DETECTION OF MELANOMA SKIN CANCER USING SUPPORT VECTOR MACHINE BASED ON DIFFERENT SEGMENTATION TECHNIQUES

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ABSTRACT: The prevalence of skin cancer is significantly increasing each year due to the damage of the ozone layer in the atmosphere that makes more ultraviolet radiation passing through. Knowing this situation, it is important to develop a simple image processing technique that can be used in the early detection of skin cancer. Early detection of Melanoma skin cancer is very much necessary for the patient because this Melanoma skin cancer directly lead to the death of a person. Image segmentation is a technique which aids with the detection of these skin diseases. This paper presents, Detection of Melanoma Skin Cancer using Support Vector Machine based on Different Segmentation Techniques. In this paper, image processing techniques like adaptive thresholding, edge detection and K-means clustering image segmentation have been used to identify the skin cancer from the given image set. This study used images from an international repository of dermoscopic images, ISIC archive 2019. Results represent that Accuracy of the Melanoma Skin Cancer detection using Support Vector Machine (SVM) is high (97%) compare to other classification models.

KEYWORDS: Melanoma Skin Cancer, Support Vector Machine (SVM), Segmentation, early detection.

I. INTRODUCTION

Melanoma skin cancer develops in melanocytes skin cells those are responsible to produce melanin [1]. Already research has been done on detection of Melanoma skin cancer but still issue exists for higher accuracy for the detection and classification of Melanoma skin cancer. According to the World Health Organization (WHO), globally, skin cancer is diagnosed in every three cancers and every year increases due to more solar ultraviolet radiation passing through the atmosphere.

The gold standard to diagnose skin cancer is skin biopsy with histopathology. However, this procedure is painful due to invasive technique to get the skin tissue sample. One of the common methods is using medical imaging tools, such as dermoscopy, cross-polarized light and fluorescence photography, high-frequency ultrasound, optical coherence tomography (OCT), and confocal microscopy [2]. The main advantages of digital dermoscopy are cost effective diagnosis tool and can be used in long-term surveillance. Since 2016, dermoscopy image analysis become one of the very active research field due to the International Skin Imaging Collaboration (ISIC) release a large public dataset, inexpensive computational unit and development of open source software in machine learning [3].

Skin cancer is any mass that results from an abnormal and an uncontrolled growth of cells in the Skin. There are two main types of cancers: malignant or cancerous cancers and benign cancers. Cancerous cancers can be divided into primary cancers that started within the Skin and those that spread from somewhere else known as Skin metastasis cancers. Benign cancers generally have a slower growth rate than malignant cancers. Its threat level depends on a combination of factors like the type of cancer, its location, its size and its state of development.

With the advances of digital image processing, radiologists have a chance to improve their performance with automatic

methods like computer-aided detection (CAD) system and Artificial Neural Networks. Computer-aided diagnosis (CAD) aims to increase the predictive value of the technique by pre-reading medical images to show the locations of suspicious And also it is provides a powerful tool to help doctors to analyse, model and make sense of complex clinical data across a broad range of medical applications [4]. Most applications of artificial neural networks to medicine are classification problems such as pattern recognition; that is, the task is on the basis of the measured features to assign the patient to one of a small set of classes.

In maximum cases, the conclusions on the patient's symptoms are tracked from doctor's experiences and subjective judgments. If the judgment is wrong or delayed, it may harm human health. Therefore, it becomes necessary and significant to develop efficient approaches to detect and diagnose the symptoms of skin cancer at early stages. Various innovations are accessible for image and pattern-based discovery of different skin diseases. Machine learning is one of the areas which can play a massive role in operative and exact identification of different classes of skin diseases and cancer. Through image classification using machine learning, diseases may be classified. Image classification is a supervised learning issue in which a lot of objective classes is characterized and a model is trained to perceive the class. There exist many machine learning and deep learning algorithms which can distinguish and predict different categories of skin diseases based upon their classifications [5].

Rest of the paper is organized below as: Section II introduces the Literature survey, Section III explains the described Melanoma Skin Cancer detection methodology, results and discussions are presented in Section IV and finally paper concludes with Section V.

II. LITERATURE SURVEY

Farzam Kharaji Nezhadian, Saeid Rashidi, et. al. [6] presents Melanoma skin cancer detection using color and new texture features. Melanoma is the most prevalent skin cancer and sometimes it is very difficult to diagnose. Noninvasive dermatoscopy is used to diagnose type of cancer. Since proposed method is based on eye-deduction, diagnosis of melanoma in early stage is difficult for dermatologist. A new algorithm is presented to classify dermoscopic images into malignant and benign. Initially the images were segmented using active counter model and two features such as texture and colorful components were extracted. Texture-based features were first in this area used to diagnose disease and its results indicated high-efficacy. In the international skin imaging collaboration dataset we achieve accuracy of 97% by support vector machine classifier.

