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Detection of Skin Cancer using Artificial Neural Network Classifier

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Abstract: Skin cancer is a harm full disease in humans. It has various types such as melanoma, basal and squamous cell carcinoma among which melanoma is the most unpredictable. It causes abnormal growth of melanocytic cells which produces sun productive pigment melanin. Due to the melanin melanoma appear as black or brown color. In this paper we present a novel approach of detection of melanoma .This melanoma detection can using medical imaging in ANN(Artificial Neural Network) method. The dermoscopy images are extracted from 2D wavelet transformation method ,then values are given to as input nodes to the neural network. It classifies the data set into cancerous or non-cancerous.
key words: Skin Cancer, Dermoscopy Images, Image Processing , 2D wavelet, Neural Network Classifiers.

I. INTRODUCTION

Skin cancer is a commonly and locally destructive cancerous growth of the skin. It originates from the cells that line up along the membrane that separate the superficial layer of skin from deep layers. There are three major types of skin cancer 1) Basal Cell Carcinoma (BCC) happened when lesions grow rapidly in skin cells termed as basal cells 2) Squamous Cell Carcinoma(SCC) affects squamous skin cells 3) Melanoma from the pigmented producing skin cells[14]. Image processing is one of the widely used methods for skin cancer detection[2]. Most of the researcher taken as dermoscopy images be a non invasive examination technique supported the causes of incident light beam and oil immersion technique to form of potential the visual investigation of surface structures of the skin. Melanoma can spread out all parts of the body through lymphatic system or blood[7]. There are some specific features that distinguish malignant melanoma from other three types of benign melanoma.

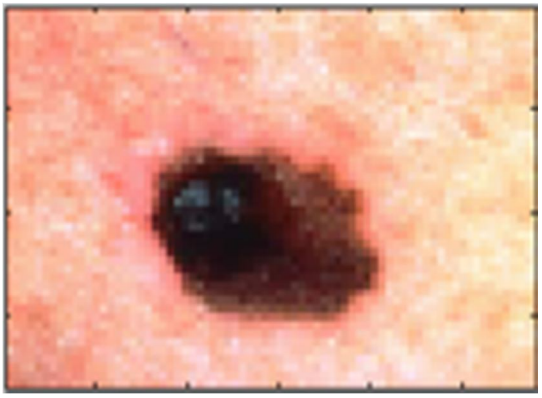

Fig 1. skin cancer Image.

In this proposed method a computer can diagnosis of melanoma by using dermoscopic images and also classifying its type as whether image is cancerous or non-cancerous[7]. This method use both the image processing for feature extraction and artificial neural network for classification purpose. It is a part of artificial intelligence and has accepted as a new techniques in computer science[2]. The ANN algorithms developed for processing the medical image and analysis often become more intelligent than convention techniques.

II. REVIEW OF LITERATURE

In this section describes the previous work done on melanoma using different classification techniques. Medical field, melanoma detection is done using a clinical screening by a trained dermatologist using the device called dermatoscope and it is done by analyzing the ABCDE rule[14].

