SMART AI BASED SKIN CANCER DETECTION

[1] Dr.V.Vasanthi,
Assistant Professor,
Department of MCA, Hindusthan College of Arts and Science, Coimbatore.

[2] Manoj Kumar S,
Department of MCA, Hindusthan College of Arts and Science, Coimbatore.

ABSTRACT:

Detection of skin cancer in the earlier stage is very Important and critical. In recent days, skin cancer is seen as one of the most Hazardous form of the Cancers found in Humans. Skin cancer is found in various types such as Melanoma, Basal and Squamous cell Carcinoma among which Melanoma is the most unpredictable. In cases of fatal diseases like Melanoma diagnosis in early stages play a vital role in determining the probability of getting cured. We believe that the application of automated methods will help in early diagnosis especially with the set of images with variety of diagnosis. The detection of Melanoma cancer in early stage can be helpful to cure it. Computer vision can play important role in Medical Image Diagnosis and it has been proved by many existing systems. In this paper, we present a computer aided method of FURIA (Fuzzy Rule Indication Algorithm) classification for the detection of Melanoma Skin Cancer using Image processing tools. The input to the system is the skin lesion image and then by applying novel image processing techniques, it analyses it to conclude about the presence of skin cancer. The Lesion Image analysis tools checks for the various Melanoma parameters Like Asymmetry, Border, Colour, Diameter, (ABCD) etc. by texture, size and shape analysis for image segmentation and feature stages. The extracted feature parameters are used to classify the image as Normal skin and Melanoma cancer lesion. This project have used AI algorithms like FURIA it with image processing tools to form a better structure, leading to higher accuracy of 90% and above.

INTRODUCTION

OVERVIEW OF THE PROJECT

Skin cancer can be defined as skin growths with differing causes and various degrees of malignancy. Skin cancer can also be referred to as Skin Neoplasm's. Skin cancer develops on skin and so can be seen. The main cause of Skin cancer all over the world is UV radiations coming from the sun and it is estimated that Americans are greatly affected by skin cancers than the Africans and Asians. This is due to the fair complexion of their skin and so less melanin. Whereas Africans and Asians due to the high melanin content in the skin is far resistant to skin cancer [1]. It has been statistically proven that fairer skin toned people are much prone to tanning and so is prone to skin cancer. Cancer is the general name for a group of more than 100 diseases. Although there are different kinds of cancer, all cancers occur because abnormal cells grow out of control. Untreated cancers can cause serious illness and death.

Skin cancer is the most commonly occurring cancer. Skin cancer develops on skin and therefore from skin cells. Based on the type of skin cells, from which cancer arise, is classified into; Basal cell cancer [BCC], Squamous cell cancer [SCC], Melanoma Basal cell cancer Basal cell cancer is the most common skin cancer occurs in sun exposed areas. It rarely causes death as it rarely spreads. It is easily treated with surgery or radiation. Symptoms for basal cell cancer are: Raised, smooth, pearly bump on sun exposed skin (head, neck or shoulders).Small blood vessels are seen sometimes. Crusting and bleeding in the centre of the tumor. Squamous cell cancer It is less common than Basal cell cancer. It spreads more frequently and is caused by UV-B radiation via direct DNA damage and often is a very rapid growing tumour. Symptoms for Squamous cell cancer are red, scaling, thickened patch, ulceration and bleeding may occur and it develops into large mass if not treated. There are many types of human cancers, the most common type of these cancers is the skin cancer [1]. It is severe among the faired-skinned population in Europe, North America, and Australia. There are two major types of skin cancer, name malignant melanoma and non-melanoma (basal cell, squamous cell, and Markel cell carcinomas, etc.) [2]. Melanoma is more dangerous and can be fatal if not treated. If melanoma is detected in its early stages, it is highly curable, yet advanced melanoma is lethal. Each year there are significant increase in the annual rates of all forms of skin cancer, which lead to increase the public concern. The most dangerous of these forms is Malignant melanoma which report a high deadly and increase rapidly in the world among the other forms of skin cancers. In Canada there are more than 5500 people affected by Melanoma and about 17.35% of these people deaths in the year 2010. While in the United States there are about 22000 people affected with Melanoma in the year 2012, and about 49.4% of them deaths [3].

Based on the Cancer Trends Progress Report by National Institute of Health of United States (NIH) [4], it is estimated that nearly half of all Americans who live to age 65 will develop skin cancer at least once [5]. Many times it is impossible to a physician to diagnose a pigmented lesion through its characteristics, even if it is an experienced professional, in the naked eye. For this, additional criteria are necessary for a clinical diagnosis. The diagnostic can be performed without any support, in the naked eye, although the result isn't always reliable, therefore dermoscopy was created. It consists in using a device to take a picture of

the lesion in order to analyze its features to determine whether the lesion is benign or not. As some people don't have access to a dermatologist, and even with an experienced eye the result can be false, it is necessary to develop automatic methods in order to increase the accuracy of the diagnostic.

Early detection is the most effective tool for controlling this kind of cancer. The main criterion to differentiate between benign and malignant skin lesion is the so-called ABCD rule. This criterion evaluates the asymmetry, edge, color and size of the skin lesion to generate a diagnostic [6].

