Lung Cancer Detection Using Machine Learning

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Abstract - Medical Image Processing Modern three-dimensional (3-D) medical imaging offers the potential and promise for major advances in science and medicine as higher fidelity images are produced. Due to advances in computer aided diagnosis and continuous progress in the field of computerized medical image visualization there is need to develop one of the most important fields within scientific imaging. From the early basis report on cancer patients it has been seen that more number of people die of lung cancer than from other cancers such as colon, breast and prostate cancers combined. Lung cancer are related to smoking (or secondhand smoke), or less often to exposure to radon or other environmental factors that's why this can be prevented. But still it is not yet clear if these cancers can be prevented or not. In this research work, approach of segmentation, feature extraction and CNN will be applied for locating, characterizing cancer portion.

KEYWORDS: Machine Learning, K-means, GLCM

I. INTRODUCTION

The image processing is a technique which is used for the enhancement of unprocessed pictures or images captured from different cameras from different origins. With the help of image processing, the significant data can be retrieved efficiently. In the last few years, various methods have been evolved in image processing techniques for the extraction of complicated information in an effective manner. The image processing technology is utilized by several operations in the last few years. This approach is widely utilized in army, clinical and investigational areas [1]. Some associations also use image processing approach for simplifying the manual workload and execution of positive actions. The image processing is applied inside numerous applications inclusively in order to improve the optical description of pictures. For the preparation of pictures, different calculations are implemented as well. The other name given to the image processing is digital image processing. The digital image processing comprises both visual and analog image processing. The digital image processing involves different methods. Image acquisition is the other name given to the imaging [2]. The visual and digital image processing can be performed with the help of imaging. This technique utilizes several domains like computer graphics for the generation of pictures [3]. This technique also provides assistance in the manipulation and modification of pictures. The picture or image is analyzed with the help of processor hallucination or computer vision. In lung cancer, anomalous cells multiply and grow in the form of a tumor. The lymph fluid which environs lung tissue carries the cancerous cells from lungs to blood. The lymph streams via lymphatic vessels. These lymph fluid drains into lymph nodules deployed in the lungs and in the middle region of chest area. The growth of lung tumor always carried out towards the middle area of chest due to the regular flow of lymph fluid towards the chest center. When a cancer cell leaves its origin area, metastasis happens [4]. This cancerous cell now goes towards a lymph nodule or to different body part with the help of blood flow. The prime lung tumor is a kind of cancer which originates from the lung. The compilation of lung pictures for the creation of data sample in the initial step. In Image Enhancement, image is processed and smoothened. This process enhances the picture quality and also eliminates noise from the picture. Thus this process offer superior key for the digital image processing [5]. Image enhancement procedure is related to the image preprocessing techniques. Image Segmentation allocates a digital picture into different sections like sets of pixels also recognized as super-pixels. The chief objective of this process is the alteration of a picture demonstration in an easier investigative manner. Picture sectioning is utilized for identifying the location of objects, limits and borders in pictures. In this process, a label is assigned to each pixel in a picture and thus the pixels with the identical label share definite features [6]. In Feature Extraction feature plays an extremely significant character. Different image preprocessing approaches such as binarization, thresholding, normalization, masking approach etc. are implemented on the sampled picture before the attainment of features. Various classifiers are used for performing the classification on the basis of retrieved characteristics. SVM stands for support vector machine and it is a classification algorithm that is based on optimization theory. As it maximizes the margin it is also known as a binary classifier. All the data points of an individual class are separated by the best hyperplane, this can be identified through the classification provided by SVM [7]. The main aim

of Naïve Bayes classifier is the implementation of a strategy where future objects are assigned to a group in the presence of a pattern of objects for every class. The applied variable vectors are demonstrated with the help of future entities. Decision Tree Classifier is considered as non-parametric supervised learning techniques and used for categorization and deterioration [8]. The main aim of this approach is the development of a model for the accurate prediction of an intended variable in accordance with several key variables. K-Nearest neighbor classifier depends on the learning by similarity. The n dimensional arithmetic qualities are utilized for the description of training sets.

