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A PROJECT REPORT

ON

"SKIN DISEASE DETECTION USING MECHINE LEARNING"

Submitted in partial fulfillment of the requirements for the award of degree of

BACHELOR OF ENGINEERING

IN

COMPUTER SCIENCE AND ENGINEERING

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EAST POINT COLLEGE OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CERTIFICATE

This is to certify that the project work entitled "SKIN DISEASE DETECTION USING MECHINE LEARNING" is a bonafide work being carried out by **ARATHI K [1EP16CS013], B DEEPIKA [1EP16CS018], BHAVANI S N [1EP16CS021] and HAMSA K V [1EP16CS041]** in the partial fulfillment of the requirements for VIII semester for the award of degree of **Bachelor of Engineering** in **Computer Science and Engineering** of **Visvesvaraya Technological University, Belagavi,** during the academic year **2019-2020**. It is certified that all the corrections/suggestions indicated for the project has been incorporated in this report. The report has been approved as it satisfies the academic requirements prescribed by theUniversity.

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ABSTRACT

Skin diseases are hazardous and often contagious, especially melanoma, eczema, and impetigo. These skin diseases can be cured if detected early. The fundamental problem with it is, only an expert dermatologist is able to detect and classify such disease. Sometimes, the doctors also fail to correctly classify the disease and hence provide inappropriate medications to the patient. Our paper proposes a skin disease detection method based on Image Processing and Deep Learning Techniques. Our system is mobile based so can be used even in remote areas. The patient needs to provide the image of the infected area and it is given as an input to the application. Image Processing and Deep Learning techniques process it and deliver the most accurate output. In this paper, we present a comparison of two different approaches for realtime skin disease detection algorithm based on accuracy. We have compared Navies Bias Classifier. The results of real-time testing are presented.

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CHAPTER 1

INTRODUCTION

The biggest organ of the body is human skin. Its weight lies between six and nine pounds and surface area is about two square yards. Inner part of body is separated by skin from the outer environment. It provides protection against fungal infection, bacteria, allergy, viruses and controls temperature of body. Situations that frustrate, change texture of the skin, or damage the skin can produce symptoms like swelling, burning, redness and itching. Allergies, irritants, genetic structure, and particular diseases and immune system related problems can produce dermatitis, hives, and other skin problems. Many of the skin diseases, such as acne, alopecia, ringworm, eczema also affect your look. Skin can also produce many types of cancers. Image processing is used to detect these diseases by using various methods like segmentation, filtering, feature extraction etc.

To get an improved image or to get meaningful information from an image, it is necessary to convert an image into digital form and then perform functions onto that image. It is a part of signal processing. The input is an image and it may be a video, a photograph and output is also another image having same characteristics as input image. Mostly Image Processing models take input samples as 2-D signals and after that they apply fixed signal processing methods to them. It is widely used technology now days and it has various applications in the area of business. It is a new research area within engineering and computer science too. The range of skin diseases is very wide.

As you know, approximately eight million people in the UK currently suffered from skin disease. Skin disease doesn't just damage the skin. It can have a large impact on human's daily life [8], destroy confidence of a person, stop their movement, and turn to depression. The worst situation is that, it can even kill. It's a serious issue that needs to be controlled, so it is necessary to take skin diseases very seriously and identify it at an early stage and prevent it from spreading. Detection of a disease depends upon many factors like which parameters are considered for disease detection. Firstly, take an image, apply filters to remove noise from the image, segment the image to extract meaningful information, feature extraction is done on the basis of input parameters and then classify the diseases by using appropriate classifier.

Skin diseases have a serious impact on the psychological health of the patient. It can result in the loss of confidence and can even turn the patient into depression. Skin diseases can thus be fatal. It is a serious issue and cannot be neglected but should be controlled. So it is necessary to identify the skin diseases at an early stage and prevent it from spreading. Human skin is unpredictable and almost a difficult terrain due to its complexity of jaggedness, lesion structures, moles, tone, the presence of dense hairs and other mitigating confusing features. Early detection of skin diseases can prove to be cost effective and can be accessible in remote areas. Identifying the infected area of skin and detecting the type of disease is useful for early awareness. In this paper, a detection system is proposed which enables the users to detect and recognize skin disease.

In this system, the user has to provide the image of the affected area, the input image then undergoes preprocessing which involves filtering to remove the noise, segmentation to extract the lesion and then feature extraction to extract the features of the image and finally classifier to detect the affected area. For classification, Support Vector Machine (SVM) is used. On the other hand, deep learning algorithms have a competency to handle large datasets of complex computation hence, Naïve Bayesian and Support Vector Machine (SVM) is also implemented as a part of the research area to detect the affected area of skin. A comparison between SVM and Naïve Bayesian is also represented with accuracy and confusion matrix. This paper proposed the solution for detecting the skin diseases viz. Melanoma, Nevus and Basal Cell Carcinoma.

1.1 Background And Motivation

Now a day's people are suffering from skin diseases, More than 125 million people suffering from skin diseases also skin disease rate is rapidly increasing over last few decades specially Melanoma is most diversifying skin disease. Nevus rate is high specially at rural areas. If skin diseases are not treated at earlier stage, then it may lead to complications in the body including spreading of the infection from one individual to the other. The skin diseases can be prevented by investigating the infected region at an early stage. The characteristic of the skin images are diversified, so that it is challenging job to devise an efficient and robust algorithm for automatic detection of the skin disease and its severity. Skin tone and skin color plays an important role in skin disease detection. Color and coarseness of skin are visually different. Automatic processing of such images for skin analysis requires quantitative discriminator to differentiate the diseases.

Proposed system is combo model which is used for the prevention and early detection of skin disease, Melanoma and Nevus. Basically skin disease diagnosis depends on the different characteristics like color, shape, texture etc. there are no accepted treatment for skin diseases Different physicians will treat differently for same symptoms. Key factor in skin diseases treatment is early detection further treatment reliable on the early detection.

In this paper, Proposed system is used for the diagnosis multiple skin disease using statistical parameter analysis. Statistical analysis is anxious with analysis of random data. Random data is pattern of skin diseases. Standard database is used this data does not have any mathematical expression, it has some statistical properties. To analyses random data we must analyze statistical properties of it.

1.2 Contribution

In this paper, we present an image to diagnose multiple skin diseases using statistical parameter analysis. Statistical analysis is concerned with the analysis of random data. This system is combo-model which is to be used to diagnose multiple skin diseases at a time. The target skin diseases are Melanoma, Nevus. The disease diagnosis and classification is built on statistical parameter analysis. Statistical parameters includes: Entropy, Texture index, Standard deviation, Correlation fact Depending on standard range of parameters skin disease is going to be diagnosed and classified.

1.3 Problem Statement

The doctors typically have assumed diagnosis opinion, which most likely begin by searching for further evidence that their assumption can be validated and in cases where it is not validated, they will have missed other potential diagnosis. Bias essentially influences analysis made by medical practitioners, just as with any human search that begins with keywords chosen by the user. Additionally, if a doctor begins searching by symptoms, while this may be accurate, the order or weight given to any of the symptoms would most likely give a bias towards related diagnosis when in fact, there may be a symptom that is not given any credit and thus not included in the search or considered in timely fashion.

The heavy dependencies on medical expert for medical image diagnosis analysis are a serious challenge for regions (especially Low and Medium Income Countries) where the expert might not be readily available, inadequate or nonresponsive to an urgent medical need (such as dermatological-related). The aforementioned problems suggest that a better and manageable solution is needed urgently with the view to minimize these dependencies and human bias, thus leading to our research question.

1.4 Existing System

In existing system, Gray-level co-occurrence matrix (GLCM) was introduced to segment the images of skin disease. And they obtain output from Convolutional neural network (CNN) to get accurate result.

1.5 Drawback of Existing System

The algorithms used are SVM and CNN which fails to provide accurate results when the size of data set is very high or if the dataset has greater amount of noise. The main drawback lays in their structural simplicity, especially in case of complex skin diseases, like psoriasis or skin cancers, the pathogenesis of which results from complicated interactions between cellular or molecular components.

1.6 Proposed System

In this paper we propose the image analysis system to detect the skin disease. Our system captures image from standard database and put into the system to inform the user for preventing the threats linked to the skin diseases. More briefly we present the image analysis system to detect different skin diseases where user will able to take image of different moles or skin patches. Our system will analyse and process the image and classifies the image to normal Melanoma, Nevus and Basal Cell Carcinoma case based extracting the image features. An alert will be provided to the user to seek medical help is the mole belongs to a typical a Melanoma category.