The skin is the human body's largest organ and its cancer is considered among the most dangerous kinds of cancer. Various pathological variations in the human body can cause abnormal cell growth due to genetic disorders. These changes in human skin cells are very dangerous. Skin cancer slowly develops over further parts of the body and because of the high mortality rate of skin cancer, early diagnosis is essential. The visual checkup and the manual examination of the skin lesions are very tricky for the determination of skin cancer. Considering these concerns, numerous early recognition approaches have been proposed for skin cancer. With the fast progression in computer-aided diagnosis systems, a variety of deep learning, machine learning, and computer vision approaches were merged for the determination of medical samples and uncommon skin lesion samples. This research provides an extensive literature review of the methodologies, techniques, and approaches applied for the examination of skin lesions to date. This survey includes preprocessing, segmentation, feature extraction, selection, and classification approaches for skin cancer recognition. The results of these approaches are very impressive but still, some challenges occur in the analysis of skin lesions because of complex and rare features. Hence, the main objective is to examine the existing techniques utilized in the discovery of skin cancer by finding the obstacle that helps researchers contribute to future research.

LITERATURE SURVEY

In [1] Detection and analysis of skin cancer from skin lesions: Nidhal Khdhair El abbadi University Of Kufa., Skin cancers are the most common form of cancers in human, a physician faces many difficulties for accurate diagnose of lesion through its characteristics and in the naked eye. For that it is necessary to develop automatic methods in order to increase the accuracy of the diagnostic. In this paper, initially, skin images are filtered to remove unwanted particles, then a new method for automatic segmentation of lesion area is carried out based on Markov and Laplace filter to detect lesion edge, followed by convert image to YUV color space, U channel will be processed to remove thick hair and extract lesion area. Diagnosis of melanoma achieved by using ABCD rules with new method for determine asymmetry based on rotation of lesion and divide lesion to two parts horizontally and vertically then count the number of pixels mismatched between the two parts based on union and intersection between the two parts. New method to determine the number of colors based on suggestion of color regions for each color shade was suggested in this paper. The performance of the proposed method is tested on 220 different images. Accuracy for this

method was encourage and reach up to 95.45%. The proposed method shows best accuracy when compared with other methods.

In [2] Techniques on Techniques of Cutaneous Examination for the Detection of Skin Cancer" A.W.Kopf, T.G. Salopek, J. Slade, A.A. Marghood, R.S. Bart, Skin cancers are the most common form of cancers in human, a physician faces many difficulties for accurate diagnose of lesion through its characteristics and in the naked eye. For that it is necessary to develop automatic methods in order to increase the accuracy of the diagnostic. In this paper, initially, skin images are filtered to remove unwanted particles, then a new method for automatic segmentation of lesion area is carried out based on Markov and Laplace filter to detect lesion edge, followed by convert image to YUV color space, U channel will be processed to remove thick hair and extract lesion area. Diagnosis of melanoma achieved by using ABCD rules with new method for determine asymmetry based on rotation of lesion and divide lesion to two parts horizontally and vertically then count the number of pixels mismatched between the two parts based on union and intersection between the two parts. New method to determine the number of colors based on suggestion of color regions for each color shade was suggested in this paper. The performance of the proposed method is tested on 220 different images. Accuracy for this method was encourage and reach up to 95.45%. The proposed method shows best accuracy when compared with other methods.

In [3] A Non-invasive Automatic Skin Cancer Detection System for Characterizing Malignant Melanoma from Seborrheic Keratosis Mai. R. Ibraheem, Mohammed M Elmogy. Due to the complexity of skin cancer treatment at later stages, the investigation of an efficient non-invasive automated system can help in guiding diagnosis. This paper proposes a non-invasive automatic system for characterizing malignant melanoma from seborrheic keratosis (BKL) using pixel-based segmentation and feature extraction techniques. The proposed system utilizes the pixel-based features to capture the main characteristics that discriminate BKL and malignant melanoma (MEL). The pixel-based technique enabled single-pixel distributions for color and texture that results in good discrimination of pigmented skin lesions from unaffected skin regions in the processed image. In the experimental results, the obtained characterization result using gradient boosted trees (GBT) is promising and outperformed other state-of-the-art techniques, which had an accuracy equaled to 97.5%, Dice measure equaled to 98.5%, sensitivity equaled to 98.3%, and specificity equaled to 92.1%.