II. LITERATURE REVIEW

Amir Roointan, et.al (2019) reviewed the development of inclusive molecular description of tumor lump [9]. It was clarified that that a fundamental role was played by the ailment biomarkers in the early detection and indulgent of tumor analysis. The presented work summarized the speedy development of biosensor equipments for lung tumor biomarkers discovery. In the near future, these intellect plans can have huge consequences on scheduled medical scrutiny of biomarkers of pharmacogenomics and pharmacogenetics importance. It was also noticed that more expansion in nanobiotechniques in association with nanobiocomposite and miniaturization approaches would considerably improve existing biodiagnostic capability for sensing tumor biomarkers in genuine organic models with sufficient compassion, actueness, sturdiness and price efficiency.

Jing Songa, et.al (2019) proposed a novel approach of microscopic hyperspectral imaging for the identification of ALK affected lung tumor [10]. In this approach, a household microscopic hyperspectral imaging scheme was utilized for capturing the pictures of five classes of lung tissues. The tested outcomes demonstrated that ALK affected set contained 77.3% comparative amount of cytoplasm while the ALK positive set contained 40.6% cytoplasm comparative quantity. The investigational outcomes related to quantitative scrutiny and ethereal curves demonstrated that the treatment of ALK affected lung tumor implemented with low concentrated medicines would be developed towards the ALK non-affected lung tumor.

Guobin Zhang, et.al (2019) presented a serious evaluation of the CADe scheme for automated lung cancer recognition with the help of CT descriptions for summarizing the existing developments [11]. These mechanisms included information attainment, preprocessing, lung image segmentation, nodule recognition and false positive diminution. A brief summary of superior nodule detection methods and classifiers was also provided on the basis of understanding, false positive value and other constrained data. After different studies it was evaluated that CADe scheme was essential for timely lung malignancy recognition.

Moritz Schwyzer, et.al (2018) estimated the usefulness of machine learning for lung tumor recognition in FDG-PET imaging in the scenario of ultralow amount PET scan [12]. In the absence of pulmonary tumor, the recital of artificial neural network on selective lung cancer patients was examined. The sensitivity rate of 95.9% and 91.5% was attained by the artificial neural system for lung cancer detection. The artificial neural network achieved precision of 98.1% and 94.2%, at average dosage and ultralow dosage PET 3.3%, correspondingly. The tested outcomes demonstrated that machine learning approach provided assistance to the completely automatic lung tumor recognition at extremely small and efficient radiation dosages of 0.11 mSv. It was also suggested that more advancements in this technique could enhance the accurateness of lung tumor testing approaches.

Suren Makajua, et.al (2017) stated that CT images could be used for the lung tumor recognition. The major objective of this study was the evaluation of different automated technologies, investigation of existing finest method, recognition of its restrictions and disadvantages and the projection of a decisive system with several advancements [13]. For this purpose, the lung tumor recognition approaches were classified on the basis of their lung cancer analyzing accurateness. In every stage, these lung cancer recognition methods were examined and their restrictions and disadvantages were considered. It was identified that different lung cancer detection techniques showed different precision. Some techniques showed least precision rate while some techniques showed good precision rate for lung cancer detection but no technique showed 100% precise lung cancer detection.

Madhura J, et.al (2017) presented a review of noise reduction approaches for lung cancer diagnosis [14]. It was stated that lung cancer was a solemn ailment which caused due to the abnormal growth of cells in the lung tissues. Amongst all the other kinds of tumors, the lung tumor was identified as the most incident cancer. Therefore this cancer became the reason of several cancer patients' deaths. The early recognition of lung cancer was very important for protecting various lives. The presented review study demonstrated a brief overview of lung tumor. This review work also described the different kinds of noises present in the pictures, techniques for the attainment of apparent pictures and noise elimination methods. A brief review on the existing noise elimination methods was also provided in this paper.

III. RESEARCH METHODOLOGY

This research work is related to lung cancer detection from the CT scan image using image processing techniques. The proposed methodology has the four phases for the lung cancer localization and characterization. Following are the various phases of the lung cancer detection:-

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1. Pre-processing:- The pre-processing is the first phase in which CT scan image is taken as input. The technique of image de-noising will be applied which will remove noise from the input image.

