SKIN DISEASE DETECTION USING IMAGE PROCESSING

Project report submitted in partial fulfilment of the requirement for the degree of

BACHELOR OF TECHNOLOGY

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

By

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UNDER THE GUIDANCE OF

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CERTIFICATE

This is to certify that the work reported in the B.Tech project report entitled **"Skin Disease Detection using Image Processing"** which is being submitted by Siddharth Singh (141032) and Sayam Gupta (141038) in fulfilment for the award of Bachelor of Technology in Electronics and Communication Engineering by the Jaypee University of Information Technology, is the record of candidate's own work carried out by him/her under my supervision. This work is original and has not been submitted partially or fully anywhere else for any other degree or diploma.

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DECLERATION BY THE SCHOLAR

We hereby declare that the work presented in the dissertation for B-Tech entitled "**Skin Disease Detection using Image Processing"** is an authentic record of our work carried out under the supervision of "**Dr. Meenakshi Sood (Electronics and Communication)."** We have not submitted this work elsewhere for any other degree or diploma.

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LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

ANN	Artificial Neural Network
RGB	Red Green Blue
NN	Neural Network
2-D	Two Dimensional
3-D	Three Dimensional
GUI	Graphical User Interface
MSL	Melanocytic skin lesions

ABSTRACT

In today's era, skin disorders can be found almost on any living being. Be it plants or animals. A skin disease can be defined as a specific or a particular type of condition caused by various factors. They may include bacteria, fungi, infection etc. Some of the diseases are mild but some pose great threat if not detected timely. Diseases such as alopecia, ringworm etc. poses quite harmful threat to the skin of an individual. They may get worse and worse with time. They have the ability to spread on the body as time passes. There are hundreds of skin conditions that affect both plants and humans. Humans suffer from various skin conditions that could irritate, inflame, clog or swell up our skin and can cause symptoms such as swelling, redness, burning, itching etc. Various infections, fungi and bacterial diseases can lead upto several skin conditions such as dermatitis, hives, melanoma, ringworm or even worse skin conditions. Hence, we can say that detection of such diseases at the earliest stage is our main goal. This is done so as to control it from spreading further. Their detection poses the major issue. We know about the diseases but not all about how to detect them at the very beginning. This is where computers come into place. Their detection can be done by using many different technologies. Some of them are image processing, ANN, data mining etc. Recently, image processing along with artificial neural network has seen a boom in it's usage and applications. Immense studies and research is being done upon them. Their combination is being used worldwide for various things. Some are facial detection. Some are disease detection. Methods such as feature extraction, segmentation, image enhancement etc. are the core of image processing. They can be used to efficiently recognize which part of the body is affected by the disease. They can also be used to identify the colour, texture and form of diagnosed part. This project presents a survey of various skin disease diagnosis systems using image processing techniques and their identification. An inclusive study of various skin diseases and their detection are done in this project report.

MOTIVATION

Dermatological or skin diseases are the most widespread and common diseases all over the globe. More than a quarter a million people are suffering from a type of skin disorder known as Psoriasis. People suffering from skin diseases report that the skin conditions or disorders that they suffer from negatively affect their quality of life. This in turn makes their day to day tasks harder.

If these skin disorders are not caught and identified at an early stage, they may get worse and worse with time. It may further lea to spreading and worse conditions. They may spread from one part to another or may spread from one individual to another. The best bet in these cases is to identify them at the earliest of stages. The attributes that skin diseases show are so diverse, hence it becomes a very difficult job to come up with a system or algorithm that can correctly and efficiently detect them. Both, the colour of the skin as well as skin itself colour plays a vital role in the detection of skin diseases as they vary from person to person.

Main objective of detecting sharp changes or sharp variations in pixel brightness or edges in images is to seize various features. It can be demonstrated that discontinuities in the brightness of pictures is probably due to the following reasons:

- Lack of symmetry of no continuation in depth,
- Lack of continuity in surface orientation,
- Different materials pose different issues with their inherent properties
- Different images have different radiance or lighting which depends on how the image was captured.

Considering an impeccable situation, if we apply an edge detector on an image, then the result may prompt some particular or specific arrangement of connected or curves that are not connected that specify the boundaries or edges of an item in image. In this way, if we apply an edge detector algorithm to an image, then it may altogether decrease the measure of information to be used. This may result in filtering of information which one may regard as less pertinent, while safeguarding the imperative basic characteristics and features of an image. On one hand, if the results obtained by edge detection technique shows correct detection of edges, the subsequent task of interpreting and extracting the information from the original image may therefore be substantially simplified and our task may become quite easy. However, it is not always the case. In reality, dealing with real images with no sharp edges, the extraction of information thus becomes a tedious task

After pre-processing, several features can be extracted such as edges of objects in images. But the edges extracted from non pre-processed images or non trivial images are often affected by fragmentation. What it means is that not all edges are connected. This leads to false image interpretation and false data. This hence complicates the task of correct feature extraction and interpretation of image data.

In this project, we aim to detect and classify the type of disease at an early stage. Basically skin disease diagnosis depends on the different characteristics like colour, shape, texture, size etc. there are no accepted treatment for skin diseases Different physicians will treat differently for same symptoms. The project can be broken down into two main stages. Pre-processing and classifications are the two major aspects of the project. The first stage includes the image of the skin disease to be subjected to various kinds of pre-processing techniques such as noise removal, image enhancement, co-relation stretching etc followed by feature extraction. In the second step, the pre-processed image is compared with the database and the disease is then identified.

CHAPTER 1

INTRODUCTION

1.1 IMAGE PROCESSING

Image processing is a method and a means to perform various operations on an image, in order to enhance it, extract some useful information from the image and find various features. Image processing can be understood as signal processing. The input taken in this is an image. The output we get in the end may be an enhanced version of the image or some features or characteristics of the same. The use of image processing is rapidly growing. Image processing makes the main area of research for computer science or other disciplines as well whether it is facial recognition or feature extraction from an image or image enhancement.

Image processing includes the following three steps:

- Acquiring the image and importing it using various image acquisition tools.
- Examining, enhancing as well as operating on the image.
- The output we get is usually an enhanced image or some features extracted from analysis of the image.

We mainly have two different modes in which image processing can be used. These are analogue and digital image processing techniques. The first one is digital technique. It is used for hard copies such as photographs or printouts. The second one is digital technique. They are used to manipulate the image by the use of computers. There are some general phases that all types of data undergo when used by digital image processing method. They are pre-processing, feature extraction, image enhancement etc.

1.2 SKIN DISEASE

Human body is made up of several organs. As far as size and area is concerned, skin is by far the largest organ. It is, in terms of both weight around 20 pounds or more, and surface area—about 18 square feet. It is responsible for separating the inside of our body from the outside world and also various diseases. Skin is responsible for protecting us from both viruses as well as bacteria, and also helps in regulating body temperature.

There are hundreds of skin conditions that affect humans. Conditions that irritate, clog, or inflame our skin can cause symptoms such as redness, swelling, burning, itching etc.

Allergies, irritants, our genetic makeup, and certain diseases and immune system problems can cause dermatitis, hives, and other worse skin conditions. Many skin problems, such as acne, also affect our skin. Our skin can also develop several kinds of cancers due to these.

1.2.1 TYPES OF SKIN DISEASES

Different skin diseases have different symptoms and vary in their severity. Depending on the duration of the symptoms one may exhibit, all the skin diseases can broadly be classified into two broad categories.

Permanent Diseases-

Why these diseases occur is not always something that we know. Almost all of these skin diseases have a successful treatment or recovery methods. These treatments can be used for extended durations for remission. But, these diseases are incurable and the symptoms can come back or return any time. A list of such diseases is Lupus, Eczema, Melanoma, Moles etc.

Figure 1.1: Melanoma

Figure 1.2: Moles

Temporary Diseases-

These diseases are usually short term and can be treated via medications or they may disappear with time. They are basically more common then permanent diseases. Some of these temporary diseases are acne, hives, warts etc.

Figure 1.3: Hives

Figure 1.4: Acne

CHAPTER 2

LITERATURE SURVEY

1. M. Shamsul Arifin , M. Golam Kibria, A. Firoze "Dermatological disease diagnosis using colour-skin images" Machine Learning and Cybernetics (ICMLC), 2012 International Conference.

- The proposed model works on two different steps. The first step is responsible for detecting whether the skin has an abnormality, the area, it's region, area etc. The second step identifies the type of disorder.
- The proposed system used various techniques such as k-means clustering, colour image processing etc to correctly recognize the disease.
- The accuracy of detecting the region of diseased area of the system is 95.99%. The accuracy of the identification of the disease is 94.016%.

2. Md. Ariful Islam, Mohammad Shamsul Arefin "A framework for detecting arsenic disease" Electrical Engineering and Information Communication Technology (ICEEICT), 2016 3rd International Conference on 22-24 Sept. 2016

- We, the humans through various sources get in contact with toxic substances. One such example is Arsenic (As). One can get Arsenic contamination from water, air, food etc. Arsenic or Arsenic compounds can prove to be highly toxic to us.
- The given paper proposes a model that can gather PSL, perform it's analysis. It can also make certain observations based on results. Further, conclusion about the type of disease and diagnosis can be done with the help of medical experts.
- The system uses image processing methods. It can analyse, create database, find features, process the information and identify the disease. All this is one on features based on the texture of the skin and other morphological features.

- A number of evaluations have already been done with the system. The input images were fed to see the output. The system was able to almost accurately identify and detect arsenic in the images.

3. Md Nafiul Alam, Tamanna Tabassum Khan Munia, Kouhyar Tavakolian "Automatic detection and severity measurement of eczema using image processing" Engineering in Medicine and Biology Society (EMBC), 2016 IEEE 38th Annual International Conference

- Different skin diseases pose different threats. Some serious ones like eczema have severer health effects on the diagnosed person. Thus they need to be detected at the earliest stage. Diagnosis at the earliest is also needed.
- The current method of treatment is very time consuming as well as requires a lot of money. The following paper presents an automated technique of detecting the skin disease such as eczema using computer algorithms and image processing.
- The proposed model by itself computes the required features and factors as well as various skin attributes. The size and region of the affected eczema region is detected and a confirmed decision about the disease is made.

4. R Suganya "An automated computer aided diagnosis of skin lesions detection and classification for dermoscopy images" Recent Trends in Information Technology (ICRTIT), 2016 International Conference

- Various skin diseases are getting recognized everyday with varying degree of danger they impose. Hence early detection of such disorders is necessary. For this purpose, a Computer Aided Diagnosis (CAD) for dermatological purposes was required.
- Segmentation is required for identifying various diagnosed regions. It was developed for both MSLs as well as Non-MSLs.

