

Lung Cancer Detection Using Image Processing and Machine Learning HealthCare System

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Abstract: Lung most cancers is one of the extensive motives for loss of life amongst India. Many analysis and detection of lungs most cancers has been done the use of various records analysis and category techniques. Since the motive of lung cancer live obscure, prevention grow to be not possible, thus early detection of tumor in lungs is the best way to cure lung most cancers. Hence, lung most cancers detection system using picture processing and system gaining knowledge of is used to categorise the presence of lung most cancers in a CT- snap shots and blood samples. In spite of CT experiment reports are extra powerful than Mammography, therefore affected person CT scan pix are classified in normal and odd. The ordinary photos are subjected to segmentation to cognizance on tumor component. Classification achieved on functions extracted from the pictures. The green technique to hit upon the lung most cancers and its levels effectively and also intention to have more correct effects by means of the use of SVM and Image Processing strategies.

I. INTRODUCTION

One of the maximum lethal sorts of the sickness, lung most cancers, is liable for the passing away of about one million human beings every year. The present day situation in the world of medicine makes it without a doubt important to carry out lung nodule identity on chest CT scans. This is because of the truth that lung nodules are getting an increasing number of common. As an immediate end result of this, the deployment of CAD systems is needed to be able to accomplish the objective of early lung cancer identity [1]. When doing a CT experiment, sophisticated X-ray gadget is utilized with a purpose to seize pictures of the human body from some of different angles. Following this, the pictures are fed into a pc, which methods them in this sort of manner as to produce a pass-sectional view of the inner organs and tissues of the frame [2]. A CAD method become skilled and assessed in separate experiments. One studies used a laptop simulation the use of ground truth that became generated through computers. In this work, the cardiac-torso (XCAT) digital phantom become used to replicate 300 CT scans. The 2nd studies made use of

affected person-based totally floor fact the use of human subjects and implanted round nodules of varied sizes (i.e., 3-10 mm in diameter) at random inside the lung place of the simulated snap shots. CT pix from the LIDC-IDRI dataset had been used to create the CAD approach. 888 CT pictures left for processing after CT scans with a wall thickness of extra than 2. Five mm were disregarded. In all investigations, a ten-fold go-validation method turned into used to evaluate community hyperparameterization and generalization. The detection sensitivities had been measured in reaction to the common false positives (FPs) according to image to assess the overall accuracy of the CAD approach. Using the unfastened-receiver reaction operating characteristic (FROC) curve, the detection accuracy within the affected person studies changed into further evaluated in nine previously posted CAD investigations. The suggest and popular error among the anticipated value and ground fact were used to degree the localization and diameter estimate accuracies. In all investigations, the average consequences during the 10 move-validation folds confirmed that the CAD approach had a excessive level of detection accuracy. In the affected person trial, the corresponding sensitivities had been ninety.Zero percentage and 95.4 percentage, showing superiority within the FROC curve evaluation over many traditional and CNN-primarily based lung nodule CAD techniques. In each investigations, the nodule localization and diameter estimation mistakes have been fewer than 1 mm. The CAD method that become created become exceedingly efficient in phrases of computing [3]. It is possibly that intravenous injection of contrast (X-ray dye) can also substantially improve the best of CT

imaging, that may reveal a extensive type of organs and tissues. This is one of the potential advantages of contrast injection. In addition, CT scans can reliably hit upon kidney or gallstones, as well as abnormal fluid buildup or enlarged lymph nodes inside the stomach place or pelvis. This is similarly to the capability to come across gallstones and kidney stones. Because the CT scan is unable to provide a specific prognosis of certain organs, including the belly, it is able to, however, be used to reveal abnormalities inside the smooth tissues which are located close by, offering an indirect analysis of these organs [4, 5]. If lung cancer is detected at an early degree, the American Cancer Society estimates that a affected person has a forty seven percent risk of surviving the sickness. It is quite not going that X-ray pictures might also accidentally display lung most cancers in its earlier levels [6]. It is famously tough to discover lesions which are spherical and feature a diameter of 510 millimeters or less. A CT test of a affected person identified with lung cancer is proven in Figure 1. The processing of pictures is an vital activity for a diverse type of commercial enterprise sectors. It is utilized in X-ray imaging of the lungs a good way to locate areas that include cancerous growths. In order to detect areas of the lung that have been stricken by most cancers, photo processing strategies along with noise discount, function extraction, identification of damaged regions, and perhaps a comparison with statistics on the clinical history of lung most cancers are applied. The majority of the time, virtual photograph processing makes use of a various set of methods to merge some of awesome factors of a picture right into a unmarried coherent entity. This research takes an innovative approach so that you can 0 down on a