Naser Alfed, Fouad Khelifi, Ahmed Bouridane, Huseyin Seker, et. al. [7] proposes an efficient system for skin cancer detection on dermoscopic images. It has been shown that the statistical characteristics of the pigment network, extracted from the dermoscopic image, could be used as efficient discriminating features for cancer detection. The proposed system has been assessed on a dataset of 200 dermoscopic images of the 'Hospital Pedro Hispano' and the results of cross-validation have shown high detection accuracy.

P.B.Nikam and V.D.Shinde, et. al. [8] proposed Skin image classification and detection using distance classifier method, this project presents a system for automatic classification of healthy or affected person using Region growing segmentation by watershed algorithm, Euclidean distance classifier for fast computation,

accompanied with pre-processing and post processing method apply on database consisting both normal and timorous samples of MR Skin images. This system had two main stages, first is pre-processing of MRI images and then other post processing operations, which includes operations like noise removal, convert input image into Gray scale image, High pass filter.

J. Abdul Jaleel, Sibi Salim, R. B. Aswin, et. al. [9] presents Computer Aided Detection of Skin Cancer. Computer based skin cancer detection is more advantageous to patients, by which patients can identify the skin cancer without going to hospital or without the help of a doctor. Computer based detection uses imaging techniques and Artificial Intelligence. The different stages of detection involves- collection of dermoscopic images, filtering the images for removing hairs and noises, segmenting the images using Maximum Entropy Threshold, feature extraction using Gray Level Co-occurrence Matrix(GLCM), and classification using Artificial Neural Network(ANN). Back-Propagation Neural (BPN) Network is used for classification purpose. It classifies the given data set into cancerous or non-cancerous.

M. Asghar, M. Asghar, S. Saqib and B. Ahmad, et. al. [10] presents a rule based web supported expert system to detect certain skin diseases using forward chaining with depth first searching. However, using a rule based system in order to detect the type of dermatological condition is not practical due to the various manifestations of a single skin disease. A selflearning model developed by us would be a better performer in this regard as the problem we are trying to address is probabilistic in nature and hence we need a system which learns the underlying pattern present in the skin disease which can be inferred by the image and the histopathological inputs.

III. DETECTION OF MELANOMA SKIN CANCER USING 'SVM'

The block diagram of Detection of Melanoma Skin Cancer using Support Vector Machine based on Different Segmentation Techniques is represented in below Fig. 1.

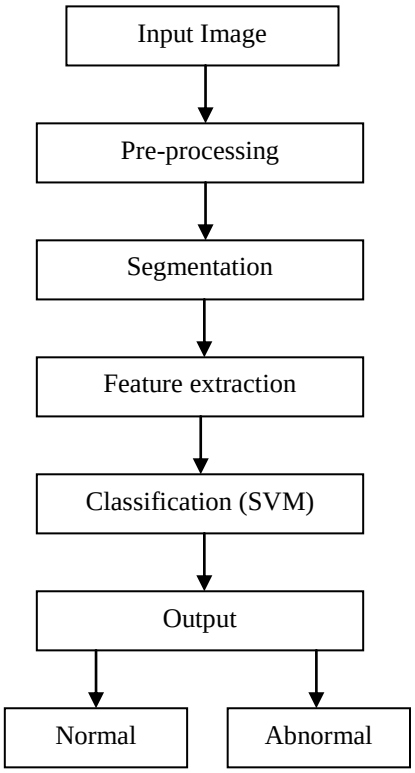

Fig. 1: WORKFLOW OF MELANOMA SKIN CANCER DETECTION

This study used images from an international repository of dermoscopic images, ISIC archive 2019, that is developed by ISIC. In total, there are 19,932 images that are used as training (14,774 images) and testing (5,158 images) processes.

Preprocessing step includes Converting the RGB acquired skin image to gray image, Contrast enhancement, Histogram modification and, Noise Filtering. While the histogram modification techniques such histogram equalization is used to enhance the contrast of the image and, therefore, making the segmentation more accurate. Contrast enhancement has been applied on the images considered to

increase the brightness or sharpness as and when required so that proper information can be obtained from the images. The images taken into consideration has been filtered with the denoising filter. In most of the cases salt and pepper noise is present and has been removed with the help of average filter.

The aim of Segmentation process is to distinguish between diseases area and skin area. To detect the diseases area correctly, should apply segmentation method with high accuracy. The best methods that give good result are Edge Detection, Adaptive Thresholding and K-means Clustering.

Edge Detection: - The filtered image is convolved with the selected operator's gradient with a referential axis. A threshold value is considered and Gaussian filter is used to blur the image and to remove noise and detail. For each pixel co-ordinate the gradient magnitude is computed and then the pixel co-ordinate is shifted to the adjacent co-ordinate.

Adaptive Thresholding: - The input image histogram is considered along with its expected background proportion. Two adaptive functions adaptive thresh mean and adaptive thresh Gaussian functions are used to calculate the thresholding value from the image which makes it easier to decide the neighborhood area.

K-means Clustering: - A set of data points and a set of centers are considered in the image. Using the elbow method 4 cluster points are considered randomly from the image. The distances between each data point and cluster centers are recorded. Each time different set of data points are considered and the distances are measured. The set of records are compared and the respective set of data points resulting in the minimum distance has been selected.