CHAPTER 3

IMAGE PROCESSING TECHNIQUES

3.1 K-MEANS CLUSTERING

k-means clustering is a method of vector quantization, originally from signal processing, that is popular for cluster analysis in data mining. K-means clustering aims to partition n observations into k clusters in which each observation belongs to the cluster with the nearest mean, serving as a prototype of the cluster. This results in a partitioning of the data space into Voronoi cells.

The algorithm has a loose relationship to the k-nearest neighbour classifier, a popular machine learning technique for classification that is often confused with k-means because of the k in the name. One can apply the 1-nearest neighbour classifier on the cluster centers obtained by k-means to classify new data into the existing clusters. This is known as nearest centroid classifier or

Rocchio algorithm.

Three key features of k-means which make it efficient are often regarded as its biggest drawbacks:

Euclidean distance is used as a metric and variance is used as a measure of cluster scatter.

- It is quite necessary to know about the number of clusters there are in the entire data set. If the estimation is wrong by a large margin, we may end up with bad results. All this must be taken care of during k-means clustering.
- The solution may converge to local minima. That may give wrong output or results.

The cluster model we have is one of the main limitations. The entire notion or idea is based on the fact that there are spherical clusters. They can be separated in a way that it's mean value converges right at the center of the cluster. We also expect that the clusters are of same or of almost same or relatable size so the classification that is done is indeed the correct one. When for example applying k-means with a value of onto the well-known Iris flower data set, the result often fails to separate the three Iris species contained in the data set. With the two visible clusters (one containing two species) will be discovered, whereas with one of the two clusters will be split into two even parts. Instead of having three different data sets, it if far more acceptable and accurate to apply this data set. Just like any other algorithm to classify results, k-means also relies on the data set that we provide to it. The system makes it's own assumptions ad works on it. It does not always works well with all type of algorithms. Some data sets work fine with it while other don't.

3.2 EDGE DETECTION

Edge Detection incorporates an assortment of scientific strategies methods that aim at identifying points in a digital image at which the image brightness changes sharply or, all the more formally, has discontinuities. The pixels of images at which the value of pixel brightness changes sharply are typically organized into a set of curved line segments termed edges. A similar issue of discovering discontinuities in one-dimensional signals is known as step detection and the issue of finding signal discontinuities over time is known as change detection. Edge detection is a one of the most basic tool and features used today in many fields in image processing, machine vision and computer vision, particularly in the areas of feature detection and feature extraction and many more. The more in depth we go, more the number of applications of image detection can be seen.

Edge Properties

We need the edges from images to be extracted. Now these edges are taken from a (2-D) image of a (3-D) view. Hence, these edges are viewpoint dependant. In some cases, they may as well be viewpoint independent. As explained, edges may depend on viewpoint or not. A viewpoint dependant edge does not change as you move within a scene. It remains the same. It basically reflects the inherent properties of the real 3-D image. Examples are the markings on surfaces or surface shapes. The opposite is the case for viewpoint dependant edges. They change as you change your viewpoint and move within a scene. It reflects the geometry. An example would be occlusion. If an object is directly in front of another object and completely covers it, then it may not be visible from the front. But if you change your viewpoint, then you may start to see the object behind. This is viewpoint dependent edges.

As far as digital images are concerned, consider a trivial coloured image with different coloured shapes. For such an image, the border would be the coloured line separating two colours. If the background of an image is constant, that is, it has a uniform solid coloured background, and then the collection of pixels of a different colour separating the background image in different parts would be an edge. Edge detection serves as an important feature in feature extraction. In image processing, different objects present different shapes. Hence edges can be used to define different objects of same colour.

A Simple Edge Model

What one wants from an image in image detection is to easily and efficiently detect edges. When natural images are in consideration, the edges we get from them are not at all perfect. Edges are usually flawed in such images. They are normally affected by various reasons. Some of them are given as follows:

- Blurring due to improper focus on the object. This is due to issues with depth of field. It can also be because of limited point spread function.
- Blur produces un-sharpness in images. This un-sharpness is significantly noticeable when edges are in focus. This un-sharpness or blurry nature of edges in image is referred to as Penumbral blur. These are caused by shadows created by sources if light in images. These sources are generally of non-zero radii.
- When smooth objects are in image, shading of them can take place that can create flaws in images.

3.3 HISTOGRAM BASED METHOD

Histograms

Histograms or histogram plots are made via dividing the amount of information in an image into equal-sized groups. For each class, the numbers of points from the data set that fall into each class are enumerated. Vertical axis gives Frequency or the count or the number of objects that fall in a specific category. Horizontal axis in image histograms tells about the pixels and pixel. Histogram plotting is a very common and important tool in image processing. It tells about intensity distribution of pixels in images. It tells about how many pixels lie in a given intensity region.

In MATLAB, histogram can be plotted by first taking the grayscale of an image. The grayscale converts an RGB image into an image with only pixel intensity distribution. Then after this, histograms can be plotted. In MATLAB Grayscale can be done by using the rgb2gray command. Histogram can be plotted by using the imhist command.

Histogram-based methods are one of the most commonly used techniques and are very efficient. Histogram based method is more accurate when compared with some other techniques. This is because they generally only need a single go through the pixels. What we do in this technique is that we plot a histogram from the majority of the pixels in the image. The Highest intensity and lowest intensity values are used to find clusters in the image. Colour or intensity can be used as the measure.

An efficient way to use the histogram based method is to recursively apply the technique over and over to the clusters so formed and divide those clusters into smaller clusters. This further improves efficiency as each cluster now contains an even highly specific and correlated data. This activity is performed again and again dividing the clusters into smaller ones till no more clusters can further be formed.

Histogram based technique has its pros and cons. One of the cons to this approach is that it may get difficult to find out the more prominent peaks and valleys in a give n image

Histogram-based techniques can also be applied to numerous frames. This is done and the single pass accuracy is also kept. The construction of histogram can be dome in multiple ways when various different frames are taken into consideration. A similar procedure can be used to compute the histogram for multiple frames. The results are then merged together. The peaks and valleys that were previously hidden or very difficult to identify are now more easily distinguishable.

CHAPTER 4

METHODOLOGY

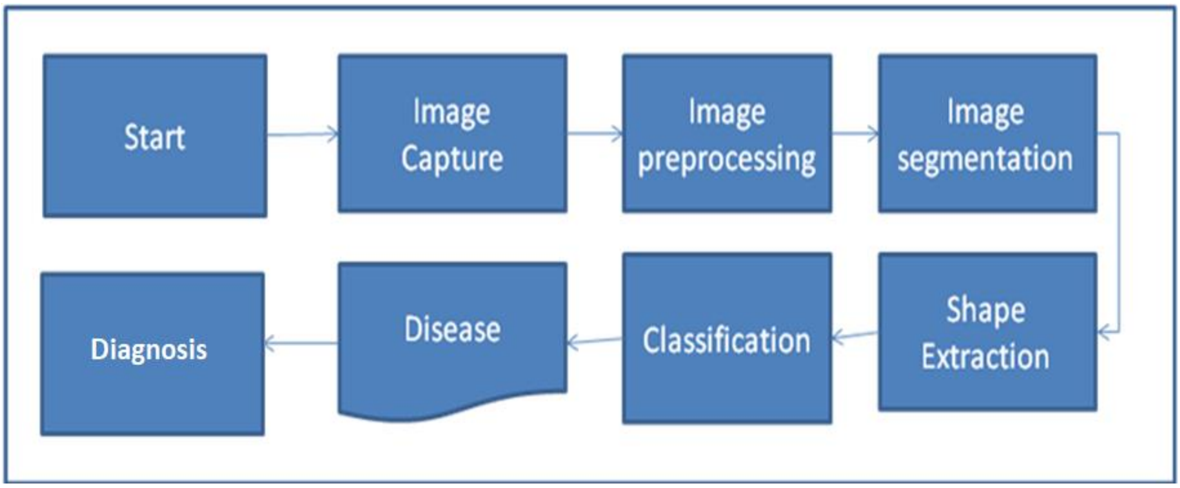

Figure 4.1: Flow chart of proposed Model

Image processing is a way and a means to execute various tasks on an image, so as to enhance it, extract some useful information from the image and find various features. We can also describe it as signal processing in which we input an image. The output we get may be the enhanced image or characteristics/features associated with that image. Image processing is among rapidly growing technologies which has many applications. It forms the main research area within engineering and computer science disciplines too whether it is facial recognition or feature extraction from an image or image enhancement.

What image processing does is it converts an image into the digital form and then performs various operations on it. This is done in order to enhance the image and then to extract some useful information from the image. In image processing, the input we feed to the system is the image captured and the output is generally various features we get from the image. From these features, useful information can be extracted. Images are made up of pixels. They are the two dimensional signals on which various set functions can be applied

4.1 IMAGE ACQUISITION

Acquiring the image ie image acquisition is the first step in this procedure. In this, the user is required to capture the image of the diseased area in such a way that the acquired image has minimum possible noise. The captured image is then fed to our software which will perform image processing technique and identify some useful features.

4.2 IMAGE PRE-PROCESSING

The aim of pre-processing an image is to convert the image into a more suitable and usable form. Pre-processing suppresses the unwanted noise and distortions, enhances colours along with other image features. This helps in further processing steps. Image pre-processing method can also be for various plots. Neighbouring pixels of a single object in an image has essentially the same or similar brightness. This allows the system to recognize the object and separate it. Image is subjected to orientation correction, resize, noise removal, greyscale conversion, colour enhancement so as to segment it properly.

RGB to grayscale conversion

The RGB colour model mainly consists of three major colours: Red, Green and Blue. These three colours can be added together in various ways with varying intensity to produce a broad array of different colours. The name of the model is RGB because it takes the first letters of the three primary basic colours used in the model.

Grayscale or greyscale image consists of such a scenario in which each pixel instead of representing the colour itself, represents only the amount if light it carries. In other words, each pixel carries the intensity profile or intensity information. It is an example of a monochrome image. Monochrome images carry only a single colour and the various shades of the same colour. Both grayscale and black and white are monochrome images and are made up of varying shades of gray. These shades vary greatly from black at it's weakest intensity all the way to white at the highest intensity.

Histogram

Histograms or histogram plots are made via dividing the amount of information in an image into equal-sized groups. For each class, the numbers of points from the data set that fall into each class are enumerated. Vertical axis gives Frequency or the count or the number of objects that fall in a specific category. Horizontal axis in image histograms tells about the pixels and pixel. Histogram plotting is a very common and important tool in image processing. It tells about intensity distribution of pixels in images. It tells about how many pixels lie in a given intensity region. In MATLAB, histogram can be plotted by first taking the grayscale of an image. The grayscale converts an RGB image into an image with only pixel intensity distribution. Then after this, histograms can be plotted.

