ISSN: 2348-2079

Volume-11 Issue-1

International Journal of Intellectual Advancements and Research in Engineering Computations

Deep Learning Based Lung Cancer Prediction Using Convolutional Neural Network Algorithm

Philip.C., B.E., M.E.,[1]. B.Narmada, M.E., (PhD).,[2]

Department of computer science and Engineering, Dhirajlal College of Technology, Salem, TamilNadu, India
Department of computer science and Engineering, Dhirajlal College of Technology, Salem, TamilNadu, India

Corresponding Author: B.Narmada
Published on: 26.03.2023

ABSTRACT

Lung cancer is the leading cause of cancer-related death in this generation and is projected to remain so for the foreseeable future. Lung cancer treatment is possible if the symptoms of the disease are detected early. Estimating motion using traditional techniques is challenging for humans. Medical imaging devices are essential for the early detection of lung cancer and the monitoring of lung cancer during treatment. Because of this, some machine learning algorithms can provide efficient, fast, low-error predictions on uncertain raw data. A deep learning (DL)-based convolutional neural network (CNN) approach is proposed to build an effective model to identify high-risk individuals with lung cancer for early intervention to avoid long-term complications. Initially, the dataset images were collected from the standard repository. Then, an image preprocessing stage begins to reduce noise and unbalanced data from the image dataset. The second stage is the segmentation step, that is, to segment each image feature according to the threshold algorithm. Finally, Classification based AI based CNN algorithm evaluating the risk factors uses the proposed model and uses each feature obtained by the last fully connected layer of the model as the input of the activation function. A sustainable prototype model of lung cancer treatment can be created using recent advances in artificial intelligence without negatively impacting the environment. Save time and money by reducing wasted resources, effort and time needed to complete manual tasks. A combination of AI-based CNN layers yielded an accuracy of 98.52%. The proposed model is a stable and consistent diagnostic model for the detection and diagnosis of lung cancer.

Keywords: Deep Learning, Convolutional Neural Network (CNN), Lung Cancer Prediction.

INTRODUCTION

Detection of lung cancer using image processing techniques. CT scan lung images of cancer patients were obtained from the Kaggle Competition dataset. Use image processing techniques such as preprocessing, segmentation, and feature extraction to isolate regions of interest. Develop algorithms to extract features such as area, perimeter, and entropy from all images. The parameter values obtained from these features are compared with the normal values recommended by the doctor. Based on the comparison result, a cancerous surface is detected. A GUI was developed to scan all images and display features and cancer noodles. It utilizes a convolution of images and channels to set invariant highlights assigned to the resulting layer. This cycle continues until the desired output is achieved.

Layers can be changed in the same way to prevent incorrect models through out-of-bounds adjustments. The number-crunching activity between the two tasks brings about another capability, called convolution. Yield activity can give us a non-literal idea of how well the graphs of the two data volumes match up with each other. The sources of the information and bits in AI computing are often complex information types. The system helps in the early detection of lung cancer with more accuracy. Deep learning is one of the fastest-growing topics in medical imaging, with rapidly emerging applications spanning medical image-based and textural data modalities. With the help of deep learning-based medical imaging tools, clinicians can detect and classify lung nodules more accurately and quickly. The recent development of deep learning-based imaging techniques for early lung cancer detection. In recent years, image processing technology has been widely used in many medical fields for early detection and image improvement in the treatment stage, where the time factor is very important for finding abnormal problems in the target image, especially in lung cancer, breast cancer and other various diseases. in cancer tumors. , etc. Lung cancer is a disease in which abnormal cells

multiply and grow into a tumor. Cancer cells can be carried away from the lungs in the blood or in the lymph fluid that surrounds the lung tissue. Lymph fluid flows through lymphatic vessels, which drain into lymph nodes located in the center of the lungs and chest cavity. Lung cancer often spreads toward the center of the chest because of the lymphatic fluid that drains naturally from the lungs. Metastasis occurs when cancer cells leave the place where it started and travel through the bloodstream to lymph nodes or other parts of the body. Cancers that originate in the lungs are called primary lung cancers. There are several different types of lung cancer, which are divided into two main groups: small cell lung cancer and non-small cell lung cancer, which is divided into three subtypes: carcinoma, adenocarcinoma, and squamous cell carcinoma.