EXISTING SYSTEM

EXISTING SYSTEM

In recent days, skin cancer is seen as one of the most Hazardous form of the Cancers found in Humans. Skin cancer is found in various types such as Melanoma, Basal and Squamous cell Carcinoma among which Melanoma is the most unpredictable. This is the scenario for which many projects have been tried and developed. Although not same but many related work have been done by many researchers. Some of papers have been referred and explored here. A detailed analysis of the existing systems is done. This study helped in identifying the benefits and also the drawbacks of existing systems. Early detection of skin

cancer has the potential to reduce mortality and morbidity. This paper presents two hybrid techniques for the classification of the skin images to predict it if exists

- Detection of the skin cancer with low variation is problematic
- Complexity of image based detection is identified
- The level variation is meant with different processing

PROPOSED SYSTEM

PROPOSED METHOD

There are many types of the skin cancer, each type has a different color, size and features. Many skin features may have impact on digital images like hair and color, and other impacts such as lightness, and type of the scanner or digital camera. In the first stage, we have obtained the features related with images using discrete wavelet transformation. In the second stage, the features of skin images have been reduced using principle component analysis to the more essential features. In the classification stage, two classifiers based on supervised machine learning have been developed. The first classifier based on feed forward back-propagation artificial neural network and the second classifier based on k-nearest neighbor. The classifiers have been used to classify subjects as normal or abnormal skin cancer images. A classification with a success of 95% and 97.5% has been obtained by the two proposed classifiers and respectively. This result shows that the proposed hybrid techniques are robust and effective.

Advantages

- The skin cancer can be detected with a high accuracy
- The system implements with a good level of system

The implementation work carried with a wide variety of system

MODULES DISCRIBTION

MODULES

- **IMAGE ACQUISITION**
- **PRE-PROCESSING**
- **IMAGE SHARPENING**
- **SEGMENTATION**
- **FEATURE EXTRACTION**
- **CLASSIFICATION**
- **CANCER DETECTION**

IMAGE ACQUISITION

Input to proposed system is dermoscopic images, dermoscopic images are images taken by dermatoscope. It is kind of magnifier used to take pictures of skin lesions (body part). It is hand held instrument make it very easier to diagnose skin disease. The skin image acquisition is the process where the image is given to the system. The image can be in any

size to be uploaded by the trainer or tester.Here the skin image are prepared for the further analysis of the cancer detection system

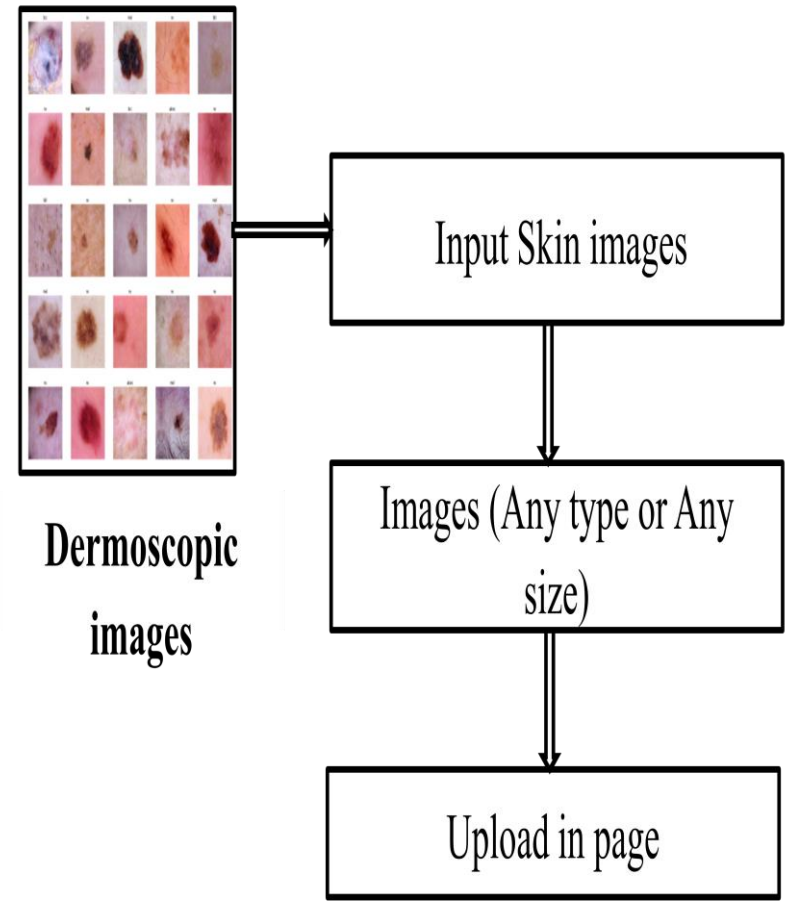


Fig 5.1 Image acquisition

PRE-PROCESSING

Goal of pre-processing is an improvement of image data that reduces unwanted distortions and enhances some image features important for further image processing. Image pre-processing involves three main things

1) Gray scale conversion

2) Noise removal.

1) GRAYSCALE CONVERSION

Grayscale image contains only brightness information. Each pixel value in grayscale image corresponds to an amount or quantity of light. The brightness graduation can be differentiated in grayscale image. Grayscale image measures only light intensity. 8 bit image will have brightness variation from 0 to 255 where '0' represents black and '255' represents white. In grayscale conversion colour image is converted into grayscale image shows in fig (6.2.1). Grayscale images are easier and faster to process than coloured images. All image processing technique are applied on grayscale image [4]. In our proposed system coloured or RBG image is converted into grayscale image by using weighted sum method by using following equations

Grayscale intensity= 0.299 R + 0.587 G + 0.114 B (6.1)

2) **NOISE REMOVAL**

The objective of noise removal is to detect and removed unwanted noise from digital image. The difficulty is in deciding which features of an image are real and which are caused by noise. Noise is random variations in pixel values. In our proposed system we are using median filter to remove unwanted noise shows in fig (4). Median filter is nonlinear filter, it leaves edges invariant. Median filter is implemented by sliding window of odd length [4]. Each sample value is sorted by magnitude, the centre most value is median of sample within the window, is a filter output.

