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A Survey on Medical Image Disease Diagnosis Features and Techniques

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Abstract- Now a days number of diseases are mostly found in animals, plants and humans. Almost in all ages of human beings infections related to brain, skin, stomach, etc. diseases can occur. So, it becomes necessary to identify these diseases at the very primary stage to control it from spreading. In this paper a deep survey of various approaches of image diagnosis was discussed. Common steps of image diagnosis was shown in the paper. he concepts, benefits, risks and applications of these techniques will present with details. Features used by the scholars for the segmentation of image was also list in paper.

Keywords- Image Processing, Medical Image Diagnosis, Feature Extraction, Segmentation.

I. INTRODUCTION

Medical imaging is the process of visual representation of the structure and function of different tissues and organs of the human body for clinical purposes and medical science for detailed study of normal and abnormal anatomy and physiology of the body. Medical imaging techniques are used to show internal structures under the skin and bones, as well as to diagnose abnormalities and treat diseases [1]. Medical imaging has changed into healthcare science. It is an important part of biological imaging and includes radiology which uses the imaging technologies like X-ray radiography, X-ray computed tomography (CT), endoscopy, magnetic resonance imaging (MRI), magnetic resonance spectroscopy (MRS), positron emission tomography (PET), thermography, medical photography, electrical source imaging (ESI), digital mammography, tactile imaging, magnetic source imaging (MSI), medical optical imaging, single-photon emission computed tomography (SPECT), and ultrasonic and electrical impedance tomography (EIT) [2].

The techniques available for segmentation of medical images are specific to application, imaging modality and type of body part to be studied. For example, requirements of brain segmentation are different from those of thorax. The artifacts, which affect the brain image, are different - partial volume effect is more prominent in brain while in the thorax region it is motion artifact which is more prominent [3, 4].

Thus while selecting a segmentation algorithm one is required to consider all these aspects.

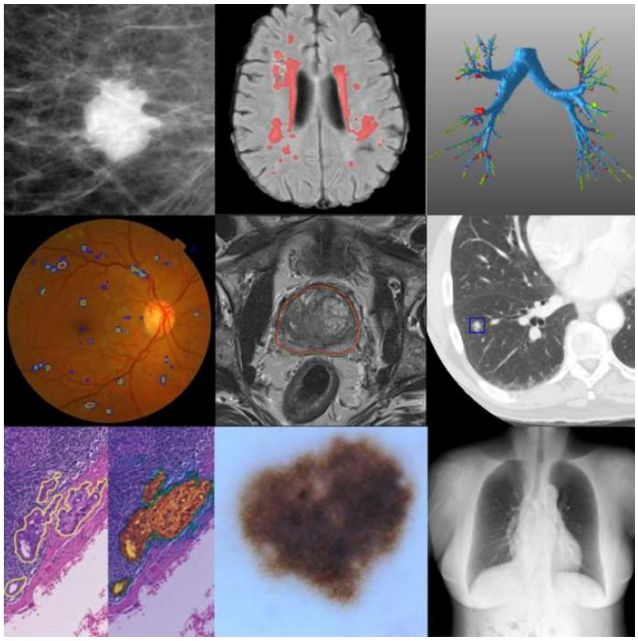

Fig. 1: Collage of some medical imaging applications in which deep learning has achieved state-of-the-art results. From top-left to bottom-right: segmentation of lesions in the brain, leak detection in airway tree segmentation, diabetic retinopathy classification, van, prostate segmentation, nodule classification, breast cancer metastases, skin lesion classification and state-of-the-art bone suppression in x-rays [3].

II. STEPS OF IMAGE DIAGNOSIS

Preprocessing The main purpose of this preprocessing is to improve the quality of skin image by removing unrelated and excess parts in the back ground of image for further processing [5]. The objective of the preprocessing is to perform three process stages i.e. image enhancement, image restoration and hair removal.