Decorrelation Stretch

Decorrelation stretching is used to enhance the colours of an image. More generally, Decorrelation is used to get rid of or reduce significantly the auto correlation between signals. It can also remove cross correlation between many signals. It is widely used in linear filtering. Majority of the decorrelation techniques are linear in nature. But non-linear decorrelation algorithms also exist. As far as image processing is concerned, images with a high amount of band-band correlation needs to be spaced and separated. This is done by stretching the band separation.

The numbers of colour bands are usually limited to three. But decorrelation stretch can be applied to this as well. It does not matter how many bands exist within an image. The originals colour bands offer a very small range of values. By using stretching, we can map the existing range of colour values to a new set of values with wider range.

In MATLAB, decorrelation stretch can be performed by using decorrstretch function.

4.3 IMAGE SEGMENTATION

In a computer system, image segmentation is used to segment a digital image into various segments. The ultimate goal of image segmentation is to convert the image into a form which clearly identifies and marks the region of interest. As far as disease detection is concerned, segmentation defines the boundaries and region of affected part of the body. It clearly identifies the affected region.

The image is converted into a binary image ie black and white. The black region is the normal skin or the unaffected region. The white region is the area of interest. It depicts the affected or diseased region. More precisely, the purpose of segmentation is to assign a value or a tag to each pixel in a digital image. All the pixels with the similar tag or value shares similar properties and attributes and features with the rest of them.

The consequence or outcome of segmentation is a group of sections or chunks in the image that altogether form the entire image. Similar regions in the segmented image share similar attributed within them. These features can be colour, shape, size, edges, textures etc. Different regions have different attributes in the segmented image.

4.4 DISEASE IDENTIFICATION

After we are done with image segmentation, next comes detecting the disease. After segmentation, we will analyze the segmented image for either the shape or colour or size or texture. This image is then compared to that of the healthy database already created in advance.

The database has the features of the healthy skin. These features include the colour of the healthy skin, its texture, shape and size. If the features do not match the ones present in the database, then the image is deemed to have the disease.

The database also has the features of different diseases. The features of the input image that most closely match that of the diseases in database; the disease is declared with the most closely related features. After comparing the input image to that of the database, the disease can be detected.

4.5 MATLAB GUI

GUI stands for Graphical User Interface. GUI is very interactive and easy to use software as far as computing is concerned. It provides with a point and click support to the user. It enables to run the applications. It eliminates the need for the user using the software or application to learn type and run the code with all the commands each time you run the application. You only need to feed data to the GUI and all the processing happens in the background. Here, we have used MATLAB GUI in order for us to take different images and find features and segment them quickly and efficiently. It saves a lot of time. We have different buttons in the GUI such as load, reset, greyscale, histogram, segmentation, finding features, disease detection etc.

It enables users to directly feed the image into the application and the software automatically runs various operations on it. The results are prompted on the screen on either the GUI itself or on a message box.

CHAPTER 5

RESULTS AND DISCUSSIONS

5.1 IMAGE ACQUISITION

This is the first step in our project. The image is loaded onto the GUI using the load button. Next, the user is prompted to browse the system to find the desired image and click open. It loads the image onto the GUI.

Figure 5.1: Image Acquisition (Ringworm)

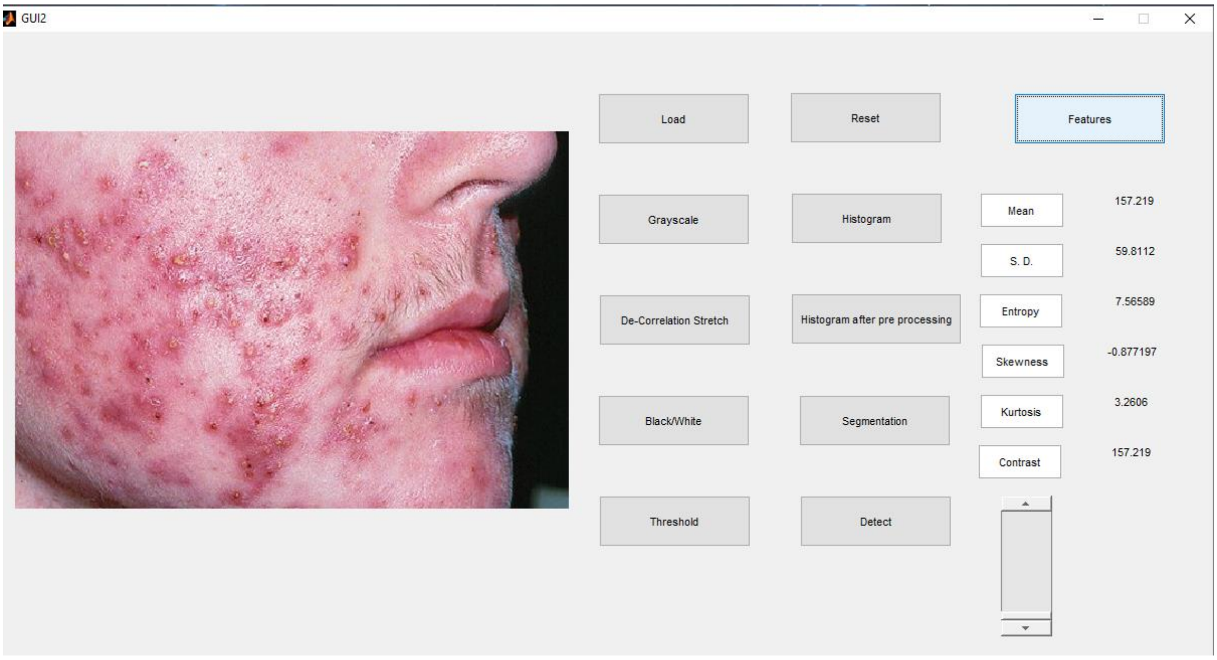

Figure 5.2: Image Acquisition (Acne)

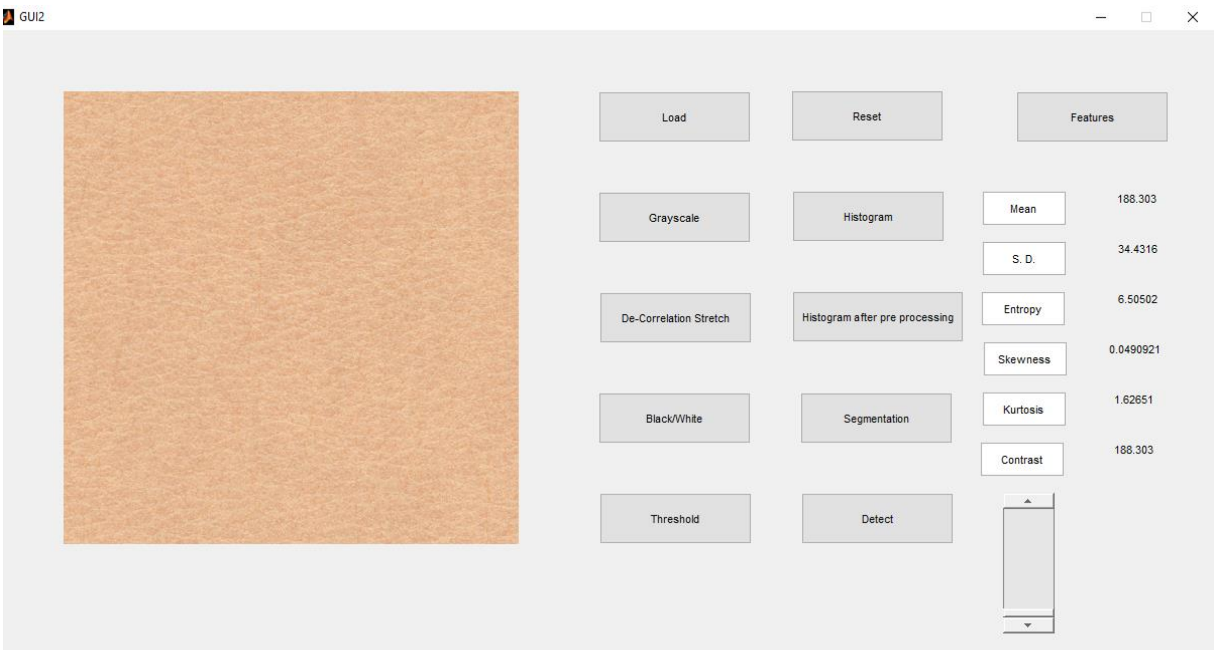

Figure 5.3: Image Acquisition (Normal Skin)

5.2 IMAGE PRE-PROCESSING

This step is used to convert the image to grayscale which allows the histogram plot to be made. If the histogram plot shows large pixel densely packed together in a specific region, then decorrelation stretch is performed. It removes the auto correlation between various colours and different bands.

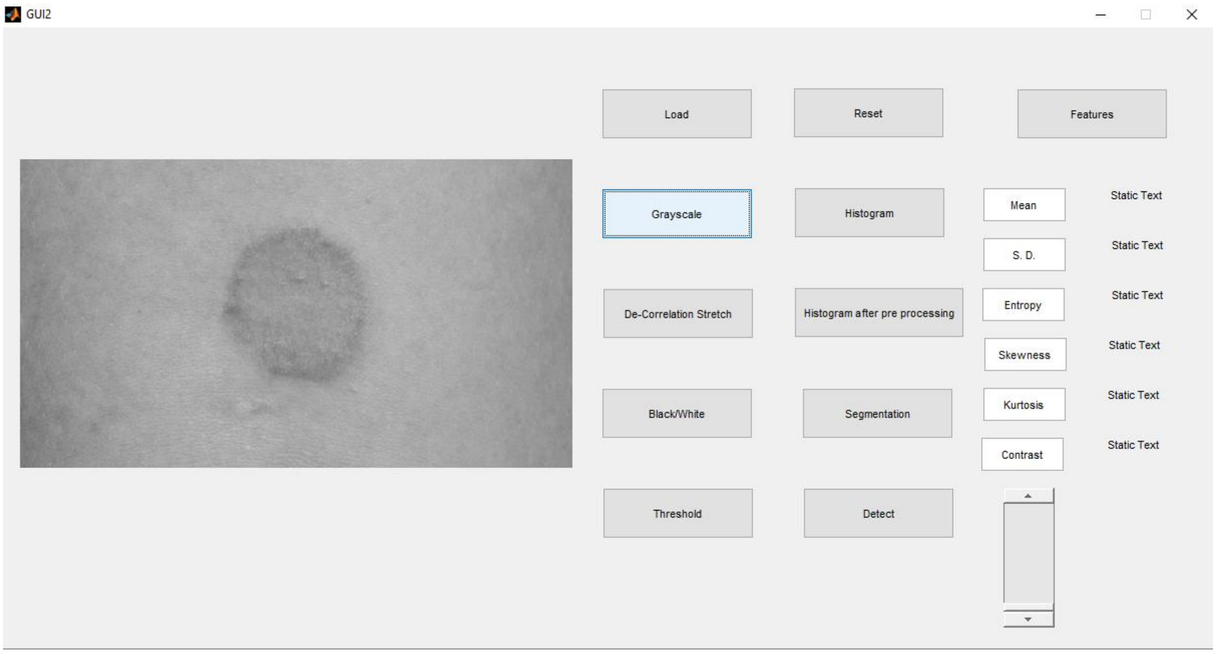

Figure 5.4: Image Pre-Processing (Greyscale of Ringworm)