specific factor of the general lung photograph. The split location can be seen in quite a few methods, which include from exceptional viewpoints and when illuminated in special methods. When utilising this approach, one of the key advantages is the capacity to differentiate between quantities of a image which have been impacted via cancer and sections which have not been suffering from most cancers via comparing the intensity of the 2 units of pix [6, 7]. As a result of the reality that almost all of sufferers are recognized at a greater advanced level, lung cancer is the number one purpose of dying as a result of cancer. There is currently no risk of a a success treatment being evolved. Lung most cancers is consistently ranked as one of the most deadly kinds of the disease, irrespective of whether a rustic is industrialized or developing. The occurrence of lung cancer in growing nations is on the upward thrust because of a longer existence expectancy, extra urbanization, and the adoption of Western lifestyles. The early detection of most cancers and the survival of human beings with the disease are both crucial to the control of lung sickness [8, 9]. The literature survey phase carries a overview of numerous techniques for the category and detection of cancer the usage of image processing and category. The method phase provides accurate class and prediction of lung cancer the use of gadget mastering and picture processing-enabled technology. First, photographs are received. Then, pix are preprocessed using the geometric mean filter out. This consequences in improving photograph quality. Then, pics are segmented the use of the K-method algorithm. This segmentation enables in the identity of the place of interest. Then, machine mastering class strategies are

implemented. The end result section incorporates details associated with the dataset and outcomes executed by means of numerous strategies. To reduce the quantity of statistics that must be broken down, this look at illustrates a method to separate the lung tissue from a chest CT. We will in all likelihood have a totally automatic computation for slicing the lung tissue into sections and for separating the 2 aspects of the lung as nicely. The threshold proven inside the photograph separates fats from low-thickness tissue (the lungs). Cleaning is achieved to take away the commotion, air, and flight routes. Finally, a mixture of morphological operations is used to tame the unexpected limit. The database used for the evaluation turned into acquired from a e book that instructs radiologists. The cutting-edge analysis indicates that the linked division computation attempts to address a wide range of various occasions. The portioned lungs' textural accents had been taken off, and it become supplied. The neurological machine is used to differentiate between the diverse lung diseases [10].

II LITERATURE SURVEY

Palani and Venkatalakshmi [11] have given predictive modeling of lung cancer infection by way of non-stop tracking. They did this with the aid of the use of fuzzy cluster-related augmentation with a categorization. The fuzzy clustering approach is critical to the manufacturing of correct image segmentation. We as a substitute utilized the bushy C-way clustering method on the way to accomplish our intention of similarly disentangling the traits of the transitional location from the ones of the lung most cancers picture. In

this unique research, the Otsu thresholding method became implemented so that it will distinguish the transition vicinity from the lung cancer representation. In addition to this, the right part image is utilized at the side of the morphological, thinning system with the intention to enhance the presentation of the segmentation. The contemporary Association Rule Mining (ARM), the conventional decision tree (DT), and the CNN are blended with a novel incremental class technique with a purpose to accomplish class in an incremental fashion. In order to perform the operations, popular snap shots from the database were utilized, in addition to the maximum current information on the affected person's health accrued from IoT gadgets that had been connected to the patient. The fruits of the studies indicates that the predictive modeling device has emerge as extra correct.

Deep residual getting to know become utilized by Bhatia et al. In order to expand a method for figuring out whether or not a CT photograph carries lung cancer. The researchers have devised a preprocessing pipeline via making use of the UNet and ResNet fashions. This pipeline is supposed to focus on and extract features from sections of the lung which might be cancerous. An ensemble of XGBoost and random wooded area classifiers is used to accumulate predictions approximately the likelihood that a CT test is malignant. The consequences of each classifier's predictions are then pooled, and the very last result is used to determine the probability that a CT experiment is malignant. The LIDC-IRDI has an accuracy this is eighty four percent better than that of standard techniques [12].