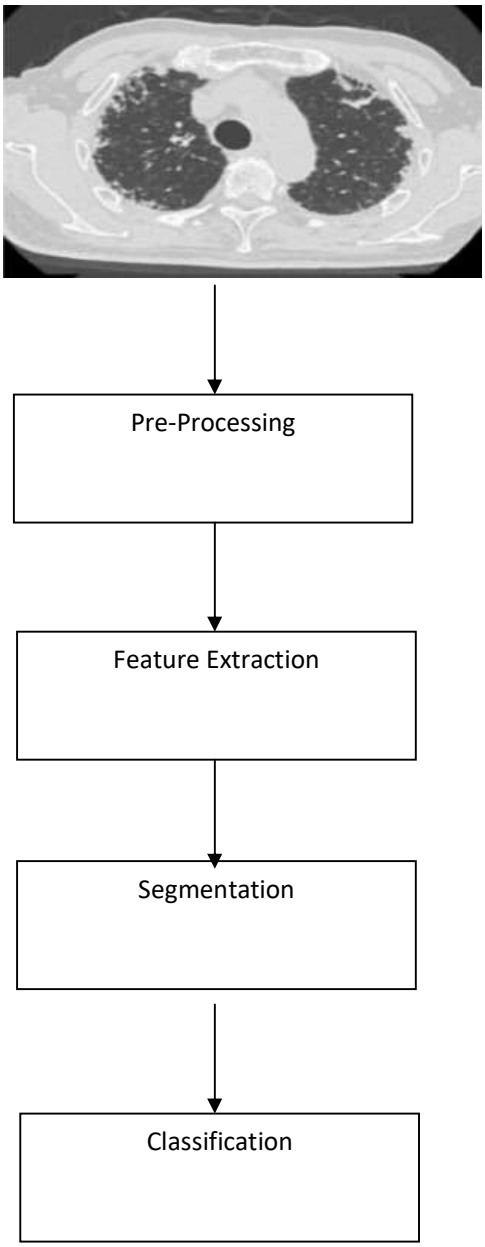

Fig. 2 Steps of image diagnosis.

Feature Extraction A feature is a piece of information which is relevant for solving the computational task related to a certain application. Feature extraction is the process of extracting this information from an image. Following features can be extracted from the skin lesions i.e. GLCM Features, First-Order Histogram Features, Dermoscopic Features etc.

Segmentation and Analysis Image segmentation is a technique to determine the shape and size of the border. It separates the object from its background based on different features extracted from the image. After removing the noise and hair from the lesion area, the lesion needs to be separated from the skin, and therefore the analysis for diagnosis is conducted purely using the necessary area.

Feature Classification Selected features are used for the recognition and classification of benign and malignant lesions. A wide range of classifiers can be built and used for this purpose. Classifiers such as SVM, C4.5 can be used for this purpose.

III. RELATED WORK

Mehedi Masud et. al. in [6] proposed an algorithm that detects a deadly and common disease called malaria specially designed as a mobile healthcare solution for the patients. The main objective of the paper focuses on convolution or deep learning architecture and it proves to be useful in detecting malaria disease in real-time accurately by imputing images and thus reduces the manual labor in the detection of the disease.

Fuhad et. al. in [7], given a deep learning technique by which analysis can be done automatically. By this, the need for trained professionals will be drastically reduced as the model will give accurate and automatic results. This model is based on CNN (Convolutional Neural Network) and can be used in the diagnosis of malaria by taking input in form of microscopic blood images. These techniques include Autoencoder, knowledge distillation, and data augmentations features and are classified in form of k-nearest neighbors or support vector machine. This was further performed by three training procedures namely autoencoder, general distillation, and distillation training to improve the accuracy of the model.

J. Zheng et. al. in [8] the work starts with an examination of breast masses for several diagnostic by using CNN-based transfer process. It includes prognostic and predictive tasks in several image patterns such as mammography, digital breast tomo synthesis, and MRI of magnetic resonance imaging. The layer contains many convolutional layers, Max-pooling, and LSTM layers. The classification was also performed in the softmax layer and fully connected layer. The paper focuses on the concept of combining such machine learning concepts for finding out the desired features and extracting them by recognizing and using this data for evaluating their output by

segmentation and various other techniques for accurate results.

Shivangi Jain et. al. in [9] given a method for the detection of skin cancer named Melanoma by using a computer-aided method and various image processing tools. At first, the input to this system was given in the form of a skin lesion image and then it is passed through unique image processing techniques to analyze the possibility of cancer in the sample. The image analysis tools checks for various Melanoma cancerous conditions parameters such as ABCD, diameter, asymmetry, border colors by analyzing the shape, size, and texture of the sample and segmenting them in various stages.

