



# Detection of Skin Diseases Using Matlab

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It is a great challenge for doctors even with the existence of emerging technology, to diagnose the symptoms of a skin disease. Many people are exposed to serious skin diseases that require them to go to hospitals and go through a number of different expensive medical examinations which takes up to days. The proposed work can solve the above problem to an extent, through the design of a program by MATLAB, a method based on vertical image segmentation, and is proposed to identify three various types of skin diseases, namely, Acne, Cancer and Psoriasis dermatitis. The work is a key to detect a range of symptoms in just a few seconds, making the diagnosis more intuitive and realistic. The aim of this project is the classification of different diseases based on images given as input. The project is based on MATLAB software platform. The images are collected from various publicly available databases Dermnet, DermWeb, etc. Firstly, the sample images of four skin diseases need to be preprocessed. Secondly, the vertical image is segmented and made corresponding geometric transformation. Based on this, three types of skin diseases' features are extracted, and their correlated parameters of feature texture and pixels of lesion areas are collected through image segmentation. Finally, the symptoms of Acne, Cancer and Psoriasis dermatitis are identified by utilizing the support vector machine (SVM) method in order to improve identification accuracy and provide an interface to doctors.

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## Introduction

The use of the doctor's experience and sensory skills of touch, consideration, hearing to detect skin diseases is not enough as was the case in the past and not acceptable in the era of modern medicine based on evidence. Today is a great challenge for doctors with the existence of advanced methods of diagnosis, whether laboratory, radiology or telescopic, and the scope of the emergence of technology and entry into the field of medical diagnosis is in fact something of the science fiction that appeared with new devices that enabled, for example, to detect a range of symptoms in just a few seconds, making the diagnosis more intuitive and realistic.

At present, most of the conclusions about the current symptoms of patients are based on year's physician experience or personal judgment, which can cause misjudgment and thus delay the treatment of symptoms. Therefore, from theoretical importance and practical value to learn about extract the symptoms of any skin disease based on technology and modern science. Effective and precise identification for skin diseases can be achieved describe treatment based on symptoms of the patient.

As has been known since the old that there are many diseases that affect the human skin, causing the deformities or the appearance of spots can be seen or distinguish by touch, but not long ago, studies have confirmed that there are also a lot of diseases that affect the skin and cannot be noticed or known. From these aspects, the idea of this work will help and contribute to the early detection of skin diseases. The aim of this paper is the classification of different diseases based on images given as input. The project is based on MATLAB software platform. The images are collected from various publicly available databases Dermnet, DermWeb, etc. A database of these images along with their labels are formed using various image processing toolbox functions of MATLAB. The database would consist of two categories: training and testing. The training images are used to train the computer and make it learn about the types of diseases. The testing set is used for verification and performance evaluation purpose.



Image processing is one of the technologies that has been developed rapidly in medicine field. The following equipment like magnetic resonance imaging (MRI), computed tomography (CT) and digital subtraction angiography (DSA) was same of the equipment that are widely used on people's life that is based on digital image technology. Researchers around the world have conducted deeper research on this trend. For example, Oyola and Arroyo have been diagnosed with dermal spasticity by turning the color of the image processing technique, equation and edge detection, and the image of the endowment was equally collected and categorized by Hough transformation. The final experimental result showed that a better diagnosis was obtained in terms of outbreak or varicella detection. And on basis the herpes zoster and varicella were conducted as preliminary tested.

Chung and Sapiro proposed a method for detecting skin lesions depending on partial differential equation (PDE), in which an extraction on a peripheral model of skin lesions has been made based on morphological filtration via PDE. The final experimental result showed that skin disease can be determined accurately by using this algorithm. Yu et al has diagnosed with herpes, herpes zoster and herpes simplex by the reflectance confocal microscopy (RCM) theory as a result that specificity are able to be extracted from the three types of herpes diseases.

Zhong et al diagnosis a common psoriasis disease by using the technology of three-dimensional tomography which known as the skin imageological technique. The final experimental result showed that the diagnosis of common Psoriasis from Munro's microabscess was very specific and highly sensitive. Sumitra et al has proposed a new method for the automatic classification and division technique of skin lesions through the SVM and also the K-nearest neighbor (K-NN).

The main aim of this paper is to design a program using MATLAB to detect human skin diseases at an early stage. The work aims to achieve the following objectives:

1. To be able to classify the images based on the type of disease.
2. To come up with a training model that can be retrained as the database increases.
3. To create a Graphical User Interface (GUI) for doctors.