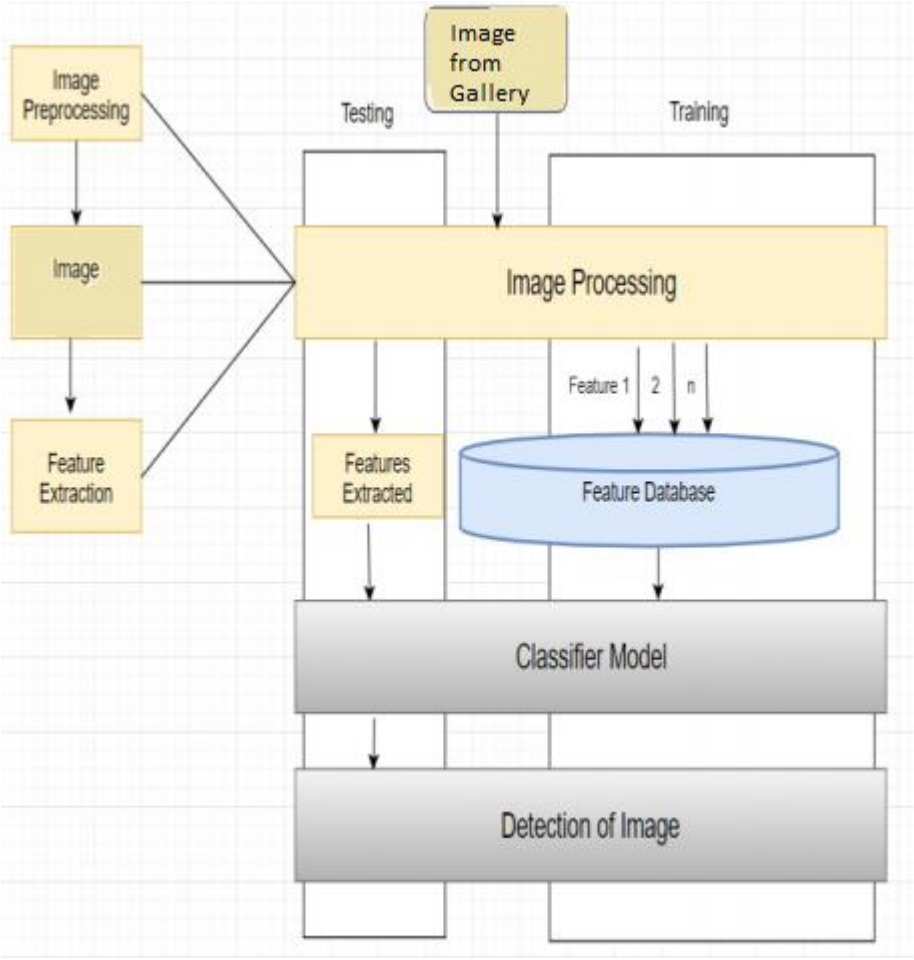

Fig 1.1: Proposed System

➢ Advantages

- **Simple to implement**

A simple random sample is used by researchers to statistically measure a subset of individuals selected from a larger group or population to approximate a response from the entire group. This research method has both benefits and drawbacks

- **Less time consumption**

In other words, companies do not structure and manage their projects to take advantage of gains in task performance (tasks that are completed in less time than planned) in order to ensure they cancel out the many delays in task performance (tasks that take longer than planned).

- **Less manpower required**

The link between manpower and company projects is fairly simple: Manpower is proportional to productivity. The more people are available to work, the faster projects can be completed or the more projects a company can take on. Conversely, a lack of adequate manpower prevents businesses from completing task.

- **Security of data**

It acts as the first line of defense against security attacks and prevents them from causing damage to your sensitive data. It takes care of a variety of security threats such as malware, viruses, spyware and adware. Some even offer Email ID protection and prevent harmful downloads.

- **Ensure data accuracies**

While it's easy to see why data has become so important to modern businesses, hazards it presents must also be accounted for. With new risks and pitfalls appearing daily as technology evolves, it's no surprise that security is usually at the top of the priority list.

1.7 Applications of proposed system

- Useful in several diagnostic and therapeutic applications.
- 24*7 skin disease detection.

CHAPTER 2

LITERATURE SURVEY

Image Analysis Model for Skin Disease Detection Alaa Haddad; Shihab A. Hameed IEEE2018

Skin disease is the most common disease in the world. The diagnosis of the skin disease requires a high level of expertise and accuracy for dermatologist, so computer aided skin disease diagnosis model is proposed to provide more objective and reliable solution. Many researches were done to help detect skin diseases like skin cancer and tumor skin. But the accurate recognition of the disease is extremely challenging due to the following reasons: low contrast between lesions and skin, visual similarity between Disease and non-Disease area, etc. This paper aims to detect skin disease from the skin image and to analyze this image by applying filter to remove noise or unwanted things, convert the image to grey to help in the processing and get the useful information. This help to give evidence for any type of skin disease and illustrate emergency orientation. Analysis result of this study can support doctor to help in initial diagnoses and to know the type of disease. That is compatible with skin and to avoid side effects.

Classification of Skin diseases using Image processing and SVM N Vikranth Kumar; P Vijeeth Kumar; K Pramodh; Yepuganti Karuna IEEE 2019

Skin diseases such as Melanoma and Carcinoma are often quite hard to detect at an early stage and it is even harder to classify them separately. Recently, it is well known that, the most dangerous form of skin cancer among the other types of skin cancer is melanoma because it is much more likely to spread to other parts of the body if not diagnosed and treated early. In order to classify these skin diseases, "Support Vector Machine (SVM)" a Machine Learning Algorithm can be used. In this paper, we propose a method to identify whether a given sample is affected with Melanoma or not. The steps involved in this study are collecting labelled data of images that are pre-processed, flattening those images and getting the pixel intensities of images into an array, appending all such arrays into a database, training the SVM with labelled data using a suitable kernel, and using the

trained data to classify the samples successfully. The results show that the achieved accuracy of classification is about 90%.

Automatic Classification of Clinical Skin Disease Images with Additional High-Level Position Information Jingyi Lin ;Zijian Guo ; Dong Li ; Xiaorui Hu ;Yun Zhang IEEE 2019

Since skin disease is one of the most common human diseases, intelligent systems for classification of skin diseases have become a new line of research in deep learning, which is of great significance for both doctors and patients. Some skin-disease datasets have already been published, such as the SD-198 dataset, which contains 6584 clinical skin-disease images of 198 categories. However, because of the diversity of clinical dermatology, previous works have showed that the performance of deep visual features is not as good as or even worse than hand-crafted features for skin disease classification. In this paper, we propose an SD-198-P dataset, which includes additional high-level position information in the SD-198 dataset to guide the generation of better deep visual features. Our experiment shows that, after adding the position information, the performance of deep visual features is better than that of hand-crafted features. To the best of our knowledge, our method outperforms the current state-of-the-art clinical skin disease classification methods.

Skin Disease detection based on different Segmentation Techniques Kyamelia Roy ; Sheli Sinha Chaudhuri ; Sanjana Ghosh ; Swarna Kamal Dutta ; Proggya Chakrabor IEEE 2019

The outer integument of the human body is skin. The skin pigmentation of human beings varies from person to person and human skin type can be dry, oily, or combination. Such a variety in the human skin provides a diversified habitat for bacteria and other microorganisms. Melanocytes in the human skin, produces melanin which can absorb harmful ultraviolet radiation from sunlight which can damage the skin and result in skin cancer. The necessary tools needed for early detection of these diseases are still not a reality in most third world communities. If the symptoms of skin diseases such as acne, dermatomyositis, candidiasis, cellulitis, Scleroderma, chicken pox, ringworm, eczema, psoriasis, etc. are left untreated in its early stage then they can result in numerous health complications and even death. Image segmentation is a technique which aids with the detection of these skin diseases. In this paper, image processing techniques like adaptive thresholding, edge detection, K-means clustering and morphology-based image segmentation have been used to identify the skin diseases from the given image set. The acquired image set was pre-processed by deblurring,

noise reduction and then processed. Depending on the definite pattern (pertaining to a distinct disease) present in the processed image the disease is detected at the output for a corresponding input image.

Soumya Sourav, Department of Electrical Engineering, Delhi Technological University

Abstract- Dermatological Diseases are one of the biggest medical issues in 21st century due to it's highly complex and expensive diagnosis with difficulties and subjectivity of human interpretation. 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. Hence, in this article we present a completely automated system of dermatological disease recognition through lesion images, a machine intervention in contrast to conventional medical personnel based detection. Our model is designed into three phases compromising of data collection and augmentation, designing model and finally prediction. We have used multiple AI algorithms like Convolution Neural Network and Support Vector Machine and amalgamated it with image processing tools to form a better structure, leading to higher accuracy.

Skin diseases detection models for humans [13, 14, 15]:

Expert System for Diagnosis of Skin Diseases [8]

Skin diseases are frequent diseases to every person and various types of infections are becoming very frequent. You know that all of these diseases are very harmful, especially if not controlled at an early stage. Skin diseases not only damage the skin. It can have a large effect on a person's daily life, destroy confidence of a person, hang their movement, and turn to depression. Sometimes, many people try to treat these allergies by using their own therapy. However, if these methods are not appropriate for that type of skin disease then it would make it more harmful. Skin diseases can easily transfer from human to human so there is a need to control it their initial stage to prevent it from spreading. This paper presents an implementation of a skin diseases diagnosis system which helps user to detect human skin diseases and provides medical treatments timely. For this purpose, user will

have to upload a disease affected skin image to our system and give answers to the questions which are asked to user according to the symptoms of the skin. These symptoms are used to identify the disease and provide a medical treatment. This system works on technologies like image processing and data mining for skin diseases detection. So the whole project is divided in to below major parts,

- Image pre processing, segmentation and feature extraction.
- Classification model and skin disease predication.
- Medical treatment suggestions or advice.

The image of skin disease is taken and various pre processing techniques are applied onto that image for noise removal and image enhancement. This image is segmented by using a segmentation technique i.e. thresholding segmentation. At last, data mining techniques are used to identify the skin disease and to provide recommendations to users. This expert system pertain disease recognition accuracy of 85% for Eczema, 95% for Impetigo and 85% for Melanoma. Both image based technique and questionnaire technique help to increase reliability and performance of the system.

Limitations

- This application is implemented only for three skin diseases (Eczema, Impetigo and Melanoma).
- It is implemented only for windows application so that is not yet develop for smart phones like Android, IOS etc.
- During image acquisition, the distance between camera lens and affected skin should be 5cm.
- When capture the image for this application, it is mandatory to capture it without any light effects.
- It only supports English language not for other ordinary languages like Sinhala,Tamil.

Online Children Skin Diseases Diagnosis System [9]

Rule based and forward chaining inference engine methods are used to implement this model which is used to identify the skin disease. By using this system, user is allowed to identify children skin diseases via online and provide useful medical suggestions or advice timely. In this system, it consists of diagnosis module, login module, info module, report module and management module.

There are two main modules called diagnosis and management module. In the diagnose module questions are asked to the user and on the basis of answers given by the user, Children's symptoms and condition are identified. This system may be an alternative for parents to identify skin diseases of children, in response to the questions about the symptoms and the condition children' skin.

An automated system for recognizing disease conditions of human skin [10]

In this model, the condition of the skin disease is identified by evaluating skin disease images by using grey normalized symmetrical simultaneous occurrence stencils (GLCM) method. The proposed system is used in an efficient and economical for the automatic recognition of skin diseases. This system is useful for the skin to reduce the error with medical diagnosis. Another is the first test for patients in rural areas, where the good doctors are missing. The system works with relational databases to the storage of implying the need for textual skin images. This system can also work for same type of images directly over feature vectors.