Joon et al. [13] segmented lung cancer the use of an active spline model as their method of evaluation. With X-ray images, thru using this approach, X-ray photos of the lung were acquired. To begin, it's miles advocated that a mean filter out be used for noise detection while the preprocessing level is being accomplished. During the phase dedicated to segmentation, similarly K-means and fuzzy C-method clustering are applied for the reason of feature capture. In this studies, the remaining function retrieval outcome is reached after the X-ray image has been segmented. The advocated model become evolved via the application of the SVM approach for classification. In order to simulate the findings of the most cancers detection machine, MATLAB is applied. The motive of this observe became to stumble on and categorize lung most cancers by way of utilising pics that were both everyday and malignant.

Nithila and Kumar [14] have advanced an lively contouring model, and this model has been deployed. An software of a version degree set characteristic became used for the segmentation of the lungs. It is important to well phase the parenchyma with a purpose to arrive at the proper analysis of lung illness. CT, which stands for computerized tomography, become the primary imaging modality to make use of photo evaluation on this manner. A giant advancement in CT lung photo segmentation has been made by using the development of the SBGF-new SPF function, which stands for selective binary and Gaussian filtering-new signed pressure force. By taking this approach, external lung barriers have been identified, and inefficient enlargement on the margins has been avoided. Comparisons are being

made among the presently underneath attention algorithm and four awesome active contour models. The consequences of the checks exhibit that the approach that became provided is reliable and can be computed right away [13].

Lakshmanaprabu et al. [15] created OODN (Optimal Deep Neural Network) by means of decreasing the range of traits in lung CT scans and comparing it to different classification algorithms. This allowed them to layout a greater correct method. The adoption of an automated class technique for lung cancer has cut down on the amount of time wanted for human labeling and eliminated the possibility of errors being made by the person doing the labeling. According to the findings of the researchers, the performance of the system getting to know algorithms in phrases of accuracy and precision in the detection of everyday and peculiar lung snap shots has substantially multiplied. According to the findings, the research turned into successful in classifying lung pix with a peer specificity of 94.56 percentage, a level of accuracy of ninety six.2 percentage, and a level of sensitivity of 94.2 percentage. It has been proven that it is viable to boom the performance of cancer detection in CAT scans [14]. The studies has proven that that is the case.

Talukdar and Sarma have located a sturdy emphasis on the use of photo processing methods for the diagnosis of lung most cancers (2018). Deep getting to know methodologies are being carried out to the have a look at of lung most cancers. The maximum common sort of most cancers, lung most cancers, is taking the lives of an alarmingly excessive number of people. The likelihood of an person acquiring lung most

cancers turned into evaluated with a computed tomography (CT) experiment. The growth of precancerous tissue is known as “nodules,” and their presence is utilized as a wellknown indication of most cancers. Educated radiologists are capable of discover nodules and frequently expect their dating with cancer. However, those radiologists are also able to producing false effective and false negative findings. Because the patient is beneath persistent stress, a wonderful quantity of records is evaluated, and a choice this is appropriate for the patient is made in a timely manner. As a result of this, growing a computer-aided detection gadget that is capable of unexpectedly detecting capabilities primarily based at the enter of radiologists is most likely to be the answer [15].

Yu et al. Have acquired histopathology complete-slide slides of lung most cancers and squamous mobile carcinoma which have been stained with hematoxylin and eosin (2016). Patients' snap shots were taken from TCGA (The Cancer Genome Atlas) and the Stanford TMA (Tissue Microarray Database), plus an extra 294 pix. Even whilst carried out with the best of intentions, an evaluation of human pathology can't well expect the affected person's analysis. A overall of nine,879 quantitative elements of an picture had been retrieved, and machine learning algorithms had been used to pick out the maximum critical aspects and differentiate among sufferers who survived for a brief period of time and people who survived for a long time frame after being diagnosed with degree I adenocarcinoma or squamous cell carcinoma. The researchers used the TMA cohort to validate the survival fee of the recommended framework (P0.036 for tumor kind). According to the findings of this examine, the

traits which can be created routinely can be capable of forecast the analysis of a lung most cancers affected person and, therefore, may additionally assist in the improvement of customized medicine. The methodologies that have been outlined can be applied inside the analysis of histopathology snap shots of diverse organs [16].

Pol Cirueda and his colleagues used an aggregation of textures that stored the spatial covariances across functions consistent. Mixing the neighborhood responses of texture operator pairs is finished the usage of traditional aggregation features just like the common; despite the fact that, doing so is a important step in fending off the problems of conventional aggregation. Pretreatment computed tomography (CT) scans were applied with a view to help in the prediction of NSCLC nodule recurrence prior to the management of drugs. After that, the encouraged methods had been put to use so that it will compute the sort of NSCLC nodule recurrence consistent with the manifold regularized sparse classifier. These discoveries, which provide up new look at opportunities on the way to use morphological, tissue tendencies to evaluate most cancers invasion, want to be showed and investigated further. However, this may now not be possible with out greater research. When modeling orthogonal facts, the writer targeted at the textural characteristics of nodular tissue and matched those characteristics with other variables together with the dimensions and shape of the tumor [17].

