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Detection of Lung Cancer in CT Images Using Mean Shift Algorithm

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Abstract-Cancer is the leading cause of death worldwide. The mortality rate of lung cancer is the highest among all other types of cancers, contributing about 1.3 million deaths/year globally. Lung cancer can be detected using chest radiograph and CT scan. Computer-Aided Detection (CAD) system can provide an effective solution by assisting radiologists in increasing the scanning efficiency and potentially improving nodule detection. Image processing is one of most growing research area these days and now it is very much integrated with the medical and biotechnology field. The automated CAD system is proposed in this paper for detection of lung cancer form the analysis of computed tomography images by performing nodule segmentation through mean shift segmentation and morphological operations. The purpose is to find positions and shape of the specific cancerous structures in lungs.The CAD of lung CT generally first segments the area of interest (lung) and then analyzes the separately obtained area for nodule detection in order to diagnose the disease. This in turn helps the physician to analyze the tumor shape and size and help in removal of chances of human error and improve accuracy.

Keywords -Lung Cancer,CT scan, Mean Shift, Computer aided diagnosis, Morphology Operation.

I. INTRODUCTION

CANCER is one of the most serious health problems in the world. In 2012, cancer is leading cause of death worldwide, accounting for 8.2 million deaths. The mortality rate of lung cancer is the highest among all other types of cancers, contributing about 1.3 million deaths/year globally [1]. According to the report of World Health Organization (WHO), death rate caused by lung cancer has already jumped to the highest among all cancers in the world. It is responsible for more than 25% of all cancer-related deaths every year and kills more people than breast, colon and prostate cancers combined [2].

Usually, lung cancer does not cause symptoms early in the disease process, and is mostly diagnosed at a late stage in a clinical setting, when the probability of cure is rare. Only 16% of lung cancer patients are diagnosed before their diseases have spread to other parts of their bodies (e.g., regional lymph nodes and beyond), compared to more than 50% of breast cancer patients and 90% of prostate cancer patients [3]. These figures call for effective cancer control and prevention strategies such as lung cancer screening programs.

Lung cancer can be detected using chest radiograph and Computed Tomography (CT) scan. Chest radiograph is used to investigate the occurrence of the disease however the extent and the type of the disease can be exposed using CT scan. In CT scan nodule is defined as a rounded and irregular opaque figure on a CT scan, with a diameter up to 30mm. Each scan contains hundreds of images that must be evaluated by a radiologist, which is a difficult process. So for this reason, the use of a Computer-Aided Detection (CAD) system can provide an effective solution by assisting radiologists in increasing the scanning efficiency and potentially improving nodule detection [4]. CAD is a relatively new technology combining elements of computer vision: an application area of artificial intelligence, and digital image processing. The applications of CAD include identification of cancer in lung(s), breast(s), and colon, coronary artery disease, heart congenital defect, and nuclear medicine. In radiology CAD implies that the radiologist uses the outcome of computerized analysis of a medical image [5]. The underlying idea is to increase overall sensitivity detection rate through automated identification of suspicious objects, rather than absolute delegation of diagnosis to deployed CAD system. Consequently, the associated advantages are manifold. CAD increases therapy success in case of early disease detection, and may avoid unnecessary biopsies. Further, it reduces error rate in screening situations with massive load of medical images [6]. In this paper we propose method for detection of Lung cancer using image processing (mean shift) algorithm followed by edge detection using Morphological operator.

II. METHODOLOGY

Image processing is one of most growing research area thesedays. It becomes one of the useful tools for processing of medical images; and its use and benefits are rapidly growing in this advanced technical world. Using some of the image processing techniques, it develops an algorithm which is useful for detecting abnormal formation of the cells in the lungs.

In this proposed algorithm, a series of operation are applied, at first image segmentation technique then edge detection techniques are applied to detect the tumor in the lungs.