Mobile-based Medical Assistance for Diagnosing Different Types of Skin Diseases Using Case based Reasoning with Image Processing [11]

In artificial intelligence (AI), medical field is a recent area for research purpose. This paper implements a mobile based medical assistance which is used for diagnosing skin diseases by the use of CBR and image processing. This model was developed to help users to pre- examine their skin situation whether they have a disease or not. Also to increase the awareness of skin diseases on what it may do to our bodies which will lead to death or infecting other people and have a cure before it gets worse. The proposed system is successfully implemented to detect 6 different skin diseases with an accuracy of 90%. The scale of symptoms, which is used for testing, is 15%, for validation it is 10% and for testing it is 75%. This supervised system identify diseases at the rate of 90% where the unsupervised system detect diseases at the rate of 80%.The detection rate of the sample disease with the other related disease is as follows: Eczema – 88%; Psoriasis – 61%; Acne – 75%; Skin Cancer – 51%; Scabies – 43%; and Seborrhea Dermatitis – 34%.

An Innovative Skin Detection Approach Using Color based Image Retrieval Technique [12]

The idea of "skin detection & quot; from an image is described as the categorization of the existence pixels in that image into two skin and Non-skin classes. Many methods uses different color space to extract features for the categorization of pixels, but most of these methods does not detect different type of skin with high accuracy. The present method in this paper is implemented by using & quot; Color based image retrieval & quot; (CBIR) technique. In this method, first of all by finding means of CBIR method and image tiling and finding the relationship between pixel and its neighbors, a set of feature vector is prepared and then at the test stage, training is used for skin detection. Experimental results show that the proposed model identifies different type of skin with a high accuracy and it is not sensitive to illumination intensity and with the movement of face. The proposed method contains two steps such as train and test. First in training step, pure skin images were trained and then in testing steps skin area were detected from non- skin areas.

CHAPTER 3

REQUIREMENT SPECIFICATION

3.1 System Requirement Analysis

The direct result of requirements analysis is Requirements specification. Hardware requirements specifications list the necessary hardware for the proper functioning of the project. Software requirements specifications is a description of a software system to be developed, laying out functional and non-functional requirements, and may include a set of use cases that describe interactions the users will have the software. In software engineering, a functional requirement defines the function of a system and its components. A function is described as a set of inputs, the behavior, and outputs. A non-functional requirement that specifies the criteria that can be used to judge the operation of a system, rather than specific behavior.

3.2Functional Requirements

A function of software system is defined in functional requirement and the behavior of the system is evaluated when presented with specific inputs or conditions which may include calculations, data manipulation and processing and other specific functionality.

The functional requirements of the project are one of the most important aspects in terms of entire mechanism of modules. After validating our model, it should be able to predict the future stock market price.

3.3 Non-Functional Requirements

Nonfunctional requirements describe how a system must behave and establish constraints of its functionality. This type of requirements is also known as the system's *quality attributes*. Attributes such as performance, security, usability, compatibility are not the feature of the system, they are a required characteristic. They are "developing" properties that emerge from the whole arrangement and hence we can't compose a particular line of code to execute them.

Any attributes required by the customer are described by the specification. We must include only those requirements that are appropriate for our project.

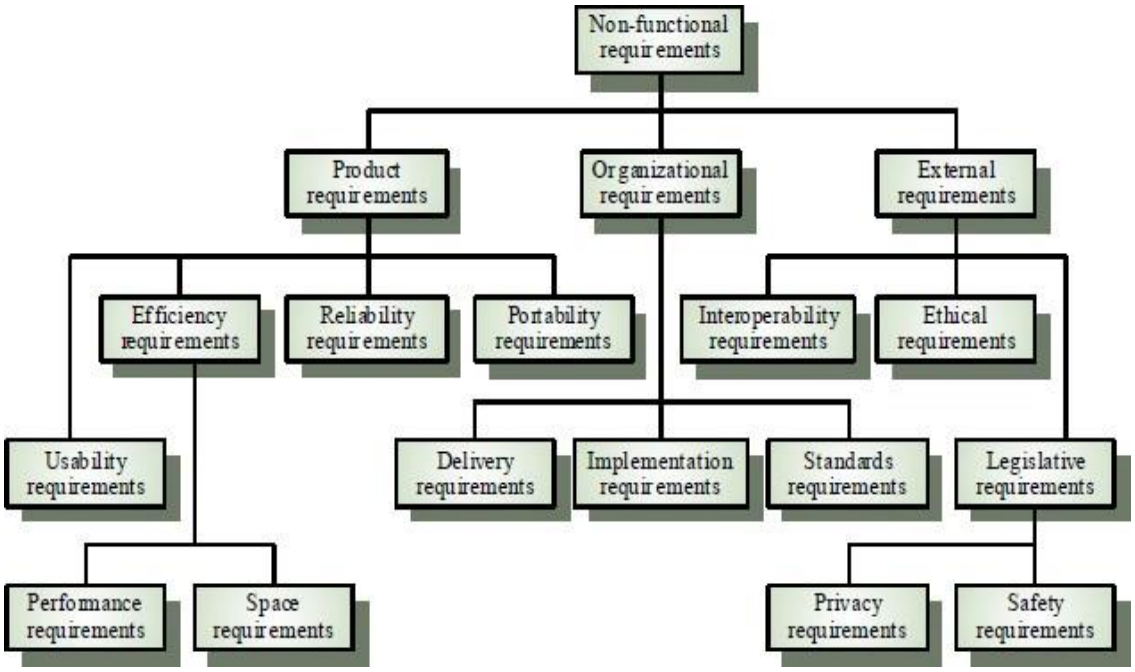

Fig 3.1 Non-functional requirements

Some Non-Functional Requirements are as follows:

- **Reliability**

The structure must be reliable and strong in giving the functionalities. The movements must be made unmistakable by the structure when a customer has revealed a couple of enhancements. The progressions made by the Programmer must be Project pioneer and in addition the Test designer.

- **Maintainability**

The system watching and upkeep should be fundamental and focus in its approach. There should not be an excess of occupations running on diverse machines such that it gets hard to screen whether the employments are running without lapses.

- **Performance**

The framework will be utilized by numerous representatives all the while. Since the system will be encouraged on a single web server with a lone database server outside of anyone's ability to see, execution transforms into a significant concern. The structure should not capitulate when various customers would use everything the while. It should allow brisk accessibility to each and every piece of its customers. For instance, if two test specialists are all the while attempting to report the vicinity of a bug, then there ought not to be any irregularity at the same time.

- **Portability**

The framework should to be effectively versatile to another framework. This is obliged when the web server, which s facilitating the framework gets adhered because of a few issues, which requires the framework to be taken to another framework.

- **Scalability**

The framework should be sufficiently adaptable to include new functionalities at a later stage. There should be a run of the mill channel, which can oblige the new functionalities.

- **Flexibility**

Flexibility is the capacity of a framework to adjust to changing situations and circumstances, and to adapt to changes to business approaches and rules. An adaptable framework is one that is anything but difficult to reconfigure or adjust because of diverse client and framework prerequisites. The deliberate division of concerns between the trough and motor parts helps adaptability as just a little bit of the framework is influenced when strategies or principles change.

3.4 Tools and Technology Details

Hardware Requirements

The most common set of requirements defined by any operating system or software application is the physical computer resources, also known as hardware, a hardware requirements list is often accompanied by a hardware compatibility list (HCL), especially in case of operating systems. An HCL list tested, compatible, and sometimes in compatible hardware devices for a particular operating systems or applications. The CPU is a fundamental system requirement for any software most software running on different kinds of architecture defines processing power as the model and he clock speed of the CPU. In this memory requirements are defined after considering demands of applications, operating system, supporting software and files, and other running process. Hardware requirements specifications list the necessary hardware for the proper functioning of the project.

- System Processor : Pentium IV 2.4 GHz
- Hard Disk : 40 GB.
- Ram : 512 MB.

✓ Any desktop / Laptop system with above configuration or higher level.

Software Requirements

Software requirements deal with software resource requirements and prerequisites that need to be installed on the computer to provide optimal functioning of an application. These requirements are prerequisites are generally not included in the software installation package and need to be installed separately before the software is installed. Software requirements specifications is a description of a software system to be developed, laying out functional and non-functional requirements, and may include a set of use cases that describe interactions the users will have the software.

Operating System : Windows 7/ 8 /10

Programming Language : Python

Framework	:	Anaconda
DLLibraries	:	Numpy, Pandas, opencv.
System tool	:	V S code

CHAPTER 4

SYSTEM ANALYSIS

4.1 System Design

The proposed method includes the following 3 processes.

1. Preprocessing
2. Feature Extraction and Selection
3. Classification

The overall flow of the proposed method is represented in Figure. The performance of the Naïve Bayes is analyzed using the feature matrix. Further, the performance of the Hog is studied for its accuracy, sensitivity and specificity values. The process of diagnosing the eye diseases is illustrated in the upcoming sections.

