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Classification of Different Types of Skin Cancer for Diagnosis using Digital Images

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Abstract **– Melanoma is considered as a destructive type of skin cancer. However, it is hard to distinguish it from other types of skin cancer due to their similar visual appearance and symptoms. The mortality rate because of this disease is higher than all other skin-related consolidated malignancies. The number of cases is increasing among young ones. The cost and time for the doctors to diagnose all patients for skin cancer is high range. In this paper, We propose an intelligent system to detect and distinguish the skin cancer images by using the image processing techniques. Initially, Median filter is used to remove the noise from the given skin lesion of the obtained images followed by the use of Multi level thresholding to segment out the lesion. By using the Lab colour space model, the colour conversion takes place in the obtained images. A Histogram of Oriented Gradient is formed by the extraction of texture and colour features from the given skin lesion. A Decision tree and Discriminative classifier is utilized for the classification of skin cancer into Melanoma, Nevus, Basal Cell Carcinoma and squamous Cell Carcinoma. Our aim is to test the effectiveness of the proposed segmentation technique, extract the most similar features and compare the classification results with two different classifiers which is used in this technique. The Proposed methodology is tested on EPIDERMIS dataset having a total number of 247 skin cancer images. Our proposed methodology archives encouraging results with high accuracy.**

INDEX TERMS **– Melanoma, Nevus, Basal cell carcinoma, Squamous cell carcinoma, Multi-level thresholding, Decision tree and Discriminative.**

I.INTRODUCTION:

Skin Cancer is considered as a major contributor to the causes of deaths around the world [1]. There are various types of cancers that are discovered. Skin cancer is fast growing cancer nowadays. According to current research, patients with skin cancer diagnosis is increasing more than any other cancer form every year [2]. According to the research, the mortality rate may be reduced up to 90%, if the skin cancer is reduced when it is diagnosed in its initial stage. That's reason behind this paper, to detect the skin cancer at its earlier stage. Then it can diagnosed easily and also reduce the mortality rate due to skin cancer.

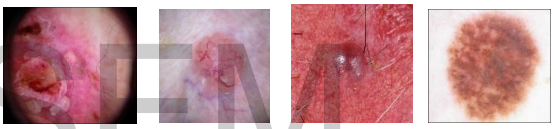


Figure 1. Types of skin cancer

Melanoma is the most common form of skin cancer that affects melanocytes which produce melanin pigment. It has cells that cause the skin to turn to black colour [3]. Melanoma can occur any area in our human body. But it mostly affect on the back of human legs [5]. Considering the complex nature of melanoma, it becomes hard for the researchers to detect skin cancer only on the basis of these of these geometrical features.

With the advent of computer aided diagnostic systems, researchers mainly emphasizes on the automatic detection and classification of skin cancer. Medical images in the form of textural features [10]-[12], geometric figures[4], colour features[13]-[15] and in a combination [16]-[18] have been used to identify and classify skin cancer.

Our research paper work aims to achieve high accuracy results in identifying and classifying the different types of skin cancer, contributing to the present literature by,

- To develop a complete automated computer based system to detect the different types of skin cancer accurately.
- Design of an improved Multi level thresholding approach for computationally efficient segmentation process
- Utilization of features incorporating both texture and colour of the lesion to classify the skin lesions.

The remaining of our research paper is organised as a detail literature review of existing techniques of features extracting and classification is discussed in section 2. The components of the proposed work are discussed in detail in section 3. Section 4 describes the experimental setup and evaluation metrics. Section 5 portrays the results and discussion on the given datasets. The conclusion is given in the last section.

II. PROBLEM DEFINITION:

The existing method of classification of skin cancer require manual involvement, human errors and the results are uncertain. The method is also time consuming and invasive in nature. But our proposed system overcomes all these errors because it takes into account the features of skin lesion for classification of different types of skin cancer.