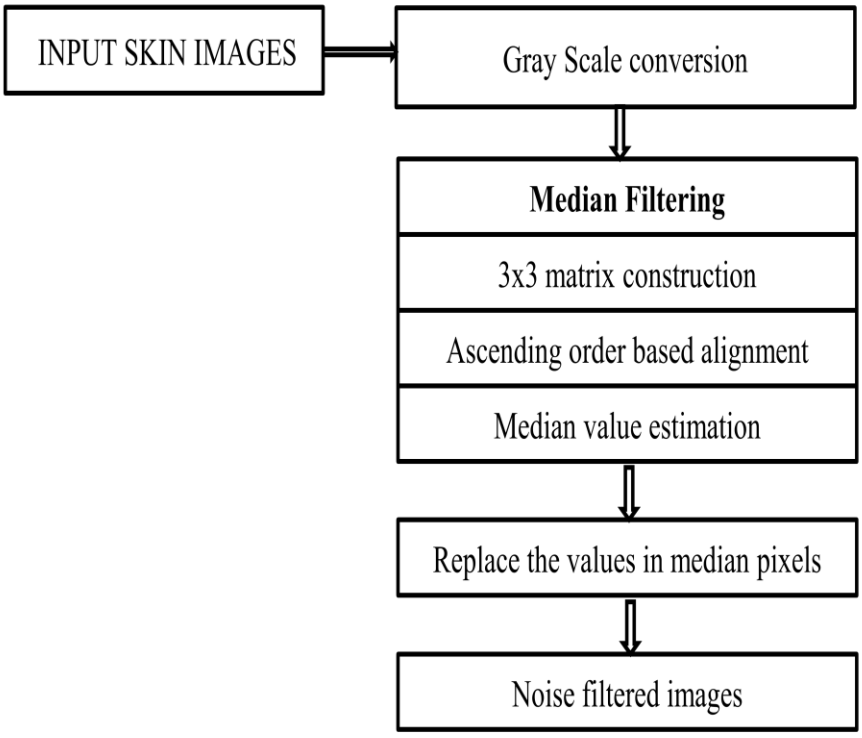


Fig 5.2 Image processing

IMAGE SHARPENING

The objective of image sharpening is to process an image to increase visibility of feature of interest. Here contrast enhancement is used to get better quality result. Image sharpening is an effect applied to digital images to give them a sharper appearance. Almost all lenses can benefit from at least a small amount of sharpening. Here the image sharpening is applied with the verification of the pre-processed image to get a vital pixel.

Segmentation

Segmentation is process of removing region of interest from given image. Region of interest containing each pixel similar attributes. Here we are using maximum entropy thresholding for segmentation [5]. First of all we have to take gray level of original image then calculate histogram of gray scale image then by using maximum entropy separate foreground from background. After maximum entropy we obtained binary image that is black and white image shows in fig 6.2.2. Image segmentation is performed by using our proposed

automatic thresholding and masking operation in R, G and B planes. First, automatic thresholding proposed by Otsu12 is applied in each plane. Binary masks for each plane are obtained and then combined to produce a final lesion mask. We use 3-plane masking procedure to increase segmentation accuracy. Then edge detection is applied to further segmentation. The main prerequisite for extracting the features is that the lesion must be separated from the surrounding normal skin. But the segmented image may contain other smaller blobs which are not the skin lesion. To overcome this, we find the biggest blob in the segmented image. The segmented image obtained contains only the skin lesion.

