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SKIN DISEASE IDENTIFICATION USING IMAGE PROCESSING AND MACHINE LEARNING TECHNIQUES

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Abstract - *Dermatological diseases are the most prevalent diseases worldwide. Even though being common, diagnosis is extremely difficult and requires extensive experience in the domain. In this project, we provide an approach to detect various kinds of these diseases.Computer vision and Machine learning are dual stages which we used for identify diseases accurately. Our objective of the project is to detect the type of skin disease easily with accuracy and recommend the best. First stage of the image the skin disease is subject to various kinds of pre-processing techniques followed by feature extraction. Then the second stage involves it uses the Machine learning algorithms to identify diseases based on the analyzing and observarance of the skin. The proposed system is highly beneficial in rural areas where access to dermatologists is limited. For this proposed system, we use Pycharm based python script for experimental results.*

***Key Words*: Computervision, Machine learning, Pycharm**

1. INTRODUCTION

Due to complexity Dermatology is one of the most unpredictable to diagnose. In most developing countries, it is expensive for a large number of people to consult a dermatologist. The ubiquitous use of smart phones in a developing country has opened up new avenues for inexpensive diagnosis of diseases. We can use the smart phone camera technology and exploit the image processing capabilities of the device for diagnosis. We have developed an application that utilizes a two staged approach in order to tackle the problem. The first stage involves Image Processing for identification and the second stage involves Machine Learning for a solution. Difficulty for the partitioned the diagnosis is that a disease may show the features of one disease in the initial stage and may have the characteristic features of another in the following stages.

Usually a biopsy is necessary for the diagnosis but these diseases share many difficult features as well. This issue is solved by using machine learning models on the clinically evaluated features which are determined by an analysis of the skin samples under the microscope. Owing to the subjective nature of diagnosis, medical students find it difficult to verify their diagnosis. This system acts as an effective learning tool, aiding verification of their results as they have access to clinical data. We have achieved higher level of accuracy using an ensemble of Computer Vision and Machine Learning algorithms. Skin disease is an abnormal condition of the skin. Skin plays an important role in protecting the body from harmful bacterial, fungal and parasitic infections. Hence the correct diagnosis of skin disease is vital. These type of skin diseases and affecting skin disorder pattern are genetics, occupation, nutrition, habits, etc. Geographical factors like season and climate also affect. In developing countries, overcrowding and poor hygiene are responsible for spreading of skin diseases. The skin diseases may varies from country to country. Moreover, remote areas are severely affected.

The identification of skin disease from dermotoscopy images are treated as an image classification problem. The tradition approach of image classification needs robust feature are feed to the classifier for training. The medical diagnostic process several color, texture and shape features are used to characterize the skin lesion. However, it is very much difficult to develop robust feature representation to deal with the dermotoscopy images obtained from different acquisition devices and captured in diverse illumination conditions. computer vision researchers to use deep convolutional neural networks.

3. SYSTEM IMPLEMENTATION

3.1 THE IMAGE PROCESSING PHASE

The image processing phase involves the extraction of features from the input images (from the data-set) using the python OpenCV module. Different functions have been used to change the input step by step to the optimum image with only the necessary features. Firstly, the image is converted to a grey scale image as luminance is the required part that represents all the features present in the image. Also since the colour of the infected region is the same for more or less every skin disease being tested, we do not need to consider the chrominance of the image. Next we apply a sharpening filter function to the image to increase the contrast of the edge mask of the image. Subsequently we apply some noise reduction filtering functions like the median filter and smooth filter. The sobel operator is used for edge detection.

3.2 MACHINE LEARNING

Finally, in the machine learning phase the feature-rich images are feed into the training set. For the implementation purpose we have used the Keras library in python to run the machine learning algorithm. Machine learning is inspired by the functioning of the brain. The whole model consists of layers, just like neurons in the brain. This model learns by considering examples. The sequential model is created using

Keras. Initially two layers are added with a rectifier function. The next step is adding a pooling layer of 2x2 matrix. Now the pooled images are converted into a continuous vector. The hidden layer is now added, this layer will contain all the nodes, called artificial neurons. These layers simulate the human brain by learning layers by layers. Once all the layers are added, the model is compiled and saved as a h5 file which can be loaded on the front end so that we don't have to train the model every time.

