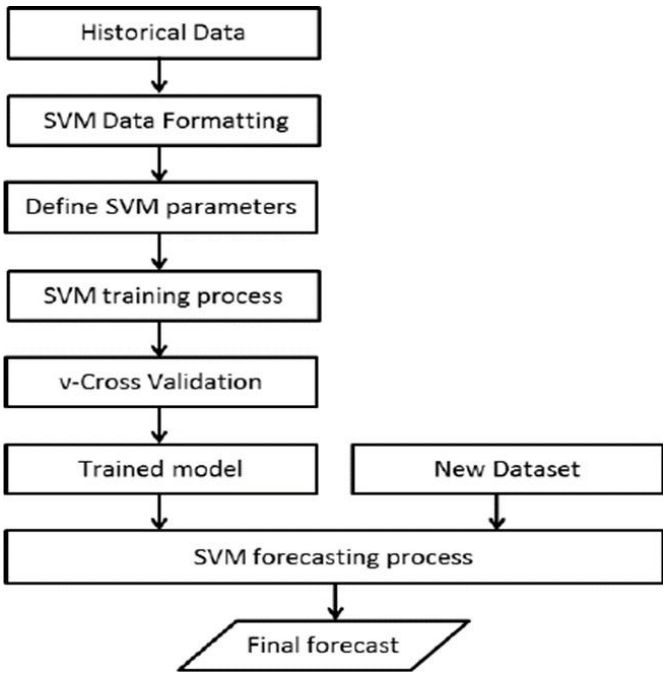
Support Vector Regression: Support Vector Regression (SVR) is quite different than other Regression models. It uses Support Vector Machine (SVM, a classification algorithm) algorithm to predict a continuous variable. While other linear regression models try to minimize the error between the predicted and the actual value, Support Vector Regression tries to fit the best line within a predefined or threshold error value. What SVR does in this sense, it tries to classify all the prediction lines in two types, ones that pass through the error boundary (space separated by two parallel lines) and ones that don't. Those lines which do not pass the error boundary are not considered as the difference between the predicted value and the actual value has exceeded the error threshold. The lines that pass, are considered for a potential support vector to predict the value of an unknown or missing values.



Convolutional Neural Network

A CNN (Convolutional Neural Network) algorithm is a deep learning algorithm used for image and video recognition. It is inspired by the structure and function of the human brain's visual cortex. CNNs use a multi-layer architecture to extract features from the input images or videos and classify them into different categories. CNNs have proven to be very effective in various computer vision tasks, such as image classification, object detection, and segmentation. They are widely used in industries such as self-driving cars, security systems, and medical imaging.

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IV. RESULTS AND SCREENSHOTS

The steps followed in the execution process are shown in the attached screenshot pictures:

1) Open the command prompt (figure6.6.1).
2) Enter the command to view the display to perform algorithms (figure 6.6.2).
3) Open the dataset(figure 6.6.3).
4) In the display click on load dataset to load the dataset(figure 6.6.4).
5) Once the data gets loaded click on pre-process data for performing data pre- processing
6) Click on the SVM
7) Click on the CNN to get the accuracy(figure 6.6.10).
8) Click on Accuracy comparison to get the graph that compares the accuracies of all the algorithms

