DETECTION OF SKIN CANCER USING ARTIFICIAL NEURAL NETWORK

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Abstract : Skin cancer is the uncontrolled growth of strange skin cells. It occurs when unrepaired DNA damages to skin cells triggers mutations, or genetic defects, that lead the skin cells to multiply readily and form malignant tumors. Image processing is a commonly used method for skin cancer detection from the appearance of affected area on the skin. Artificial Neural Network (ANN) is one of the important branches of Artificial Intelligence, which has been accepted as a brand new technology in computer science for image processing. Neural Networks are currently the area of interest in medicine, particularly in the fields of radiology, urology, cardiology, oncology, etc. Neural Network plays a vital role in an exceedingly call network. In this paper, a computerised method has been developed to make use of Neural Networks in the field of medical image processing. The ultimate aim of this paper is to implement cost-effective emergency support systems, to process the medical images. It has been used to analyse Melanoma parameters Like Asymmetry, Border, Colour, Diameter, (ABCD), etc. which are calculated using MATLAB from skin cancer images intending to developing diagnostic algorithms that might improve triage practices in the emergency department. Using the ABCD rules for the melanoma skin cancer, we use ANN in classification stage with Back Propagation Algorithm. Initially, we train the network with known target values. The network is well trained with 96.9% accuracy, and then the unknown values are tested for the cancer classification. This classification method proves to be more efficient for the skin cancer classification.

IndexTerms - **Preprocessing, segmentation, feature extraction, neural networking, Back Propagation.**

I. INTRODUCTION

Skin cancer is increasing in different countries especially in Australia [5]. Skin cancer is the uncontrolled growth of abnormal skin cell. Skin cancer diseases are very dangerous, particularly when not treated at an early stage. Skin cancer is the most common of all cancer type. In skin cancer number of cases has been going up over the past few year. Many skin cancers are caused by much exposure to ultraviolet (UV) rays[6]. Most of this exposure comes from the sun and man-made sources[6]. The three most common types are: Melanoma: Melanoma begins in melanocytes. On any skin surface melanoma can occur. Melanoma is rare in dark skin people. It is found on skin on the head, on the neck, between the shoulders, on lower legs, on palms of the hands, on the soles of feet or under the finger nails[6]. Basal Cell Skin Cancer: Basal cell skin cancer begins in the basal cell layer of the skin. It is usually occurs in places that have been in the sun[6]. Basal cell skin cancer is the most common type of cancer in fair people. Squamous Cell Skin Cancer: Squamous cell skin cancer begins in squamous cells. Squamous cell skin cancer is the most common type of skin cancer in dark people and its usually found in places that are not in the sun such as the legs or feet[6].

In recent days, skin cancer is seen as one of the most Hazardous forms of the Cancers identified in Humans. Skin cancer is classified into various types such as Melanoma, Basal and Squamous Cell Carcinoma out of which Melanoma is the most unpredictableMelanoma could be a notably deadly variety of skin cancer, and though it justifies solely 4% of all skin cancers, it is chargeable for 75% of all skin cancer deaths. Image processing is one of the widely used methods for skin cancer detection. Dermoscopy could be a non-invasive examination technique supported the cause of incident light beam and oil immersion technique to form potential the visual investigation of surface structures of the skin. The detection of melanoma using dermoscopy is higher than individual observation based detection[3], but its diagnostic accuracy depends on the factor of training the dermatologist. The diagnosis of melanoma from melanocytic nevi is not clear and easy to identify, especially in the early stage. Thus, automatic diagnosis tool is more effective and essential part of physicians. Even when the dermoscopy for diagnosis is done with the expert dermatologists, the accuracy of melanoma diagnosis is not more than 75- 84%[4].