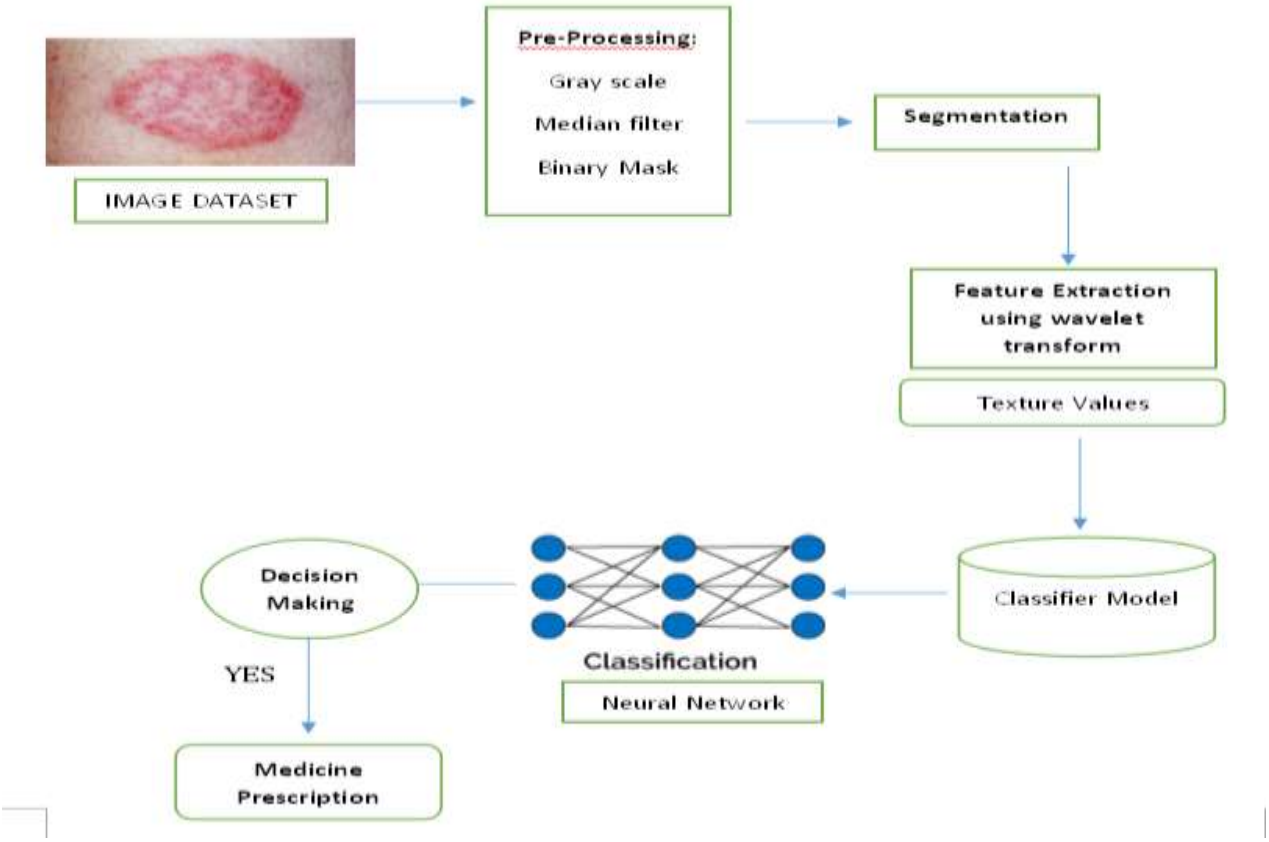


Fig -1: System Architecture

4. MODULES

The System module is categorized into four sub-modules namely,

Module 1: Image Acquisition

Module 2: Image Segmentation

- Otsu's Method
- Histogram Chart
- Algorithm

Module 3: Feature Extraction

Module 4: Convolutional Neural Network

4.1 IMAGE ACQUISITION

Images are acquired through a camera or locally stored device. Images are obtained from surveys and websites. Image Pre-processing: For Pre-processing of Image, Filtering is performed on image which is a non-linear process used for enhancing the overall image by preserving the edges of the image. Median filtering is used especially to reduce impulsive, salt-pepper noise. In this, each pixel value in an image is replaced with the median value of its neighboring pixels including itself.

4.2 IMAGE SEGMENTATION

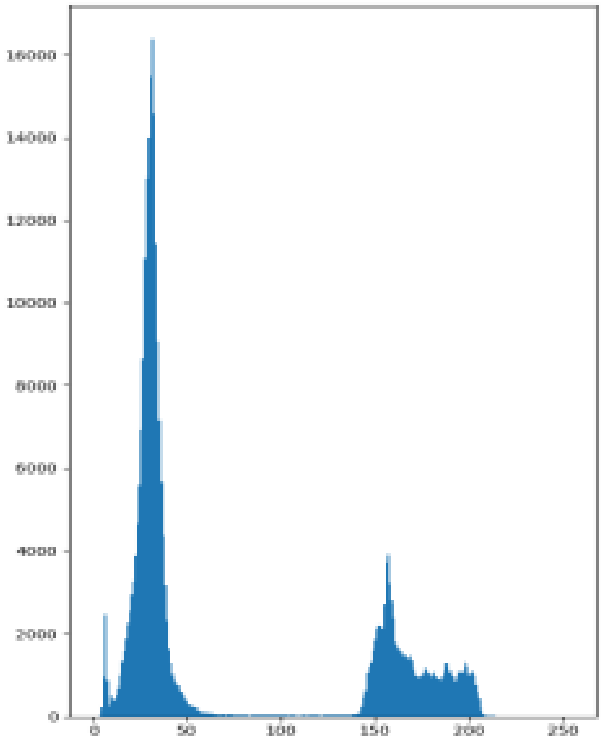
Image segmentation is performed to separate something dangerous lesion from normal skin. For image segmentation, multilevel thresholding using Otsu method is performed where image is segmented into 3 levels using IM Quantize with 2 threshold level. The Segmented image is converted into a color image.