Related work

Lung Cancer Detection Based on Electronic Nose Technology [J]. Pattern recognition algorithms are extremely important for electronic nose systems, but due to the assumption of equal misclassification costs, traditional learning algorithms usually prefer majority classes for class imbalance learning [1]. However, the process for physicians to review thousands of histopathology images is tedious, especially for inexperienced physicians. Therefore, the objective pathological diagnosis results can effectively help doctors choose the most appropriate treatment mode, thereby improving the survival rate of patients [2].

3D Convolutional Neural Networks and achieved state-of-the-art performance on the lung nodule detection and malignancy classification tasks in the publicly available Kaggle Data Science Bowl challenges. Although nodule detection systems are usually self-designed and optimized, we found it important to consider the coupling between detection and diagnostic components [3]. The Lung Screening Trial (NLST) demonstrated the efficacy of low-dose computed tomography (LDCT) in identifying early-stage disease, setting the stage for widespread implementation of lung cancer screening programs. However, the specificity of LDCT lung cancer screening is not ideal, with a significant false positive rate [4]. The exact location of pulmonary nodules is an important and complex task. Researchers in the field have been working extensively for almost two years. However, previous computer-aided detection (CAD) modules, such as transforming CT, segmenting lung nodules, and extracting features, are mostly complex and time-consuming, as more modules will be required to create a complete image processing system [5].

Accurate detection of pulmonary nodules in computed tomography (CT) images is a crucial step in the diagnosis of lung cancer [6]. To achieve this, it is necessary to reduce the false positive detection rate. Due to the heterogeneity of pulmonary nodules and their similarity to the background, it is difficult to distinguish true pulmonary nodules from numerous candidate nodules [7]. Advanced computer-aid techniques such as image processing and machine learning can help doctors to identify the Osteosarcoma lung nodules easier and more accurately. Convolutional Neural Networks (CNNs) are promising techniques since they could be trained by experienced radiologists. Nodule location and size information was critical for treatments that were obtained by object detector CNNs models [8].

Vulnerability detection is an essential technique for the cyber resilience of medical digital twins. Recently, deep learning (DL) has been applied to address the limitations of conventional machine learning in vulnerability detection [9]. Lung parenchyma segmentation is valuable for improving the performance of pulmonary nodule detection in computed tomography (CT) images. Traditionally, these two tasks are carried out separately. In this paper, we propose a deep multi-task learning (MTL) approach to integrate these tasks for better lung nodule detection. Three novel ideas lead to our proposed approach [10].

MATERIALS AND METHOD

A new model is presented to classify malignant nodules in CT images. Different from previous works using multi-stream networks to extract multi-scale features from images, a multi-convolution process is employed to learn discriminative scale features with fewer computational parameters and complexity. High-level semantic information is extracted from nodule images by using residual blocks as basic units. A fusion strategy is applied by fusing the features of the layer and the last residual block to further improve the performance of our model.

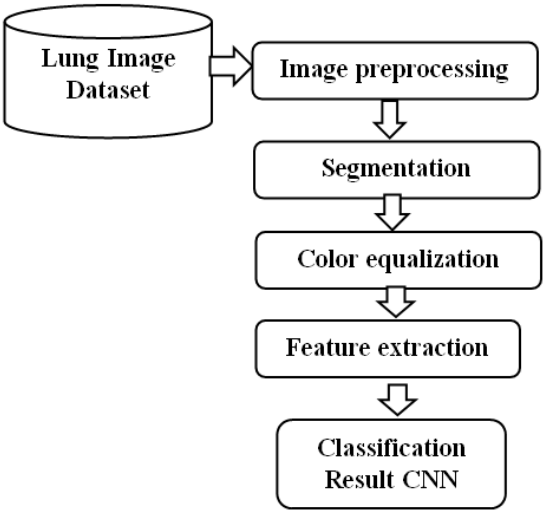

Fig 1: Proposed block diagram

Fig 1 shows the proposed block diagram for evaluating the risks based on CNN algorithms. The prospective lung malignancy diagnostic procedure, which comprises five phases: contrast enhancement and Noise reduction through pre-processing, thresholding algorithm to segment the lesion from its backgrounds retrieval of regions of concern, retrieval of descriptors from segmented lung lesions, and, in the last phase CNN has been used to assess if the lesion is abnormal or normal. The next sections provide detailed descriptions of the above-mentioned phases.

.

Dataset collection

The lung image of MRI image dataset is applied to evaluate the proposed CNN method. The dataset includes more than 300 Magnetic Resonance Images (MRI) and it's collected from various hospitals. The region of 256x256 were extracted from the different original region images.