The computer aided diagnostics is more useful to increase the diagnosis accuracy as well as the speed[5]. The computer is not more inventive than human but probably it may be able to extract some information, like colour variation, asymmetry, exture features, more accurately that may not be readily observed by naked human eyes[5]. There have been many proposed systems and algorithms such as the seven-point checklist, ABCD rule, and the Menzies method[2,3] to improve the diagnostics of the melanoma skin cancer. Melanoma could be a notably deadly variety of skin cancer, and though it justifies solely 4% of all skin cancers, it is chargeable for 75% of all skin cancer deaths. Image processing is one of the widely used methods for skin cancer detection. Dermoscopy could be a non-invasive examination technique supported the cause of incident light beam and oil immersion technique to form potential the visual investigation of surface structures of the skin. The detection of melanoma using
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The key steps in a diagnosis of melanoma skin cancer are image acquisition of a skin lesion, segmentation of the skin lesion from skin region, extraction of geometric features of the lesion blob and feature classification. Segmentation or border detection is the course of action of separating the skin lesion of melanoma from the circumferential skin to form the area of interest. Feature extraction is done to extract the geometric features which are accountable for increasing the accuracy; corresponding to those visually detected by dermatologists, that meticulously characterizes a melanoma lesion. Figure 1 shows the medical diagram of a melanoma skin cancer in advanced stage.

Fig.1 Melanoma Skin Cancer

The feature extraction methodology of many melanoma detection systems has been largely depending on the conventional clinical diagnostic algorithm of ABCD-rule of dermoscopy due to its effectiveness and simplicity of implementation [14]. The effectiveness of methodology stems from the fact that it incorporates the classic features of a melanoma lesion such as asymmetry, border irregularity, colour and diameter (or differential structures), where surveyable measures can be computed. Dermoscopy is a diagnostic technique that is used worldwide in the recognition and interpretation of copious skin lesions [4].Other than dermoscopy, a computerised melanoma detection using Artificial Neural Network classification has been adapted which is efficient than the conventional one and Melanoma detection using Artificial Neural Network is a more effective method compared
to other.

II. LITERATURE REVIEW

Image processing techniques provide a efficient tool to classify the cancer from the images. In the recent year neural network also used to detect the cancer to obtain proficient results. Different authors have used different ways to combine these technologies to achieve better conclusion. Various works have been done in the detection of Skin cancer using image processing and combination of neural network. Some of them discussed. Azadeh et al. [5] have carried out a survey in which Skin Cancer is detected. This describe the automatic detection of Skin Cancer can help to increase the accuracy and also review the techniques used in recent years, for the early detection of skin cancer. This describes the different step of process, image acquisition, image pre-processing, feature extraction, and classification. Sonali et al. [6] have implemented a simple algorithm for detection of skin cancer and also finding shape and infected area. This describe the different step of process in first step pre processing done using median filter and in second step segmentation done using two methods, Threshodling and Fuzzy c-means. In third step feature extraction done by Gray Level Co- occurrence Matrix (GLCM) and contour signature. Ho Tak Lau et al.[7] have describe automatically skin cancer classification system and relationship of skin cancer image using different type of neural network and different type of pre processing. This describe that the image acquire and different image processing procedure used to enhance the image properties and then useful information extract from the image and pass to the classification system for training and testing.

Abdul et al.[8] have recommended a technique in which early detection of Skin Cancer using Artificial Neural Network. The diagnosing methodology uses Image processing technique and Artificial Intelligence. This describe the dermoscopy image of skin cancer is taken and it subjected to various pre processing for noise removal and image enhancement. Then image segment using Thresholding. Feature are extract using feature extraction technique- 2D wavelet transform. And Back Propagation Neural Network used for classification purpose. Liu Jianli et al.[9] have carried out a survey in which Skin Cancer is segment by genetic neural network. The segmentation speed of the genetic neural network is much higher as compared with the standard BP neural network. The skin cancer images segmented by gentaic neural network have continuous edge and clear contour, which can be used in the quantitative analysis and identification of skin cancer. Nilkamal et al. [12] have described the past and present technologies for skin cancer detections along with their relevant tools. This design new approach for Skin Cancer detection and analysis from given photograph of patient's cancer affected area, which can be used to