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Ho Talk Lau et al (2009) proposed a method for by image classification system for skin cancer through image processing algorithms and enhance the dermoscopy images are extracted from wavelet decomposition methods. The proposed system used median filter technique and histogram equalization technique. The result of segmentation by thresholding using ROI in image segmentation. SRM algorithm is based on the region growing and merging it is better than ROI segmentation result. The feature extraction are accessed in neural network of two classifier, they are back propagation neural network and auto associative neural network [8]. The accuracy of BNN is 89% and AANN is 80.8%. Abdul Jaleel et al (2012) proposed to detect the skin lesion in image processing algorithms and image are feature extracted statistical values are given to as input to a multilayer feed forward network. This system is proved to convenient than the conventional biopsy method. It produce best accuracy of detection of cancer[1],[2]. Saudamini et al(2013) worked as automatic dermoscopy image analysis system has usually three stages, 1) proper segmentation 2) feature extraction and selection 3)lesion recognition . The system can be used for dermoscopic images. The proposed image is segmented using Texture distinctiveness lesion segmentation(TDLS) method to extract the lesion area from the back ground skin[16]. Feature extraction done by GLCM and classified by ANN classifier and SVM classification[11]. This method dives better diagnosis and accuracy of conventional clinical screening and biopsy test. Mohamed khaled Abu Mahmoud et al (2014) introduced novel approach of image processing for CAD based on pigment network and elements detection pathology images. Image features extracted through classifier for training and testing to define whether malignant or not. Swarm based SVM and particle swarm optimization are parameter to optimized to find the melanoma detection. This system perform accuracy is 80%[13]. Jayant Ghode et al (2015) proposed in this work based on dermoscopy images are extracted the feature in matlab and this image are preprocessed in Dull Razor software using removing noise[12]. This approach of seven feature are extracted and composing in ANN classifier . activation function is log sigmoid function which gives output as 0 or 1 and calculate mean square error. The accuracy of the proposed technique is 90%[9]. T. K.Kanimozhi et al (2016) proposed method to diagnosis of melanoma easily to identified early stages. This methods useful to increase the diagnosis is accuracy. The images are processed by several image processing methods and finally image feature extracted used classic, geometry features , greatest diameter, circularity, index, irregularity. ABCD rules to detect skin cancer using ANN architecture. The Back propagation algorithm for training ANN. It consume few seconds of execution time and result to found better with the accuracy of 96%[10].

III. METHODOLOGY

A. System Architecture

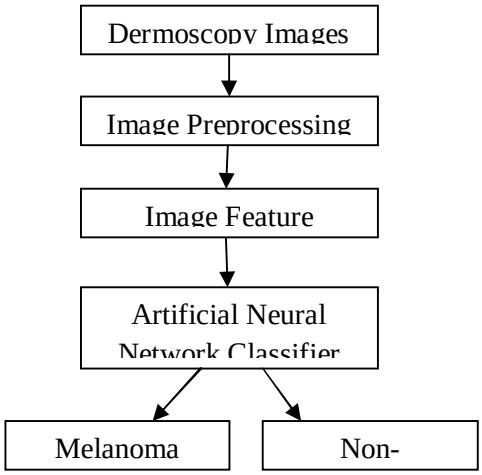

Fig 2. Proposed System Architecture

B. Skin Cancer Detection System

Skin cancer detection is a classification system which classifies malignant melanoma using image processing techniques and software of MATLAB[1][2][5]. This system architecture shown in fig 2 . It consist of different process which include preprocessing , segmentation, feature extraction and classification. The preprocessed images are preserved edges. These images are extracted using 2D wavelet transformation in MATLAB .These features are given as input to the ANN based classifier, is used to detect the images

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are cancerous or non-cancerous[3]. Computational system have been developed to assist dermoscopic in early diagnosis is skin cancer or monitor skin lesions[15].

C. Dermoscopy Images

Dermoscopy or Epiluminescence Light Microscopy(ELM) is mainly used to evaluate pigmented ski lesions[5]. The lightly can magnify the skin that improves on reveal most of the pigmented ,structure, different color shades that is not visible to normal eye and allows direct viewing and analysis of the epidemics[6][10].

D. Image Processing

The dermoscopy images are in digital format. The standard image size is taken as 512*512 pixels. The image consist of hairs and other components and the causes of in accuracies in the detection of melanoma[11]. The aim of the preprocessing can be done through three process they are image enhancement , image restoration and hair removal. Image processing[2],[11] is removal of noise in the images like hairs are removed using software dull razor. The post-processing is done for enhancing shape and edges of images are applied into segmentation processing.

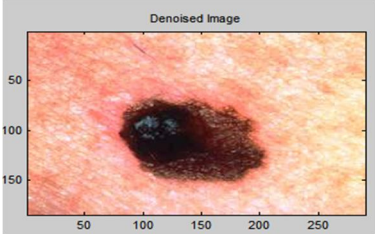

Fig 3. Denoised Image.

