Skin Disease Identification using MATLAB

DR. M. SUNIL BABU[1], M. SAI MANIKANTA[2], P. GANESH[3], M. DHARMA RAKSHAK[4], P. PRUDVI TEJA[5]

[1, 2, 3, 4, 5] *Department of Electronics and Communication Engineering, Vasireddy Venkatadri Institute of Technology, Nambur(V), Guntur(Dt), Andhra Pradesh, India.*

Abstract- Skin is the largest organ of the body and it is the protective layer of the human body which protects from microbes and gems guarding the body against extremes of temperature, damaging sunlight, and harmful chemicals. It also releases antibacterial substances that prevent infection. Suppose that skin is affected with harmful diseases, especially in remote areas where a dermatologist is not available. We have to detect the disease is dangerous or not before it become worse and causes death. So to use in especially in remote areas we implemented an idea about skin disease identification using matlab and completely non-invasive to patient skin. In this based on image of the infected skin provided by the user, image processing is done and tells the user weather the infected portion of skin is harmful or not. Here we are using matlab software which compares original diseased image with user image and decides disease is harmful or not.

Indexed Terms- Infected image, MATLAB software, matching algorithm.

I. INTRODUCTION

Skin disease is an unusual condition of the skin. Skin is the protective cover to the body from harmful fungal, bacterial and parasitic infections. Hence correct identification of skin disease is crucial. Various factors causing skin diseases are fungus, parasites, or microorganisms living on the skin, weakened immune system, nutrition, habits, etc. Geographical factors like seasons and climatic changes also affect human skin. And in developing and developed countries overcrowding and poor hygiene are reasons for spreading. In addition, remote areas are severely affected.

In this paper, image processing is used to detect diseases in humans. This paper describes how to identify diseases using digital method. And also includes detailed description of the transforms used and algorithm used to diagnosis skin disease. The transform implemented are compared on accuracy parameter.

II. LITERATURE REVIEW

Recently WHO (World Health Organization) has highlighted the severity of the skin diseases in India which accounts for 10 to 12 percent of India's population. There are only 7000 dermatologists present to serve a population of 1326 million people and most of these dermatologists serve in cities. Due to this lack of dermatologists in rural areas.

The current practice is an invasive method to detect skin disease by biopsy, scraping, patch testing and prick testing. In patch testing and prick test, the allergen is directly applied to the infected area. This might think skin takes a long time to react to it.

III. PROPOSED SOLUTION

The proposed solution in this paper is a prototype with a database of six common skin diseases which a patient can self-diagnose and get a proper knowledge of the skin disease before consulting a dermatologist. This prototype used in rural areas. Now a days everyone had a mobile phones. Thus, this prototype can be accessed in remote areas. Patient has to just upload a picture of the infected portion of the skin disease to the prototype to get the results. Which tells that weather it is benign tumor or malignant tumor.

The proposed method is noninvasive method to identify the skin disease where the patient provide the infected portion of the skin disease no pricking or prodding of the skin is required.

A. Block Diagram

The proposed system consists of two processes: Training and Testing.

In training process analyses the image and performs image processing on the training database whereas the testing analyses the input image provided by patient. But before any analysis image pre-processing is done so that all images are in desired feature. Resolution matching is done on the image so that they all are in same size.
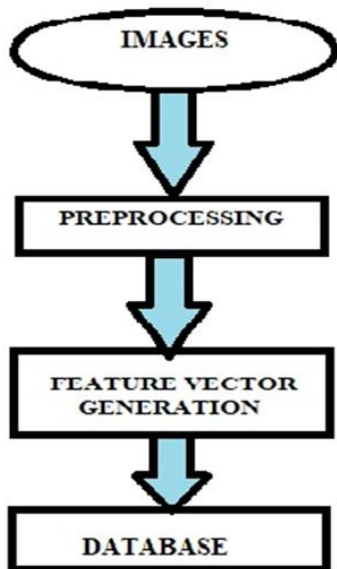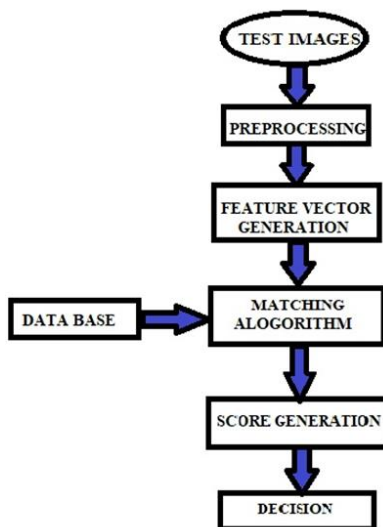
Fig: Block diagram for database creation

Fig: Block diagram for testing process

B. Diseases being considered

According to the prototype six common diseases in which three are benign tumor and three are malignant tumor.