Project Limitations: at present the work is limited to detect only three skin diseases. Also it is not yet developed for smart phones like Android or IOS. The work doesn't consider the light effects while taking pictures.

## Methodology

For this project the method that will be used is Iterative Model which is a portion of the software development life cycle. The Iterative approach is the specific implementation of the software development life cycle which focuses on the beginning, and the simplified implementation that earns more complexity and a wide benefits group gradually pending the whole system is complete. So, the Iterative model is a method of breaking down the software development life cycle of huge application to smaller portions.

In addition, the Iterative method starts with a small implementation of the branch of the requirements of the software and it boosts the developing versions pending the whole system is completed. As well as, in each iteration, it required to make some modifications and added new practical capabilities. The main idea of this approach is to improve the system over iterative cycles and in smaller parts at the specific time.

“The key to a successful use of an iterative software development lifecycle is rigorous validation of requirements, and verification & testing of each version of the software against those requirements within each cycle of the model. (ProfessionalQA 2019)”.

The following points shows the main features of the Iterative method;

1. In this model obtains the results periodically and early.
2. The iterative model can measure progress.
3. Planning the parallel development.
4. It is not expensive to change the requirements or the scope.

On the other hand, the methodology has few disadvantages such as more resources and management. Figure 1 below shows an example of the iterative model diagram.



**Figure 1.** Example of the iterative model diagram.(professionalqa.com, 2018)

The main phases of the iterative model of this paper are

**Collecting and analyzing requirements:** At this stage, all system requirements information is collected and documented. So, all the data that according to this project are collected and analyzed through the literature review.

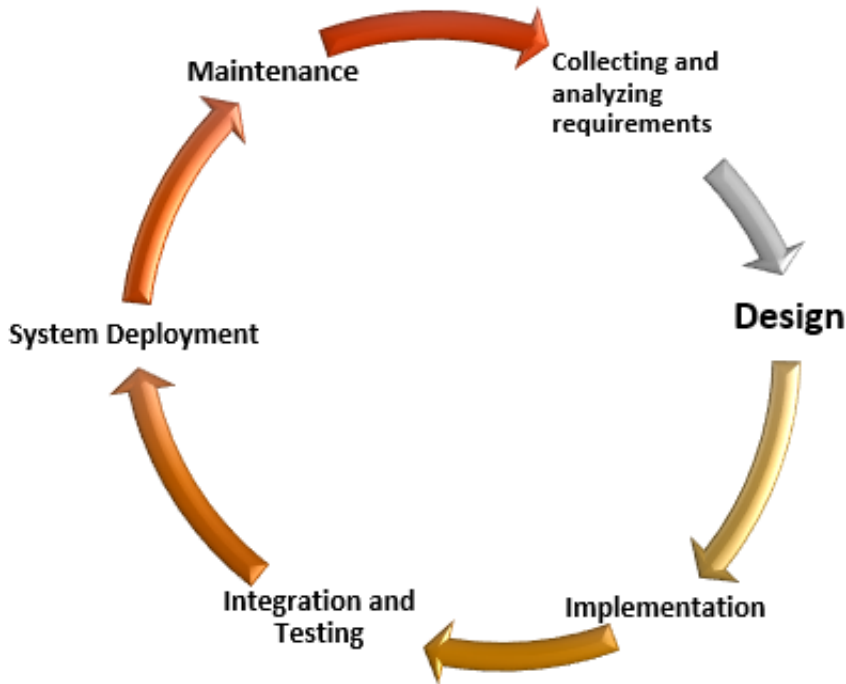
**Design phase:** This stage analyzes the system requirements collected in the first stage and processing system design that by design the block diagram and determine the Matlab software that will be used in this project to determine the diseases.

**Implementation:** At this stage, the project is implemented based on the requirements and information available and the implementation of the system is divided into small programs called units that to make the project implementation easier in the Matlab.

**Integration and Testing:** All units are integrated into the previous stage of the system after testing. The system is tested after the whole consolidation process to detect any error or failure and try to solve the errors and avoid them.

**System Deployment:** After all the functional and non-functional testing of the system has been completed, the product is published in the work environment or launched in the market.

**Maintenance:** There are some problems that appear in the work environment, after using the product. So, this stage is to solve the errors in the project system in the Matlab.



