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PULMONARY VISIONORGANIZATIONUSING EXPROPRIATE ENSEMBLE LEARNING AND ARTIFICIAL NEURAL NETWORKS

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ABSTRACT

Pulmonary diseases, including conditions like chronic obstructive pulmonary disease (COPD) and lung cancer, are major global health concerns, requiring early diagnosis and effective treatment for improved patient outcomes. Traditional diagnostic methods often rely on medical imaging, spirometry, and clinical assessments, which can be time-consuming and prone to variability. To address these limitations, the application of advanced machine learning techniques, such as ensemble learning and artificial neural networks (ANNs), offers a promising solution for enhancing diagnostic accuracy and decision-making in pulmonary disease management**.**This paper presents a novel approach to pulmonary vision organization through the use of expropriate ensemble learning combined with artificial neural networks. Ensemble learning methods, which aggregate the predictive power of multiple models, are integrated with deep neural networks to improve the detection and classification of pulmonary diseases. The proposed method leverages diverse datasets, including medical imaging and clinical data, to train and validate the models, leading to higher diagnostic precision. By combining the strengths of ensemble learning and ANNs, this approach achieves superior performance in identifying complex patterns associated with pulmonary conditions, surpassing traditional machine learning techniques. The results demonstrate improved accuracy, sensitivity, and specificity in detecting pulmonary abnormalities, contributing to earlier and more reliable diagnoses.

Keywords:*Pulmonary Image Technique*, *Artificial Neural Networks,Deep Convolution Neural Network*, *Ensemble Learning* , *Machine Learning.*

INTRODUCTION

Now a days machine learning is widely used for various diseases prediction accurately with provided and trained datasets.This paper provides is a study of Predictive Analysis of Pulmonary nodules Disease Based on study of appropriate neural network selection and by using ensemble learning.As our proposed pulmonary image classification based neural network selection using VGG_16 Model, Inception_v3, ResNet50 and VGG19.Nodule detection is an acute pulmonary infection caused by bacteria, viruses, or fungi that infects the lungs, producing inflammation of the air sacs and pleural effusion (fluid in the lung). It is the cause of over 15% of all deaths in children under the age of five. Lung infections are more common in undeveloped and underdeveloped countries, where overcrowding, pollution, and unsanitary environmental circumstances worsen the problem, and medical resources are limited [1]. As a result, early detection and treatment can help prevent the disease from progressing to the point of death. The use of computed tomography (CT), magnetic resonance imaging (MRI), or radiography (X-rays) to examine the lungs is commonly employed for diagnosis. X-ray imaging is a non-invasive and painless method of obtaining information. Figure 1 displays an example of a lung X-ray with a damaged and a healthy lung. Infiltrates, or white patches on the Lung X-ray Chest X-ray exams for infection identification, on the other hand, are vulnerable to subjective variability. As a result, an automated technique for detecting Nodules Infection is necessary. We created a method based on deep learning methods for dealing with such automation difficulties in this research [2]. The most extensively used and common type of clinical assessment for pulmonary nodules is a chest X-ray film.Despite this, respiratory problems are still the most common symptom of infectious diseases. In terms of diagnosis, thoracic radiography's specificity for infectious diseases is debatable, and its usefulness for frontline prescreening is also debatable. Several radiology organizations, such as the American College of Radiograph, advise against utilizing clinical radiography to diagnose pulmonary causes [3]. Nonetheless, a few researchers believe that a lung scan examination might be utilized as a primary tool for screening various locations, and that it could provide essential information for diagnosis and, in particular, the management of respiratory tract infections. We contributed a better investigation and established a novel Protocols to measure ML models when using heterogeneous data sources, particularly with a large number of patient cases, because to the limits of Strategies for ensuring that the ML models' visual features are particularly documenting the locations of lung anomalies rather than bright objects like medical equipment or hard tissue; Algorithms for tracking the position of a feature in a CXR image processing task and evaluating the relationship with essential factors linked to a variety of viral diseases in the lungs [4].The following is the outline for this paper. We begin by reviewing current studies in order to identify potential flaws in employing neural networks to process radiography pictures. Then, using the open-access benchmark dataset Infectious Diseases as a case study, we present protocols and strategies for evaluating deep learning models for segmentation and classification.Deep learning is a powerful artificial intelligence technology that can help solve a variety of difficult computer vision problems. For diverse picture categorization issues, deep learning models, notably convolutional neural networks (CNNs), are widely used. However, such models work best when they are given a huge amount of data to work with. Such a large volume of labelled data is challenging to obtain for biomedical image classification challenges because it requires professional doctors to classify each image, this is a time-consuming and costly task [5]. A workaround for overcoming this barrier is transfer learning. In this strategy, a model trained on a big dataset is re-used and the network weights determined in this model are employed to solve a problem with a small dataset. For biological image classification tasks, CNN models trained on a large dataset like ImageNet, which contains over 14 million images, are widely utilized.Ensemble learning is a popular method for combining the decisions of multiple classifiers to produce a final prediction for a test sample. It is done so that discriminative information from all of the base classifiers may be captured, resulting in more accurate predictions. The most extensively used and common type of clinical assessment for pulmonary nodules is a chest X-ray film. However, because to the fast increase in the number of infectious diseases, which is also a major potential source of diagnostic error, the number of radiologists clearly cannot keep up with this eruption. The deep learning method is the most suited method for dealing with such automation issues. Previously, experts offered a framework for conducting ML research in medicine. In order to evaluate the existing ML algorithm in Lung Infectious Disease prediction, systematic review and meta-analysis, which are the foundations of modern evidence-based medicine, must be undertaken.