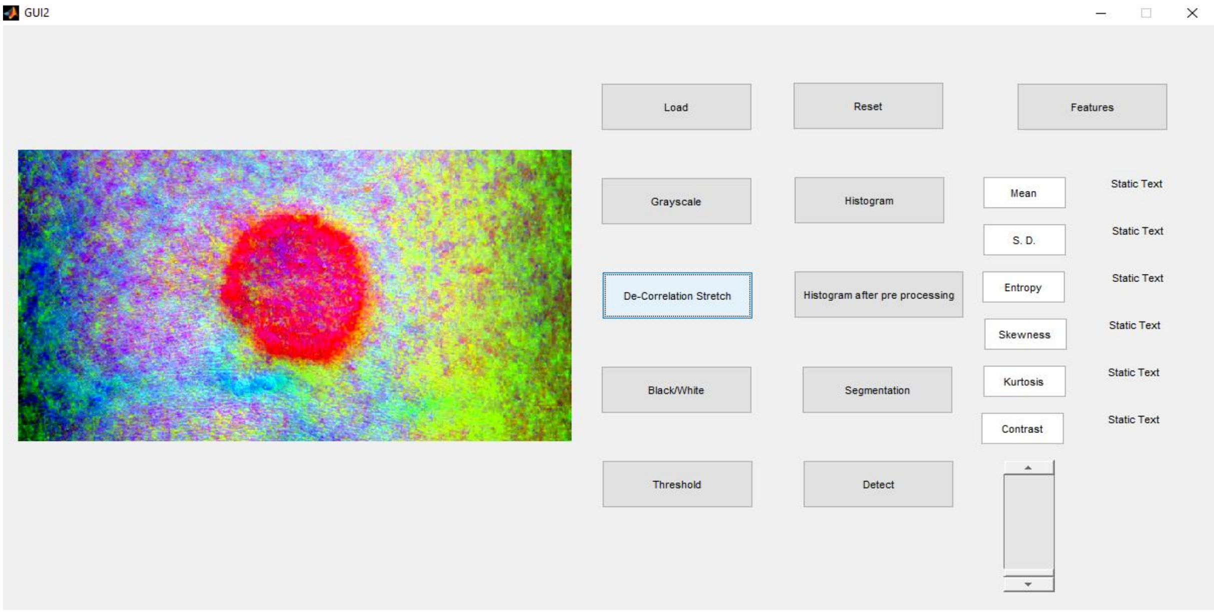

Figure 5.5: Image Pre-Processing (Decorrelation stretch of Ringworm)

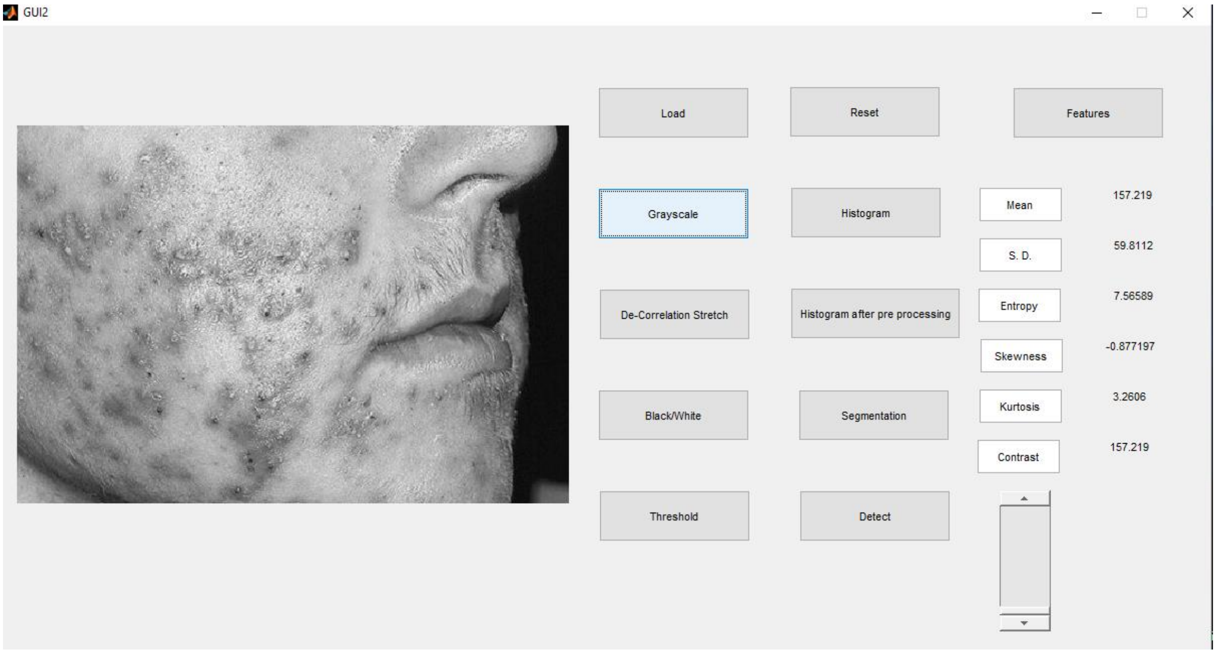

Figure 5.6: Image Pre-Processing (Greyscale of Acne)

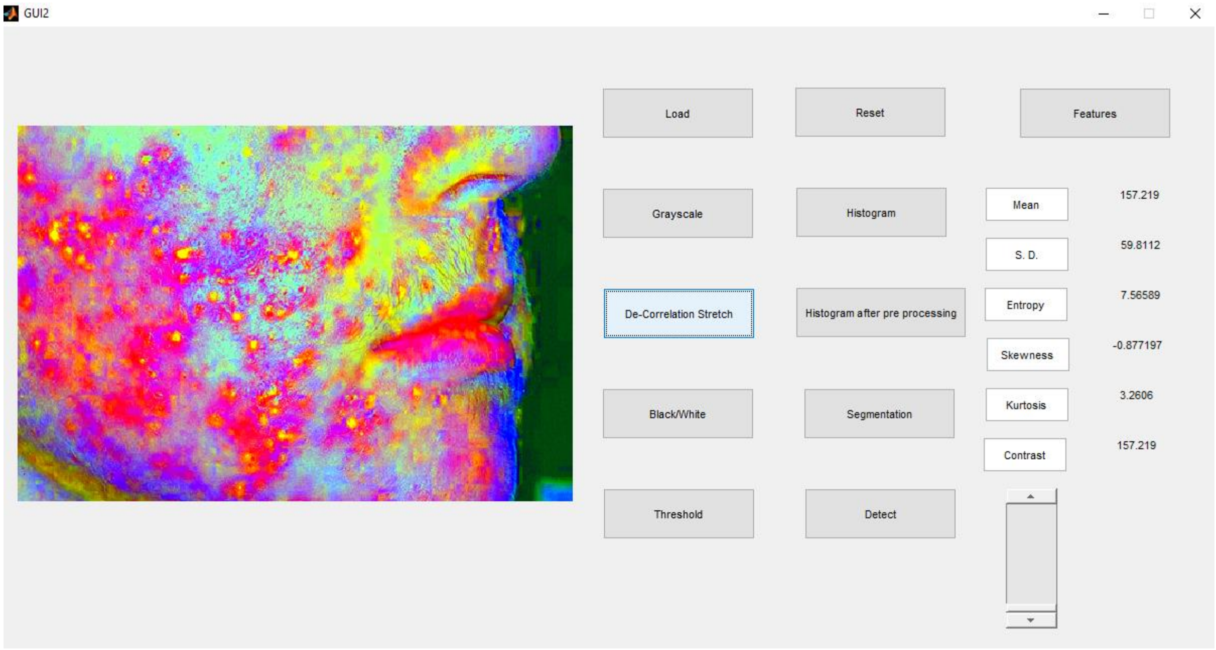

Figure 5.7: Image Pre-Processing (Decorrelation stretch of Acne)

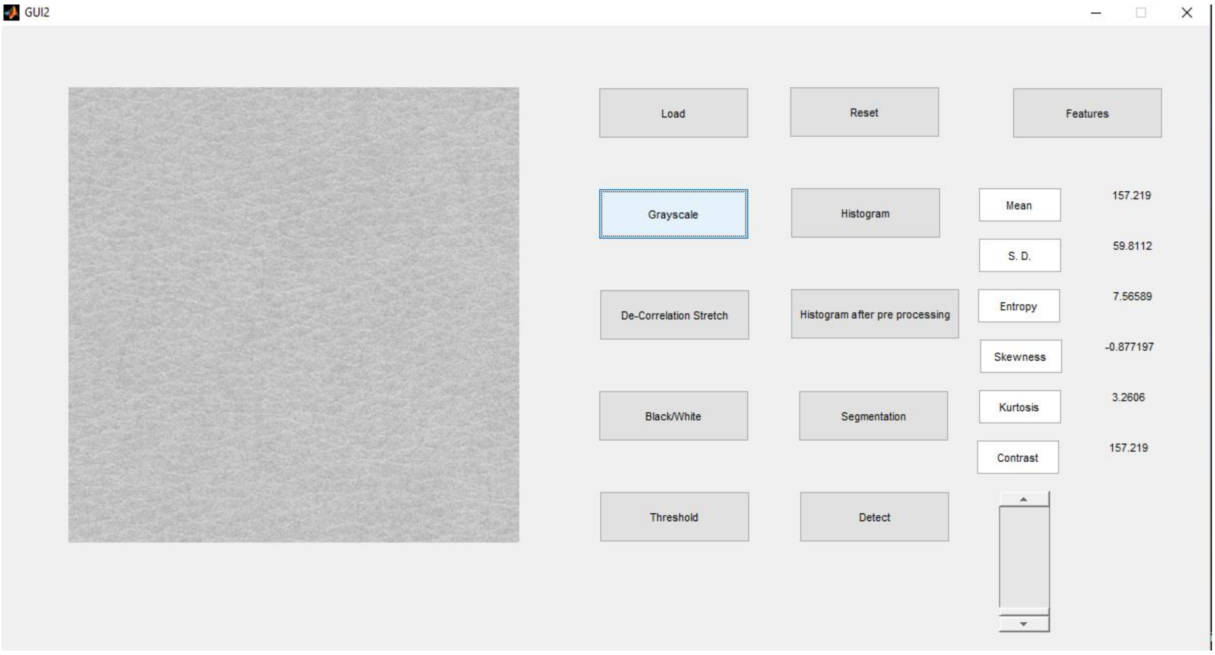

Figure 5.8: Image Pre-Processing (Greyscale of Normal Skin)