The creation of a technique for the early detection and accurate prognosis of lung cancer that makes use of CT, PET, and X-ray pics by Manasee

Kurkure and Anuradha Thakare in 2016 has garnered a significant quantity of attention and exuberance. The usage of a genetic algorithm that permits the early identification of lung cancer nodules by diagnostics permits for the optimization of the findings to be accomplished. It was important to appoint both Naive Bayes and a genetic set of rules so one can properly and hastily classify the various tiers of cancer photographs. This changed into done which will circumvent the intricacy of the generation technique. The categorization has an accuracy price of as much as eighty percentage [18].

Sangamithraa and Govindaraju [19] have used a preprocessing approach so one can take away the unwanted unaffected by way of using median and Wiener filters. This became performed which will enhance the first-class of the information. The K-means approach is used to do the segmentation of the CT images. EK-imply clustering is the technique this is used to obtain clustering. To extract comparison, homogeneity, location, corelation, and entropy features from pix, fuzzy EK-suggest segmentation is utilized. A lower back propagation neural network is applied if you want to accomplish the classification [20].

According to Ashwini Kumar Saini et al. (2016), a precis of the types of noise that would motive lung cancer and the strategies for casting off them has been provided. Due to the reality that lung most cancers is taken into consideration to be one of the most lifestyles-threatening sorts of most cancers, it's miles vital that it be detected in its in advance degrees. If the cancer has a excessive prevalence and mortality price, that is some other indication that it's far a especially risky form of the ailment. The excellent of the virtual dental X-ray image

evaluation must be considerably advanced for the look at to be successful. A pathology prognosis in a health center remains the gold preferred for detecting lung most cancers, notwithstanding the reality that one of the number one focuses of studies right now is on locating ways to reduce the quantity of photograph noise. X-rays of the chest, cytological examinations of sputum samples, optical fiber investigations of the bronchial airways, and very last CT and MRI scans are the diagnostic gear which might be applied most regularly in the detection of lung malignancies (MRI). Despite the supply of screening strategies like CT and MRI that are extra touchy and accurate in many elements of the sector, chest radiography continues to be the primary and most prevalent sort of surgical treatment. It is habitual exercise to check for lung most cancers in its early levels the usage of chest X-rays and CT scans; however, there are problems related to the scans' susceptible sensitivities and specificities [19].

Neural ensemble-primarily based detection is the name given to the automated technique of illness diagnosis that was advised in Kureshi et al.'s research [21] (NED). The method that became advised applied function extraction, classification, and analysis as its 3 main additives. In this experiment, the X-ray chest films that have been taken at Bayi Hospital had been applied. This approach is suggested because it has a high identification charge for needle biopsies in addition to a reduced number of false poor identifications. As a end result, the accuracy is progressed automatically, and lives are saved [22]. Kulkarni and Panditrao [23] have created a novel algorithm for early-stage cancer identification that is extra correct than previous methods. The

application uses a generation that approaches images. The quantity of time that passes is one of the elements that is taken into consideration while searching out anomalies in the goal images. The function of the tumor can be seen quite absolutely within the original image. In order to get advanced outcomes, the techniques of watershed segmentation and Gabor filtering are applied on the preprocessing stage. The extracted hobby sector produces three phases that are helpful in spotting the numerous levels of lung cancer: eccentricity, region, and perimeter. These stages may be discovered inside the extracted interest area. It has been discovered that the tumors are available in a variety of dimensions. The proposed approach is capable of presenting precise measurements of the size of the tumor at an early level [21].

Westaway et al. [24] used a radiomic technique to perceive three-dimensional homes from photos of lung most cancers for you to offer prediction facts. As is widely known, classifiers are devised to estimate the period of time an organism will be capable of maintain current. The Moffitt Cancer Center in Tampa, Florida, served as the location from where these pictures for the experiment's CT scans were acquired. Based on the residences of the pics produced through CT scans, which might also advise phenotypes, human evaluation can be capable of generate more correct predictions. When a decision tree become used to make the survival predictions, it was possible to accurately forecast seventy-5 percent [23] of the results.