E. Image Segmentation

Image segmentation plays a major role in segmentation subdivides an image into continuous region or object. Segmentation removes the healthy skin from the image and find the ROI. The ROI is an cancerous regions and it has to be extracted from the healthy skin[7] shown in fig 4 . In this technique provides thresholding segmentation. The input to a thresholding operation is typically gray scale or color image. The region based area use a statistical information of image intensity of pixels by pixels as binary image[15][18].

Fig 4.Detection of Cancer region.

F. Feature Extraction

Discrete wavelet transformation image pixels into wavelet, which are then used for wavelet based compression and coding. It is a powerful tool for numerous application such as signal analysis ,image compression and numerical analysis[3]. DWT method an images is decomposed into different frequency ranges that allows frequency isolation into certain sub bands shown in fig 5. The image decomposition of 2D wavelet transform is perform by applying 1D DWT along the first row of an image, then the result is decomposed into columns as like tree structure shown in fig 6 . The decomposition images is divided into four sub images is represented as Low-Low(LL), Low-High(LH), High-Low(HL), High-High(HH) shown in fig 7. It is easy to implement and reduce the computation time and resource required.

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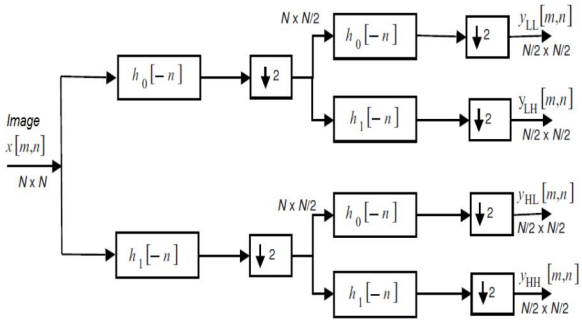

Fig .5 DWT transformation methods

G. HARR Wavelet Transformation

The harr wavelet is a sequence of rescaled square shaped functions which together wavelets are directly sampled family or basis. A wavelet analysis is similar to a forward transformation analysis is similar Fourier over an interval to be represented in terms of an orthogonal functions basics. The harr wavelet is a simple wavelet transformation in image enhancement[17],[9].

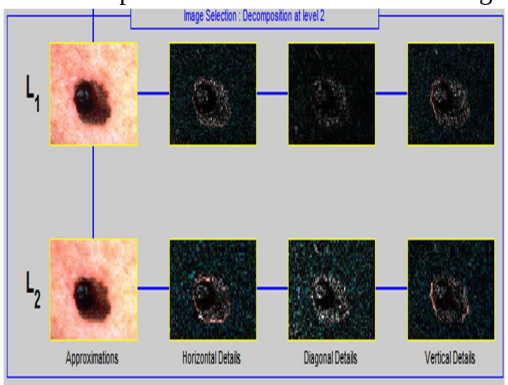

Fig 6. 2D wavelet tree view structure

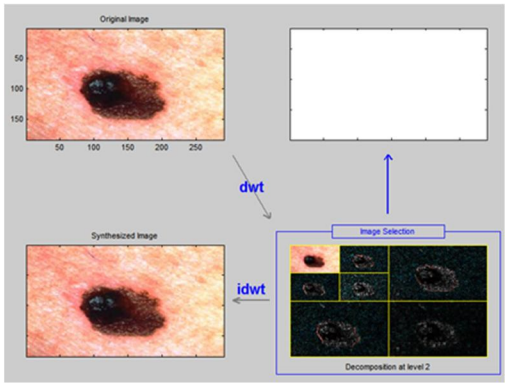

Fig 7.2D wavelet of decomposition of sub image

In this existing system Harr 2D wavelet packet is used and the enhanced image in gray scaled as input. Most of the researcher following two level of decomposition process, it produce best result .The wavelet of primary image divided into an appropriate and the detailed images which show the basic information are vertical, horizontal and diagonal detail respectively[4] shown in fig 7 . the features are extracted using the wavelet transformation are Mean, Standard Deviation ,Mean Absolute Deviation,L1 Norm, L2 Norm.