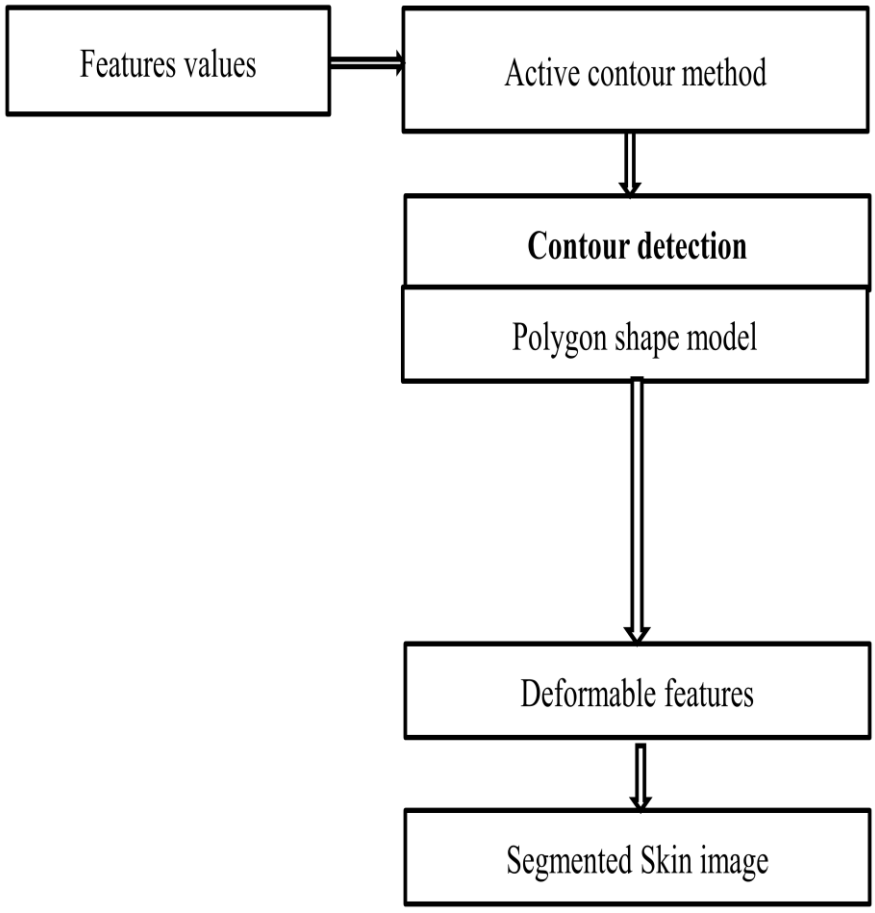


Fig 5.3 Image segmentation

The skin-images on which we are going to work contain the cancerous mole along with the skin part, so it is very important to remove the region of interest. So for this purpose we are going to use contour segmentation method.

Feature Extraction

To create a GLCM, the gray co-matrix function is used. The gray-level co-occurrence matrix (GLCM) is created by gray co matrix function. This is done by determining how often a pixel with the intensity (gray-level) value i occurs in a specific spatial relationship to a pixel with the value j. Each element (i, j) in GLCM is found by the sum of the number of times that the pixel with value i occurred in the specified spatial relationship to a pixel with value j in

the input image. Because the processing is required to calculate a GLCM for the full dynamic range of an image is prohibitive, gray co-matrix scales the input image. The scaling is used by gray co-matrix for reducing the number of intensity values in grayscale image from 256 to eight. The size of the GLCM is determined by the number of gray levels. The number of gray levels the matrix called GLCM and intensity value scaling can be controlled by the Num Levels and the Gray Limits parameters. Certain properties of the spatial distribution of the gray scale image can be revealed by gray-level co-occurrence matrix.

For instance, when most of the values in the GLCM are clustered along the diagonal, the texture is coarse with respect to the specified offset. Several statistical measures can be derived from the GLCM. Segmentation is followed by feature extraction. No machine learning algorithm can work without predefined features set. The type of features can be broadly divided into following categories.