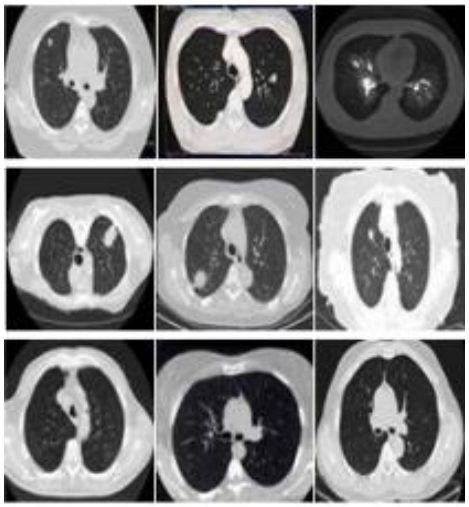

Fig 2: Sample Dataset collection

The entire dataset is already classified benign or malignant based on the physician suggestion. Figure 2 shows an example of sample collected MRI (Magnetic Resonance Images) lung image dataset.

Image Preprocessing

Image filtering with Bilateral Filter helps to improve the quality of image pixels. It includes the process of altering an image according to pixel values (blurring, smoothing, etc.). A bilateral filter is similar to a Gaussian convolution in that it is an average of pixels, but a bilateral filter considers changes in intensity, thus preserving the edges of the image. The symbols r and s represent the amount of filtering, the first equation represents the normalized weighted average, where the spatial Gaussian G_σs reduces the influence of distant pixels, and the range Gaussian G_σr reduces the influence of A pixels whose intensity values are different from B_ARange, and Range represents A quantity, such as a pixel value, refers to the pixel's position compared to space.

Lung Image segmentation

After the preprocessing stage, image segmentation is the action process of separating the image into different parts, which can conveniently extract the information of interest from the input image. The lung segmentation method based on the threshold technique can repeat the process until the T value is calculated. Once convergence is reached, the threshold is set to Tc, then to indicate body pixels, any pixel with an intensity above Tc is set to 0, for non-body pixels other pixel values are set to 1. Output The result of this step will appear as a thresholded image. Meanwhile, the subsequent stage of segmentation is background removal.

Feature Extraction based Support Social Spider Optimization (S^3O)

In this problem, society members include both sexes, and each spider is a solution. These spiders are randomly distributed with each attribute. 67-97% is the range for unselected female Nf. Interpretations of female and male spiders were characterized and weights were assigned to each spider. The public network describes aspects of the search space. A spider web can be thought of as a search space for breakthrough problems. Each spider position delineates each way out within the search space. The fitness value of the key is described by the weight of each spider. Information between groups or group members travels over public networks encrypted into small vibrations.

Classification based on Convolutional Neural Network (AI-CNN)

The convolutional layers of a generate feature maps by convolving different sub-regions of the image with the learned kernel. Additionally, non-linear activation functions can be applied, such as sigmoid, tanh, or rectified linear functions (ReLu). Another way to reduce the amount of computation is pooling layers, where regions of the image/feature map are selected and the maximum value within them is chosen as a representative pixel. Usually, the network uses the kernel function to obtain the output value of the dependent variable y in terms of independent x, because it produces a low error rate when classifying features. Generally, this network has many layers, such as input layer, hidden layer, and output layer, and each layer performs a specific function while taking output.

RESULT AND DISCUSSION

Image Accuracy Performance

The proposed system Convolutional Neural Network (CNN) for image processing is implemented to detect lung diseases.

Disease detection consists of image datasets, image preprocessing and classification. This describes a method for detecting lung diseases using images of leaves. Also, the algorithm is described as detecting lung disease.