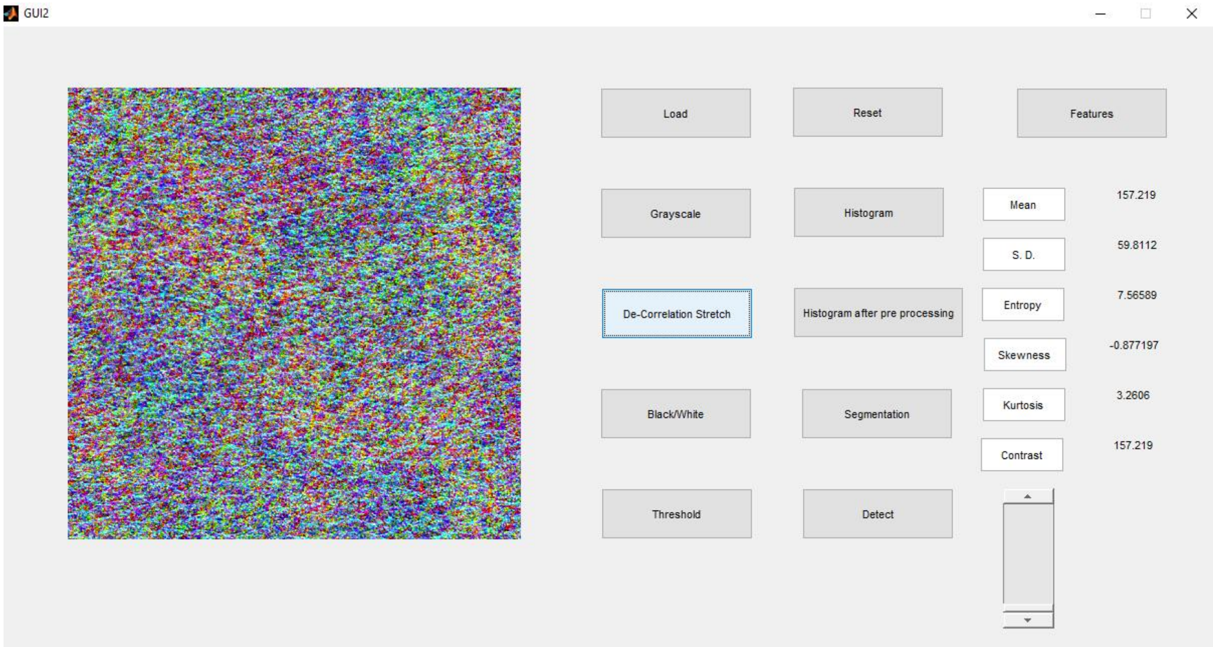

Figure 5.9: Image Pre-Processing (Decorrelation stretch of Normal Skin)

5.3 HISTOGRAM PLOT

Histogram plot tells about the pixel distribution for various intensity regions. Distribution is very cluttered and confined if only greyscale is done. If decorrelation stretch is done and then greyscale is taken, histogram plot is more evenly distributed.

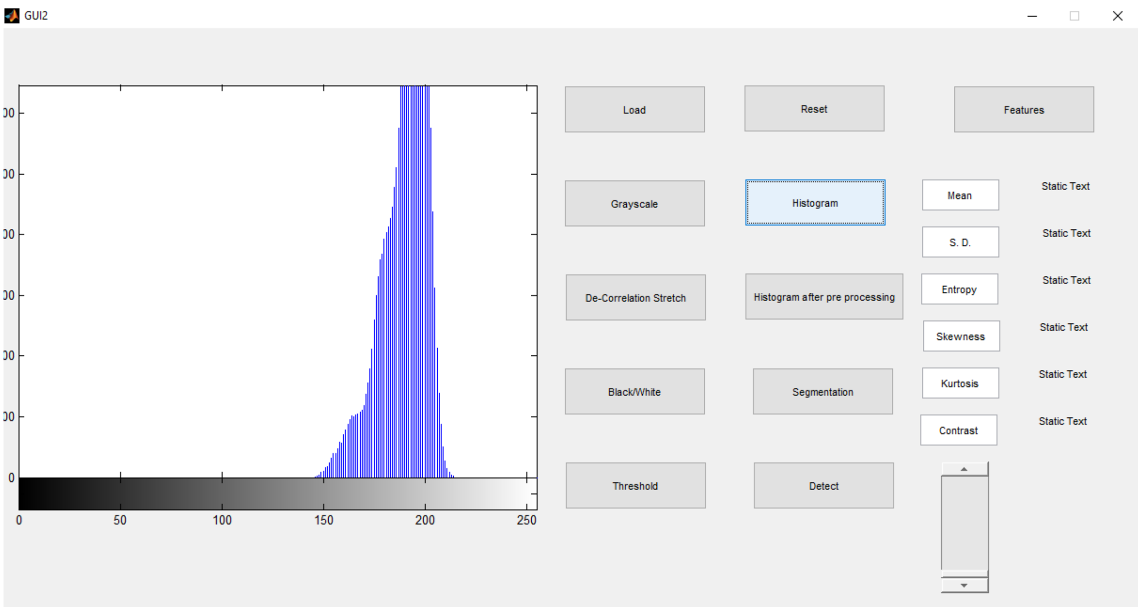

Figure 5.10: Histogram Plot (Ringworm)

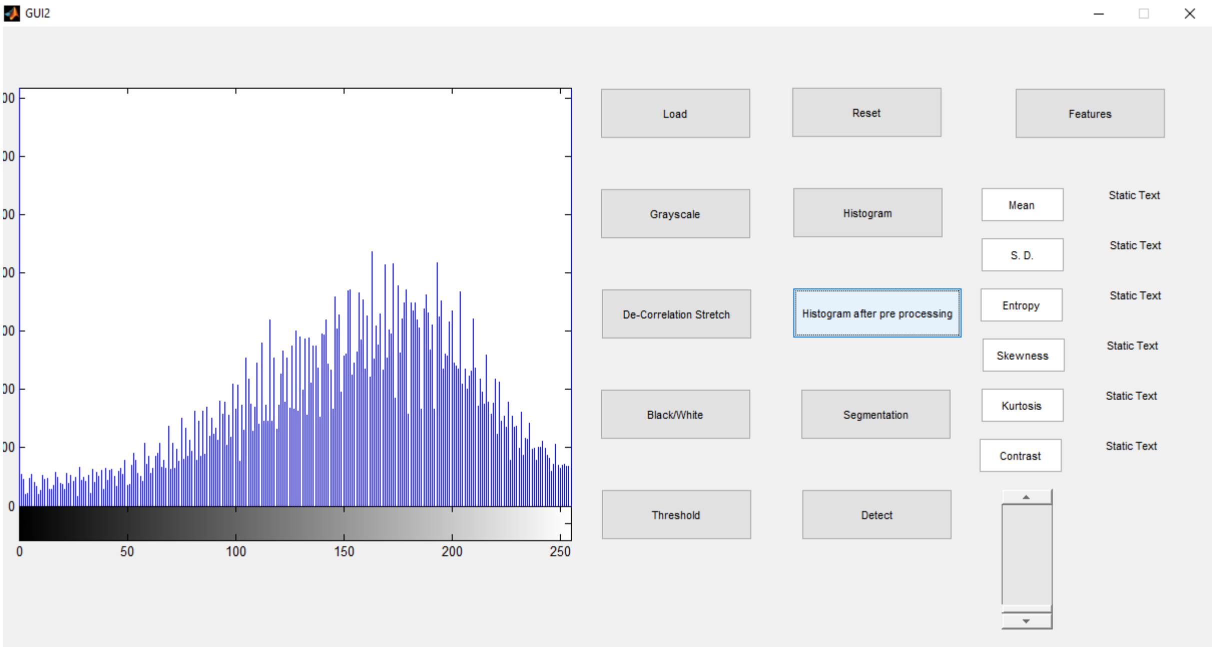

Figure 5.11: Histogram Plot (Ringworm after decorrelation stretch)

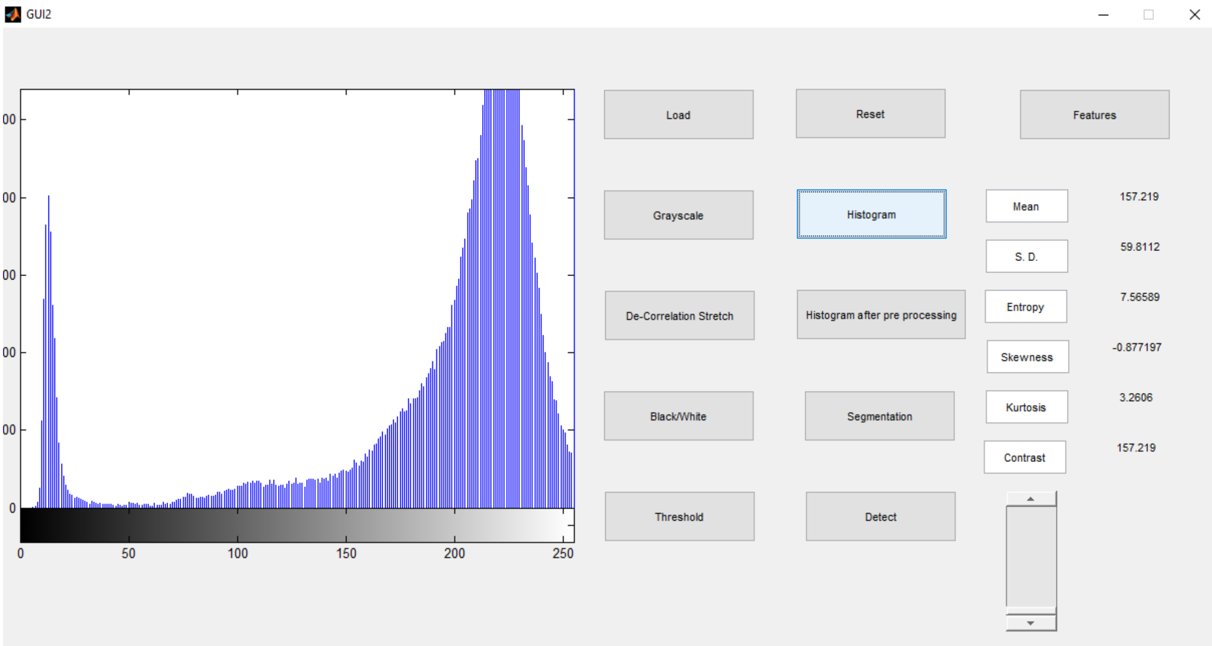

Figure 5.12: Histogram Plot (Acne)