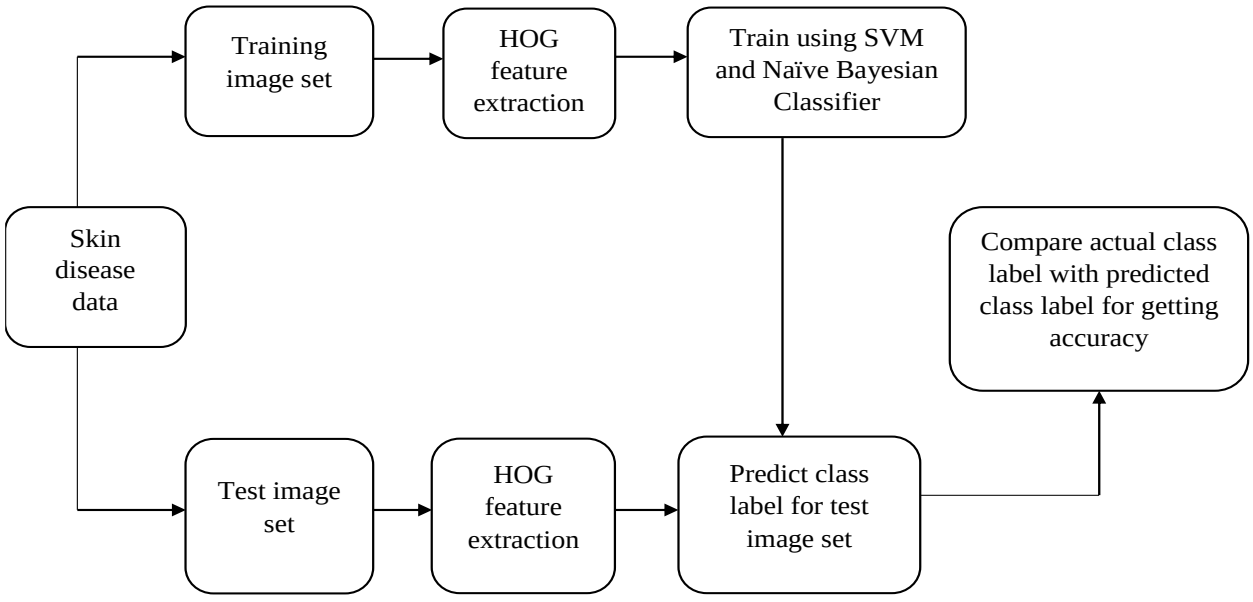

Fig 4.1: data flow of proposed system

4.1.1 Pre Processing

Image pre-processing is the initial step to identify the affected area. Multiple steps are performed in the preprocessing phase to make the image suitable for the feature extraction process. The abnormalities in the input image are detected and preprocessed for the following purpose:

- To avoid uneven illumination
- To enhance the contrast among image background pixels and exudates
- To eliminate the noise in the input image

In this research work, the techniques used for the preprocessing phase are:

- Image resizing.
- Color transformation(RGB to Gray) and
- Histogram equalization.

2 Image Resizing

An image size can be changed in several ways. One of the simpler ways of increasing image size is nearest-neighbor interpolation, replacing every pixel with the nearest pixel in the output; for up scaling this means multiple pixels of the same colour will be present. Image resizing is necessary when you need to increase or decrease the total number of pixels, whereas remapping can occur when we are correcting for lens distortion or rotating an image. Zooming refers to increase the quantity of pixels, so that when you zoom an image, we will see more detail.

3 Color Transformation

The retinal images are taken from the fundus camera in the form of RGB (Red, Green, and Blue). Grayscale is a range of shades of gray without apparent color. The darkest possible shade is black, which is the total absence of transmitted or reflected light. The lightest possible shade is white, the total transmission or reflection of light at all visible wavelengths. Intermediate shades of gray are

represented by equal brightness levels of the three primary colors (red, green and blue) for transmitted light for reflected light. In the case of transmitted light (for example, the image on a computer display), the brightness levels of the red (R), green (G) and blue (B) components are each represented as a number from decimal 0 to 255, or binary 00000000 to 11111111. For every pixel in a red-green-blue (RGB) grayscale image, R = G = B. The lightness of the gray is directly proportional to the number representing the brightness levels of the primary colors. Black is represented by R = G = B = 0 or R = G = B = 00000000, and white is represented by R = G = B = 255 or R = G = B = 11111111. Because there are 8 bits in the binary representation of the gray level, this imaging method is called 8-bit grayscale.

In some cases, rather than using the RGB or CMY color models to define grayscale, three other parameters are defined. These are hue, saturation and brightness. In a grayscale image, the hue (apparent color shade) and saturation (apparent color intensity) of each pixel is equal to 0. The lightness (apparent brightness) is the only parameter of a pixel that can vary. Lightness can range from a minimum of 0 (black) to 100 (white).

4.Histogram Equalization

The use of fundus camera to capture the retinal image results in an uneven illumination. The portions near the center are well illuminated and hence it looks very bright. But the porti ons on the sides are less illuminated and hence looks very dark. To address this issue, the histogram equalization is used. As the regions of exudate and optic disc are much greater in intensity than the neighboring regions of the image, the histogram equalization method is used to assign the neighboring regions greater intensity.

Adaptive Histogram Equalization

Adaptive Histogram Equalization differs from ordinary histogram equalization in the respect that the adaptive method computes several histograms, each corresponding to a distinct section of the image, and uses them to redistribute the lightness values of the image. It is therefore suitable for improving the local contrast and enhancing the definitions of edges in each region of an image.

Contrastive Limited Adaptive Equalization

Contrast Limited AHE (CLAHE) differs from adaptive histogram equalization in its contrast limiting. In the case of CLAHE, the contrast limiting procedure is applied to each neighborhood from which a transformation function is derived. CLAHE was developed to prevent the over amplification of noise that adaptive histogram equalization can give rise to.

4.2 Algorithms Used In Feature Extraction

The HoG features are extracted from the localized ROI. The HoG features are invariant to geometric and photometric transformation and thus used to describe the shape and edge of the structures present within the image. As HoG features are related to edge information, the optic disc deformation due to the presence of Eye disease can be depicted with these features. Deformation in the Optic disc is one of the key parameters in the detection of Eye disease. To compute the HoG features, the image is divided into small cells and the shape of the objects is obtained by counting the strength and orientation of the spatial gradients in each cell.

4.2.1 Histogram of Gradient (HOG)

The HoG extracts the features of the images that are present over the grid of overlapping rectangular blocks in the search window. The histogram of each block is used to describe the frequency of the gradient directions inside each block. The image is generally described by a set of local histograms. These histograms count the occurrences of the gradient orientation and they become the local parts of the images. The steps involved in calculating the histogram are:

• Computing the gradients of the image

• Constructing the histogram orientation of each cell

• Normalizing the histograms in each block of the cells

A histogram of oriented gradients (HOG) is used in image processing applications for detecting objects in a video or image, which by definition is a feature descriptor [2], proposed by Dalal and Triggs who used their method for pedestrian detection. Figure shows the block diagram and block normalization scheme of HOG feature extraction.

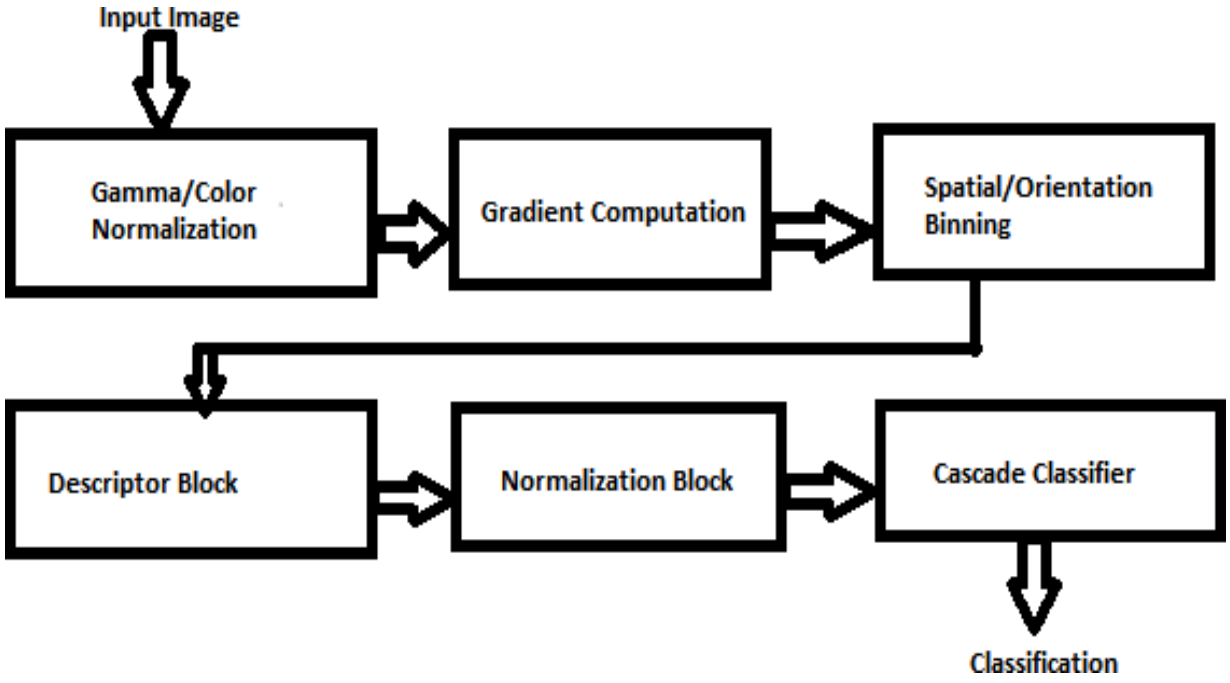

Fig 4.2: HOG algorithm

Gradient Computation

By applying two one-dimensional filtering techniques, the gradient of the image is easily obtained. The calculated gradient can be either signed or unsigned. The next step involves the orientation binning. Based on the number of bins, a histogram is calculated for each cell. This method is used to 0.split the image into various cells. Each cell has a spatial region with a predetermined size of pixels. During each orientation, the HoG is calculated by gathering the number of feature values (votes) into bins. The histogram considers the gradient at each point. By considering the magnitude of the gradient, the edges are weighted. The gradient orientations around the edges are more prominent than the uniform regions. The increase in the number of bins, in turn, increases the details of the histogram. Based on the gradient distribution within the pixel patches, multiple feature descriptors are available. The HoG are the feature descriptors to detect the object and it counts occurrences of gradient orientation in the localized image portions. This process is same as the edge orientation histograms, contrasts of shape and the descriptors of scale-invariant feature transform. As preprocessing provides a slight impact on the performance, the HoG ensures normalized color and gamma values by computing the gradient values.

4.2.2 SVM

An SVM is a classification based method or algorithm. There are some cases where we can use it for regression. However, there are rare cases of use in unsupervised learning as well. SVM in clustering is under research for the unsupervised learning aspect. Here, we use unlabelled data for SVM.