CT (computed tomography) pictures of lung most cancers had been categorised with the usage of a lung most cancers detection technique that uses picture processing. This approach become

described by means of Chaudhary and Singh [25]. Several other methods, such as segmentation, preprocessing, and the extraction of capabilities, have been investigated to date. The authors have distinguished segmentation, augmentation, and function extraction, each in its personal unique section. In Stages I, II, and III, the cancer is contained inside the chest and manifests as larger, more invasive tumors. By Stage IV, but, cancer has unfold to different elements of the body [24], at which point it's miles said to be in Stage IV.

Existing work:

Some of the software are design to detect the lungs cancer but they are not accessible to the normal patient or else they are not free of cost. Because of they are available offline hence it consume more space to store all the dataset hence it increase space complexity and make that application heavy.

III PROPOSED SYSTEM

In this proposed system, our main aim to detect the lungs cancer and its stages using CT scan images. The user will upload his CT scan report on website and hence the query is generated at the client side and send it to the sever side. Some algorithm are performed on it and generated output is again send it to the client side and guide him about whether the user is having cancer or not? And in which stage? Following are algorithms of proposed system as shown in Fig.1.

Image acquisition:-

The first step we gone follow in this system is acquiring CT scan images of user. As compared to X-ray and MRI images CT scan replica have less noise therefore CT scan image is taken as input. To get better accuracy and less distortion, these images are used. The input images are acquired from ELCAP Public Lung Image DB which contains near about 200 lung images of both

cancerous and noncancerous patient CT scan report. We will also take blood sample as a input with CT Scan images which is the one of the perimeter to check the lungs cancer detection while performing Machine learning algorithm which will be explained further. In the obtained images more noise is observed. Pre-processing of images is used to improve the contradiction and clarity of images. Hence, various techniques such as Grayscale conversion, noise reduction, and binarization techniques are applied to get image in required form.

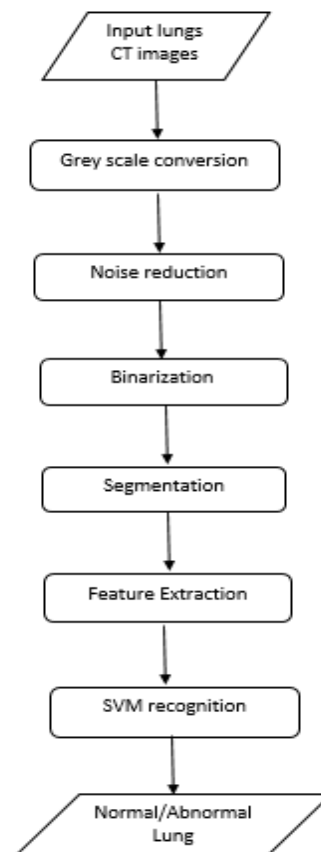


Fig.1 Flow Chart of Algorithms

Grayscale conversion:

In this step an RGB image is converted to Grayscale image. A pixel is made of 4 components such as alpha, red, green, blue .where alpha determine the transparency while red, blue, and

green determines the color of pixel. We can represent these 4 components as, A stands for alpha, R stands for Red, G stands for Green, B stands for Blue. Each of these components (ARGB) having the values in between 0 to 255; where 0 means the component is absent and 255 means component is fully present. We can represent the value between 0 to 255 using 8-bits. Hence we need 32bit to represent the pixel. For converting the color image into grayscale we find the average of it; and replace the R,G,B pixel value with Average

$$\text{[Average:- } \frac{R + G + B}{3} \text{]}$$

ALPHA								RED								GREEN								BLUE									
16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
7	6	5	4	3	2	1	0										7	6	5	4	3	2	1	0									

Noise Reduction:

Noise reduction is the mechanism of discarding noise from grayscale image. In Proposed system median filter is used to remove the noise. Therefore median filter will arranged nearby pixels as per the intensity and the following median value turn out to be recent value for the central pixel and it is a non- linear function using in image processing. This filter is more effective while reducing noise, maintain edges and it also removing „salt and pepper“ type noise.

Binarization:

Binarization is the process of converting the grayscale image (which is having pixel range from 0 to 255) into binary image (which is having (0, 1)) by a threshold value of 175. The pixel value which is less than 175 are turned to white (0) and pixel value which is greater than 175 are turned to black (1).