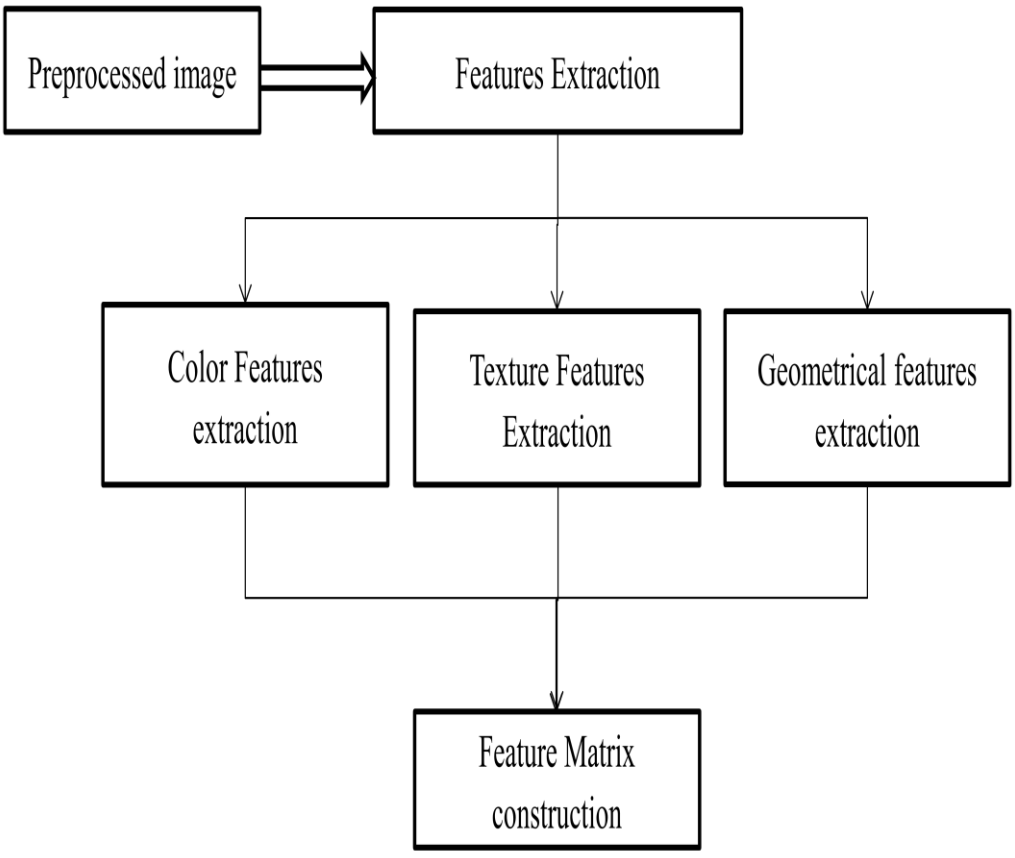


Fig 5.4 Feature extraction

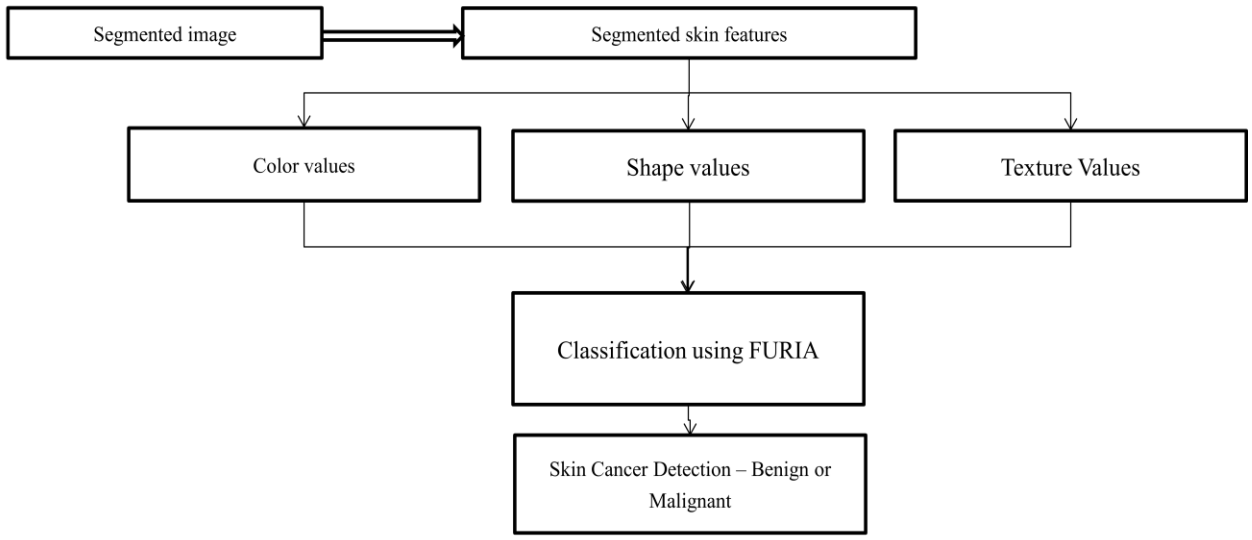
The main features of the Melanoma skin Lesion are its Geometric Feature. Hence, we propose to extract the Geometric Features of segmented skin lesion.

Here, we used some standard geometry features (Area, Perimeter, Greatest Diameter, Circularity Index, and Irregularity Index) adopted. From the Segmented image containing only skin lesion, the image blob of the skin lesion is analyzed to extract the it's geometrical

features. The Different Features extracted are as follows: Area (A): Number of pixels of the lesion. Perimeter (P): Number of edge pixels. Major Axis Length or Greatest Diameter (GD): The length of the line passing through lesion centroid and connecting the two farthest boundary points.

FURIA Classification

Using the FURIA rules for the melanoma skin cancer, we use some pre-defined thresholds in classification stage. The Feature Values Extracted in the Feature Extraction stage is compared and the skin lesion is classified as Melanoma Skin Cancer or normal skin or Mole. This classification method proves to be efficient for most of the skin images. FURIA is often referred to as technique for reducing the number of variables in a data set without loss of information and as a possible process for identifying new variables in to another smaller set the newly created variables are not usually easy to interpret. FURIA has been most successful in applications such as image compression where data reduction and not interpretation is of primary importance. FURIA allows one to identify the uncorrelated components of an ensemble of data. FURIA is used for classification, to classify the skin cancer. FURIA uses a method of analysis which involves finding the linear combination of a set of variables that has maximum variance and removing its effect and then testing and training is done. With the results of testing and training, FURIA will find whether the given values are benign or malignant. If the values are below 1 then it is benign. In case, the values are above 1, it's a malignant. FURIA extends the well-known RIPPER algorithm, a state-of-the-art rule learner, while preserving its advantages, such as simple and comprehensible rule sets. With the generative rule set the detection of the algorithm can be done with the verified pattern which is used/ the possible feature identification with FURIA will tends a fuzzy classification with the generative rule scheme. The detection of the full training features and tested with the extracted values.