automate the diagnosis and theruptic treatment of skin cancer. The proposed scheme is using Wavelet Transformation for image improvement, de noising and Histogram Analysis whereas ABCD rule with good diagnostic accuracy worldwide is used in diagnostic system as a base and finally Fuzzy Inference System for Final decision of skin type based on the pixel color severity for final decision of Benign or Malignant Skin Cancer**.** image processing methods can be used for image filtering and for feature extraction and pattern recognition in the selected images. Apart from standard approaches based on geometrical features and color/pattern analysis we propose to enhance the computer-aided diagnostic tools by adding non-standard image decompositions and applying classification techniques based on statistical learning and model ensembling. Ensembles of classifiers based on the extended feature set show improved performance figures suggesting that the proposed approach could be used as powerful tool assisting medical diagnosis. Maglogiannis et al. [18] have review the state of the art in systems by first presenting the installation, the visual features used for skin lesion classification, and the methods for defining them. Then, describe how to extract these features through digital image processing methods, i.e., segmentation, border detection, and color and texture processing, and we present the most prominent techniques for skin lesion classification. The describe the statistics and the results of the most important implementations that exist in the literature, while it compares the performance of several classifiers on the specific skin lesion diagnostic problem and discusses the corresponding findings.

III. METHODOLOGY

The offered methodology for discovery of melanoma Skin Cancer using image processing as a key apparatus for making or put right things is made clear in number in sign 2.the input for the system is the image of the skin wound which is speculated to be a melanoma wound image, which is then preprocessed to make good the image quality. The position subtraction and edge discovery are used for image breaking down into parts. The segmented image is then given to the point extraction solid mass, which inheres of field, range wound observations for its great geometrical points. The geometrical features are well-judged since they are the most not simple features of the skin cancer wound. The got from features are in addition given to the point order stage which puts in order the skin wound as cancerous or normal by neural network.

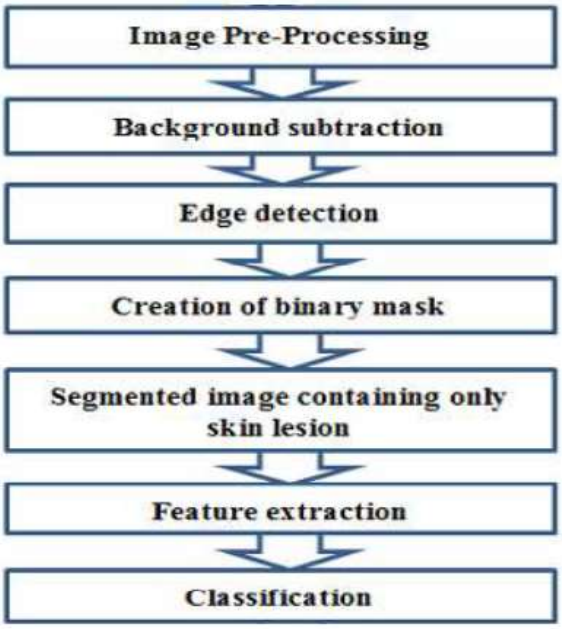

Fig.2 Melanoma detection using ANN Classifier

A. Image Pre-Processing

The image of skin lesion is given to the computer diagnostic system can be captured in any lighting condition or by using any camera. Hence, it needs to pre-process. Here, the pre-processing is the process of image resizing (scaling) and contrast and brightness modification, which is done in furtherance of compensating the non-uniform illumination in the image.

1. Image scaling

Fig.3 Resized image

Image scaling is the course of action of resizing a digital image. The size of an image is reduced or enlarged, the pixels that form the image become increasingly visible, making the image appear “soft”.

2.RGB to grayscale image

The rgb2gray function converts the true color image RGB to the grayscale intensity image, by eliminating the saturation information.

Fig. 4 Gray scale image

3. Grayscale to Binary image

Im2bw command converts the grayscale image to a binary image. The output image replaces all pixels in the input image with luminance exceeding the level with the value 1(white) and substitute all other pixels with the value 0 (black). If you do not define the level, then im2bw uses the value 0.5.

Fig.5 Binary image

B. Segmentation

Image segmentation is the course of action of segregating an image into multiple parts, which is used to identify objects or other relevant information in digital images.