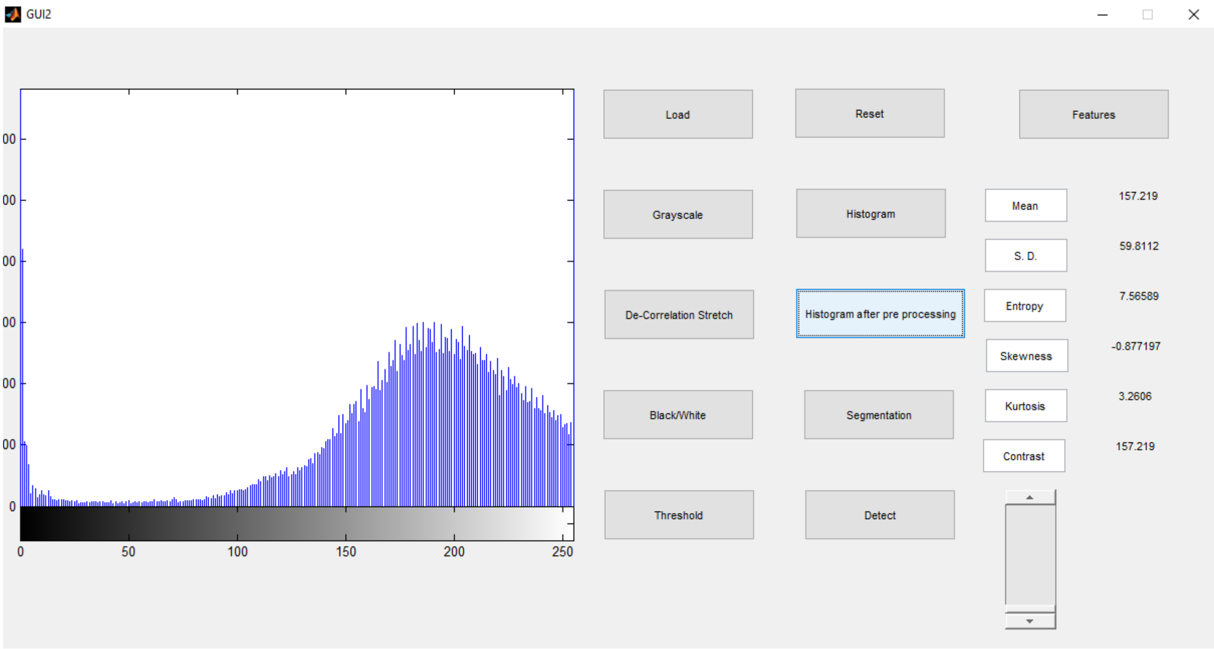

Figure 5.13: Histogram Plot (Acne after decorrelation stretch)

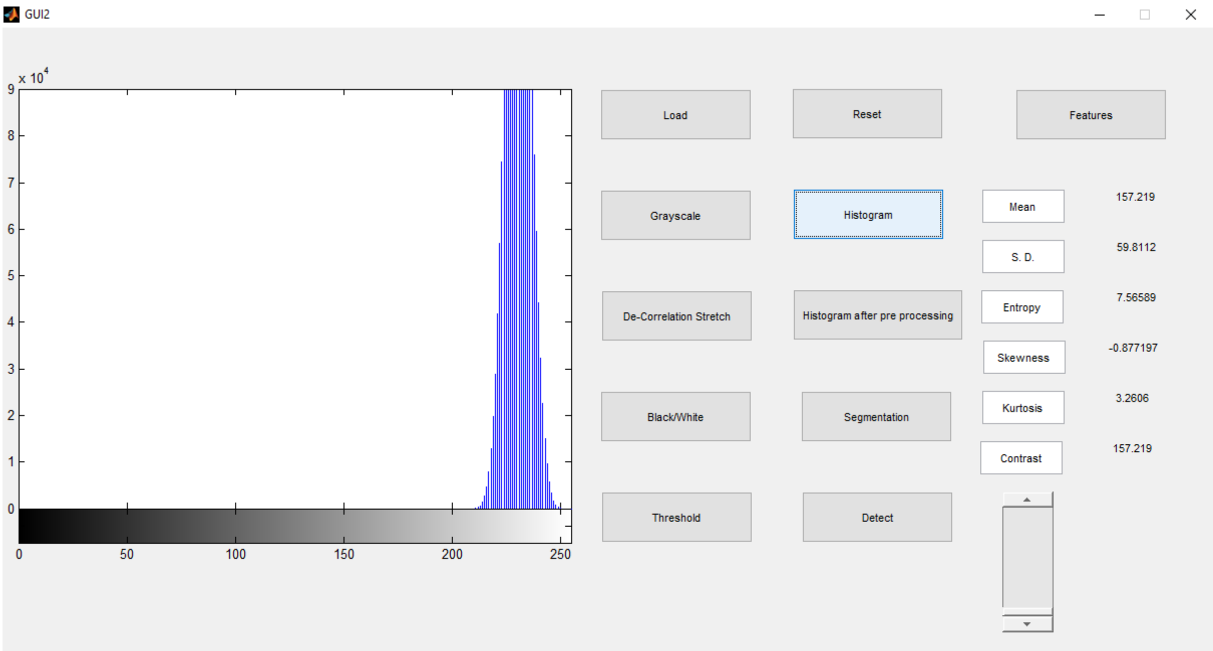

Figure 5.14: Histogram Plot (Normal Skin)

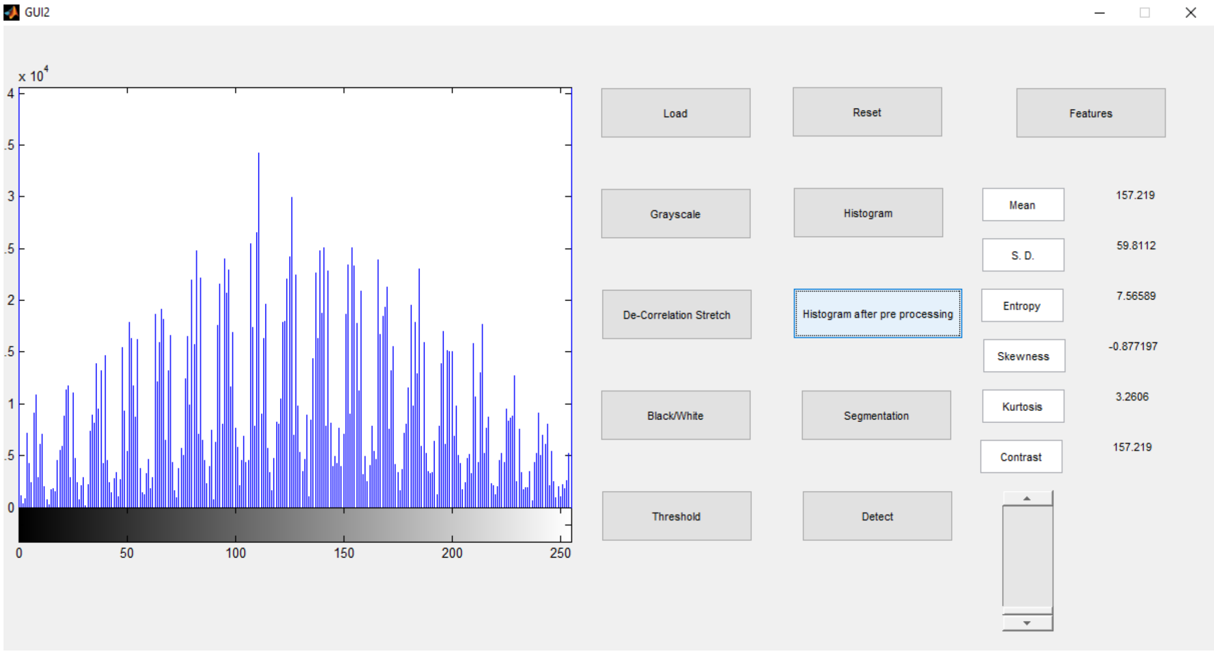

Figure 5.15: Histogram Plot (Normal Skin after decorrelation stretch)

5.4 THRESHOLDING

Thresholding is done in order to set a minimum value for features for which segmentation takes place. Thresholding decides whether a given pixel is information or is a part of background. We have used adaptive thresholding technique.

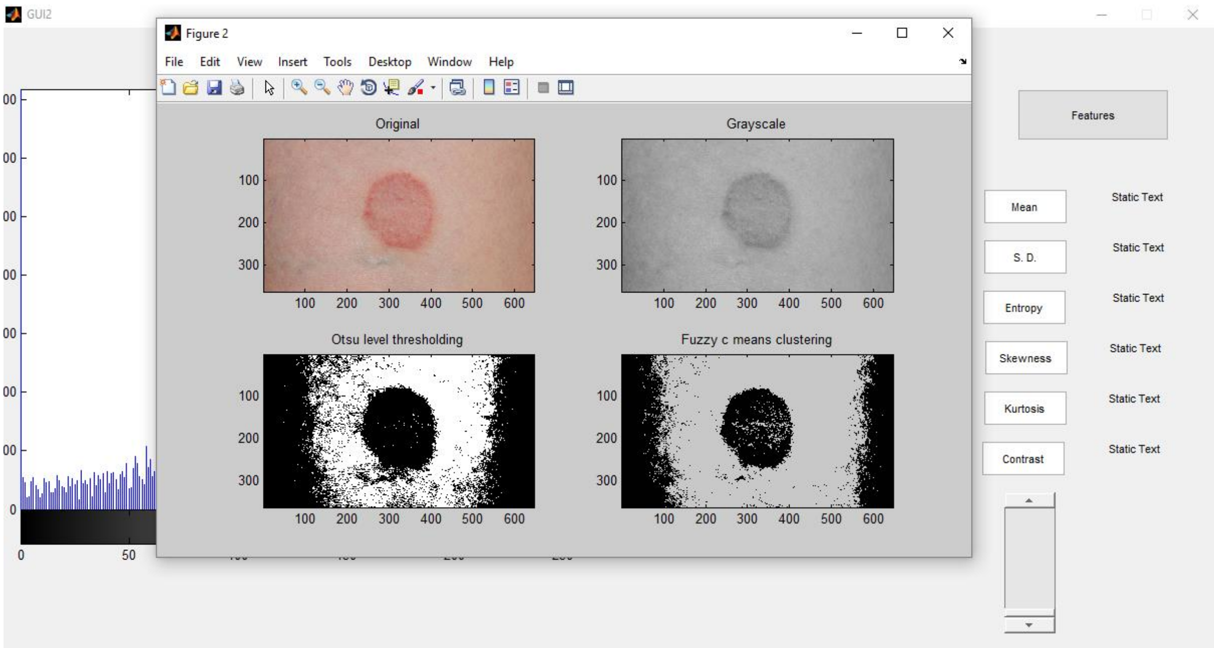

Figure 5.16: Thresholding (Ringworm)