Let input image is $p(m,n)$, T can be defined as threshold value and the output image is $q(m,n)$ of thresholding process therefore mathematically it can be expressed as:-

$$q(m,n)=1, \text{ if } p(m,n) \geq T \text{ otherwise } 0.$$

Segmentation

Image segmentation act as a part of screening in medical imaging field. Segmentation algorithm divides the replica into multiple meaningful segments. In computerized vision system and recognition, the digital image is divided into many segments. The main objective of segmentation is to make simple and transform the delegation of CT scan replica into more informative and examine it easily in details. Segmentation of Image is used to reduce unnecessary information in the image and locate object, boundaries like lines, curves etc. in images. In the proposed system, segmentation process consist of some steps. Firstly, it transforms the original/real image into edge only image. The transformed edge only image into dilated image and filled image and at last finally both (left and right lungs) are segmented.

Feature Extraction:

Feature Extraction is an essential step/stage that uses algorithms and techniques to recognize the patterns of an replica. The Segmented output are given as input for the feature extraction. The following features are covered under feature extraction such as Area, Perimeter and Eccentricity and these all are scalar quality.

These features are declared as:

Area: Area that gives absolute variety of overall lump pixel element within the extracted ROI. Transformation function generates array of region of interest (ROI) that contains pixels with 255 values.

$Area = a = (a_l, m, P_{ROI}[Area] = l, Q_{ROI}[Area] = m)$ where l and m are the pixels among the figures. $P_{ROI}[]$ is vector contain ROI x region, $Q_{ROI}[]$ is vector contain ROI y region.

Perimeter: Perimeter will gives an actual number of nodule elements which is a scalar quantity. It will tell the length of extracted ROI boundary. The transformation function is created with atleast one pixel which contain 0 value under array of edge that contain pixel with 255 values.

$Perimeter = X = (X_l, m, P_{edge}[X] = l, Q_{edge}[X] = m)$ Where, $P_{edge}[]$ and $Q_{edge}[]$ are vector represents the region of the l th and m th pixel respectively forms curve.

Eccentricity: This metrical value for the nodule can be decided if circularity or irregularity portion will be 1 then it is in circular shape and if circularity or irregularity will be not greater than 1 then it is in different shapes.

$$Eccentricity = \frac{\text{Length of major axis}}{\text{Length of minor axis}}$$

IV RESULTS AND DISCUSSION

The standard database images of lungs are taken from the available Database from IMBA Home (VIA-ELCAP Public Access)[5]. Fig2 contains the standard database image of lung and fig3 contains the image that we get after thresholding. But after thresholding we cannot get exact tumor area in some cases.



Fig 2. Lung Image



Fig 3. Image obtained after thresholding

Since, we cant get perfect result after thresholding for all images, K-means clustering is used to reduce this error. Because sometimes bone defect or other abnormalities in lung can also be shown as lung tumor. Fig 4 and Fig 5 shows lung image and image after preprocessing. Fig 6 shows the extracted tumor region from lung image



Fig 4. Lung image



Fig 5. Image After Thresholding

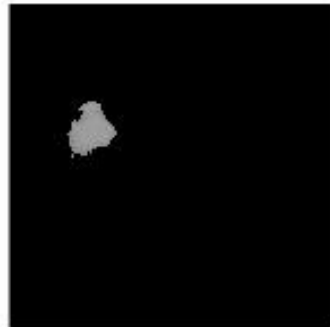


Fig 6. Tumor is Extracted

V CONCLUSION

Lungs cancer is a serious disease that described by unlimited growth of cells in tissues of the lungs. Detection of lungs cancer in earlier stages is very crucial it can save many lives. In our proposed system we are describing the lungs cancer and its stages using different image processing and machine learning algorithms such as, grayscale conversion, noise reduction and binarization. All this algorithms are used for the pre-processing of the given CT scan image. ROI is defined from main CT scan image. For pre-processing stages, median filter and segmentation gives accurate result. From the extracted ROI some features are extracted i.e., Area, Perimeter, and Eccentricity. This characters are helpful for defining the lungs

cancer at earlier stages. For grouping purpose Support Vector Machine (SVM) classifier classifies the positive and negative samples of lung cancer images in this system.

FUTURE SCOPE:

In Future work, proposed system will help to suggest to diagnose cancer in different organs of human being. Proposed technique can be implemented for specific cancer i.e., group of diseases which help in reducing the growth of abnormal cells or spreading to other parts of body.

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