Since the topic is under research, we will only look at what it means. In regression, we call the concept **SVR or support vector regression**. It is quite similar to SVM with only a few changes. However, it is more complicated than SVM.

Now, we come to SVM. It is a strong data classifier. The support vector machine uses two or more labelled classes of data. It separates two different classes of data by a hyperplane. The data points based on their position according to the hyperplane will be put in separate classes. In addition, an important thing to note is that SVM in Machine Learning always uses graphs to plot the data. Therefore, we will be seeing some graphs in the article. Now, let's learn some more stuff.

Parts of SVM in Machine Learning

To understand SVM mathematically, we have to keep in mind a few important terms. These terms will always come whenever you use the SVM algorithm. So let's start looking at them one by one.

1. Support Vectors

Support vectors are special data points in the dataset. They are responsible for the construction of the hyperplane and are the closest points to the hyperplane. If these points were removed, the position of the hyperplane would be altered. The hyperplane has decision boundaries around it. And, the support vectors help in decreasing and increasing the size of the boundaries. They are the main components in making an SVM. We can see the picture for this.

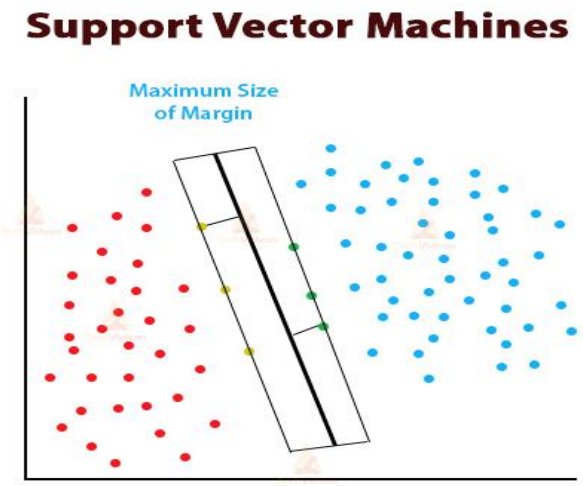

Fig 4.3: support vector machines

The yellow and green points here are the support vectors. Red and blue dots are separate classes. The middle dark line is the hyperplane in 2-D and the two lines alongside the hyperplane are the decision boundaries. They collectively form the decision surface.

2. Decision Boundaries

Decision boundaries in SVM are the two lines that we see alongside the hyperplane. The distance between the two light-toned lines is called the margin. An optimal or best hyperplane form when the margin size is maximum. The SVM algorithm adjusts the hyperplane and its margins according to the support vectors.

3. Hyperplane

The hyperplane is the central line in the diagram above. In this case, the hyperplane is a line because the dimension is 2-D. If we had a 3-D plane, the hyperplane would have been a 2-D plane itself. There is a lot of mathematics involved in studying the hyperplane. We will be looking at that. But, to understand a hyperplane we need to imagine it first. Imagine there is a **feature space (a blank piece of paper)**. Now, imagine a line cutting through it from the center. That is the hyperplane. The math equation for the hyperplane is a linear equation.

$$a_0 + a_1x_1 + a_2x_2 + \ldots\ldots + a_nx_n$$

This is the equation. Here a0 is the intercept of the hyperplane. Also, a1 and a2 define the first and second axes respectively. X1 and X2 are for two dimensions. Let us assume that the equation is equal to E. So if the data points lie beneath the hyperplane then E<0. If they are above it, the E>=0. This is how we classify data using a hyperplane.

In any ML method, we would have the training and testing data. So here we have n*p matrix which has n observations and p dimensions. We have a variable Y, which decides in which class the points would lie. So, we have two values 1 and -1. Y can only be these two values in any case. If Y is 1 then data is in class 1. If Y is -1 then data is in class -1.

4.2.3 Naive Bayes Classifier

The Naive Bayes classifier is an efficient and simple probabilistic classifier based on Bayes' theorem. It is based on the Bayes Theorem. It predicts the class membership probabilities. "Naïve Bayesian classifiers assume that the effect of an attribute value on a given class is independent of the values of the other attributes. This assumption is called class conditional independence". Due to this assumption, the computation of the NB classifiers is better than the other classifiers. It is a simple model that assigns class labels from a finite set to a vector of feature values. These classifiers assume that the value of a particular feature is independent of any other feature. The advantage of naïve Bayes is that it requires only a small number of training data. With the small number of training data, the parameters can be estimated for classification. It classifies the data in two phases namely training phase and prediction phase. In training phase, using training data, the parameters for probability distributions are estimated, and in the prediction phase, for any unseen test data, the method computes the posterior probability of that sample belonging to each class. The method thus classifies the test data according to the largest posterior probability. Once the features of the training set are fed into the classifier, the probabilities of individual features P(X) being presented the outcome (i.e., the class – 'Normal' or 'Eye disease '), as well as the probabilities of each of the two classes, are calculated. The Naive Bayes method is suitable for the discrete valued attributes as well as for large size dataset, but in case of continuous valued attributes, Naive Bayes method is lacking in attribute interactions. On the other hand, the decision tree does not give good performance when the data size is very large. These limitations have been overcome by the notion of NB Tree algorithm. Proposed a hybrid algorithm called Naïve Bayes Tree, which is a hybrid approach appropriate in learning

environment when various attributes are likely to be relevant for a classification task. NB Tree gives relaxation to the attribute independence assumption of the Naïve Bayes algorithm. “NB Tree is a hybrid classification technique which combines Decision Tree and Naive Bayes classification algorithms. The algorithm is similar to the classical recursive partitioning schemes except that the leaf nodes created are Naive-Bayes categorizers instead of nodes predicting a single class and the learned knowledge is represented in the form of a tree. It combines the advantage of both Decision Tree and Naïve Bayes Classification.” NB Tree induces highly accurate classifiers in practice. It has been shown that NB Tree is accurate and scale up in terms of accuracy on real world datasets.

4.2.4 Naive Bayes algorithm

It is a classification technique based on Bayes’ Theorem with an assumption of independence among predictors. In simple terms, a Naive Bayes classifier assumes that the presence of a particular feature in a class is unrelated to the presence of any other feature.

For example, a fruit may be considered to be an apple if it is red, round, and about 3 inches in diameter. Even if these features depend on each other or upon the existence of the other features, all of these properties independently contribute to the probability that this fruit is an apple and that is why it is known as ‘Naive’.

Naive Bayes model is easy to build and particularly useful for very large data sets. Along with simplicity, Naive Bayes is known to outperform even highly sophisticated classification methods.

Bayes theorem provides a way of calculating posterior probability P(c|x) from P(c), P(x) and P(x|c). Look at the equation below:

Above,

- P(c|x) is the posterior probability of class (c, target) given predictor (x, attributes).
- P(c) is the prior probability of class.
- P(x|c) is the likelihood which is the probability of predictor given class.
- P(x) is the prior probability of predictor.

CHAPTER 5

SYSTEM DESIGN

System design is the process of planning a new system to compliment or all together replace the old system. The purpose of the design phase is the first step in moving from the problem domain to the solution domain. The design of the system is the critical aspect that affects the quality of the aspects of the system into physical aspects of the system. It is the process of defining the architecture, modules, interfaces, and data for a system to satisfy specified requirements. System design could be seen as the application of system theory product development. There is some overlap with the disciplines of system analysis, system architecture, and system engineering.

5.1 Data Flow Diagram

A data flow diagram (DFD) is a graphical representation of the flow of data through an information system, modeling its process aspects. A DFD is often used as a preliminary step to create an overview of the system without going into great detail, which can later be elaborated. DFDs can also be used for the visualization of data processing. DFD shows what kind of information will be input to and output from the system, how the data will be advanced to the system, where the data will be stored. It does not show information about process timing on weather processes will operate in sequence or in parallel, unlike a traditional structured flowchart which focuses on control flow, or a UML activity workflow diagram, which presents both control and data flows as a unified model.

The dataflow diagram is also known as bubble charts. DFD is a designing tool used in the top-down approach to systems design. The DFDs can be used to provide the end user with the physical idea of where the data the input ultimately has an effect upon the structure of the whole system from order to dispatch to report.