LITERATURE SURVEY

Marcin Wozniak , DawidPołapproposed a method to perform computer aided diagnosis the goal of this study is to investigate the possibilities of using deep learning algorithms to diagnosis respiratory diseases images by using firefly algorithm, artificial bee colony algorithm ,artificial ant colony, cuckoo algorithm, practical swarm algorithm and extraction is carried out by bim tissue keypoints and aggregated key points [6]. In the images of lung illnesses like pneumonia, lungs sarcoidosis and cancer medical experts search for tissues that have changed structure. These types of changes are visible in x-ray images with a solid structure similar to bone tissues, which are not permeable to x-ray radiation and therefore visible in images. Schematic Tissue Key-Area’s position detection in x-ray image is performed by the proposed BIM approach over the input imageS.Mukherjee et al. proposed a method for autonomously detecting lung nodules based on geometric parameters. The x-ray pictures are used to

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classify benign and malignant pulmonary nodules based on shape factors such as roundness, eccentricity, diameter, and aspect ratio.Noise Removal using Bilateral Filtering then Image Binarization and Segmentation and classification is carried out by using Bayesian classifier. Woniak et al. proposed a probabilistic neural network-based lung cancer classification system. This method is basic, yet it has a decent classification effect and can detect nodules with low contrast. The following probabilistic neural network was used to extract features from a lung image [7]. By using this vector, the pattern layer computes a probability vector whose components define the belonging to the different classes. Finally, the output layer selects the largest value of the probability vector to predict the target class, determining whether an input vector belongs to that class.Here, to create and apply feature extraction methods and algorithms, most of these methods require required professional knowledge or a significant amount of time and effort. With the progressive advancement of deep learning research, the technology that can be employed with photos has also made a qualitative leap. by using a variety of datasets to train a certain domain and a variety of model architectures. Long and Wang proposed a method to address the problem of domain adaptation in transfer learning they introduced a unique Deep Adaptation Network (DAN), which extends Deep Convolutional Neural Networkto domain Adaptation [8]. This architecture optimizes the transferability of features from the task-specific layers of the neural network. In a replicating kernel Hilbert space, mean-embedding matching of multi-layer representations across domains can considerably increase feature transferability. While an unbiased estimate of the mean embedding naturally leads to a linear time approach, which is particularly desirable for deep learning from large-scale datasets, an efficient multi-kernel selection strategy boosts embedding matching effectiveness even more.The usage of multiple classifier systems (or ensemble systems) and then merging the results of their outputs is one of the suitable ways for improving classification accuracy. The "creation of ensemble" and "combination of class label" are the two main components of a multiple classifier system.