H. Artificial Neural Network Classification

The neural network structure consist of input layer in the middle layer(hidden) and output layer. The hidden layer and output layer adjust weights value based on the error output in classification of different feature[8]s. In back propagation network input signals follows in forward direction and the output of the network is compared with desired output. If both are not same an error occurs at

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the reverse pass, the error is back propagation and weights of hidden and output layer are adjusted[1,][2] .This process continues until error is zero or with in set to liable limits .

Error =Desired Output-Actual Output (1)

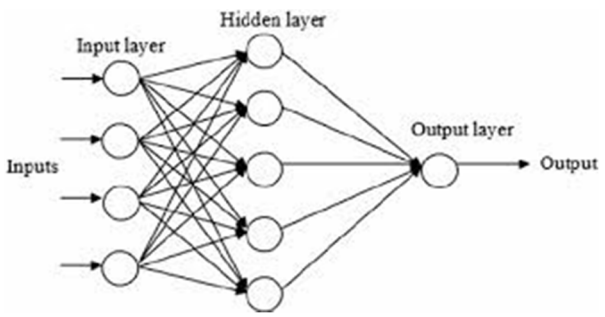

Fig 8. Structure of Neural Network

In this proposed system five features given as input to a multilayer with 3 hidden neurons and one output neurons. Activation function used in a linear function which gives output as 0 for non-cancerous and 1 for cancerous. Neural network tool of MATLAB is used for the classification[15]. The network is trained with known values. After training network perform decision making. The data for classification is given as input to classifier. 30 images features are extracted values are given to classification. The output of the classifier is either 0 or 1.

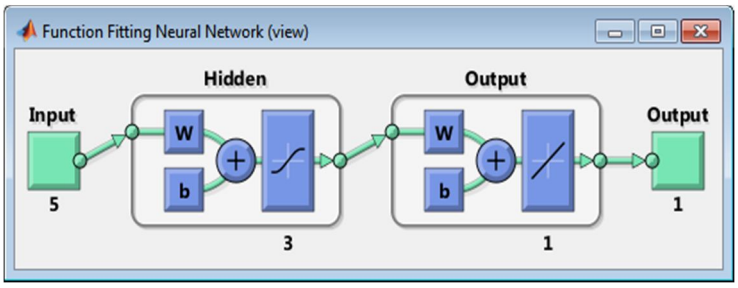

Fig 9. Proposed system process in ANN

IV. EXPERIMENT RESULT

The dermoscopy images are collected from various website on internet. These images are processed for hair removal by dull razor software segmented by active counter approach. The feature extraction is done by 2D wavelet transformation[3]. The five features are selected for classification and given as input to as neural network classifier. Activation function used in linear function which gives an output as 0 or 1[6],[9]. The datasets were classified in artificial neural network for diagnosis an result of 20 were melanoma and 10 images are non-melanoma shown in fig 10 . The accuracy of the proposed techniques is 97%.

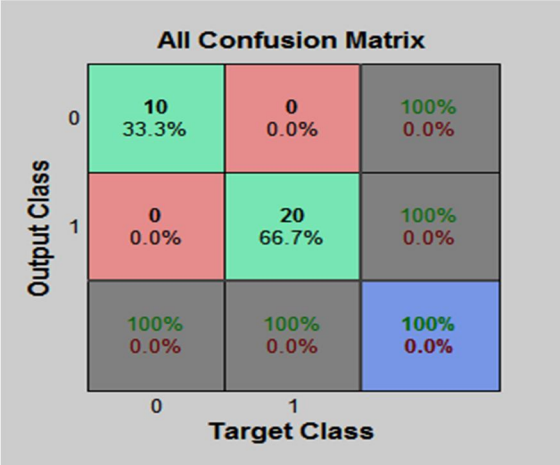

Fig 10 Confusion Matrix for Diagnosis Image

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V. CONCLUSION

In this paper we have discussed a computer aided diagnosis system for melanoma skin cancer with ANN as classifier using back propagation . It proves to be a better diagnosis method. There are many techniques to detect the cancer (i.e), thermal imaging, wavelet transformation, mammogram images etc. skin cancer diagnosis system identifies and recognize skin cancer symptoms and diagnosis melanoma in early stages[10]. The features of the segmented images were extracted using 2D wavelet transformation. These images are classified as cancerous or non-cancerous. The diagnosis method include both image processing and neural network with accuracy of 97%.