**Figure 2.** Iterative model phases of this project.

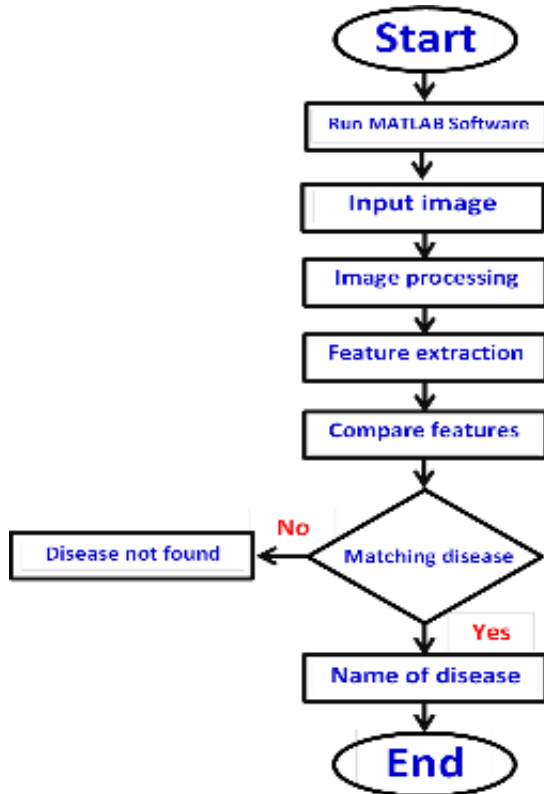
A comparative study on various past related work is done which assisted in the processing of the original image, feature extraction and classification based on SVM. Previous papers discuss the effect of the use of the advantage of colors and recognition of the surface of human skin by distinguishing the changes in the proportion of colors in each region of the skin and by using the technique (RGB YCrCb-HSV) and we found that compared to the project on which we work in the discovery of diseases that there is a clear difference in the method of extracting features, they go directly to determine the skin area only and this means that the primary goal is to know the location or surface of the skin either in the project of disease detection, it is possible to follow this method in the discovery of colors for the purpose of identifying diseases and known there are also several other ways to set the target of Extracting energy values from the image is what we will achieve in this project, while it is possible to improve the performance of the project in addition to the extraction of more than one feature so that the detection system to extract the features of color and energy to confirm the success of the classification of images every time new user image.

One of the studies that we have reviewed which is the image processing for recognition of skin diseases that contains valuable information and useful to the community, which works to address the image of the discovery of cancer in particular and that it is one of the most serious diseases that can affect humans. The disease detection device is in several stages to detect three diseases and cancer will be among the diseases that we discover through detection and comparison with the treatment of images of cancer, this initiative will increase the success rate in the discovery of more diseases And the development of the system in terms of accuracy in the processing of images and it will be by extracting the parameters of energy for each image is introduced into the system.

## Design and Analysis

The training images are subjected for feature extraction. During this stage various image processing features are extracted and saved in a matrix. The feature matrix thus obtained is used for classification purpose. The test image given is compared with the training images and best possible closest match is found through machine learning algorithms.

The complete system would be integrated through a graphical user interface (GUI) for better user reference. Using the flowchart we can give full explanation of the device operation system the skin disease detection includes a set of stages that and each stage works on certain function this detection devise flowchart consists of collecting database, image processing, feature extraction, SVM training, comparison between loaded image and database and predict proper disease



**Figure 3.** System flow chart

Images of various skin diseases is collected to form an image database. These images are collected from various publicly available database. The first stage is image processing, it is necessary to filter the image to remove the noise because image may contain some unwanted noise. Three common skin diseases are selected in this project as the main research objects, which are Acne, Cancer and Psoriasis dermatitis, respectively. Due to differences in ways of acquiring the source images of skin epidermis and in resolution and size, image preprocessing on source images are needed for the sake of subsequent vertical image segmentation. The specific processing is as follows.

Firstly, considering that noise constantly exerts a negative impact on acquired samples of skin epidermis's source images, it is necessary to de-noise through median filtering for the reduction of the impact on skin segmentation and identification brought by irrelevant background in the images. Preserve edges and keep useful information. In this project, the median filter is adopted to preprocess and smoothen the source images. The used formula is as follows:

Secondly, images are rotated in order to get the medial axis to segment the images. For the purpose of getting the line of discrimination better, Images are rotated to a specific angle, where the height and width of new images are as shown in the equation:

Finally, the images are divided into ten vertical slices. It is necessary to create an oblong rectangle on the image in order to determine the disease area.