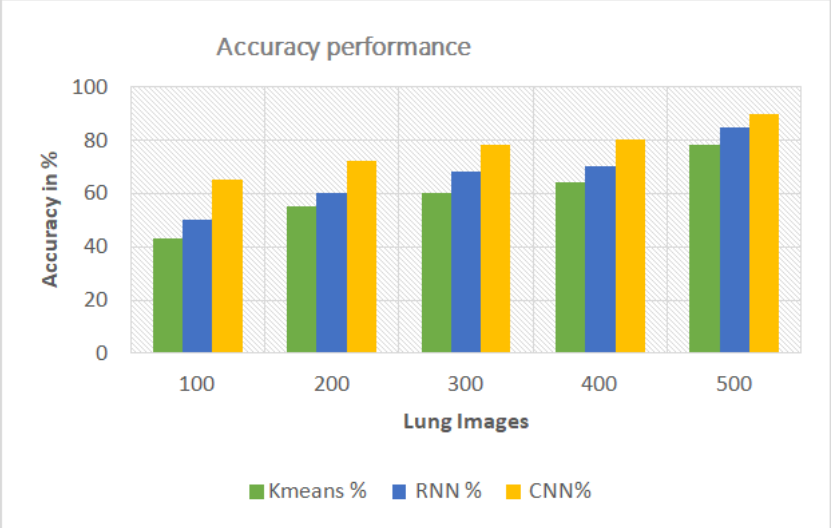

Fig 3: Analysis of accuracy performance

Fig 3 shows Accuracy performance analysis of the proposed algorithm convolutional neural network (CNN). The existing system K-means provides 78%, the improved feature selection based on eigenvector centrality provides 85%, then, the proposed algorithm Convolutional Neural Network (CNN) provides 98% accuracy performance.

Analysis of lung leaf Prediction performance

Prediction-level performance analysis of the proposed algorithm convolutional neural network (CNN) compared to other algorithms.

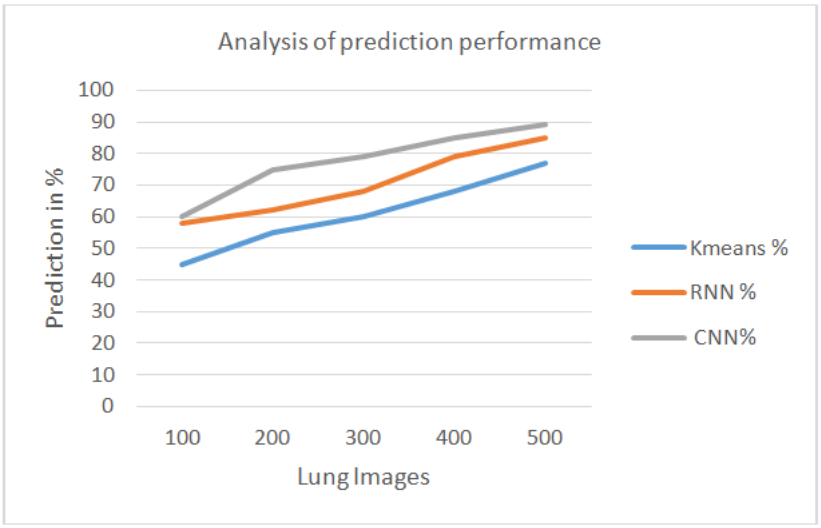

Fig 4: Analysis of prediction performance

Fig 4 shows the Prediction-Level Performance Analysis of Proposed Algorithmic Convolutional Neural Networks (CNN). The existing system Kmeans provides 75%, the improved feature selection based on eigenvector centrality provides 89%, and then the proposed algorithm convolutional neural network (CNN) provides 98% prediction performance.

Analysis of time complexity performance

Time complexity performance analysis of the proposed algorithm Convolutional Neural Network (CNN) compared with other algorithms.

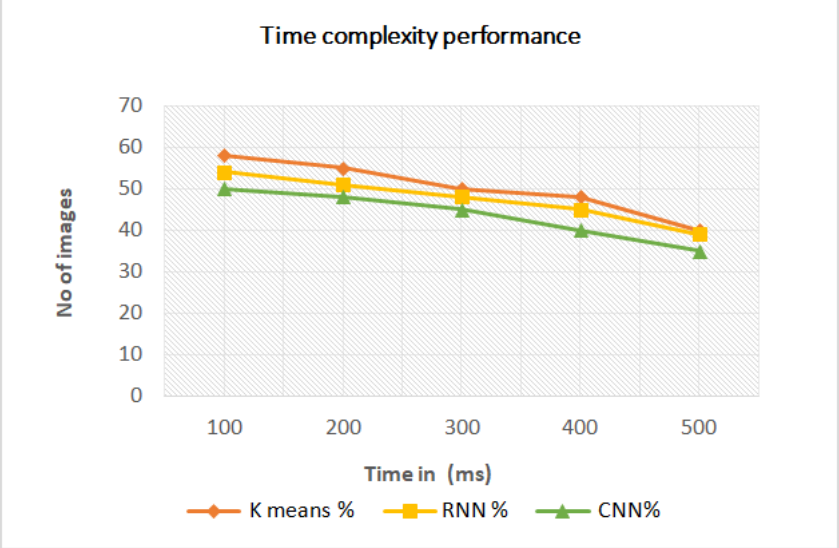

Fig 5: Analysis of Time complexity

Fig 5 shows Time complexity performance analysis of the proposed algorithm Convolutional Neural Network (CNN). The existing system Kmeans yields 44 (ms), the improved feature selection based on eigenvector centrality yields 40 (ms), then, the proposed algorithm convolutional neural network (CNN) yields the lowest time performance of 32 (ms).