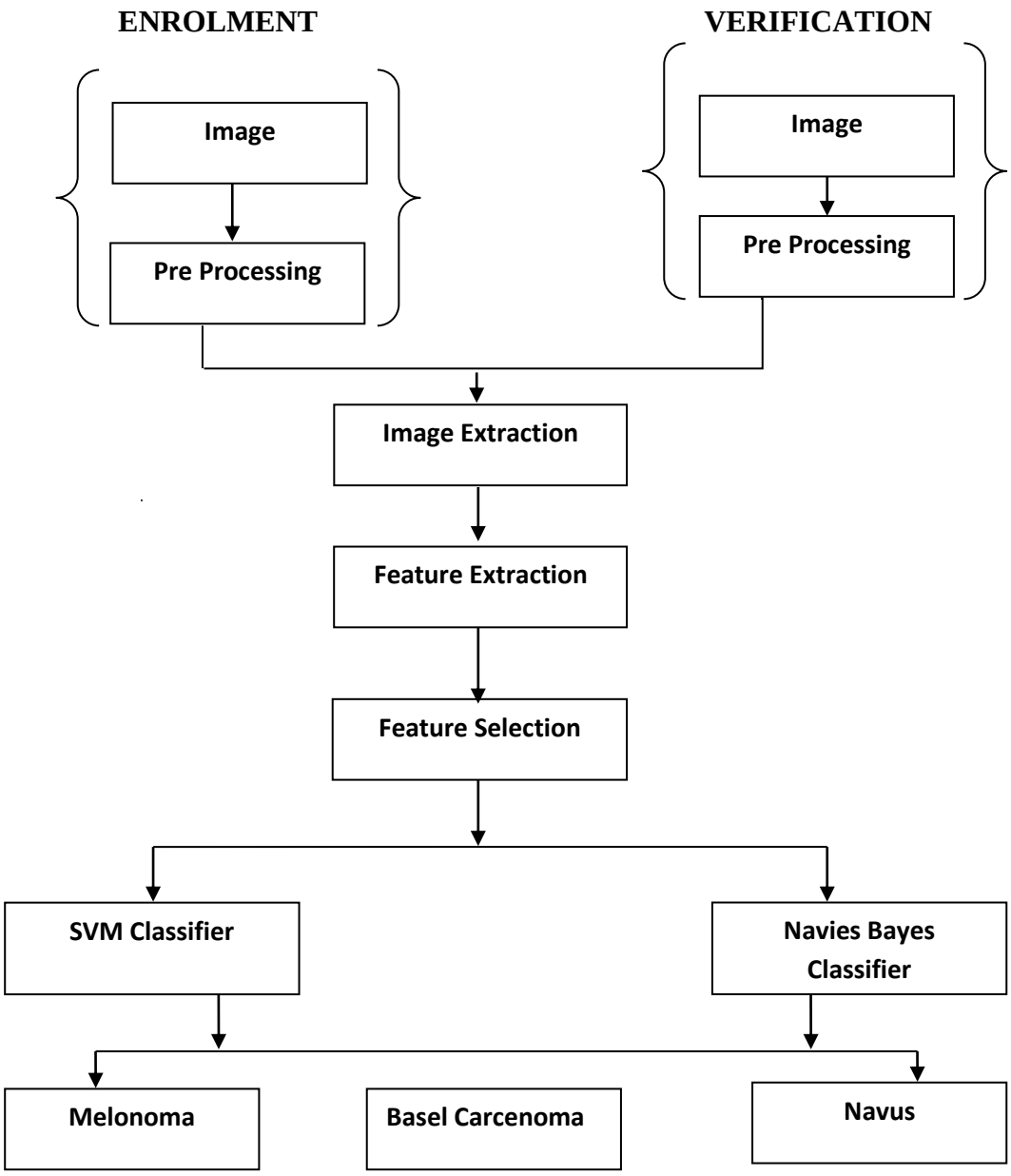

Fig 5.1: Data Flow Diagram

In Fig 5.1 there are mainly two stages i.e., Enrollment and Verification respectively. In the enrollment and verification stage the image can be preprocessed and improves the low contrast image, it also includes the image enhancement, resizing of the image. After preprocessing the feature of the image can be extracted, Hog features are extracted from the localized ROI. The feature extraction followed by feature selection, In this the ROI is located using a rectangular mask and this

mask is selected by feature matrix, then finally the selected image is classified using Naïve Bayes classifier and SVM classifier to detect the disease.

5.2 Activity Diagram

Activity diagram is defined as a UML diagram that focuses on the execution and flow of the behavior of a system instead of implementation. Activity diagrams consist of activities that are made up of actions which apply to behavioral modeling technology. It is a behavior that is divided into one or more actions. Activities are a network of nodes connected by edges. There can be action nodes, control nodes, or object nodes. Action nodes represent some action. Control nodes represent the control flow of an activity. Object nodes are used to describe objects used inside an activity. Edges are used to show a path or a flow of execution. Activities start at an initial node and terminate at a final node.

In Fig 5.2 Image can be preprocessed and it also extracts its feature by using the feature extraction method (Histogram of Gradients). Extracted feature of image can be verified by using INST rule and it must hold the condition that, eye asymmetry is less than 0.2. After verifying the particular image, it will detect whether that particular image is disease effected eye or normal eye by using Naïve Bayes classifier. If the image matrix is less than or equal to 0 then it is considered as affected eye otherwise it would be a normal eye.

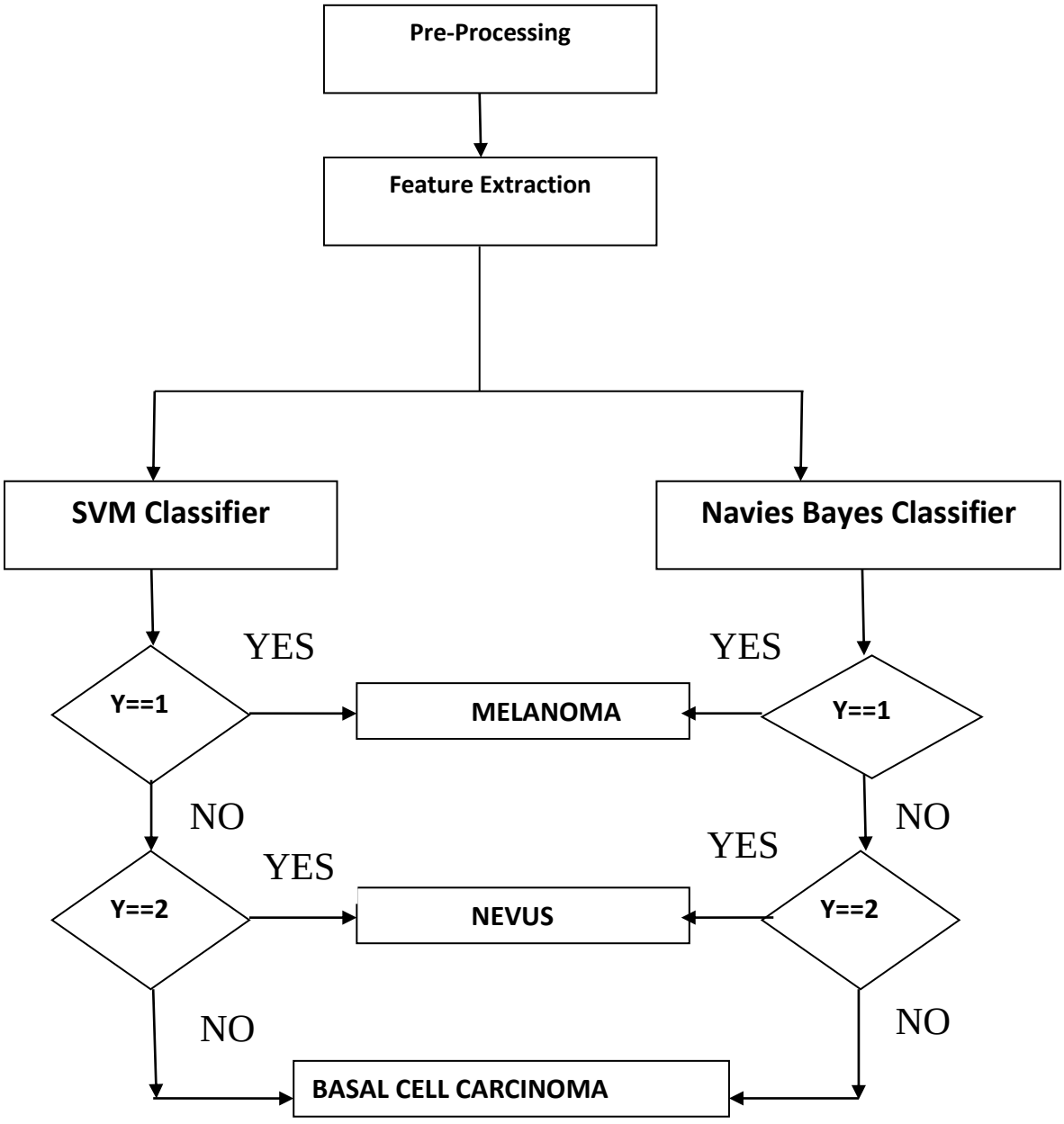

Fig. 5.2: Activity Diagram

CHAPTER 6

IMPLEMENTATION

6.1 METHODOLOGY

The image is initially pre-processed and Resize, Histotrophic Equalization (HE) in image acquisition. The HoG (Histogram of gradients) features are extracted from Collective competitive ratio and number of statistical properties is derived. The derived properties constitute the HoG features that are fed to the Naïve Bayes classifier and SVM classifier for identifying the diseases. The classifier is trained and tested with disease image dataset. The methodology of the proposed methodology is shown in Fig.6.1

- **Image Acquisition**
- **Noise Removal**
- **Feature Extraction using HOG**
- **Classification**

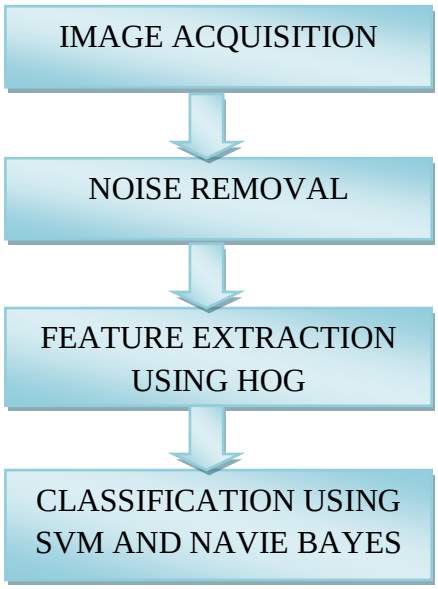

Fig 6.1: Methadology

- **Image Acquisition**

The first stage of our automated image analysis system is image acquisition. This stage is essential for the rest of the system; hence, if the image is not acquired satisfactorily, then the remaining components of the system may not achievable, or the results will not be reasonable. In this stage first image system requires the resized image for the better results. Input image given to the system is in RGB form. But for our proposed system requires gray images. Hence using RGB to GRAY conversion in MATLAB we convert RGB images in to Gray images.

- **Noise Removal**

It's necessary to have quality images without any noise to get accurate result. Noisy images may lead your algorithm towards incorrect result. Hence it becomes necessary to de-noise the image. Image de noising is an important image processing task; there are many ways to de noise an image. The important for good image de noising model is that it will remove noise while preserving edges. Traditionally, linear model have been used. To de-noise the image we can use median filter. Median filter does the work of smoothening of images.

- **Feature Extraction**

To get an accurate result in biomedical image processing it is always necessary that biomedical image must be a very good quality. However, practically this is not easy. Due to different reasons obtain low or medium quality images. Hence it becomes necessary to improve their quality. To improve the quality of an image using image enhancement algorithm. This algorithm enhances the iamge by focusing on parameters like contrast, brightness adjustment.