2. Segmentation:- In the second phase, the approach of region based segmentation will be applied which will segment the similar and dissimilar regions from the CT scan image The outh's segmentation technique is applied for the segmentation. The sectioned picture attained from thresholding comprises several benefits like lesser storage space, speedy dispensation velocity and easiness in exploitation in comparison with gray level picture that generally includes 256 steps. In the presented work, a gray scale picture is utilized for thresholding process. In this process, rgb picture is converted into binary picture. The obtained picture is in the form of black and white.

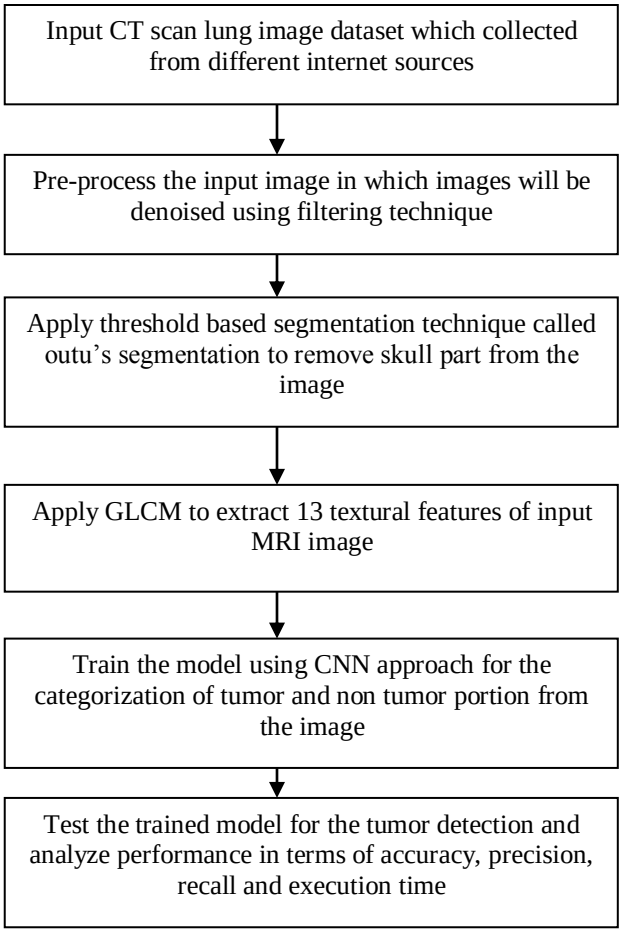
3. Feature Extraction:- The feature extraction is the third phase, in which GLCM algorithm will be applied for the feature extraction of the CT scan image In this step, the GLCM algorithm is applied for the feature extraction. The GLCM algorithm will extract the textural features of the input image. The GLCM algorithm extracts 13 features of the image for the tumor detection

$$\text{Energy} = \sqrt{\sum_{i,j=0}^{N-1} p_{i,j}^2}$$

$$\text{Entropy} = \sum_i p_i log_x i$$

$$\text{Contrast} = \frac{I_{max} - I_{min}}{I_{max} + I_{min}}$$

4. Classification:- In the last phase, the approach of CNN will be applied which can categorize and localize the cancer part.All the data points of an individual class are separated by the best hyperplane, this can be identified through the classification provided by CNN. In the CNN the largest the best hyperplane is described by the largest margin between the two classes. There are no interior data points when there is maximum width between the slabs parallel to the hyperplane which is also known as margin. The maximum margin in hyperplane is separated by the CNN algorithm.



IV. EXPERIMENTAL RESULTS

The proposed research is implemented in MATLAB and the results are evaluated by comparing proposed and existing techniques in terms of various performance parameters.