METHODOLOGY

To create and apply feature extraction methods and algorithms, most of these methods require required professional knowledge or a significant amount of time and effort. The technology that can be applied to photos has evolved qualitatively as a result of the progressive advancement of deep learning research, giving rise to the notion of medical picture categorization based on deep learning. Deep learning does not demand any medical or engineering technology qualities, nor does it necessitate any medical-related specialist knowledge. To categories pulmonary pictures, the existing system uses the inception-v3 transfer learning model. On the JSRT database, the neural network model based on transfer learning outperforms the original DCNN model in pulmonary image categorization. Then, automatically extract

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features from pulmonary images using the fine-tuned Inception-v3 model based on transfer learning.

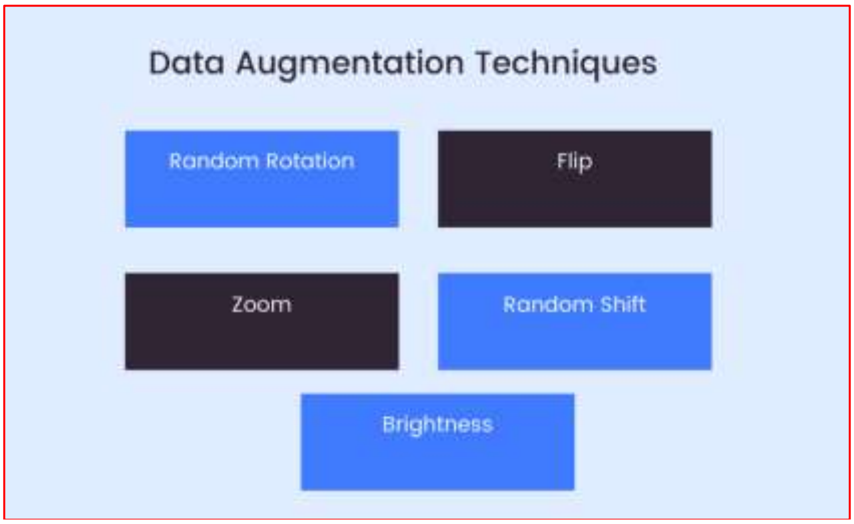

Figure 1:Data augmentation method used for pulmonary Analysis

Data Augmentation

As a result, only professional radiologists can label these data, and it requires complex skilled radiologists to spend more time observing images over and over. As a result of the paucity of professionals, medical imaging data will unavoidably suffer from a lack of data. The Z-score standardization approach was used to normalize the data in order to avoid dimensional effects. Zero-phase Component Analysis was also used to whiten the data (ZCA). The fundamental goal of Z-Score is to convert data with diverse magnitudes into data with the same magnitude. When compared to other methods of normalizing, The Z-score can speed up the gradient decline.The two types of whitening are Principal Component Analysis (PCA) and ZCA whitening.. CA whitening is the singular value decomposition of the data in the specified data set's covariance matrix, while ZCA whitening is the transformation of the data acquired by PCA whitening back to the original space. When compared to PCA, ZCA ensures that data dimensions have the same variance, guaranteeing that the whitened data is as close to the original as possible. As a result, ZCA was chosen as a whitening agent.

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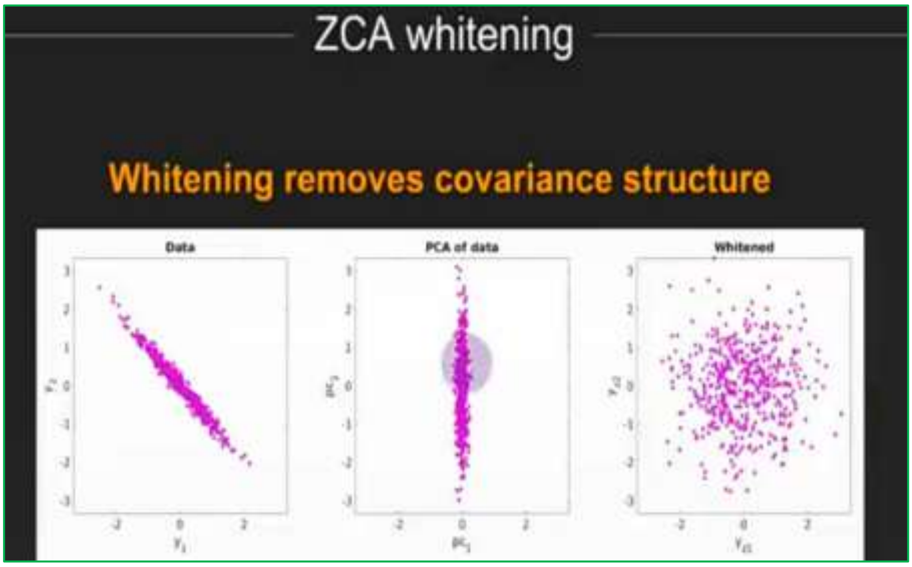