4.2.1 OTSU'S METHOD

Otsu's method is used to perform automatic image thresholding . The algorithm returns a single intensity threshold that separate pixels into two classes, foreground and back ground. This threshold is determined by minimizing intra - class intensity variance , or equivalently, maximizing inter - class variance. It is equivalent to a

globally optimal k-means performed on the intensity histogram

4.2.2 HISTOGRAM CHART



4.2.3 ALGORITHM

1. Compute histogram and probabilities of each intensity level.

2. Set up initial ω i (0) and μ i.

3. step through all possible thresholds t=1,…… maximum intensity.

1. Update ω i and μ i .

2. Compute σ2(t).

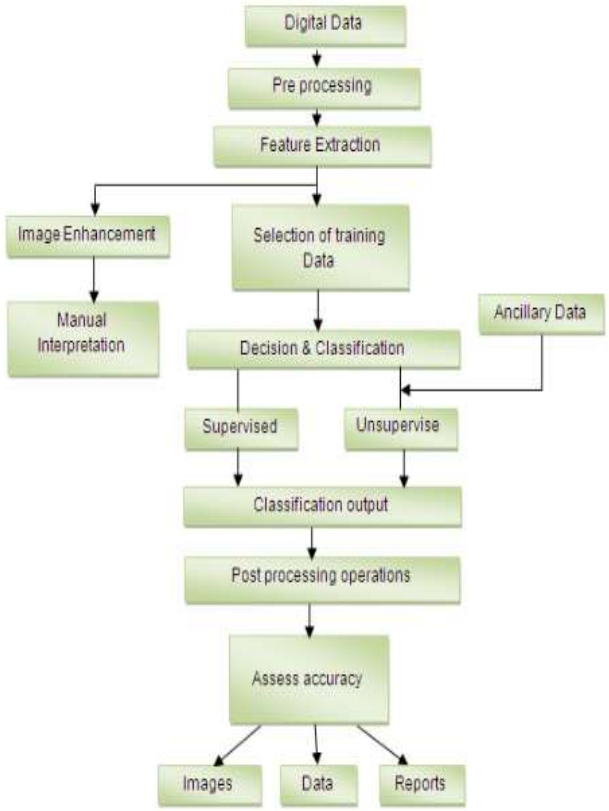
4.3 FEATURE EXTRACTION

Unique features of skin lesion are extracted. Features are extracted using the 2D Wavelet Transform. Features extracted using the wavelet transform are Entropy, Mean, Mean Absolute Deviation, Median Absolute Deviation, Energy, Standard deviation, L1 norm, L2 norm, Kurtosis, Skewness. Texture Features extracted are Contrast, Correlation, Energy and Homogeneity. Dataset comprises of visual features (features extracted from images using image processing). For skin disease classification, Convolutional Neural Networks (CNN) classifier is used.

4.3 CONVOLUTIONAL NEURAL NETWORK

A convolutional neural network (CNN) is slightly in variance with the multilayer perceptron. A CNN can have a single convolution layer or it can contain multiple convolution layers. These layers can be interconnected or pooled together. A convolution operation is performed on the input and then the results are passed to the further layers. Thus, due to this, the network can be deep but will contain only a few parameters. Due to this property, a convolutional neural network shows effective results in image and video recognition, natural language processing, and recommender systems. Convolutional neural networks give accurate results in semantic parsing and paraphrase detection. This is the reason to use CNN for skin disease detection. CNN classifier is implemented to train and test skin disease images. CNN classifier is a layered architecture where multiple layers perform various operations to train and test the image data.

5. WORKFLOW



6. CONCLUSION

The proposed system is able to successfully detect the dermatological disease present in the image. It can be used to help people from all over the world and can be used in doing some productive work. The tools used are free to use and are available for the user, hence, the system can be deployed free of cost. Though the machine learning data-set was small, the system was able to identify the disease with minimum error. The application developed is light-weight

and can be used in machines with low system specifications. It has also a simple user interface for the convenience of the user. The image processing and machine learning algorithms were successfully implemented.

7. FUTURE ENHANCEMENT

Future scopes of improvement in present methodologies are:

1. A common model should be adopted for the identification of all types of skin diseases

2. Support for multilingualism to develop user-friendliness

3. To expand the multiplatform capability through an introduction to IOS compatibility

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