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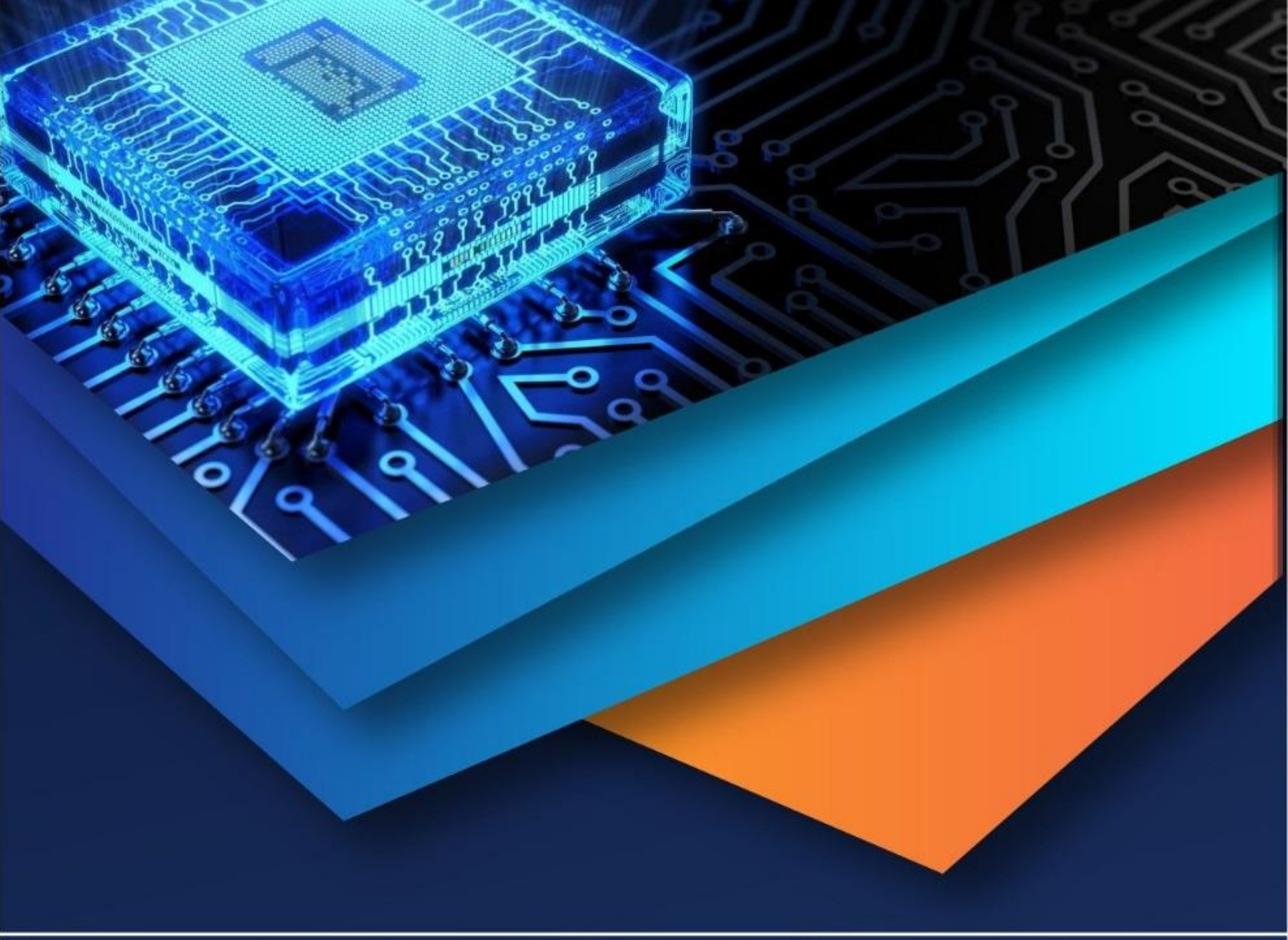

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