Fig 1. Melanoma   Fig 2. Basal Cell Carcinoma

Fig 3. Squamous Cell Carcinoma

Fig 4. Melanocytic Nevi   Fig 5. Seborrheic Kerasotes

Fig 6. Acrochordon

These are the skin diseases in database which are trained and compared with processed input image and give the result.

IV. IMPLEMENTATION

The proposed method is implemented and processed with the help of following three transforms.

A. Discrete Cosine Transform

The discrete cosine transform (DCT) represents an image of sum of sinusoids of varying magnitude and frequencies. And it also transforms a signal or an image from spatial domain to frequency domain.

The discrete cosine transform (DCT) is closely related to the discrete Fourier transform. It is a separable linear transformation; that is, the two-dimensional transform is equivalent to a one-dimensional DCT performed along a single dimension followed by a one-dimensional DCT in the other dimension. The definition of the two-dimensional DCT for an input image A and output image B is

$$F(u,v) = \left(\sqrt{\frac{2}{N}}\right)\left(\sqrt{\frac{2}{M}}\right) \sum_{i=0}^{(2/N)-1} \Lambda(i) \sum_{j=0}^{(2/M)-1} \Lambda(j) \cos\left(\frac{\pi 4}{2N}(2i+1)\right) \cos\left(\frac{\pi 4}{2M}(2j+1)\right) f(i,j)$$

Where,

$$\Lambda(\xi) = \begin{cases} \frac{1}{\sqrt{2}} & \text{for } \xi = 0 \\ 1 & \text{otherwise} \end{cases}$$

F (u, v) = DCT transformed image

f(i, j)= Original image

B. Discrete Cosine Transform

Wavelet transform has become a powerful statistical tool in signal processing, data compression, fingerprint verification, speech recognition and in finance as well, for detecting the properties of quick verification values. Wavelet transform is based on wavelets. Wavelets have zero mean and

Thus, the 2D signal is divided into four sub-bands:
LL – this quadrant contains all coefficients obtained after low pass filtering along the rows followed by low pass filtering along the columns. This upper left quadrant represents the approximated version of the original image at half the resolution. Hence this sub-band is also called as approximation sub-band.

HL – this quadrant contains coefficients obtained after high pass filtering along the rows followed by low pass filtering along the columns. This upper right quadrant represents the horizontal edges of the original image.

LH – This quadrant contains coefficients obtained after low pass filtering along the rows followed by high pass filtering along the columns. This lower left quadrant represents the vertical edges of the original image.

HH – This quadrant contains all coefficients obtained after high pass filtering along the rows followed by high pass filtering along the columns. This lower right quadrant represents the diagonal edges of the original image.

As mentioned above, that wavelet transform hierarchically decomposes the signal; the decomposition can be of level 1, level 2 or level n decomposition depending on the application.

Fig 1: Original image

Fig. 1 shows a pre-processed image. After level 1 decomposition of the image, approximation and detail (horizontal (H), vertical (V) and diagonal (D)) coefficients are obtained which is represented by Fig. 2.

In this paper, the images are decomposed using DWT of db4 type into number of levels for comparative analysis. The approximation coefficients are the features of the decomposed image, which are later used to detect a disease.
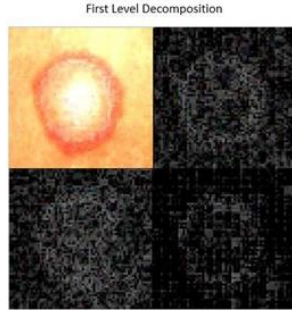
First Level Decomposition

Fig.2. DWT Transform applied on Input Image when L=1

C. Support vector machine

"Support Vector Machine" (SVM) is a supervised machine learning algorithm which can be used for both classification and regression challenges. However, it is mostly used in classification problems. In the SVM algorithm, we plot each data item as a point in n-dimensional space (where n is number of features you have) with the value of each feature being the value of a particular coordinate. Then, we perform classification by finding the hyper-plane that differentiates the two classes very well (look at the below snapshot).
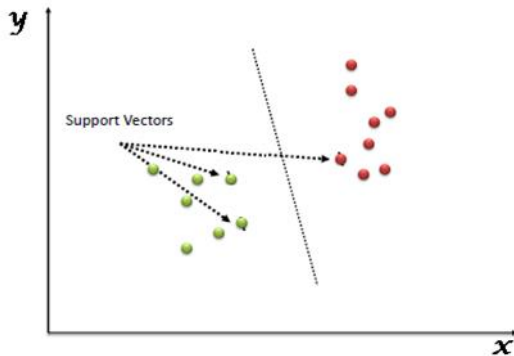
D. Levenberg-Marquardt Algorithm

The Levenberg-Marquardt (LM) algorithm is an iterative technique that locates the minimum of a multivariate function that is expressed as the sum of squares of non-linear real valued functions [4, 6]. It has become a standard technique for non-linear least-squares problems [7], widely adopted in a broad spectrum of disciplines. LM can de thought of as a combination of steepest descent and the Gauss-Newton method. When the current solution is far from the correct one, the algorithm behaves like a steepest descent method slow.