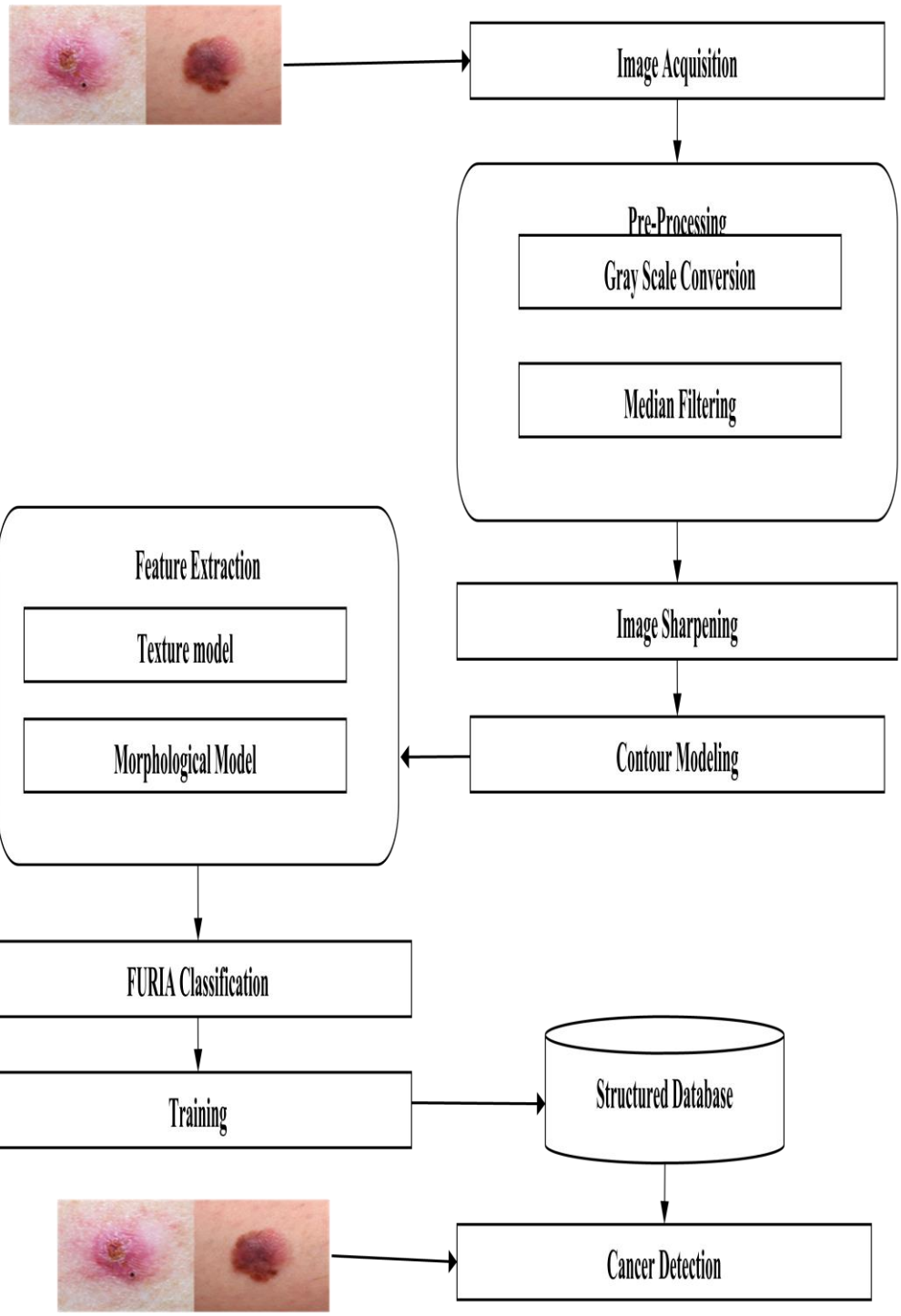


Fig 5.5 FURIA Segmentation

Classifier is used to classify cancerous image from other skin diseases. For simplicity FURIA classifier is used here. FURIA takes set of images and predicts for each input image belongs to which of the two categories of cancerous and non-cancerous classes. The purpose of FURIA is create hyper plane that separates two classes with maximum gap between them.

ALGORITHMS AND METHODS

System design is the process of planning a new system to complement or altogether replace the old system. The purpose of the design phase is to plan a solution for the problem. The phrase is the first step in moving from the problem domain to the solution domain. The design process also helps the programmer to decompose our project into various parts to complete to the work and separates the conceptual representation from the data structure.

METHODS

A two-dimensional diagram explains how data is processed and transferred in a system. The graphical depiction identifies each source of data and how it interacts with other data sources to reach a common output. Individuals seeking to draft a data flow diagram must identify external inputs and outputs, determine how the inputs and outputs relate to each other, and explain with graphics how these connections relate and what they result in.

EXPREMENTAL ANALYSIS

INPUT DESIGN

In an information system, input is the raw data that is processed to produce output. During the input design, the developers must consider the input devices such as PC, MICR, OMR, etc. Therefore, the quality of system input determines the quality of system output. Well designed input forms and screens have following properties − It should serve specific purpose effectively such as storing, recording, and retrieving the information.

- It ensures proper completion with accuracy.
- It should be easy to fill and straightforward.
- It should focus on user's attention, consistency, and simplicity.