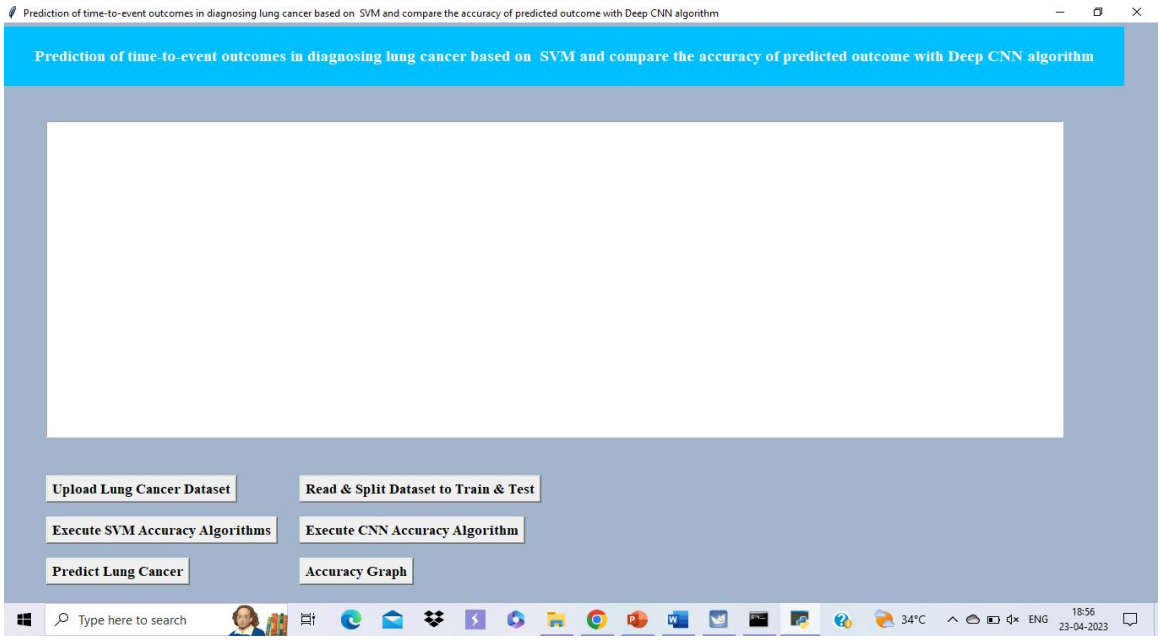


Figure: GUI Window

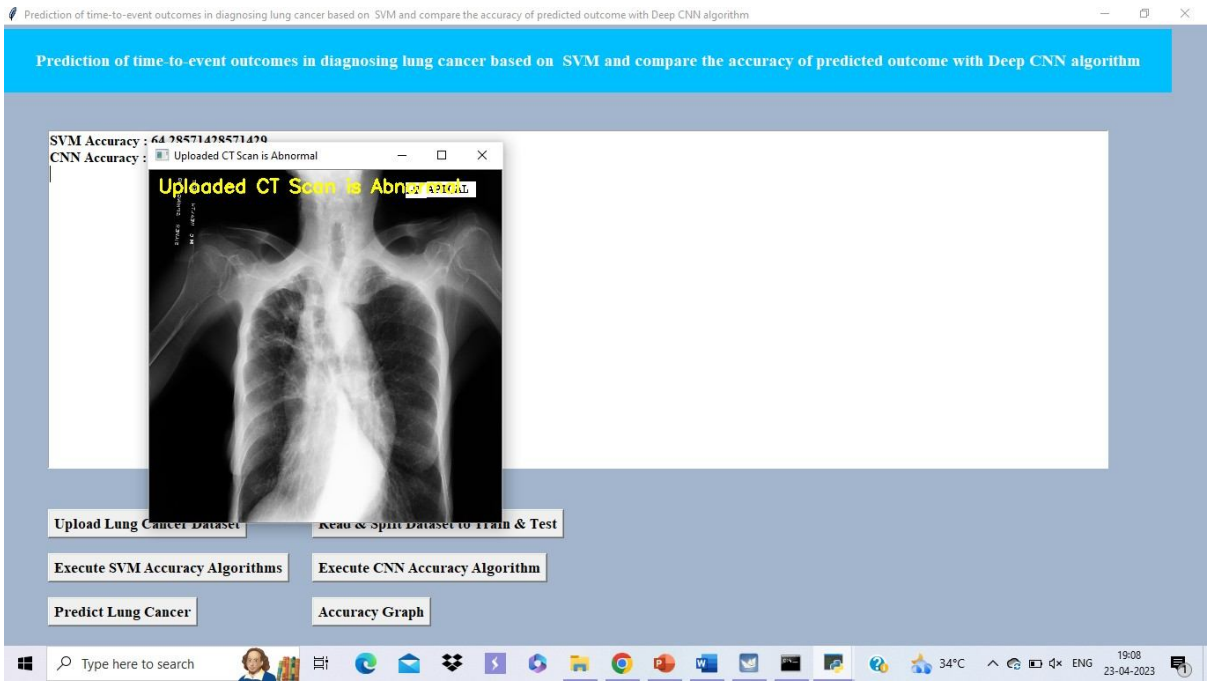


Figure: Output Window

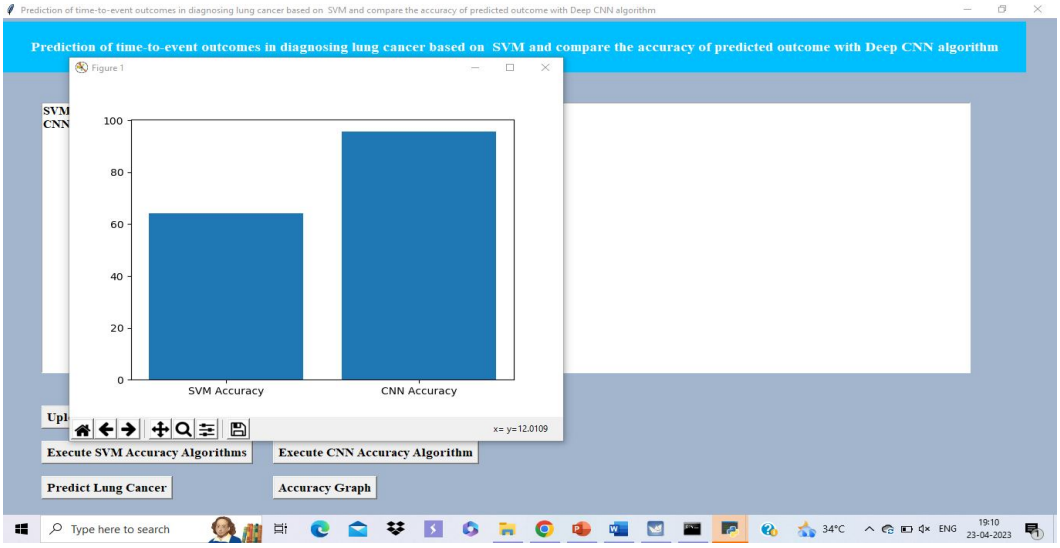


Figure: Comparison Results of all models

V. CONCLUSIONS

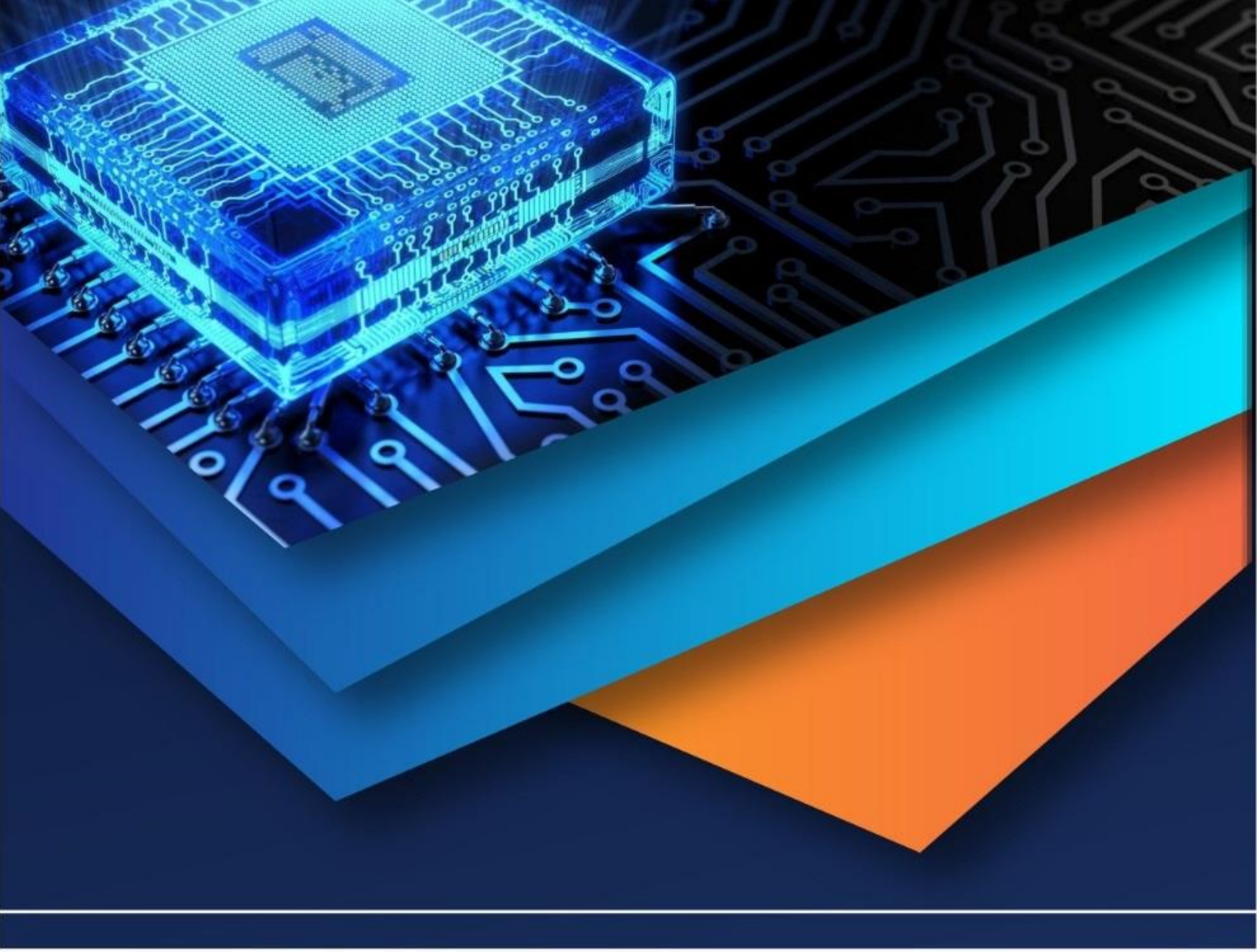
In the proposed Lung cancer detection, ML & DL algorithms are work well for this model. Here we are implementing 2 algorithms called SVM and CNN algorithms. We analyse and detect the result whether the patient has lung disease, no disease and the stages of disease using ML & DL algorithms. After the comparative analysis of the various Machine Learning models, we can conclude that the CNN algorithm is the best approach to be used for detect lung cancer disease. Based on these results it can be shows that the proposed system gives the good performance in the category of optimization and our project provides an easy and efficient system for Lung Cancer detection.

In the future, the study intended to estimate lung cancer disease utilizing ML & DL algorithms approaches and larger datasets. This work leaves an application that can be used as support for medical personnel in medical decision making, but discrete data variables. It can also detect future work, heart disease, cancer, arthritis, and other chronic diseases. As the developed system is generalized, it can utilize it to analyse various datasets in the future.

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