III. METHODOLOGY

Following are the various levels involved in image processing

1) Low level processing
2) Medium level processing
3) High level processing

LOW LEVEL PROCESSING:

1. Filtration
2. Enhancement
3. Sharpening
4. Noise reduction

MEDIUM LEVEL PROCESSING:

1. Feature Extraction
2. Classification

HIGH LEVEL PROCESSING:

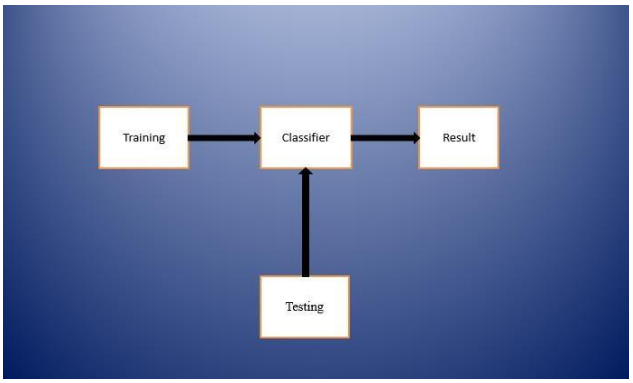
1. Result Identification

Figure 2 Image processing classification proces

Methodologies of different types of level processing in the given data set that explained below:

- Low level processing (LLP): It involves image enhancement, remove noise using median filter and resize the image.
- Medium level processing (MLP): It involves image segmentation and classification.
- High level processing (HLP): It involve image identification.

Basic Block Diagram:



Figur.3 Basic Block Diagram

Flow Diagram:

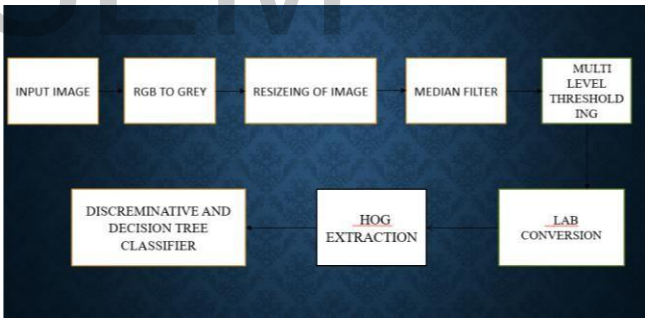


Figure.4 Flow Diagram

Filtration:

Filtration in our proposed system I done using Median Filter. In image processing, a median filter is a linear filter used for colour analysis. A filter is defined by a kernel, which is a small array applied to each pixel and its neighbors within an image. Itis usually used to blur the image or to reduce noise.

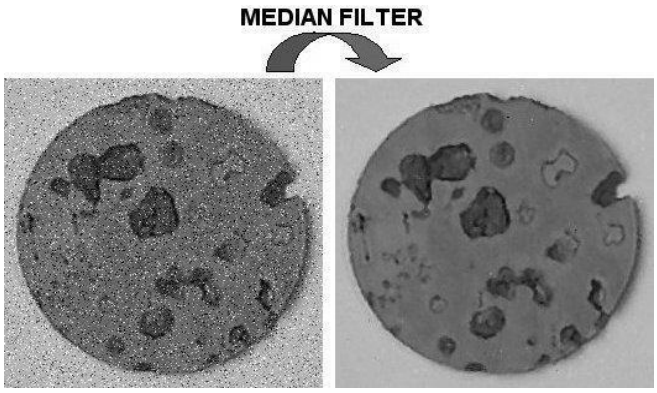


Figure.5 Median Filter

Image Enhancement:

There are two methodologies in image enhancement:

- Frequency domain Processing
- Special domain Processing

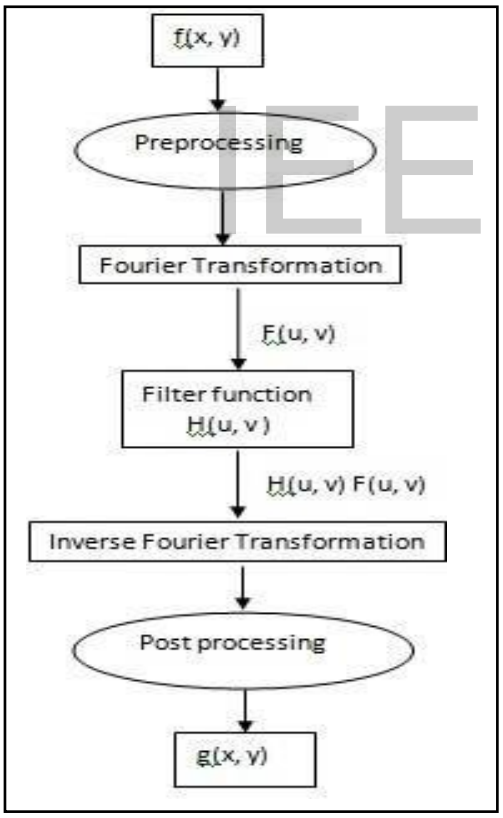


Figure.6 Image enhancement steps

FDP: It is basically achieved by filter operation based on Fourier transformation as given in equation no I.

$$G(u, v)=H(u, v)F(u, v) \quad \text{..... (I)}$$

Where:

F(u, v) : Fourier Transformation

H(u, v) : Filter function

G(u, v) : Yields

SDP: It is based on manipulation of pixel in an image and It is achieved by equation no II.

$$g(x, y)=T[f(x, y)] \quad \text{..... (II)}$$

Where:

f(x, y) = input image

g(x, y) = processed image

T = operator on f, divided over neighbour f(x, y)

Enhancement can be done by using gray level transformation, histogram processing, arithmetic logic operation and special filtering.

Multi level thresholding Segmentation:

Image thresholding is one of the most exploited techniques to accomplish image segmentation. The segmented image quality is based on the techniques incorporated to choose the threshold value. Thus the objective of convert pixels value in binary is to pixels that belong to true foreground region with a single intensity and background region with different intensities. Histogram shows the graph of pixel intensity of image, it helos to select the threshold level to separate the image, it helps to select the threshold level to separate the image into groups.

The MATLAB code is used for segmentation is

%thresh = multithresh(I3,2);

%segmentation seg I = imquantize(I3,thresh);

Figure.7 Multi level thresholding

Lab colour conversion:

"Lab" colour model that spilts the image into completely independent brightness(called luminousity or 'L' layer) and colour information (may described as two independent chromaticity

layers ‘a’ and ‘b’).Lab colour space is a 3-axis colour system with dimension L for lightness and a and b for the colour dimensions.

This system has been widely used to determine the colour coordinates L*(luminousity, from black to white), a*(coordinate from red to green), and b* (coordinate from yellow to blue).

Figure.8 Lab conversion

Feature Extraction:

Histogram of **O**riented **G**radient **(HOG)** is used for feature extraction in our proposed system. The existing system used for feature extraction is Local Binary Pattern. In our proposed techniques are used to extract necessary features so as to classify the different types of skin cancer and the accuracy exceeds the bar which was set by the existing tests.

Histogram of Oriented Gradient (HOG):

Using this model, the HOG descriptor focuses on the structure or the shape of an object. In the case of edge features, we only identify if the pixel is an edge or not. HOG is able to provide the edge direction as well. This is done by extracting the gradient and orientation of the edges.

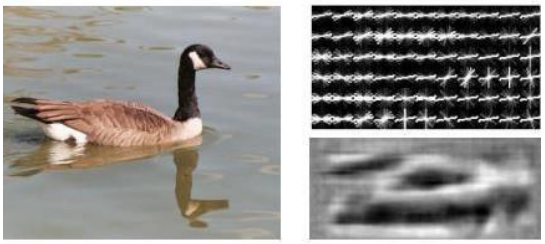


Figure.9 Histogram of Oriented Gradient

The complete image is broken down into smaller regions and for each region, the gradients and orientation are calculated. Finally the HOG would generate a Histogram for each of these regions separately.