All these objectives are obtained using the knowledge of basic design principles regarding −

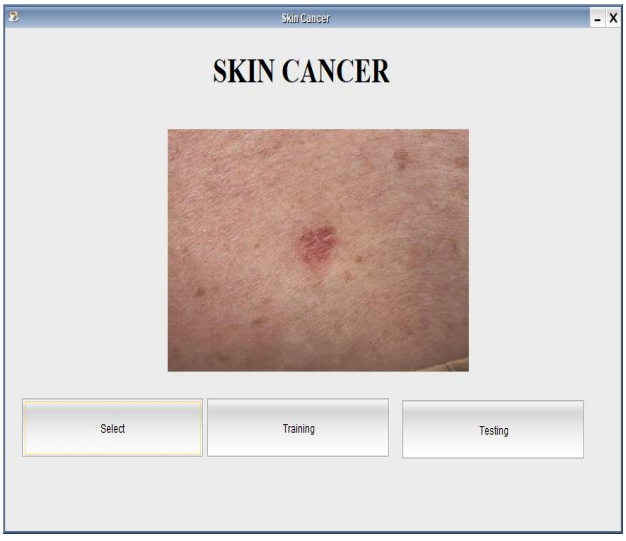


Fig 7.2 Input Design of image acquisition

OUTPUT DESIGN

The design of output is the most important task of any system. During output design, developers identify the type of outputs needed, and consider the necessary output controls and prototype report layouts. Manufacturers create and design external outputs for printers. External outputs enable the system to leave the trigger actions on the part of their recipients or confirm actions to their recipients.

Some of the external outputs are designed as turnaround outputs, which are implemented as a form and re-enter the system as an input.

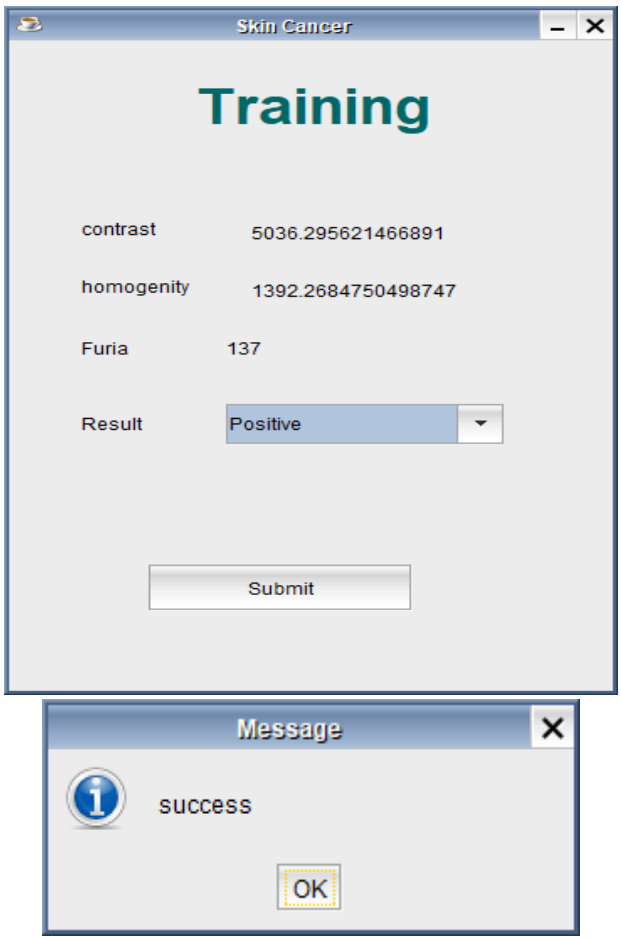


Fig 7.3 Output design of skin cancer

FUTURE ENHANCEMENT

In future system, by comparing the first two techniques it is found that FURIA and takes less processing time, whereas ABCD method gives an accuracy of 90%. Third classification technique is the method called AIS (Artificial Immune System) using clonal selection method which is the future work.

CONCLUSION

It can be easily concluded that the proposed system of skin cancer detection can be implemented using gray level co-occurrence matrix and support vector machine to classify easily whether image is cancerous or non-cancerous. Accuracy of proposed system is 95%. It

is painless and timeless process than biopsy method. It is more advantageous to patients. This project we have discussed a computer-aided diagnosis system for melanoma skin cancer. It can be concluded from the results that the proposed system can be effectively used by patients and physicians to diagnose the skin cancer more accurately. This tool is more useful for the rural areas where the experts in the medical field may not be available. Since the tool is made more users friendly and robust for images acquired in any conditions, it can serve the purpose of automatic diagnostics of the Skin Cancer.

REFERENCES

[1] Steven Holzner, "PYTHON: The Complete Reference ", McGraw Hill Education; Raunak Python study edition, 1 July 2017

[2] Richard Blum," PYTHON, MySQL & JavaScript All - in - One For Dummies", Wiley, 2018

[3] Robin Nixon "Learning PYTHON, MySQL & JavaScript with j Query, CSS & HTML5", Shroff Publishers & Distributers Private Limited - Mumbai; Fourth edition,2015

[4] Laura Thomson,Luke Welling," PYTHON and MySQL Web Development", Pearson Education; Fifth edition, 20 December 2016