



Lung Cancer Detection Using Machine Learning Algorithms

¹Aboli Suresh Kalyankar, ²Prof. Dr. Mrs. Suhasini A. Itkar

¹Student, ²Professor

¹Computer Science,

¹PES Modern College of Engineering, Shivajinagar, Pune, India.

Abstract: Lung cancer is the cause of every sixth death around the world making it the second leading cause of death. Approximately 42 million people across the world suffer from cancer and this figure is continuously increasing. In India, approximately two and half million people are suffering from different types of cancer. If most cancers are detected in an early stage, then with the right remedy they can be cured. This paper details different methods used for the detection of illnesses like lung cancer. This paper also details the different machine learning techniques used to classify cancer into malignant and normal categories. Three machine learning algorithms Support Vector Machine, CART and Random Forest are used for classification. Prediction accuracy depends on the correctness of the input dataset and the algorithm used for the classification.

IndexTerms – Convolutional Neural Network, Deep Learning, Machine Learning, Cart4.5, Support Vector Machine, Random Forest, Image Processing

I. INTRODUCTION

Despite numerous developments in the field of diagnosis of illnesses like cancer, still, the tumor is one of the most risky and dangerous illness. Lung Cancer is the second most popular cause of death not only in India but across the world. Diagnosis of a tumor is a totally critical and important task. The detection and remedy of cancerous tumors are one of the most important research and study areas. If the cancer is identified at an early stage and if right remedy is given quickly after the detection of the disorder, the rate of survival for the patients can be improved. There are numerous strategies or techniques used to seize various types of cancers, like PET scan, CT scan, Mammograms, MRI, 3D Ultrasound, Single Photon Emission Computed Tomography (SPECT), etc. Mammograms are used for breast cancer detection analysis. CT scan, MRI and several other techniques are used to identify brain tumors, lung cancer, etc. The imaging method taken into consideration is mammogram and the type of classification strategies used are Feed forward back propagation, Extreme Learning Machine (ELM) ANN, backpropagation ANN, Particle Swarm Optimized Wavelet Neural Network, and CNN based on deep learning. For brain tumors, the imaging technique used is MRI and CT scan and the classification techniques considered are Level Set, K means Algorithm, SVM, Fuzzy Cmeans, Ad boost, Naïve Bayes classifier, and ANN classifier. For lung cancer, the medical imaging technique used is PET/CT. Also, classification techniques considered are FCM classifier, Feed Forward ANN, ANN, SVM binary classifier, and Entropy degradation method. Medical imaging techniques such as MRI and classification methods like ANN, SVM, and Multilayer perceptron neural network are considered for spine tumor detection. The two kinds of cancers are harmful and harmless growths. Standard MRI successions are for the most part used to separate various sorts of cerebrum cancers dependent on visual characteristics and different surface investigations of the delicate tissue. More than 120 classes of cerebrum cancers are known to be grouped in four levels as per the level of harm by the World Health Organization (WHO). A wide range of cerebrum cancers brings out certain indications dependent on the impacted district of the mind. The significant manifestations might incorporate migraines, seizures, vision issues, spewing, mental changes, memory slips, balance loss and so forth. Causes of cerebrum cancers are hereditary qualities, ionizing radiation cell phones, very low recurrence attractive fields, synthetic compounds, and head injury. Also, injury-resistant elements like infections and hypersensitivities may cause mild to severe cancer. The dangerous growths, otherwise called destructive cancers, are of two sorts - essential growths, which start from the cerebrum, and optional growths, which begin someplace and spread to the mind. The danger factors for mind growth are openness to vinyl chloride, neurofibromatosis, ionizing radiations, etc.

II. LITERATURE SURVEY

Wadood Abdul [1] used the architecture of CNN, a deep learning solution, in classifying the lung nodules as benign or malignant. LIDC-IDRI database was tested and the best results were obtained with 97.2% accuracy, 95.6% sensitivity, and 96.1% specificity, which outperforms the results obtained with other learning techniques. So, the ALCDC system performs better than the existing state-of-the-art systems.

Chao Ma, Gongning Luo, and Kuanquan Wang Waghmode et al. [2] stated that in this work, we introduce a new methodology that combines random forests and an active contour model for the automated segmentation of the glioma a type of tumor that

occurs in the brain and spinal cord from multimodal volumetric MR images. Specifically, we employ a feature representation learning strategy to effectively explore both local and contextual information from multi-modal images for tissue segmentation by using modality-specific random forests as the feature learning kernels.