The aim of Feature extraction is to extract meaningful features of the image diseases area that can help in identification and evaluation or diseases state. Grey Level Co-occurrence Matrix (GLCM): One of the foremost methods of texture analysis involves extraction of features from GLCM. These features include autocorrelation, contrast, cluster prominence, energy, entropy, cluster shade, dissimilarity, homogeneity, maximum probability, inverse difference normalized, inverse difference moment normalized etc.

SVM is one of the most common machines learning algorithm that can be used in data classification. It's based on the concept of decision planes that define decision boundaries, a decision plane separates the objects to distinguish classes. The simplest SVM plane is linear whenever the data can be linearly separated. But the data here is not linearly separable. Therefore, kernel SVM with radial basis function was used to classify the data into benign or malignant. In the training stage, the classifier model was built using cross validation procedure to find the optimize parameters of the hyperplane to avoid biasing with overfitting.

Results explain the performance of the SVM classifier model in discriminating the skin lesion into normal or abnormal.

IV. RESULT ANALYSIS

International repository of dermoscopic images, ISIC archive 2019 is used in this method. The dataset is split into the dataset of instruction and testing: 75% percent for instruction and 25% percent for testing. The performance of the described model is evaluated by using Accuracy paramerter.

Accuracy, also known as classification rate, can be de- scribed as right predictions of the overall results proportion.

$$Accuracy = \frac{TP + TN}{TP + TN + FN + FP} \dots (1)$$

Where,
The true negatives (TN), true positives (TP), false negatives (FN) and false positives (FP) scores are stored in a matrix for each class.

Fig. 2: NON CANCER TYPE IMAGE

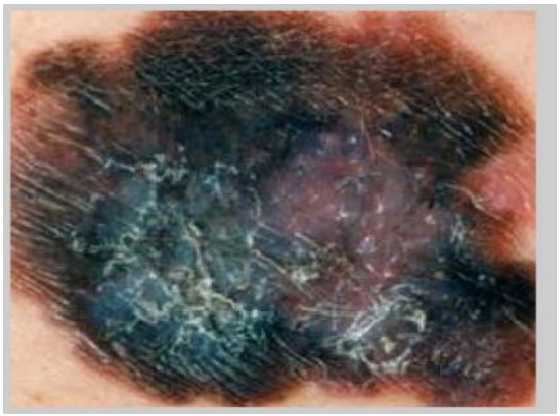

Fig. 3: CANCER IMAGE

The comparative performance analysis of Detection of Melanoma Skin Cancer using Support Vector Machine based on Different Segmentation Techniques and other classification models as K-Nearest Neighbor (KNN), Decision Tree (DT) is represented in below Table 1.

Table 1: COMPARATIVE PERFORMANCE ANALYSIS

Classification models	Obtained Accuracy (%)
SVM	97
KNN	91
DT	88

Fig. 4 shows non cancer type image while Fig. 5 represent cancer type image. Below Fig. 4 shows the graphical representation of Accuracy parameter for three classification models.

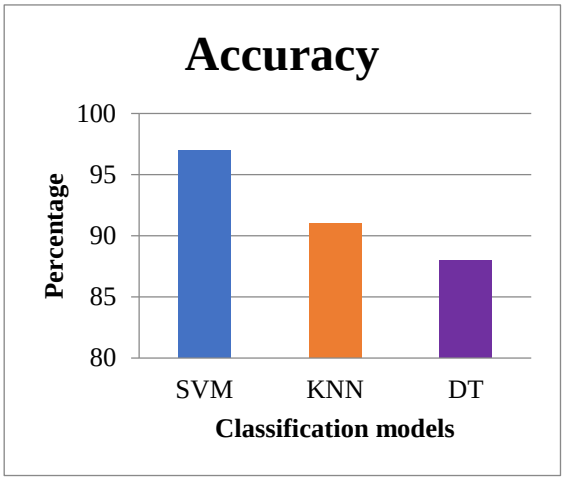

Fig. 4: COMPARATIVE ACCURACY ANALYSIS

From results it is clear that, the accuracy of described model is efficient and higher than remaining models and it is obtained as 97%.

V. CONCLUSION

In this paper, Detection of Melanoma Skin Cancer using Support Vector Machine based on Different Segmentation Techniques is described. Melanoma skin cancer develops in melanocytes skin cells those are responsible to produce melanin. This study used images from an international repository of dermoscopic images, ISIC archive 2019. In this paper, image processing techniques like adaptive thresholding, edge detection and K-means clustering image segmentation have been used to identify the skin cancer from the given image set. Grey Level Co-occurrence Matrix (GLCM) method is used as feature extraction technique. SVM is used classifier in this model. Accuracy is the parameter used for performance analysis. From results it is clear that, the accuracy of described model is efficient and higher than remaining models as K-Nearest Neighbor (KNN), Decision Tree (DT) and it is obtained as 97%.

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