Fig 1: Original CT scan image used for evaluation

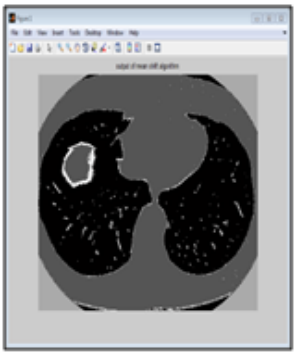

Fig 2: CT scan image afterMean Shift Algorithm

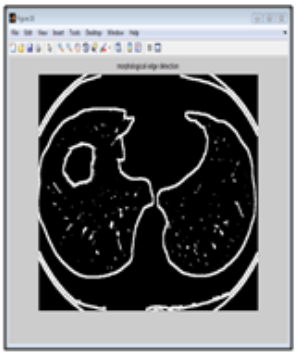

Fig 3: CT scan image after Morph--ological edge detection

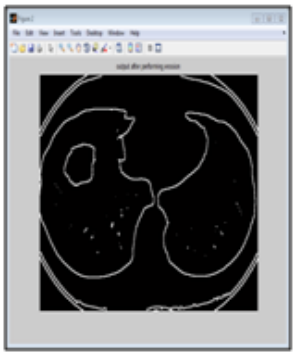

Fig 4: CT scan image after performing erosion

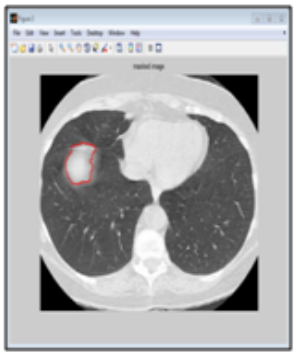

Fig 5: Final Output image showing marked Cancer area

The initial stage of the proposed Computer Aided Diagnosing (CAD)techniques is the extraction of lung region from the CT scan image. The lung CT images having low noise when compared to scan image and MRI image. So it takes the CT images for detecting the lungs .

Preprocessing is the initial step for detecting the lung cancer. It aims to attenuate noise without blurring the images.

After that segmentation algorithm is applied to segment the image's desired part, in this case the tumor part is desired one. Image Segmentation is a process of partitioning an image into multiple regions or sets of homogenous pixels. The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. The result of image segmentation is a set of regions that collectively cover the entire image, or a set of contours extracted from the image. In some applications it may be useful to classify image pixels into anatomical regions, such as bones, muscles, and blood vessels, while in others into pathological regions, such as cancer, tissue deformities and multiple sclerosis lesions.

To segment the image it uses the Mean shift algorithm. Mean shift segmentation is based on the fact that pixels in the same region share some similar modes. By including both spatial position and range as features, mean shift takes into account both the geometrical closeness and the photometric similarity of image during image filtering and segmentation [7].

After segmentation of abnormal region, a series of morphological operations are applied. Mathematical morphology is used to process and analyze images. It process images based on shapes. It apply structuring element to an input image and produces the output image of an equivalent size. The Erosion process erodes away the pixels of the image boundary. The number of pixels added or removed depends upon the size and shape of structuring element [8,9].

After the application of morphology, it becomes easyto distinguish between the source image which is taken as input and the result image which comes as output. The output image clearly shows the tumor part with less blurring and noise.

III. CONCLUSION AND FUTURE WORK

This work has successfully developed a solution for the detection of lung cancer using image processing algorithms. The method proposes automatically detects and identifies the cancerous cells of the lungs. It fulfills the purpose of developing an automatic CAD system for early detection of lung cancer by analyzing Lung CT images. The proposed work acquires the lung CT images and then performs the series of operations to enhance the image quality and to analyze and detect the tumor. At first pre-processing is done for removal of noise which can occur while taking/capturing the images and then the image is segmented using Mean Shift Algorithm, which would segment or extract various regions of the lung CT scan. After that the edges of the segmented image are detected using Mathematical morphology, which would identify

the edges of the lungs and other accumulations like cancer. The processing on the edge detected image is applied to give the diagnosis result.This in turn helps the physician or the doctor to analyze the tumor shape and size since the shape and size of the tumor plays a vital role in the treatment to the tumor. It also identifies the cells which might have been unnoticed by human eyes. Detection of lung cancer at an early stage can be difficult but using the proposed work detection becomes uncomplicated and the chances of the early treatment of the patient and therefore chances of survival of the patient increases. Thus using an automated system not only reduces chances of human error but also increases the accuracy.

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