1. Background subtraction

Background subtraction, also known as blob detection, is an emerging technique in the fields of image processing wherein an image's foreground is extracted for further processing. Typically, an image's regions of interest are objects in its foreground.

Fig. 6 Blob Detection

2. Edge detection

Edge detection is a significant image processing technique for catching the boundaries of objects within images. It works by detecting discontinuities in brightness.

Fig.7 Edge detection

3.Masking

Masking involves setting the pixel values in an image to zero, or some other "background" value. It is used to separate the lesion from the skin image. The masked image obtained contains only the skin lesion.

Fig 8. Masked skin lesion

C. Feature Extraction

The foremost features of the Melanoma Skin Lesion are its Geometric Features. Hence, we propose to extract the Geometric Features of the segmented skin lesion. Here, we used some classic geometry features (Area, Perimeter, Greatest Diameter, Circularity Index, Irregularity Index)[11] adopted from the segmented image containing only skin lesion, the image blob of the skin lesion is analysed to extract the geometrical features. The various Features extracted are as follows.

Area (A): Number of pixels of the lesion

Perimeter (P): Number of contour pixel.

Major Axis Length (Ma L): The length of the line passing through lesion centroid and joining the two farthest boundary points.

Minor Axis Length (Mi L): The length of the line passing through lesion blob centroid and joining the two adjacent boundary points.

Circularity Index (CI): It gives the shape uniformity.

$$CI = \frac{4A\pi}{P^2} \quad (1)$$

Irregularity Index A (IrIA):

$$IrIA = \frac{P}{A} \quad (2)$$

Irregularity Index B (IrIB):

$$IrIB = \frac{P}{MaL} \quad (3)$$

Irregularity Index C (IrIC):

$$IrIc = P \times \left(\frac{1}{MiL} - \frac{1}{MaL}\right) \quad (4)$$

Irregularity Index D (IrID):

$$IrID = MaL - MiL \quad (5)$$

D. Classification

using the ABCD rules for the melanoma skin cancer, we use not natural neural network in the order stage. The building of the neural network over-comes in three different levels with get food to forward buildings and structure design [15]. It is the most having great effect network 4 buildings and structure design in use today. The input level of the neural network is a group of the point values got from in the point extraction stage. The input units (neurons) are entirely joinedto the kept secret level with the kept secret units. The kept secret units (neurons) are also completely connected to the out-put level. The out-put level gives (up/over/to) the move of the neural network to the putting in operation good example instrumented to the input level. The single out-put from the system is the sign of whether the input skin has in it cancer or not. The knowledge given to a neural network is procreated layer-by-layer from the input level to out-put level through (not any) one or more kept secret levels.

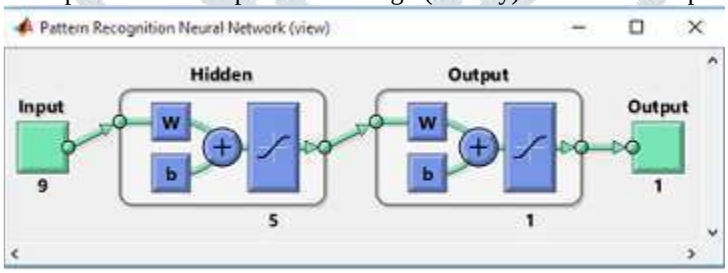

Fig. 9 The structure of the ANN.

Once a network has been put clearly for a right purpose, that network is able of being trained. To start this process, the first weights are selected as if by chance. Then, the training, or learning, starts. The Ann has been trained by going to person in authority it to groups of having existence facts where the outcome is experienced. multi-layer networks use a number of learning expert ways of art and so on, the most highest are back propagation algorithm. It is one of the most in operation moves near to machine learning algorithm developed by David Rummelhart and Robert McLelland (1994)[14]. Informations are forward development from the direction of the input level in the direction of the out-put level. A network is trained rather than knowledge processing machine orders listed.