Classification:

Classification is based on the features of image and category of organised data. Basically classification method has two phases:

- Training phase
- Testing phase

Types of classification:

- Supervised Classification
- Unsupervised Classification
- Statically process

Classification can be done by following six steps as shown in figure

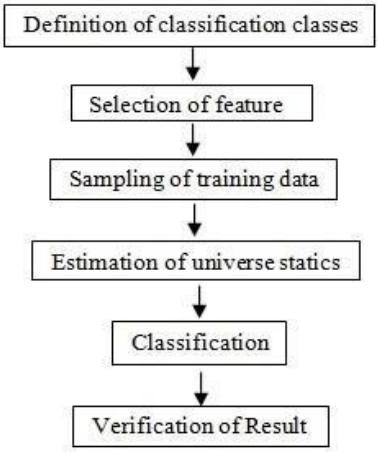


Figure.10 Steps of classification

Classifier:

Decision Tree classifier:

It is used in our proposed system. Decision tree builds classification models in the form of a tree structure. It breaks down a data set into smaller and smaller subsets while at the same time an associated decision tree is incrementally developed. A decision node has two or more branches. Leaf node represents a classification or decision.

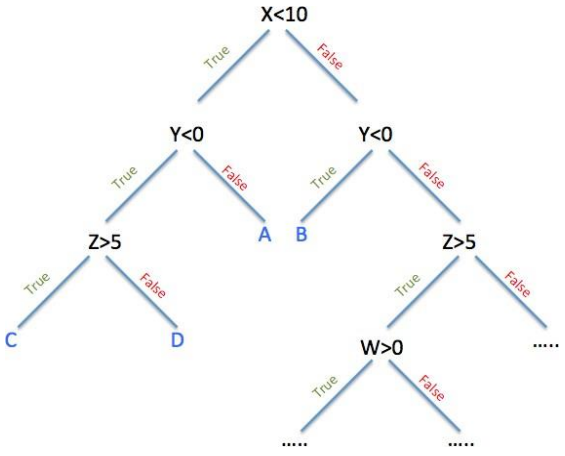


Figure.11 Decision Tree Classifier

Discriminative classifier:

It is a class of models used in statistical classification, especially in supervised machine learning. A discriminative classifier tries a model by just depending on the observed data while learning how to do the classification from the given statistics. It is used for modelling differences in groups.

IV.I MPLEMENTATIONS:

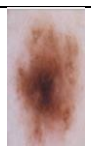
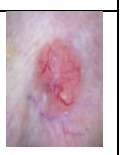
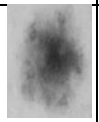
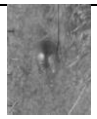
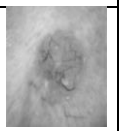
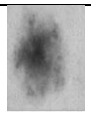
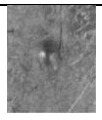
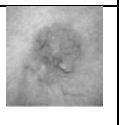
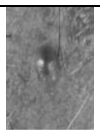
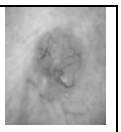
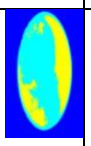
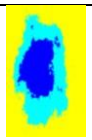
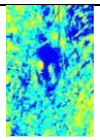
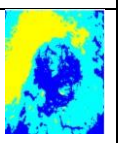
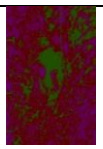
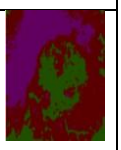
MATLAB 2018(A)

MATLAB is a scientific programming language and provides strong mathematical and numerical support for the implementation of advanced algorithms. It is for this reason that MATLAB is widely used by the image processing and computer vision community. New algorithms are very likely to be implemented first in MATLAB, indeed they may only be available in MATLAB. We used Computer Vision and Image Processing Tools.

System Requirements:

- Windows 7 (or) higher
- 64 bit operating system
- Minimum 2GB RAM needed
- No specific graphic cards required
- Disk space
  - ✓ 2 Gb for MATLAB only,
  - ✓ 4-8 GB for a typical installation

V.RESULT ANALYSIS

Type of Cancer	MELANOMA	NEVUS	BASAL CELL CARCIN	SQUAMOUS CELL CARCIN
Input Image				
RGB to Gray				
Noisy Image				
Filtered image				
Segmented Image				
Lab conversion				
Feature Extraction				

VI. CONCLUSION

The proposed system has added features like important types of skin cancer can be detected, which couldn't be found in existing systems. Thus our proposed idea will make sure to help patients, to identify about that belongs to which type of skin cancer is affected to the given skin lesion. In the future, we want detect the skin lesions which affected by skin cancer at low cost and high accuracy to increase the efficiency of this project.

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