Then, the representation of an image into something that is easier and more meaningful to analysis



by using image rotation and segmentation. The specific areas of skin lesions are precisely divided, and through vertical image segmentation, the identification accuracy is improved. Various features are extracted from the database images. The features include different spatial, spectral and wavelet domain attributes. These features are saved in matrix. A computer program would train the machine using a machine learning algorithm called SVM.

SVM is the statistical method based on the statistical learning theory, which is suitable for the classification of small sample numbers. It can obtain the minimized training error and a confidence interval term by analyzing the given training set to predict the test set. In this project, we use SVM to identify four different skin diseases. Firstly, the sample number and training number are selected from the extracted features (such as color feature, and texture feature), and then by using the rational kernel function of support vector machine, the classification model can be established. When a new image is given to the computer, the same features are extracted from this new test image. The trained model is used for comparison of database features with the test image features. A closest match among the images is found to determine the probable disease.

	Photographic images	Logos and line art graphics
Properties	Images represented as continuous tones includes colors of 24-bit or 8-bit gray.	Graphics in some cases are known as solid color, contains limited colors of 256 colors only, with lines and sharp edges or text.
For best quality images	PNG and TIF or LZW has no JPG artifact and causes wast on compression.	PNG and TIF or LZW causes lossless on compression and has no JPG artifact.
Smallest file size	Top quality factor with JPG provides quality that can be small and dignified at the same time.	TIF LZW, PNG, GIF logos and graphics with on gradients usually allows indexed colors from 2 to 16 different colors for smaller file size.
Maximum compatibility: window, Mac, Unix	JPG\TIF.	TIF\GIF.
Worst choice	GIF represents limited colors of 256 colors but including file larger than 24-bit JPG.	Compression of JPG provide artifacts and smears logos, text and lines.

Table 1. Best file types for the comprehensive goals

## Results

We are doing SVM classification (fitsvm) and after this command we get three such models for classification where SVM is simply creates a dialog partition between one class and other classes for example it can creates a partition between Acne and other two diseases so partitioning is actually done by the SVM. These are visual interpretation of how the feature values are located for each class. They must be as separable as possible for better classification accuracy.

Figure 4. Scatter diagram of feature

Since noise continuously affects the samples obtained from skin epidermises of source images, it is necessary to reduce noise through daubechies filtering to minimize the effect on skin fragmentation and identify inappropriate image background as shown in figure 4. daubechies filter is common method used to remove noises from applied images while edges and useful information preserved and kept as it is in original form this filter is used in order to perform for processing and smoothen the image from it is source

The features of (Acne, Psoriasis, Cancer) are expected for the image in database those feature are expected to use wavelet transform of energy so it creates three multiple lines in order to separates





the three regions of (Acne, Psoriasis and Cancer) so whenever a new image is given it will see how close it is to the three region and it will accordingly classify whether it is among one of the diseases and if it not there will be no match between the image and the models which indicates that the image is not from the database and that can be done through predict function of diseases.

**Figure 5.** Scatter diagram of feature

For each disease, 10 images were found permanently in the database of each disease stored in three files that were stored in the PC. Each image has advantages and we have taken these special features only energy to be used as a basic feature through which to compare 10 images of each disease in the database with any image from outside the system to be recorded energy values according to the data. We have worked to extract the feature through which similarities occur and allow percentages to emerge to know the similarities achieved. Since we have 10 images per disease, this means that we have 30 images from which values have been extracted and stored in advance to be systematically compared and each time values are extracted for only one image that has been entered.

Figure 6 shows the energy properties of cancer and psoriasis. Cancer disease values have been extracted from the database (DB2) and in Psoriasis disease from (DB3). The database contains all the necessary information that helps in the search process. When inserting an image under an unknown name, each extracted value is compared with the energy values stored in the database. The process is performed by checking the values for each image in order from 1 to 10 to reach the required similarity ratio to classify the image with the appropriate group.

**Figure 6.** Energy values of Cancer and Psoriasis disease

We used GUI technology as one of the main factors in determining the source and evaluation of the image. We have designed a five-button interface and each button has its own name in a particular function while pressing one of the available buttons as shown in Figure 7. The system known as the computer consists of four buttons and a page to display the image to be classified. The first button (load test image) is a function of receiving the image from outside of the system and loading it in the program to be displayed in the space allocated to it the second button (create database) allows to read each image stored in three folders containing images of cancer, Acne and Psoriasis diseases while the features are extracted and saved in the database. The third button is called as (train database) which is actually applies the SVM training. The function of the fourth button (Predict disease) is to make a match between the image of the test and the database and once it pressed it gives the results of the prediction of a particular disease. We performed a simple test of three images of each disease by uploading one image in each test and observing the match ratio. To verify the detection system, we downloaded three images of unknown diseases in the database to ensure that the system detected images of cancer, Psoriasis and Acne disease with other images that do not belong to any rating in the folders available.