Figure 2: ZCA whitening Removes covariance

Figure 3: SCA Whitening Activity using Data Augmentation Procedure

TRANSFER LEARNING

As a result, deep learning based on transfer learning emerges as a cost-effective method of training. The practice of transferring trained model parameters to a new model to aid in its training is known as transfer learning. As a result, the learning efficiency of the new model can be boosted and improved. amount of data required by the neural network model. model's accuracy,We created an ensemble framework of several classifiers in this study. Using a weighted average ensemble technique, in which the weights assigned to the classifiers are produced using a novel scheme, as detailed in the sections below. Using Ensemble learning in the Proposing system, the categorization of Pulmonary Image and performance may be improved. The following are the study's primary contributions.

Dataset:A laser digitizer with a 2048x2048 matrix size (0.175-mm pixels) and a 12-bit grey scale digitized 154 conventional chest radiographs with a lung nodule (100 malignant and 54 benign nodules) and 93 radiographs without a lesion for the database (no header, big-endian raw data). Additional information in the database includes the patient's age, gender, and diagnosis (malignant or benign).The proposed system is depicted in Fig. 2 as a systematic overview. In brief, the system accepts lung CT scans as input and processes them using two key techniques: image processing and classification. In the first module, noise is removed from photos, segmentation is performed, backgrounds are removed, and the interested items and their features are extracted from raw images. The remaining potential objects are categorized in the second module based on their attributes extracted during the feature extraction phase, allowing lung cancers to be diagnosed. Among suspicious items, the system would be able to differentiate between nodule and non-nodule. This classification is based on a committee of three different classifiers comprising VGG-16,INCEPTION-V3,RESNET-50,and VGG-19 . Following, the steps of the proposed system have been described, respectively.

Preprocessing:Image preprocessing is a technique for removing main noise and image distortion from CT scans while simultaneously enhancing key characteristics. By using some image enhancement methods.

Resize images: When adjusting the aspect ratio of images, image resizing is a new and effective way for image resizing that keeps image content and does not create visible distortion. here we change the image into(224,224,3)ratio.

Sampling: we use to down-sampling and up-sampling to make the classes into equal number of images. Before sampling Lung Nodule 154 images and non-Nodule 93 images. After sampling Lung Nodule 250 Non- Nodule 250.

Labeling and Encoding: the labelling of images are carried out by lung-nodule into LN and non-nodule into NN. And thereafter the LN and NN is encoded in to the binary form, where (0,1) is non-nodule and vice-versa.

Feature Extraction: Further work is needed to extract specific features from raw images in order to identify suspected objects as nodule or non-nodule in two-dimensional images.A nodule id called cancer nodule if its size is more than 30 mm diameter. The study was performed by using 247 images including both men and women collected by JSRT the extracted features from The ensemble system uses suspected items as inputs, which are normalized between zero and one. Lung lesions(nodules) in these images are marked as nodule or non-nodule by radiologists.

RESULT ANALYSIS

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The proposed model accuracy is compared with the existing ML models which were depicted in vgg-16 shows 0.9 test accuracy, 0.925 sensitivity, 0.98 specificity. Inception v3 shows 0.96 test accuracy, 0.96 sensitivity, 0.96 specificity. Resnet50 shows 0.93 test accuracy, 0.88 sensitivity, 0.85 specificity.The proposed system detects suspected objects in each image as nodule or non-nodule. In fact, the collected dataset is divided into two categories (positive and negative). There are a variety of metrics that may be used to assess the success of categorization methods that are regularly employed in automatic medical diagnosis systems. TP is the number of accurate predictions for a positive instance; FN denotes the number of erroneous predictions for a negative instance; For a positive instance, FP signifies the number of incorrect predictions; for a negative instance, TN denotes the number of accurate predictions. We could generate the measures below to evaluate the system's performance based on these indicators.