Kalwa, U. et. al. in [10] Presented a smart phone app to capture the border irregularity, asymmetry, color variegation, and diameter of the entered skin lesion sample. Using all the above features the classification of the malignancy was provided by using the concept of vector machine classifiers. Several adaptive algorithms and data processing algorithms were used to make the app user-friendly and reliable to detect Melanoma cancerous conditions in the skin lesion. Input can be in the form of public datasets or images captured from the camera. The app runs n any Android smart phone that is equipped with a detachable lens of 10x and can process the image within a second.

Mohammad Ashraf Ottom in [11] built a deep learning computer model to predict the new cases of cancer. In this, the first stage is to analyze the image and segment and prepare its data to find the useful part of the image. It also reduces the amount of noise and illumination in images to detect the sharp boundaries of the image or objects. Finally, the proposed scheme of the network contains three max-pooling layers, three convolution layers together with four fully connected layers.

Quan et. Al. in [12] propose an efficient and novel classification network named Attentive Dense Circular Net (ADCN) which based on Convolutional Neural Networks (CNN). The ADCN is inspired by the ideas of residual and dense networks and combines with the attention mechanism. We train and evaluate our proposed model on a publicly available red blood cells (RBC) dataset and compare ADCN with several well-established CNN models.

IV. FEATURE OF IMAGE DIAGNOSIS

Color Feature The image could be a matrix of light intensity values, and each of these intensity values would represent a different kind of colour [7]. The colour feature could be described as: Therefore, the ability to recognize an object's colour is a very important feature, and a low computation price is an essential component of this feature. There are many different image files available, each with its own unique colour format. For example, images can have any number of colour formats, ranging from RGB, which stands for red, green, and blue.

Edge Feature: As an image can be a collection of intensity values, and with the rapid change in the values of a picture, one important feature emerges as the Edge, as shown in figure 4. Edge Feature: As an image can be a collection of intensity values. This feature can be utilized for the detection of a wide variety of image objects, including roads, buildings, and other similar elements [5, 7]. There are several rules that have been developed to effectively illustrate all of the pictures of the image or frames, such as Sobel, perwitt, and canny, among others. Out of all of those algorithms, canny edge detection is one of the most effective algorithms to search out all of the potential boundaries of a picture.

Texture is a property that enumerates qualities such as regularity and smoothness [6]. Texture can be thought of as a degree of distinction in the intensity of a surface's appearance. When compared to the paint house model, the texture model requires an additional step in the process. The feel options based on the colour premise are less sensitive to changes in illumination than the same on edge options.

Corner Feature: In the event that the camera is moving, it is necessary to be able to differentiate between the two frames that are being displayed within the image or frame thanks to the corner feature. This allows the video to remain stable. Therefore, resizing the window in the original text can be accomplished by locating the corner position of the two frames and using that information. This function can also be used to determine the angles still as the distance between the item in the two distinct frames. because they serve a purpose within the image and can therefore be used to trace the objects that are the focus of attention.

DWT Feature: It is a frequency domain feature that is used to transform pixel values in frequency domain having four region first is flat region, other is horizontal edge region, similarly vertical and diagonal edge region [8,9]. [DWT Feature] A combination of low pass and high pass filters was used to obtain each image subsection.

DCT Feature: This is another feature that falls under the frequency domain umbrella. In the top left corner of the image matrix, low frequency values were found to be present. In order to obtain these feature set coefficients, the cosine transformation operation was applied. The Discrete Cosine Transmit, also known as DCT, is an image processing technique that is

considered to be both an industry standard and one of the most widely used today. The DCT makes it possible to separate an image into a number of distinct frequency bands, which makes it much simpler to secretly embed data hiding information into the middle frequency bands of an image. Due to the fact that this part of the spectrum is unaffected by either noise or compression, the middle frequency region is utilized here for the purpose of data hiding. The fact that the visual frequency region can be found in the low frequency part of the image is yet another consideration. Therefore, embedding is accomplished by positioning the least significant bit (LSB) of the pixel.

V. TECHNIQUES OF IMAGE CLASSIFICATION

Region based segmentation: This segmentation is basic as contrast with different strategies and furthermore clamor strong [13]. In view of pre-characterized criteria, it partitions a image into various regions i.e. color, power, or entity. Region based image segmentation are group into three principle classifications, i.e. region developing, region part, and region combining.

Edge based: This kind of segmentation speaks to an expansive gathering of techniques in light of data about edges in the images. This segmentation rely upon edges found in a image by edge recognizing administrators – these edges check image regions of discontinuities in dark level, color, surface, and so on.