In function optimization problems with neural networks, the training algorithm is designed to determine the best network parameters in order to minimize network error. Various function optimization methods can be applied to ANN model training. One of these methods is the Levenberg-Marquardt algorithm. The Levenberg-Marquardt algorithm provides a numerical solution to the problem of minimizing a nonlinear function, over a space of parameters for the function. It is a popular alternative to the Gauss–Newton method of finding the minimum of a function.
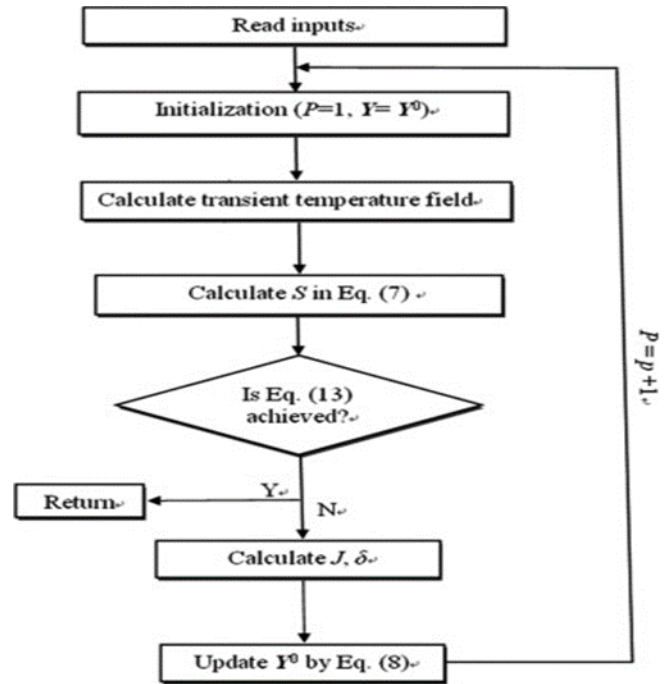
V. RESULT ANALYSIS

The disease was first detected using DCT (Discrete Cosine Transform). And DWT (Discrete Wavelet Transform) with different levels of decomposition of the image and DWT is also used for lossless image compression in which if there is any loss data disease identification is not possible.

Here we use an algorithm called levenberg marquardt algorithm, it is used to meet database images with input images from the patient and gives disease name and status of the disease.

CONCLUSION

The proposed system was implemented in MATLAB version 7.12.0 on a Windows 10 64-bit operating system with Intel(R) Core(TM) i3-6100U CPU @2.3 GHz processor.

Skin disease is extremely common and dangerous must be detected at the earliest stage. The proposed solution in this paper is easy to detect diseases with an efficiency of up to 80%. The average training time for two transforms and the parallel combination was found to be 2.066 seconds. And average testing time found to be 0.7866 seconds.

FUTURE SCOPE

The proposed system has only six common diseases pictures in its database, more skin diseases with pictures of all skin tones and types we can include. This would lead to accurate detection of diseases in the most efficient way.

We can develop it as a mobile application in android phones so the user can make use of it in a more efficient way

APPENDIX

Appendixes, if needed, appear before the acknowledgment.

ACKNOWLEDGMENT

The preferred spelling of the word –acknowledgment‖ in American English is without a –e‖ after the –g.‖ Use the singular heading even if you have many acknowledgments. Avoid expressions such as –One of us (S.B.A.) would like to thank ....‖ Instead, write –F. A. Author thanks ....‖ Sponsor and financial support acknowledgments are placed in the unnumbered footnote on the first page.

REFERENCES

[1] M. Depietro and V. Hiugeria,"Skin infection: types, causes, and treatment", Healthline, 2017.

[2] d. Dimri, V.reddy B and A. Kumar Singh, "Profile of skin disorders in unreached hilly areas of north India", Hindawi, 2017.

[3] BioSpectrum Bureau,"Skin diseases to grow in India by 2015: report", Biospectrum, 2014.

[4] E H. Page, MD, nAssistant Clinical Professor of Dermatalogy; Physician, Harverd Medical School;Lahey Hospital and Medical Center"Diagnosis of skin disorders", MSD Manual Consumer Version, 2017.

[5] M. rodri & shy;guez, "The median filter problem".

[6] P. Miami, "10 most common skin diseases", Positive Med, 2014.

[7] "Discrete cosine transform – MATLAB & Simulink", In.mathworks.com, 2016.

[8] "The discrete cosine transform (DCt)", Users.cs.ac.uk, 2017.

[9] M. Sifuzzaman, M.R. Islam and M.Z. Ali, "Application of wavelet transform and its advantages compared to fourier transform", journal of Physical sciences, Vol.13,2009.

[10] W. K. Saad, "Method for detection and diagnosis of the area of skin disease based on colour by wavelet transform and artificial neural network", Vol. 2, No.4, 2009.