E. Results

As first started, 31 skin cancer persons getting care, skin wound image has been self control from different hospitals and places in the net, and these images were pre-processed with the coming after techniques like image scaling, rgb to grayscale, grayscale to based on 2 image make into different sort and breaking down into parts processes. at last, the covered image gets from the pre-processing way of doing has in it only the skin wound. It gives more than 96% of act of having no error. The quality example geometric features part, Perimeter, the most great distance across circle, the shortest distance across circle, Circularity index, unregularity index, are very useful to put in order the melanoma skin cancer more accurately. So that these parameters are

got from the covered image of the skin wound using matlab code as made clear in number in sign 10. They took out features are given as input to the neural network with experienced results as Target values. The neural network is trained with these experienced Target values. We use the Back propagation algorithm for training the Ann. In the matlab operating system, we have a Ann training working instruments box as made clear in number in sign 11. The out-put got from the network is made a comparison of with the Target values, and the orderless mind matrix is made outline of events for Target teaching room and out-put teaching room. Once the network is trained with the experienced Target values, the unknown images are given as the input to the Ann. The Ann is already trained so that the network produces whether the image is cancerous or not. For cancer condition, the network out-put is 1 and for normal skin the network out-put is 0.

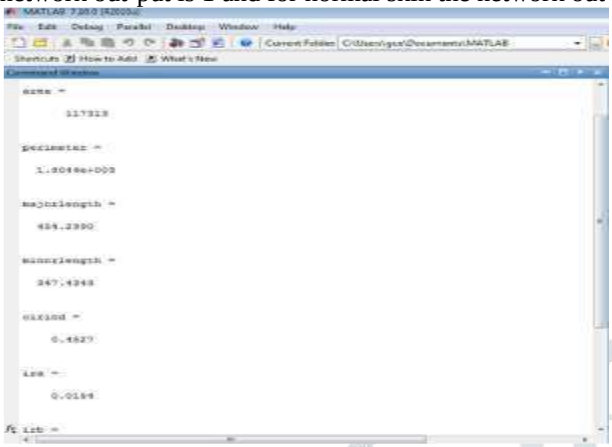

Fig.10.Results of feature extraction

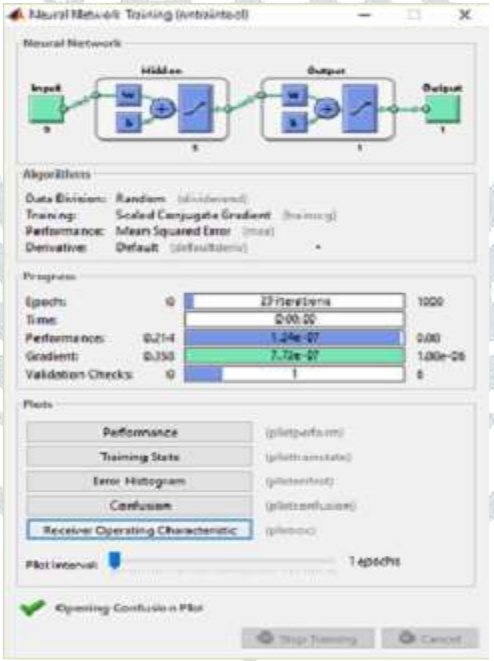