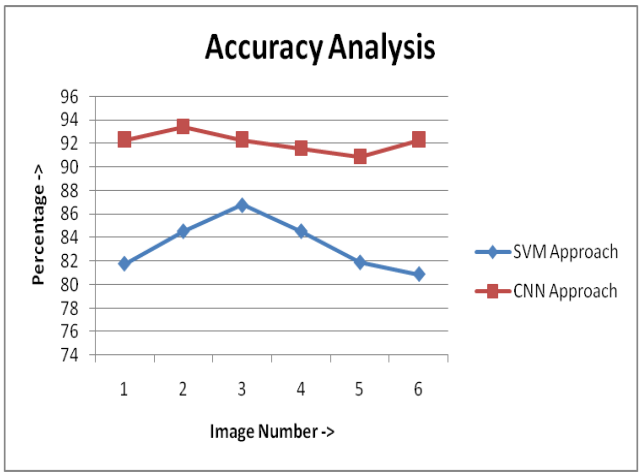


Fig 2: Accuracy Analysis

As shown in figure 2, the accuracy of the existing system which is SVM approach is compared with the proposed approach which is CNN approach. The system is tested on different number of images and it is analyzed that CNN give best results as compared to SVM approach.

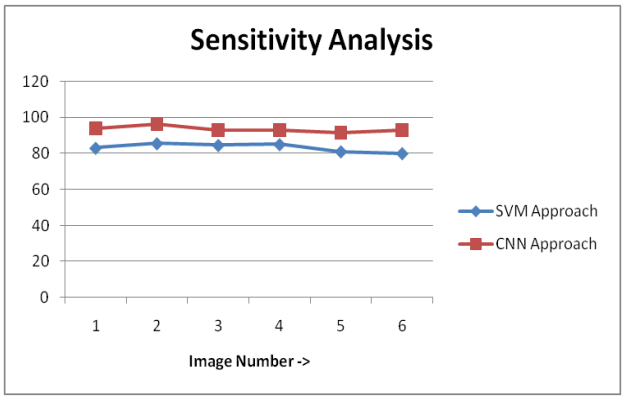


Fig 3: Sensitivity Analysis

As shown in figure 3, the sensitivity of the existing system which is SVM approach is compared with the proposed approach which is CNN approach. The system is tested on different number of images and it is analyzed that CNN give best results as compared to SVM approach.

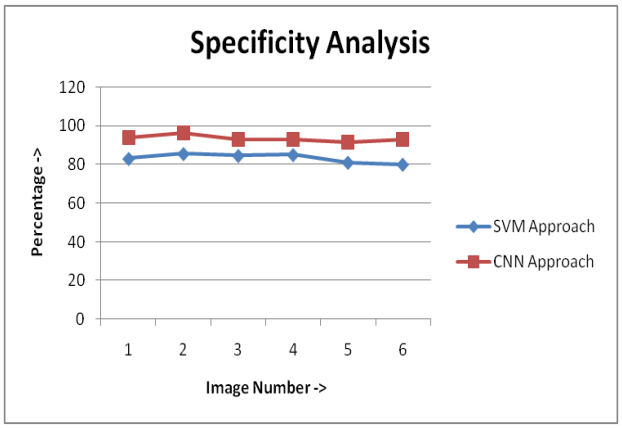


Fig 4: Specificity Analysis

As shown in figure 4, the specificity of the existing system which is SVM approach is compared with the proposed approach which is CNN approach. The system is tested on different number of images and it is analyzed that CNN give best results as compared to SVM approach.

V. CONCLUSION

For lung cancer detection image processing is used. There are three steps for the detection of cancer nodule. To detect the presence of cancer nodule CT scan images are used. Further the pre-processing composed of two processes. Image enhancement and image segmentation are that two processes. The purpose of image segmentation is to partition the image into meaningful region and to identify the object or relevant information from the digital image. The output from the segmentation process is goes to feature extraction stage. Features such as area, perimeter and irregularity are found out in feature extraction. On the basis of the extracted features the abnormality in lung are found out by the cancer cell identification module. The approach of GLCM and CNN will be used in this research work for localizing and characterizing cancer portion from the CT scan image. The proposed approach is implemented in MATLAB and results are analyzed in terms of accuracy. It is analyzed that with the proposed approach results are optimized upto 8 percent.

VI. REFERENCES

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