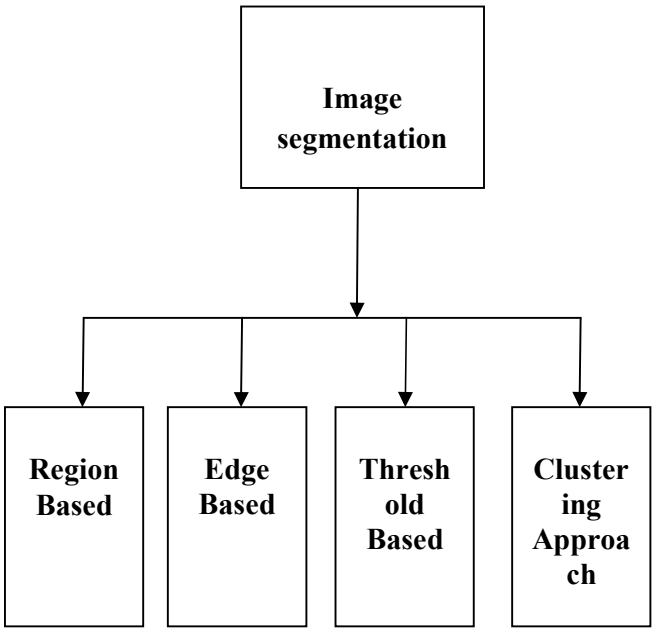

Fig. 3: Segmentation Techniques [13].

Segmentation in view of discontinuities find for unexpected changes in the pixel value. These strategies are additionally called as edge or limit based techniques. Edge recognition is for the most part utilized for discovering discontinuities in dim level images. There are numerous strategies for edge location, yet the greater part of them can be assembled into two classifications to be specific search based and zero-intersection based. [14]

Threshold based segmentation*:* Thresholding is most regularly utilized system for dividing a image [13]. Contingent on the choice of edge value two sorts of limit strategies exist. Thresholding is an old, straightforward and famous strategy for image segmentation. Limit based systems characterizes the image into two classes and chips away at the propose that pixels having a place with certain scope of pixel values speaks to one class and whatever is left of the pixels in the image speaks to alternate class. Any pixel(x, y) is considered as a piece of protest if its power is more prominent than or equivalent to limit value i.e., $f(x, y) \geq T$, else pixel have a place with foundation thresholding can be executed either all around or locally.

Global Threshold*:* just on Gray level values Global limit value depends and the edge value altogether connected with the nature of pixel. Limit segmentation strategy involves techniques. Worldwide thresholding use twofold segment to fragment the image and pick the limit value and recognizes entity and foundation pixels by contrasting and. The pixels value that finish the edge test are considered as protest pixel and are alloted the paired value "1" and different pixels are have a place as foundation pixels and doled out double value "0" and. The edge based segmentation procedures are computationally quick, economical and can be utilized as a part of continuous applications with help of particular equipment [13].

Local Threshold: Local edge relies upon the normal dark value and power estimation of info image. This strategy separate information image into a few sub regions and for each sub region chooses distinctive Threshold value.

Clustering Approach

Two prevalent techniques for Clustering are-

i) K-means clustering: K-means calculation is an unsupervised classification calculation that characterizes the given information point into numerous classes in light of their understood separation from each other. In k means calculation information vectors are gathered into predefined number of bunches and toward the starting the centroid of the predefined groups are

introduced haphazardly. The measurements of the cancroids are same as the measurement of the information vectors. Every pixel is appointed to the bunch in view of the closeness; at that point after the mean of each group is recalculated. This procedure is rehashed until the point that no critical changes result for each bunch mean or for some settled number of cycles. [15]

ii) Fuzzy clustering: Fuzzy c-means (fcm) is a method of grouping in which an informational index is gathered into n bunches with each datum point in the dataset having a place with each group to a specific degree. Fuzzy classification strategy can be thought to be better than those of their hard partners since they can speak to the connection between the information design information and group all the more normally Fuzzy c-means is a standout amongst the best fuzzy grouping techniques. Much of the time, It is more adaptable than the hard-grouping calculation.

VI. CONCLUSION

With the increasing capability to trace and gather large amount of sensitive information, from different sources of medical equipments. Diagnosis of each type of image need experts.. This paper presents a brief survey on various standard techniques for image diagnosis done: Here detailed discussion of different features and combination of those are done. In future, work can develop one single model which overcome some challenges and threats discuss in the research area.

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