Fig.11 ANN training toolbox in MATLAB

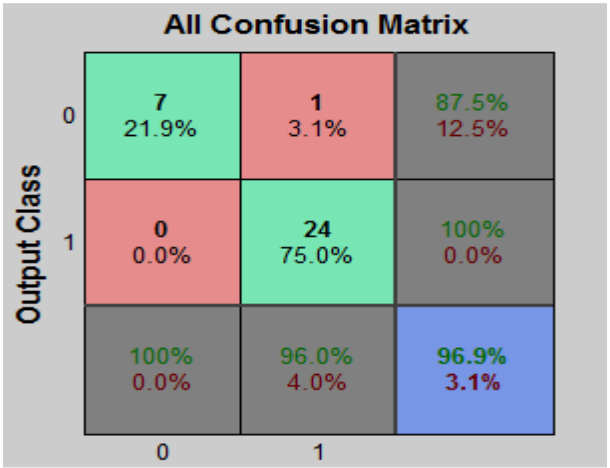

Figure12. Confusion matrix diagram between output class and target class

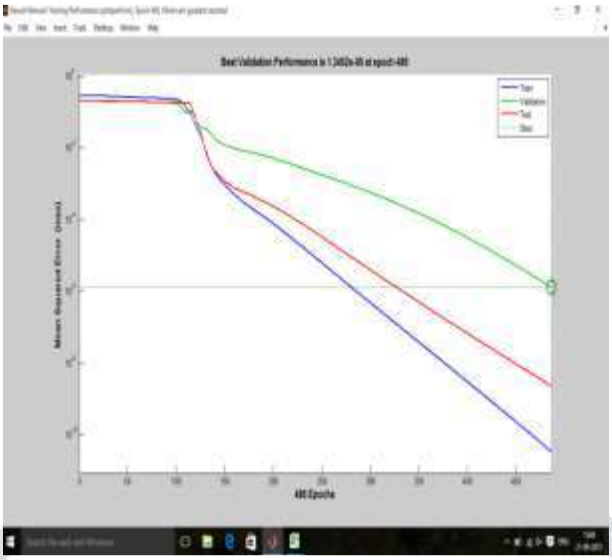

Figure13.The Best validation performance of the ANN for the diagnosis system

Figure 12 shows the confusion matrix which shows that the network is trained with 96.9% accuracy, and Figure 13 shows the best validation performance of the network.

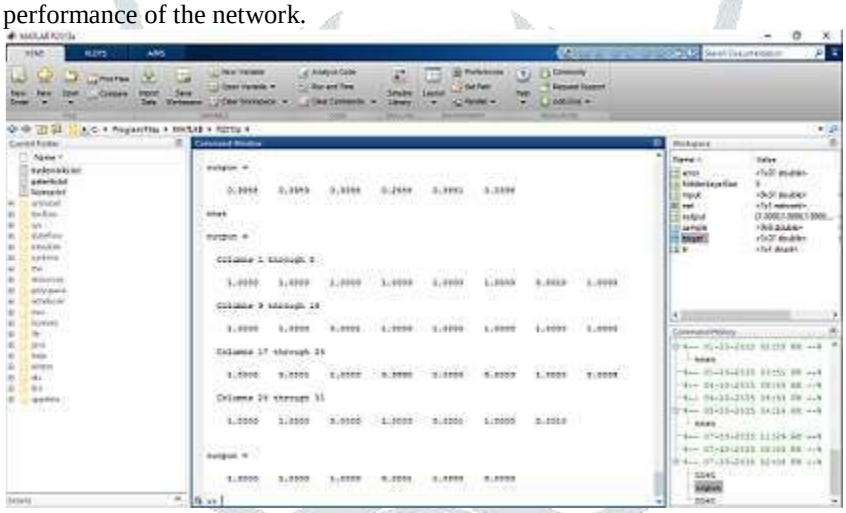

Figure14. Network output for samples

For the unknown input images, the network output is shown in Figure 14.

III. CONCLUSION

In this paper, we have had a discussion about a diagnosis system for melanoma skin cancer with not natural neural 4 network as a classifier using Back propagation algorithm. The present algorithm is tightly, destruct only a few seconds of Execution time and results are discovered to be better with the act of having no error of 96.9%. It can be concluded from the network results that the suggested system can be ably used by persons getting care and medical men and women to work out the skin cancer more without error, rightly. This apparatus for making or put right things is useful for the country, not town areas where the experts in the diagnosis field may not be able to be used. Since the apparatus for making or put right things is made more possible and strong for images gotten in any conditions, it can hand over the purpose of automatic diagnostics of the melanoma Skin cancer. image processing isa wide part where different classifiers are undergone growth in near in time days. In future, we could undergo growth a knowledge processing machine algorithm for skin cancer diagnosis using Support guide Machine, which is also a coming-to-be-important technology in our time.

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