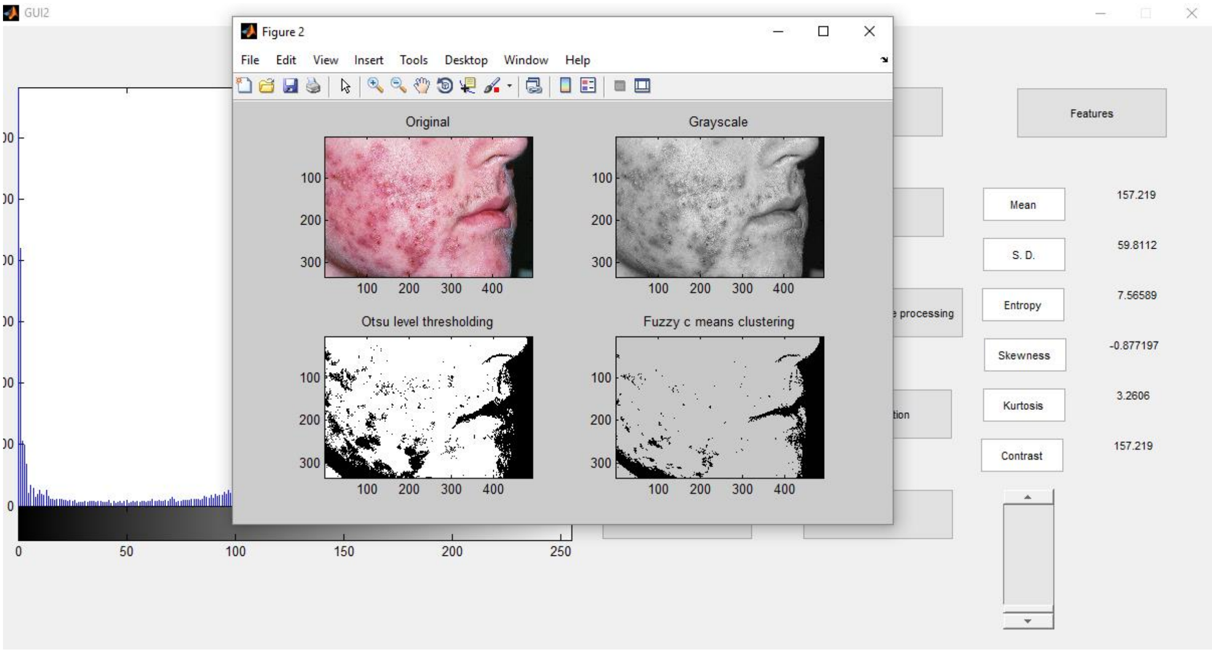

Figure 5.17: Thresholding (Acne)

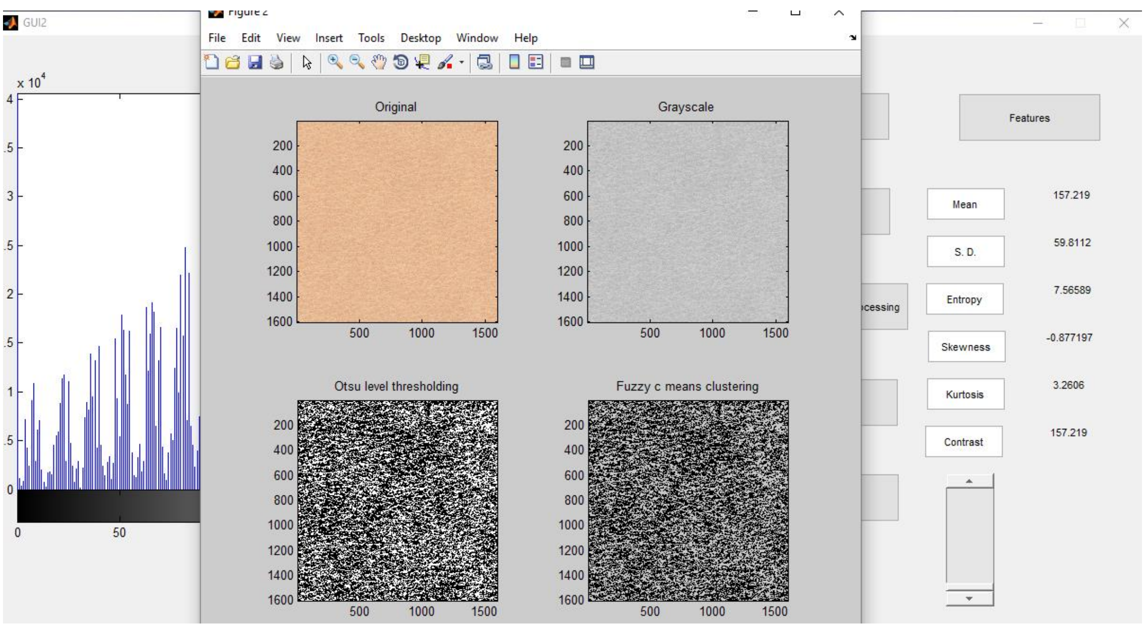

Figure 5.18: Thresholding (Normal Skin)

5.5 IMAGE SEGMENTATION

Image segmentation allows the image to be converted into a binary image. The thresholds are used and are inverted to convert the image into a solid black and white image. Holes are filled and the image is smoothened out with suitable filters. If any blur or discontinuity is present in the image, then that area may also get shown in the segmented image as part of the affected region.

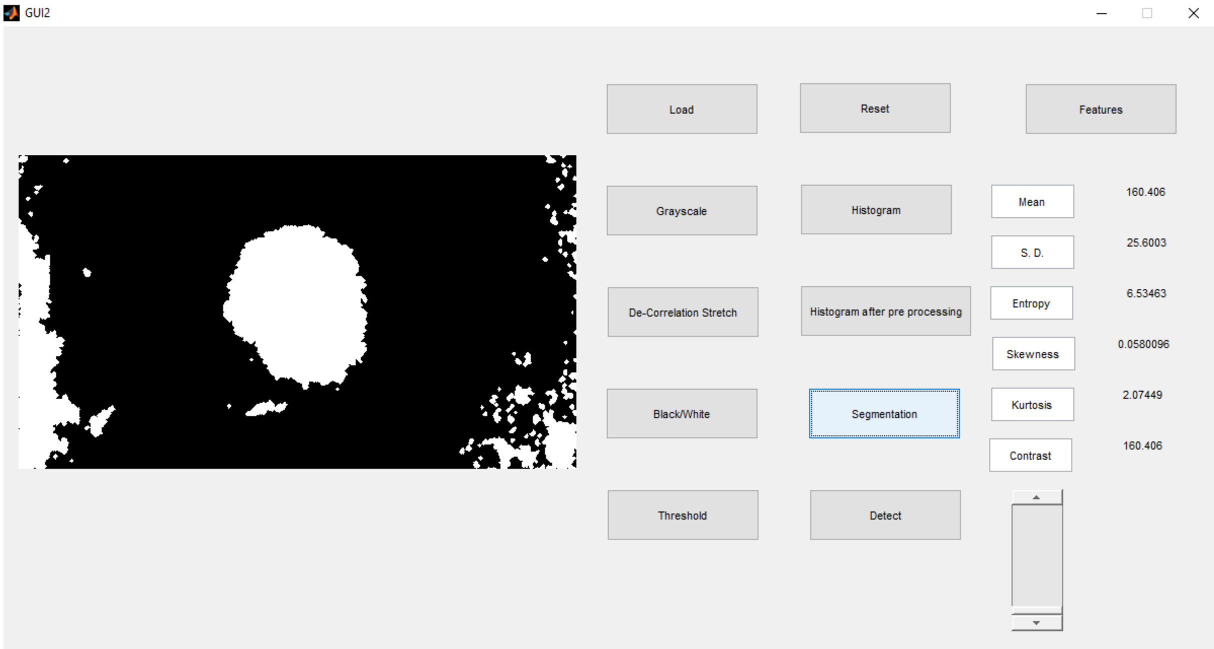

Figure 5.19: Segmentation (Ringworm)

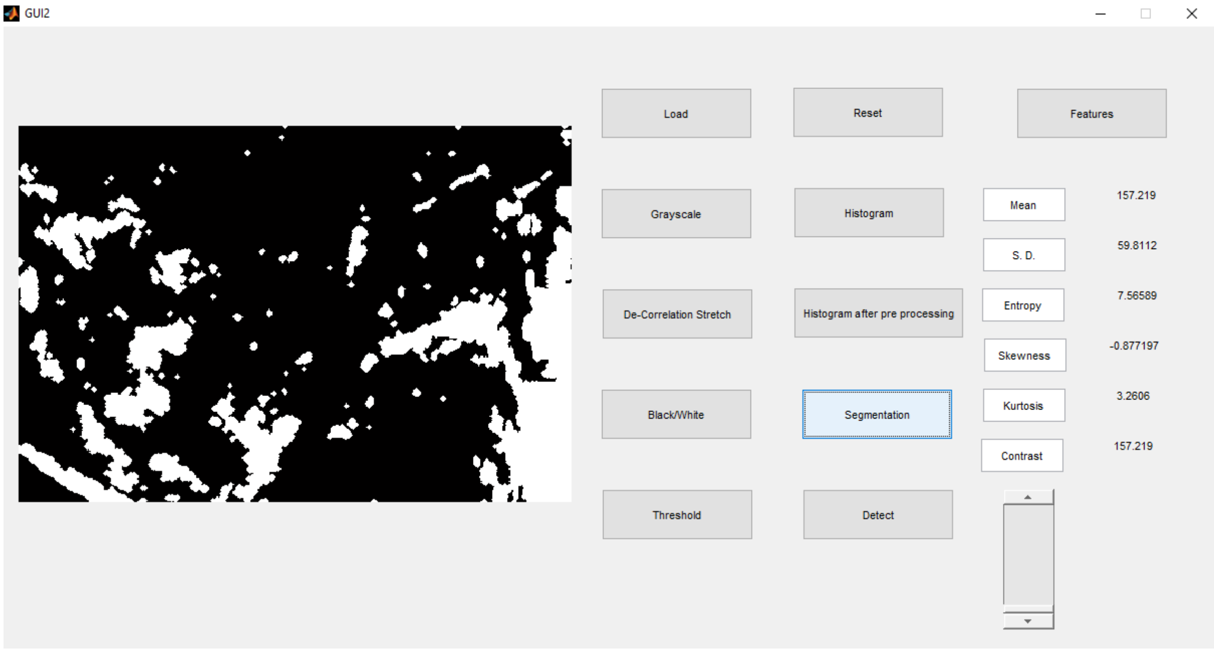

Figure 5.20: Segmentation (Acne)