- **Classification**

The overall flow of the proposed method is represented in Figure. The performance of the Naïve Bayes is analyzed using the feature matrix. Further, the performance of the Hog is studied for its accuracy, sensitivity and specificity values. The process of diagnosing the eye diseases is illustrated in the upcoming sections.

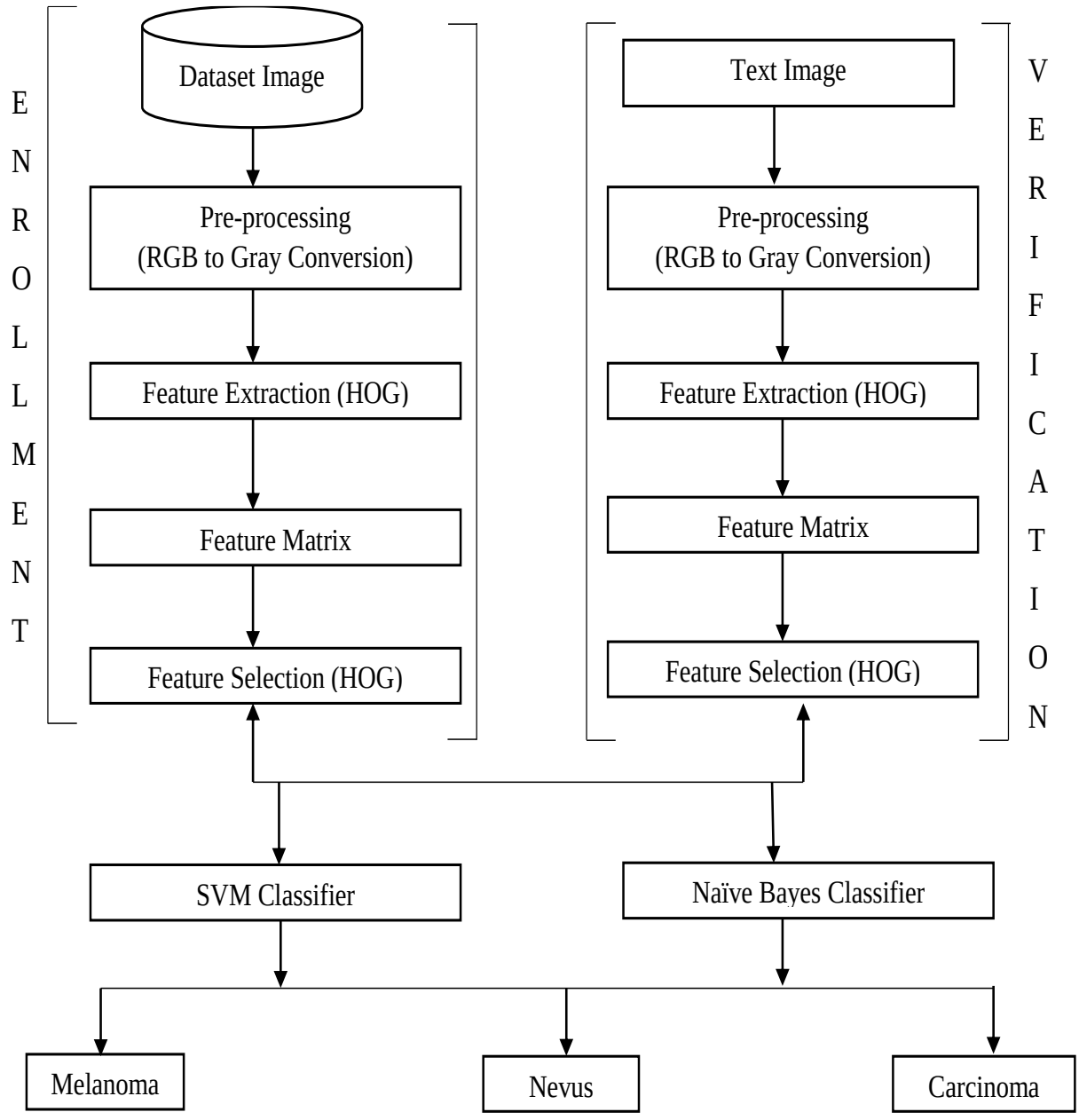

Fig.6.2: Architecture of Proposed System

- **Data Set Image**

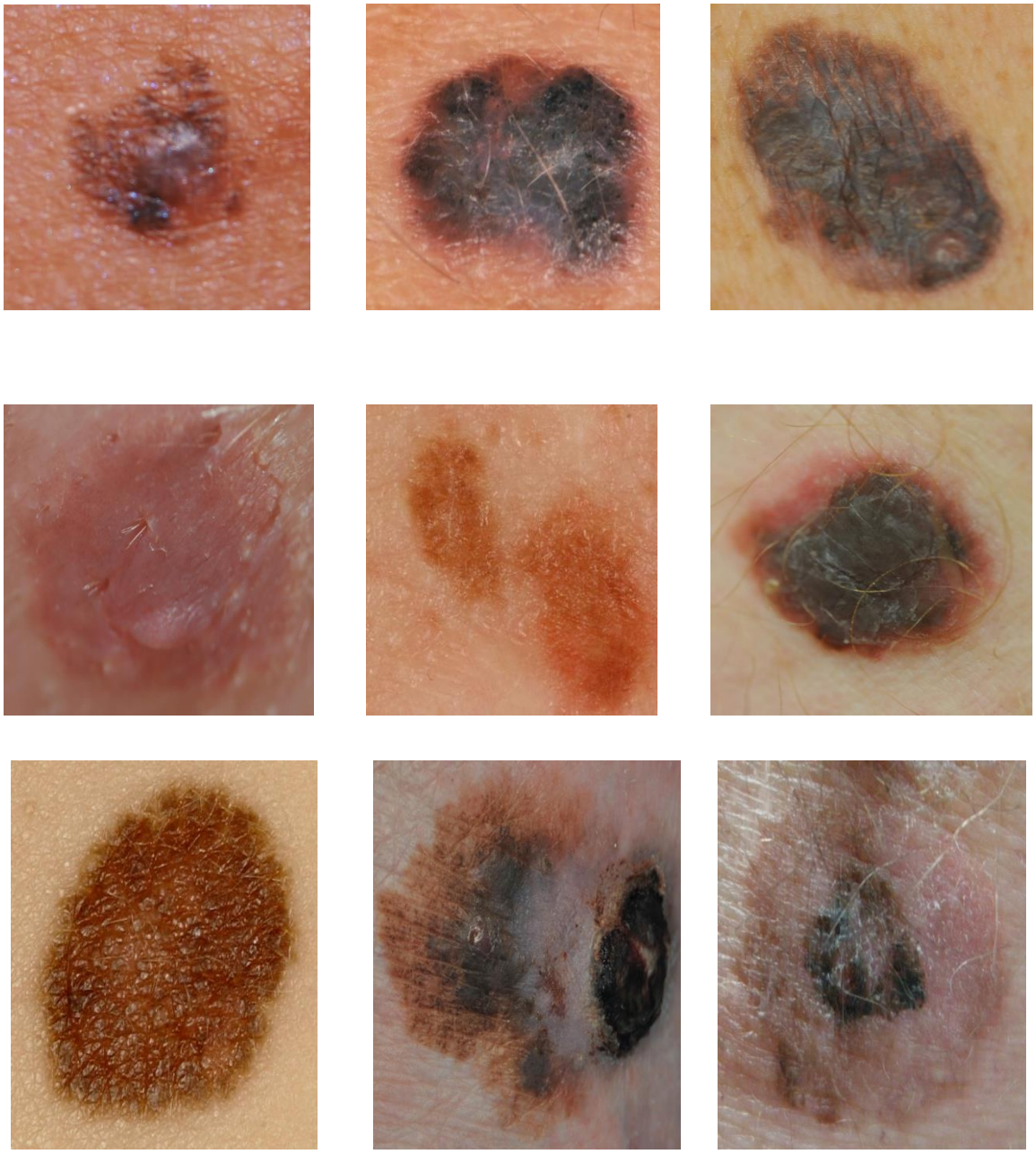

Fig 6.3: Images of dataset

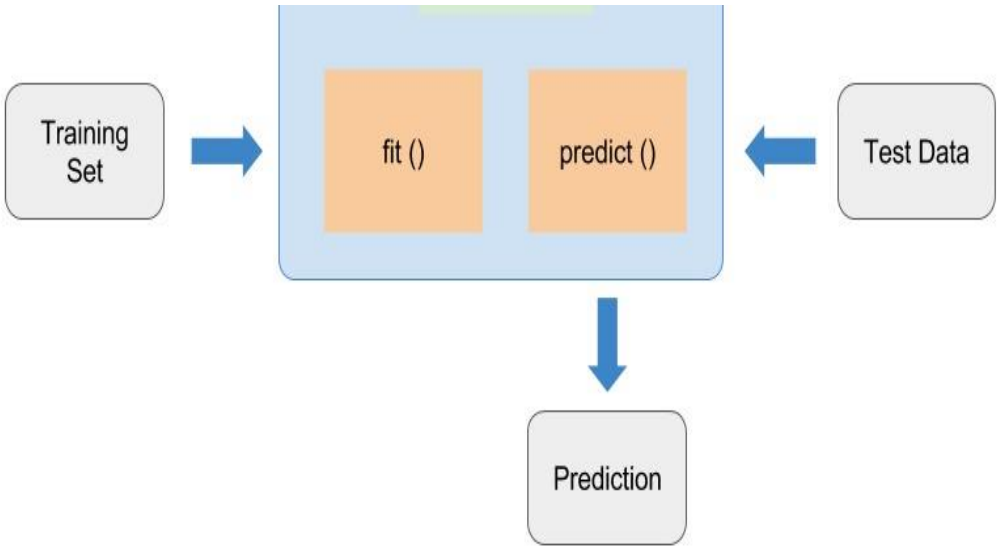

Fig 6.4: training and testing of data

Naive Bayes Classifier

Naive Bayes is a kind of classifier which uses the Bayes Theorem. It predicts membership probabilities for each class such as the probability that given record or data point belongs to a particular class. The class with the highest probability is considered as the most likely class. This is also known as **Maximum A Posteriori (MAP)**.