Onur Ozdemir et al. [3] proposed that the entirely 3D convolutional neural networks achieve state-of-the-art performance for both lung nodule detection and malignancy classification tasks on the publicly available LUNA16 and Kaggle Data Science Bowl challenges. It is important to have the coupling between detection and diagnosis components as nodule detection systems are typically designed and optimized on their own.

Anum Masood, Bin Sheng, Po Yang, and Ping Li, [4] proposed experimented enhanced multidimensional Region-based Fully Convolutional Network (mRFCN) based automated decision support system for lung nodule detection and classification. The mRFCN is used as an image classifier tool for feature extraction along with the novel multi-Layer fusion Region Proposal Network (mLRPN) with position-sensitive score maps (PSSM) being explored. They applied a median intensity projection to leverage three-dimensional information from CT scans and introduced a deconvolutional layer to adopt the proposed mLRPN in the architecture to automatically select potential regions of interest.

Khan Muhammad, Salman Khan [5] stated that an in-depth review of the surveys published so far and recent deep learning-based methods for BTC. Our survey covers the main steps of deep learning-based BTC methods, including pre-processing, features extraction, and classification, along with their achievements and limitations.

Chun-Mei Feng, Yong Xu [6] et al. Stated that discriminative information and sparsity in the PCA model. Specifically, in contrast to the traditional sparse PCA, which imposes sparsity on the loadings, here, sparse components are obtained to represent the data.

David N. Louis et al. [7] stated that notable changes include the addition of brain invasion as a criterion for atypical meningioma and the introduction of a soft tissue-type grading system for the new combined entity of solitary fibrous tumor human gliopericytoma—a departure from how other CNS tumors are graded. Overall, this will facilitate clinical, experimental, and epidemiological studies that lead to improvements in the lives of patients with brain tumors.

Pär Salander et al. [8] proposed that most spouses witnessed months of global dysfunction preceding the symptom leading to physician consultation. The patient factors 'less alien symptoms', 'personality change' and 'avoidance'; the spouse factors 'spouse's passivity and 'spouse's successive adaptation'; and the physician factors 'reasonable alternative diagnosis', 'physician's inflexibility and 'physician's personal values' were identified as obstacles on the pathway to appropriate medical care.

Et al. [9] stated that the term brain tumor refers to a mixed group of neoplasms originating from intracranial tissues and the meninges with degrees of malignancy ranging from benign to aggressive. Each type of tumor has its biology, treatment, and prognosis and each is likely to be caused by different risk factors. Even benign tumors can be lethal due to their site in the brain, their ability to infiltrate locally, and their propensity to transform into malignancy. This creates problems in describing the epidemiology of these conditions and makes the classification of brain tumors a difficult science.

Jan J Heimans et al. [10] Proposed that a large number of Quality-of-Life instruments have been developed. The European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ-C30) and the MOS Short-Form Health Survey are two frequently used general HRQL instruments. A specific brain tumor scale is the Brain Cancer Module, which is designed to be used in combination with general questionnaires. HRQL measurement and neuropsychological examination were used to investigate the impact of radiotherapy and surgery in low-grade glioma patients and the influence of tumor volume, tumor localization, performance status and age in both low-grade and high-grade glioma patients.

Malavika Suresh [11] stated that a noncognitive computer user interface has the endowment to perceive gestures and execute commands based on that. The design is implemented on a Linux system but can be implemented by installing modules for python on a windows system also. OpenCV and KERAS are the platforms used for identification. Gesture displayed on the screen is recognized by the vision-based algorithms. Using background removal technique, an assortment of skin color masks was trained by Lenet architecture in KERAS for the recognition.

M. Gurbina, M. Lascu, D. Lascu [12] stated that differentiate between a normal brain and a tumor brain (benign or malign). The study of some types of brain tumors such as metastatic bronchogenic carcinoma tumors, glioblastoma and sarcoma are performed using brain magnetic resonance imaging (MRI). The detection and classification of MRI brain tumors are implemented using different wavelet transforms and support vector machines. Accurate and automated classification of MRI brain images is extremely important for Medi-Cal analysis and interpretation.

S. Somasundaram, R. Gobinath [13] stated that focus on six features that are entropy, mean, correlation, contrast, energy and homogeneity. The performance metrics accuracy, sensitivity, and specificity are calculated to show that the proposed method is better compared to existing methods. The proposed technique uses MATLAB to detect the location and the size of a tumor in the brain through an MRI image.

Dhanasekaran Raghavan [14] proposed that the target with the aid of the following major steps, which include: Pre-processing of the brain images segmentation of pathological tissues Fluid (CSF)), extraction of the relevant features from each segmented tissue and classification of the tumor images with NN. As well, the experimental results and analysis are evaluated using Quality Rate (QR) with normal and abnormal Magnetic Resonance Imaging (MRI) images.