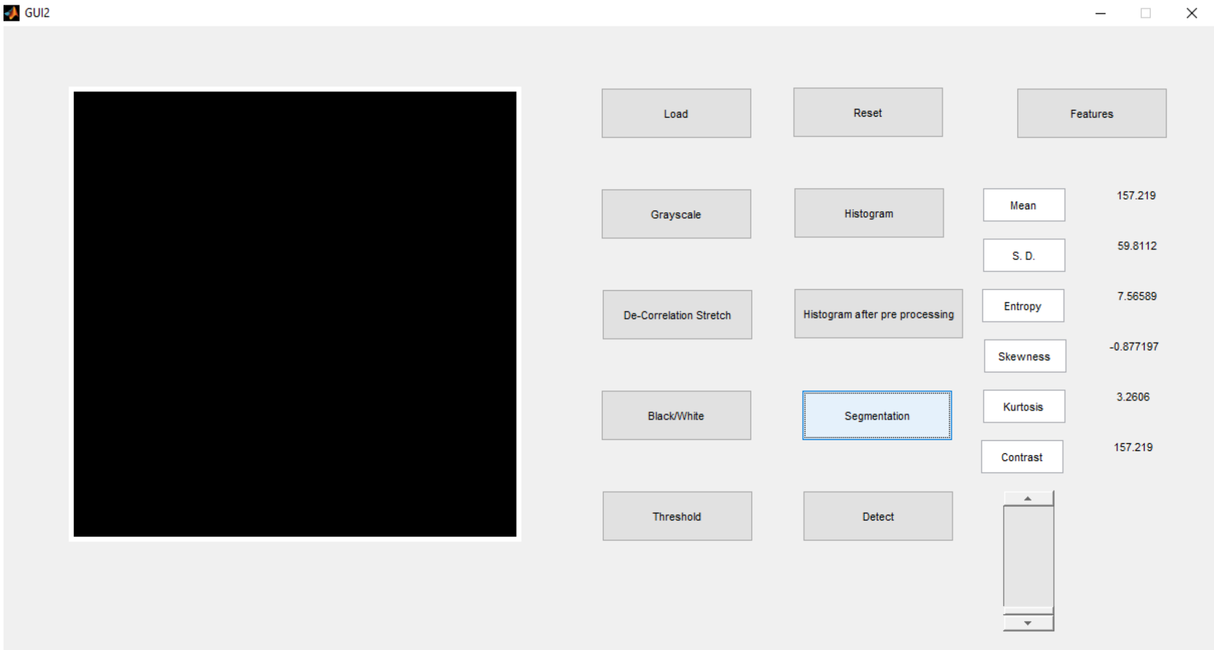

Figure 5.21: Segmentation (Normal Skin)

5.6 DISEASE IDENTIFICATION

Next step is to identify the disease. The features are matched to that of the database. The disease whose features match closest to that of the input image features, the disease is declared according to it. The statistical features used to create and match the database are mean, standard deviation, entropy, skewness and kurtosis.

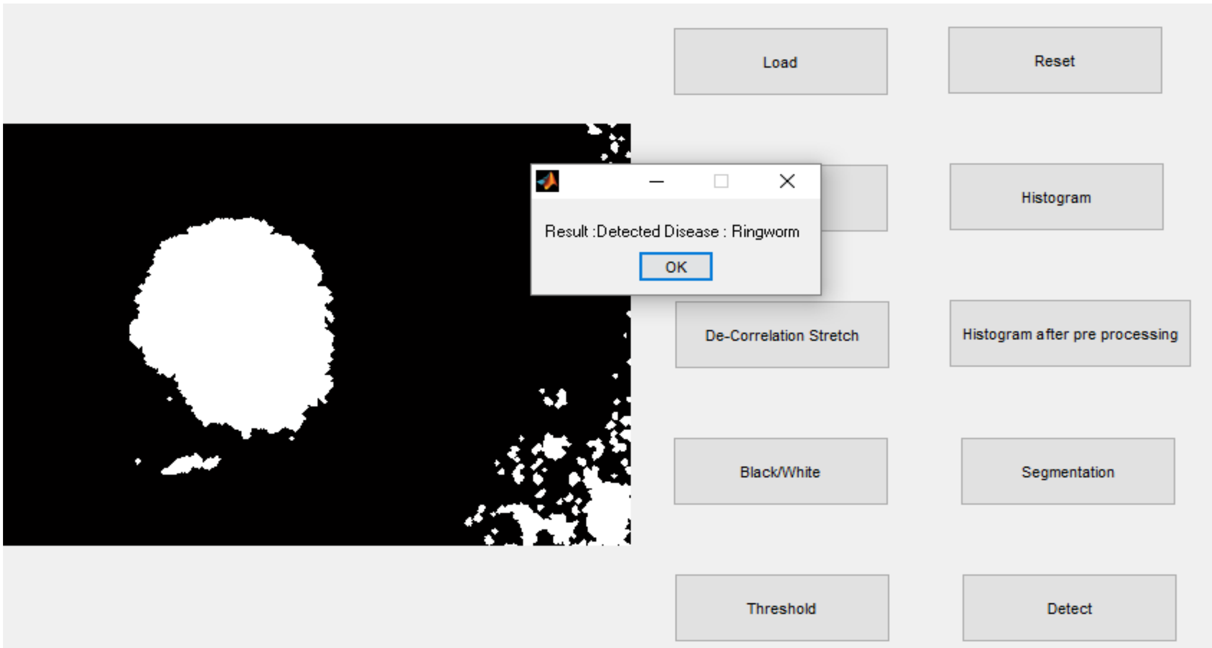

Figure 5.22: Disease Detection (Ringworm)

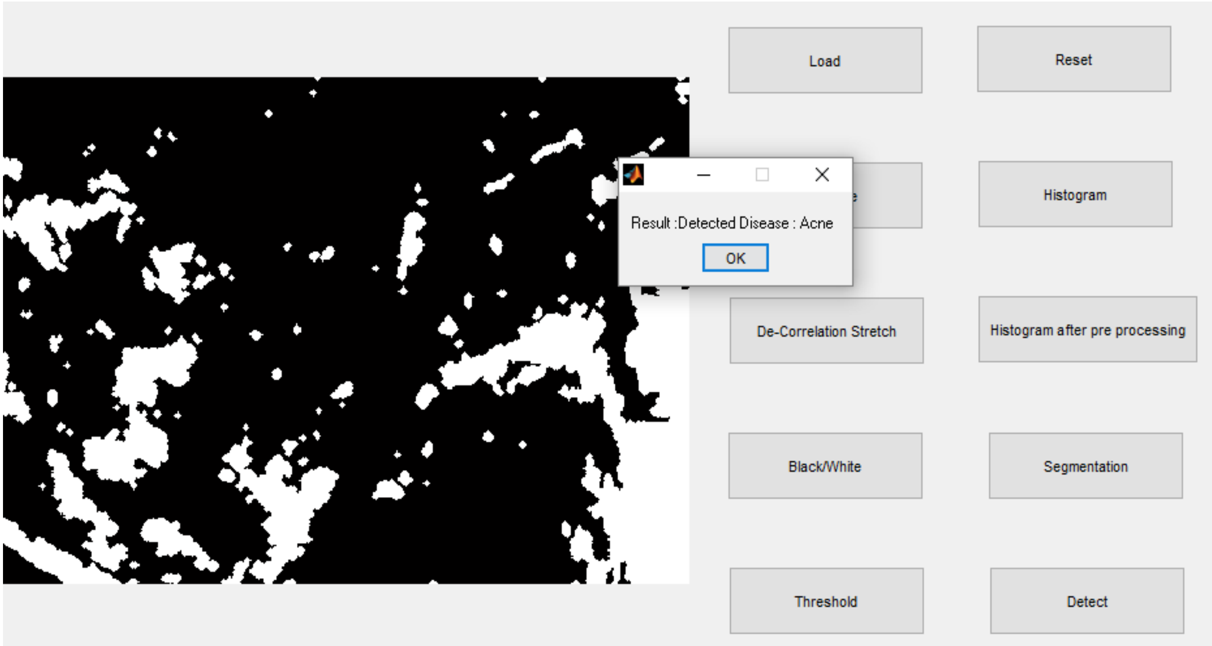

Figure 5.23: Disease Detection (Acne)

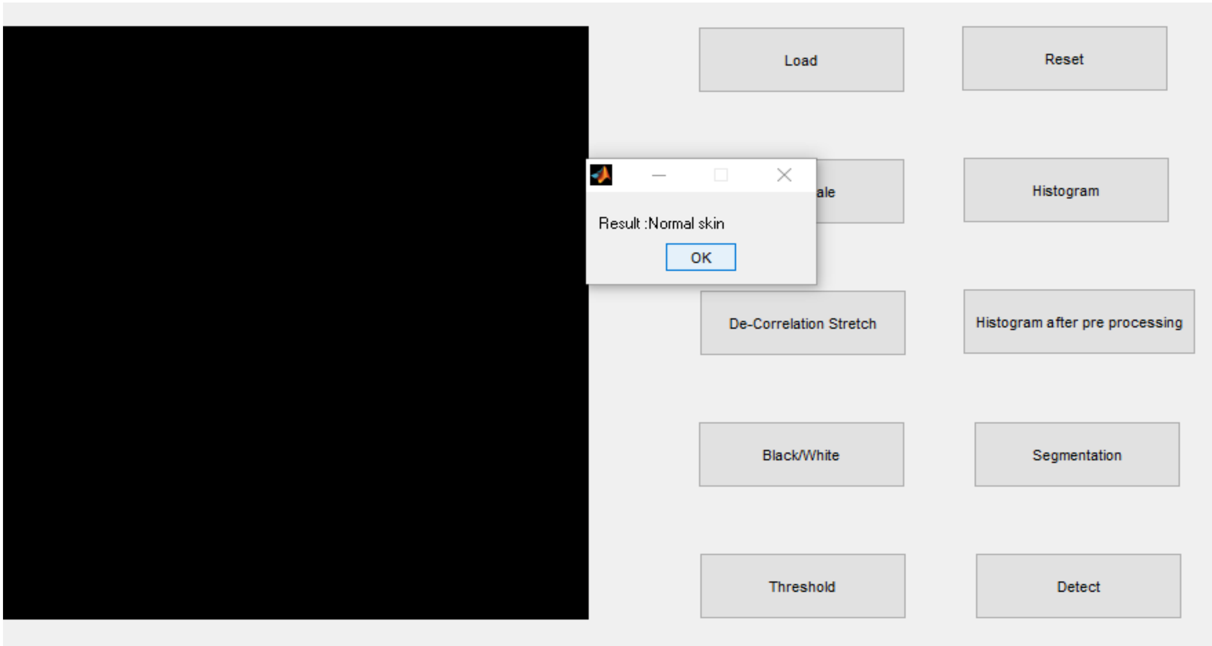

Figure 5.24: Disease Detection (Normal Skin)

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