**Figure 7.** Implementing GUI technology

**Figure 8.** Skin disease detection of Acne

**Figure 9.** Skin disease detection of Acne



Figure 9 describes the second and third testing of applying the two images the second image is almost blank and barely contain protrusions in the skin and as a result we found that it achieved 100% of the similarity ratio and on the other hand the third image tested is opposite to the second image in shape and the look it has allot of points that needed to be analyzed extract the feature from it and after executing it achieved for about 102% as a result these three images has scored the desired value of similarity and satisfied the condition by showing the conformation on Acne disease.

## Discussion

The work of any system depends on the probability of occurrence of a particular event contains a large range of possibilities that occur in this project, we find that the comparison of images of a particular disease needs to be compared and identify the category to which it belongs by reference to a database containing several models Which can match the pathology with an image outside the database. While working on the identification and classification of diseases, we found that insufficient information was collected for the database, which reduces the success of the matching process because the number of stored images is low due to the absence of various pictures of all known diseases that were previously diagnosed by experts. The database is very important and we need to focus on improving the content of the database so that it is easy to identify any disease compared to images stored in the dermatology system.

We solved this problem by intensive research in several electronically sites linked to the idea of the project and extracted a quantity of images that may be sufficient in terms of number and quality of images. A number of images have been collected to be used directly in the database and according to the inputs we will be presenting, we will be able to obtain the desired results from the comparison process.

## Conclusion

Skin diseases seriously affect people's lives and health. The current project proposes an effective approach to identifying one type of skin disease. It is necessary to change traditional methods and develop automatic methods to increase diagnostic accuracy of multi-species dermatological diseases. In this project, three types of skin diseases were identified as Acne, Cancer and psoriasis skin diseases. The program is designed through the MATLAB program which will detect and identify dermatology. This project will serve a large segment of the society and solve the problem of the difficulty of identifying and distinguishing the types of skin diseases that are exposed to the human, because of the similar effects and symptoms that the patient feels and will certainly contribute to the discovery of skin diseases early and faster.

The devise of skin disease detection has been gone through a several of testing stages in order to achieve more accurate image processing we have done simulation testing using MATLAB program on three different diseases. This project was very useful to increase our understanding in programming using C++ language as we conformed the testing result by performing images to confidence on similarity ratio for Psoriasis, Acne and Cancer diseases. As we have predicted the outcome of system detection has been used with GUI technology to make it as an assistant for all users including doctors and nurses so it can be used on the hand of any person whether he/she was a professional, programmer or a normal person.

As the objective listed in the first chapter we have achieved the three main basics of classifying images to one of the selected diseases and predicting the similarity ration each time an image is loaded in the system and a training model has been successfully achieved that can trained whenever database is increased and because that this project can help allot of people in the hospital it was necessary to add Graphical User Interface GUI in to the system to make it much easier to be used and we have completed these three parts in a very successful way including





wavelet transform in energy feature extraction and classification on images of different diseases that has been fetched from the user and not included in database system but will be compared with this particular database.

The use of the skin diseases detection device is one of the most important devices that will positively affect the medical field in terms of detecting the disease early and determine the quality of drugs faster and also work to reduce the number of patients because they will not need to spend long time in the hospital to carry out the examination procedures that Also take the time of nurses and doctors so that the process becomes faster and we keep time for other diseases that require several procedures to complete the examination. The development of the skin diseases detection system in all aspects, including the method of receiving the system of images, how to extract the features from the images and increase the accuracy of the work of the project will make a significant difference for users in the community benefit and reduce diseases. And we recommend that government agencies and private in the field of medicine to contain this device, which can be developed in terms of:

1. Increased number of skin diseases.
2. Use more than one feature to extract image data for higher resolution such us contrast, entropy, correlation and uniformity feature extraction.
3. Use a camera to take pictures directly from the patient.
4. Treatment of more than one image of a different disease at the same time.
5. Adding a function of determine the quantity and type of medication assigned to the patient.

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