CONCLUSION

Lung cancer is one of the deadliest diseases, claiming approximately one million lives each year. Given the current state of medicine, lung nodule identification on lung CT scans is critical. It is used in x-ray imaging of the lungs to find areas of the body that have developed cancer. Image processing techniques such as noise reduction, feature extraction, identification of damaged areas, and possible comparison with lung cancer history data can be used to locate lungs affected by cancer. This ultimately improves image quality. Then the CNN method is used to segment the image. This segmentation makes it easier to identify regions of interest. Then, a classification algorithm based on deep learning is used. A convolutional neural network (CNN) was implemented to classify images of three different classes of benign, adenocarcinoma, and squamous cell carcinoma. The model was able to achieve 98% training and validation accuracy. Plot the confusion matrix to measure the performance of the model.

REFERENCES

1. Sruthi G, Ram CL, Sai MK, Singh BP, Majhotra N, Sharma N. Cancer prediction using machine learning 2nd International Conference on Innovative Practices in Technology and Management (ICIPTM), Gautam Buddha Nagar, India. Vol. 2022; 2022. p. 217-21. doi: 10.1109/ICIPTM54933.2022.9754059.
2. Rawat D. Validating and strengthen the prediction performance using machine learning models and operational research for lung cancer IEEE International Conference on Data Science and Information System (ICDSIS), Hassan, India. Vol. 2022; 2022. p. 1-5. doi: 10.1109/ICDSIS55133.2022.9915898.
3. Mamun M, Farjana A, Al Mamun M, Ahammed MS. Lung cancer prediction model using ensemble learning techniques and a systematic review analysis. 2022 IEEE World AI IoT Congress (AIIoT), Seattle, WA, USA;2022:187-93. doi: 10.1109/AIIoT54504.2022.9817326.
4. Singh V, Khare Y, Balamurugan B. Lung cancer and a comparison of its present prediction algorithms 2nd International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE), Greater Noida, India. Vol. 2022; 2022. p. 1958-61. doi: 10.1109/ICACITE53722.2022.9823650.
5. Bharathi PS, PKRT. Neural Network based Earlier Stage Lung Cancer Prediction Scheme with Differential Learning Assistance International Conference on Advances in Computing, Communication and Applied Informatics (ACCAI), Chennai, India. Vol. 2022; 2022. p. 01-6. doi: 10.1109/ACCAI53970.2022.9752490.
6. Rawat D, Meenakshi L, Pawar L, Bathla G, Kant R. Optimized Deep Learn Model Lung Cancer Prediction Using Ann Algorithm 3rd International Conference on Electronics and Sustainable Communication Systems (ICESC), Coimbatore, India. Vol. 2022; 2022. p. 889-94. doi: 10.1109/ICESC54411.2022.9885607.
7. Qureshi R, Alam T, Wu J. Drug response prediction for lung cancer patients using biophysical simulation and machine learning IEEE International Conference on Bioinformatics and Biomedicine (BIBM), Las Vegas, USA. Vol. 2022; 2022. p. 3867-9. doi: 10.1109/BIBM55620.2022.9995622.
8. Roopa DEM, Rajadevi R, Shanthakumari R, Praveen E, SethuRaj S, Shyam AC. Mortality prediction of lung cancer from CT images using deep learning techniques Fifth International Conference on Computational Intelligence and Communication Technologies (CCICT), Sonepat, India. Vol. 2022; 2022. p. 13-8. doi: 10.1109/CCiCT56684.2022.00015.

9. Jabir K, Raja AT. A comprehensive survey on various cancer prediction using natural language processing techniques 8th International Conference on Advanced Computing and Communication Systems (ICACCS), Coimbatore, India. Vol. 2022; 2022. p. 1880-4. doi: 10.1109/ICACCS54159.2022.9785331.
10. Agarwal S, Thakur S, Chaudhary A. Prediction of lung cancer using machine learning techniques and their comparative analysis 10th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO), Noida, India. Vol. 2022; 2022. p. 1-5. doi: 10.1109/ICRITO56286.2022.9965052.