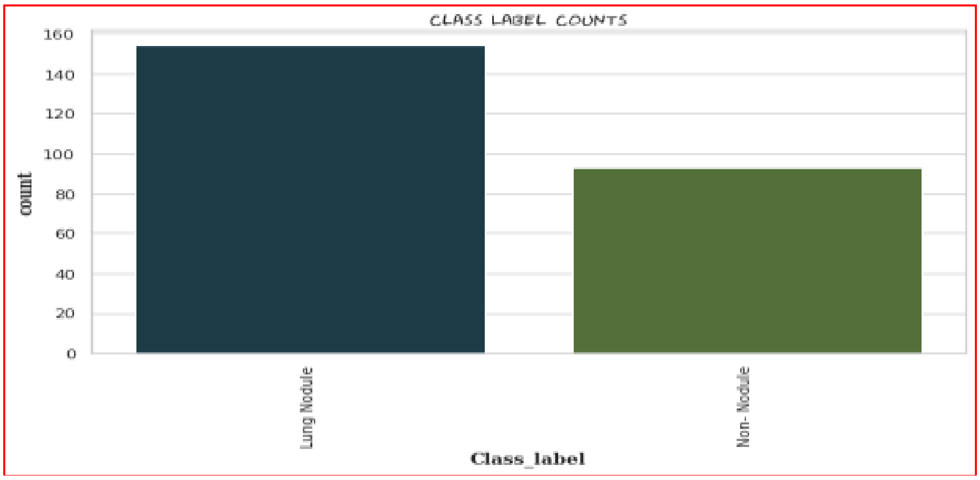

Figure 4: Chart Indicating Lung Nodule and Non Nodule comparison

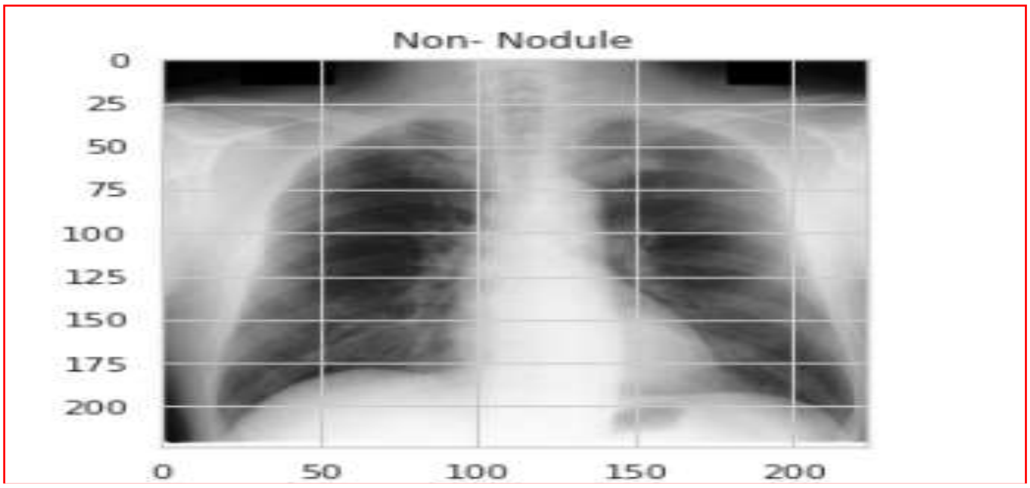

Figure 5: Xray Displaying Non Nodule Image with pulmonary readings

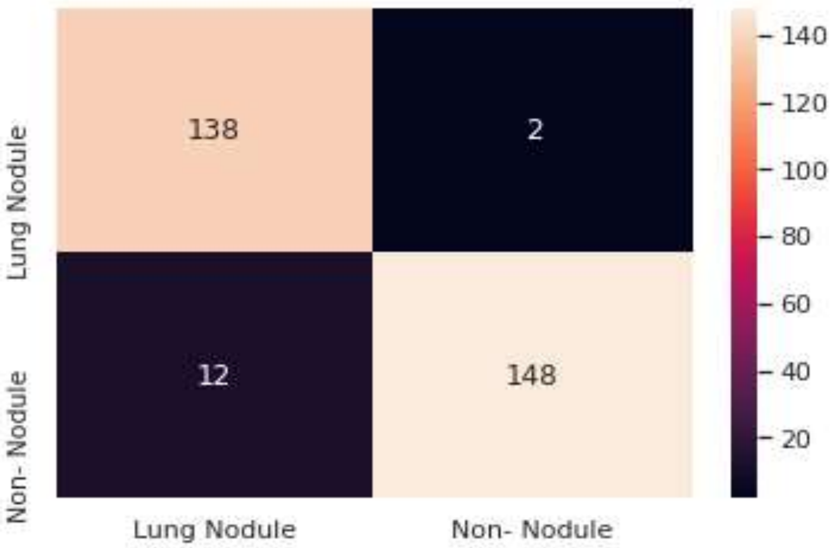

Figure 6: Heatmap displaying Comparisons

Figure 7: Line Chart demonstrating Train and Test Accuracy Comparisons

CONCLUSION

The use of expropriate ensemble learning in conjunction with artificial neural networks (ANNs) for pulmonary vision organization represents a significant advancement in the field of pulmonary disease diagnosis. By integrating the predictive capabilities of multiple machine learning models through ensemble learning, combined with the pattern recognition strengths of ANNs, this approach demonstrates substantial improvements in the detection, classification, and diagnosis of pulmonary conditions such as COPD and lung cancer.The results show that this method offers superior diagnostic accuracy, sensitivity, and specificity compared to traditional approaches. The ability to efficiently analyze complex patterns in medical imaging and clinical data leads to earlier detection of pulmonary diseases, enabling timely interventions and better patient outcomes. Furthermore, the robustness of the ensemble learning approach reduces the risk of misclassification and improves overall reliability in clinical decision-making.This hybrid methodology of ensemble learning and ANNs provides a scalable, adaptable, and efficient tool for healthcare professionals, potentially revolutionizing the diagnosis and management of pulmonary diseases. Future work can focus on expanding the dataset diversity, further optimizing model performance, and integrating these models into real-world clinical settings for widespread application.

REFERENCES