G. Hemanth; M. Janardhan [15] stated highly efficient and precise methods for brain tumor detection, classification and segmentation. To achieve this precise automatic or semi-automatic methods are needed. The research proposes an automatic segmentation method that relies upon CNN (Convolution Neural Networks), determining small 3×3 kernels. By incorporating this single technique, segmentation and classification are accomplished. CNN (an ML technique) from NN (Neural Networks) wherein it has layer-based for results classification. Various levels involved in the proposed mechanisms are data collection, preprocessing, average filtering, segmentation, feature extraction, CNN via classification and identification. With the use of Data Mining (DM) techniques, significant relations and patterns from the data can be extracted. The techniques of Machine Learning (ML) and DM are being effectively employed for brain tumor detection and prevention at an early stage of cancer.

S.K. Lakshmanprabu [16] stated that Optimal Feature Level Fusion (OFLF) is considered to fuse low and high-level features of brain images; from this analysis, the images are classified as Benign or Malignant. From this implementation of medical images, the experiment results are evaluating performance metrics that are compared to existing classifiers. From the proposed MRI image classification process the accuracy was 96.23%, sensitivity was 92.3% whereas specificity was 94.52%; compared to the existing classifier. This proposed methodology is implemented in the working platform of MATLAB.

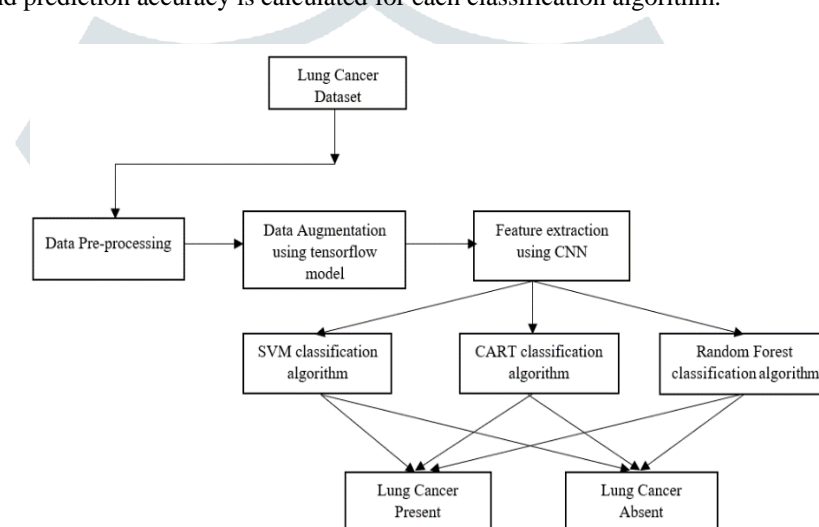
Panuwat Mekha et al [17] used the Random Forest classification algorithm, Decision Tree classification algorithm, Gradient Boosting classification algorithm and Naive-Bayes classification algorithm for the classification of rice leaf diseases such as Brown Spot Rice disease (BSR), Brown Spot Rice disease (BSR), Bacterial Leaf Blight disease (BLB). It is concluded that the random forest algorithm is having the maximum accuracy for image classification compared with other algorithms.

III. PROPOSED METHODOLOGY

In a proposed system, an experiment on lung cancer disease with a limited set of supervised data is demonstrated. A combination of a Convolutional neural network-based multimodal disease risk prediction model and SVM, CART and Random Forest algorithm for the classification of data with higher accuracy is used. The accuracy issue in the diagnosis of lung cancer with accurate stage predictions is solved in the proposed system.

A. ARCHITECTURE

In proposed system, firstly dataset is taken from Kaggle as an input. On this dataset, pre-processing is done where corrupted images are removed and unwanted noise is also eliminated. The output of data pre-processing is given for data augmentation. In data augmentation one image is converted into four types of images by using zoom, rotate, low brightness and high brightness functions. All augmented images are then processed for feature extraction. Features are extracted using convolutional neural network (CNN) algorithm. After features are extracted, classification is done by using Support Vector Machine (SVM), Classification and Regression Tree (CART) and Random Forest (RF) algorithms for lung cancer detection. These three algorithms are simultaneously deployed and prediction accuracy is calculated for each classification algorithm.



IV. CONCLUSION

The proposed system gives a hybrid approach for lung cancer detection systems over machine learning and CNN techniques. This system is a combination of CNN with SVM, Random Forest and the CART algorithm which resolves the accuracy problem. This system tries to improve accuracy and reduces the death rate. In the proposed method, three machine learning algorithms such as Random Forest, SVM and Cart are used for the detection of lung cancer and their accuracies are compared.

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