[1]Pushkar Sathe, Alka Mahajan, Deepak Patkar, Mitusha Verma, "End-to-End Fully Automated Lung Cancer Screening System", *IEEE Access*, vol.12, pp.108515-108532, 2024.

[2]T. Chitra, S V Hemanth, S. Karthikeyan, Vallem Ranadheer Reddy, K.M. Banupriya, G. Amirthayogam, "Predicting Lung Cancer Disease Using Optimized Weighting-Based Enhanced Neural Network Classification", *2024 3rd International Conference on Artificial Intelligence For Internet of Things (AIIoT)*, pp.1-6, 2024.

[3]Sabilla Halimatus Mahmud, Indah Soesanti, Rudy Hartanto, "Deep Learning Techniques for Lung Cancer Detection: A Systematic Literature Review", *2023 6th International Conference on Information and Communications Technology (ICOIACT)*, pp.200-205, 2023.

[4]Jyothi Chillapalli, Shilpa Gite, Bunny Saini, Ketan Kotecha, Sultan Alfarhood, "A Review of Diagnostic Strategies for Pulmonary Embolism Prediction in Computed Tomography Pulmonary Angiograms", *IEEE Access*, vol.11, pp.117698-117713, 2023.

[5]V A Binson, M Subramoniam, G K Ragesh, Ajay Kumar, "Early Detection of Lung Cancer Through Breath Analysis Using AdaBoost Ensemble Learning Method", *2021 2nd International Conference on Advances in Computing, Communication, Embedded and Secure Systems (ACCESS)*, pp.183-187, 2021.

[6]Herng-Hua Chang, Cheng-Zhe Wu, Audrey Haihong Gallogly, "Pulmonary Nodule Classification Using a Multiview Residual Selective Kernel Network", *Journal of Imaging Informatics in Medicine*, 2024.

[7]Herison Surbakti, Athmakuri Naveen Kumar, Saikumar Tara, Ismail Keshta, Amit khare, G. N. R. Prasad, "Support Vector Machine for Multiclass Classification of Redundant Instances", *Intelligent Computing and Networking*, vol.699, pp.413, 2023..

[8]Iftikhar Naseer, Tehreem Masood, Sheeraz Akram, Arfan Jaffar, Muhammad Rashid, Muhammad

Amjad Iqbal, "Lung Cancer Detection Using Modified AlexNet Architecture and Support Vector Machine", *Computers, Materials & Continua*, vol.74, no.1, pp.2039, 2023.