The MAP for a hypothesis is:

MAP(H)

= max(P(H|E))

= max((P(E|H)*P(H))/P(E))

= max(P(E|H)*P(H))

P(E) is evidence probability, and it is used to normalize the result. It remains same so, removing it won't affect.

Naive Bayes classifier assumes that all the features are **unrelated** to each other. Presence or absence of a feature does not influence the presence or absence of any other feature. We can use Wikipedia example for explaining the logic i.e.,

A fruit may be considered to be an apple if it is red, round, and about 4″ in diameter. Even if these features depend on each other or upon the existence of the other features, a naive Bayes classifier considers all of these properties to independently contribute to the probability that this fruit is an apple.

In real datasets, we test a hypothesis given multiple evidence(feature). So, calculations become complicated. To simplify the work, the feature independence approach is used to 'uncouple' multiple evidence and treat each as an independent one.

P(H|Multiple Evidences) = P(E1| H)* P(E2|H) ……*P(En|H) * P(H) / P(Multiple Evidences)

How to run:

Open vscode using command prompt : code .

Run manage.py

In terminal type python manage.py runserver

Cntrl+click on the localhost Link

Register yourself if you are new user.

Go to login page.

Enter Email ID id and password.

It will ask for upload file.

Pick correct image file.

Click submit button.

It will display the result with disease details.

In this research, diabetic retinopathy method is used to diagnose the Diabetic Retinopathy (DR). Initially, the dataset images are resized and histogram equalization is applied. Then the key

features from the preprocessed images are extracted using the Histogram of Gradient (HoG). Then from HOG features model is constructed using navis bayes algorithm.

The dataset is used here is binrushed which consists of 4 classes of diseases. Total numbers of images are 1285. When we tested with testing test for 4 classes it shows 90.02% of accuracy. To get more number of disease classes we divided the images into 8 classes. Navis Bayes algorithms showed overall accuracy of 77.23% even though other algorithms for multiclass classification failed to cross 50%. We also tested various scenarios for login pages, different types of images. Our algorithm proven better results for most of the cases.

Pseudo code for Naive Bayes

Input:

Training dataset T,

F. (ft, f2, f3,.., In) II value of the predictor variable in testing dataset.

Output:

A class of testing dataset.

Step:

1. Read the training dataset T;
2. Calculate the mean and standard deviation of the predictor variables in each class;
3. Repeat

   Calculate the probability of fi using the gauss density equation in each class;

   Until the probability of all predictor variables (ft, f2, f3,.., fn) has been calculated.
4. Calculate the likelihood for each class;
5. Get the greatest likelihood;

Pseudo code for HOG

1. sds_alloc (ROB, Gray, Grad,r, Grad_y Mag. Orient, Hist. binHist)
2. RGB2Gray(RGB. Gray)

3. Gratilent(Gray, Grad x, Grady)
4. Magnitude(Grad x. Grady, Mag)
5. Orientation(Grad x. Grady, Orient)
6. Histogram(Orient, Mag, Hist)
7. Normalization(Hist, normHist)
8. sds_free(RGB, Gray, Grad,r, Grady, Mag, Orient, Hist, normHist)

Pseudo code for login

- **EmailID field**: input type = EmailID, placeholder: "your@email.com"
- **Password field**: input type = password, placeholder: "Password"
- **Login submit**: value: "Login", default state, disabled

Pseudo code for Classification of an image

- **Image file**: input type = image
- **Upload submit**: value: "upload", default state, disabled

Pseudo code for SVM

Require: X and y loaded with training labeled data, a <= 0 or a <= partially trained SVM

1. C <= some value (10 for example)
2. Repeat
3. For all {xi,yi}, {xj,yj} do
4. Optimize ai and aj
5. End for
6. Until no changes in a or other resource constraint criteria met

Ensure: Retain only the support vectors (ai>0)

6.2 ACCEPTANCE TESTING

User Acceptance Testing is a critical phase of any project and requires significant participation by the end user. It also ensures the system meets the functional requirements.

Table Test Cases:

Test Case No.	1
Name of Test	Login Page
Test Case Description	User enters the valid EmailID and password
Sample Input	EmailID -*****@*****com Password-*******
Output	Home page displayed

Table 6.1: Login page Test Case

Test Case No.	2
Name of Test	Upload Image File
Test Case Description	User should selects the original retina image
Sample Input	Retinal image
Output	Image will be uploaded

Tabl 6.2: Upload Image file

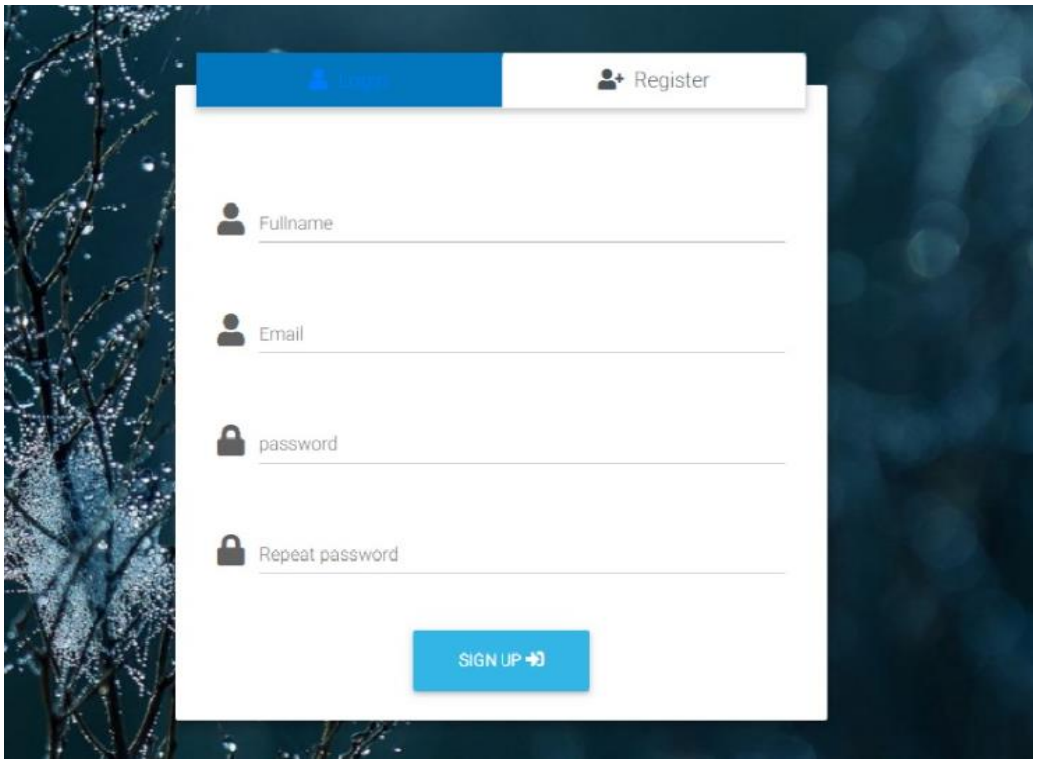

Fig 6.5: Registration form

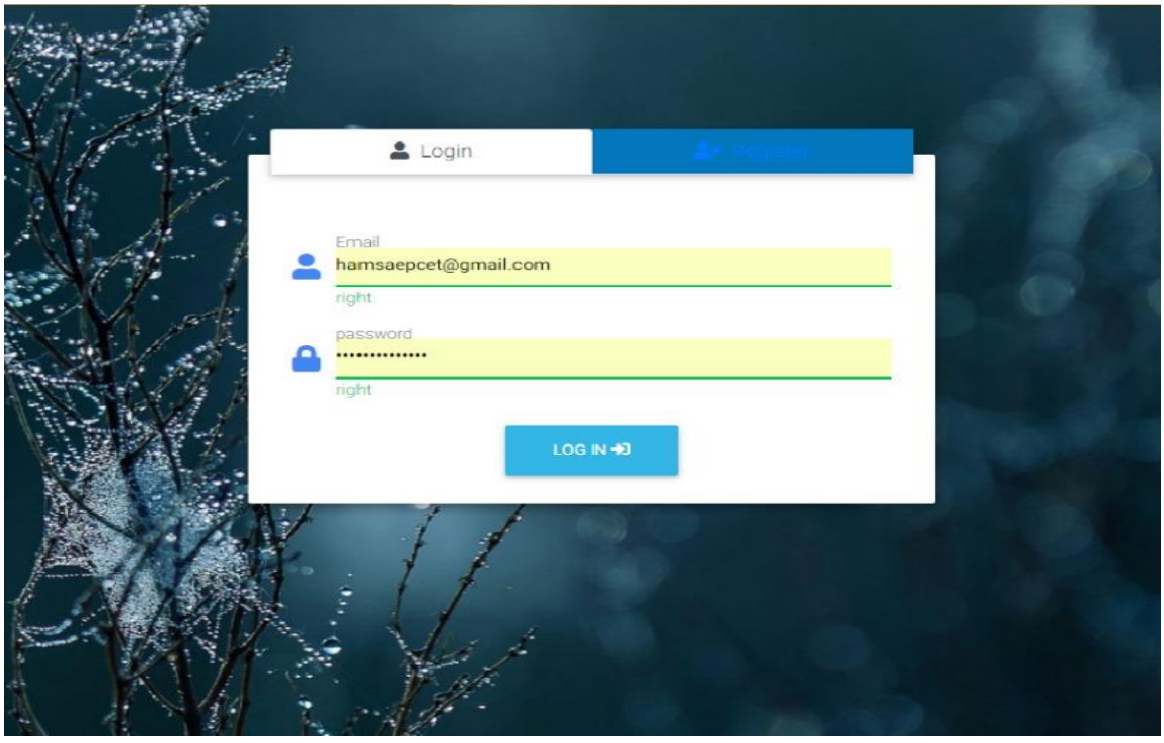

Fig 6.6:login form

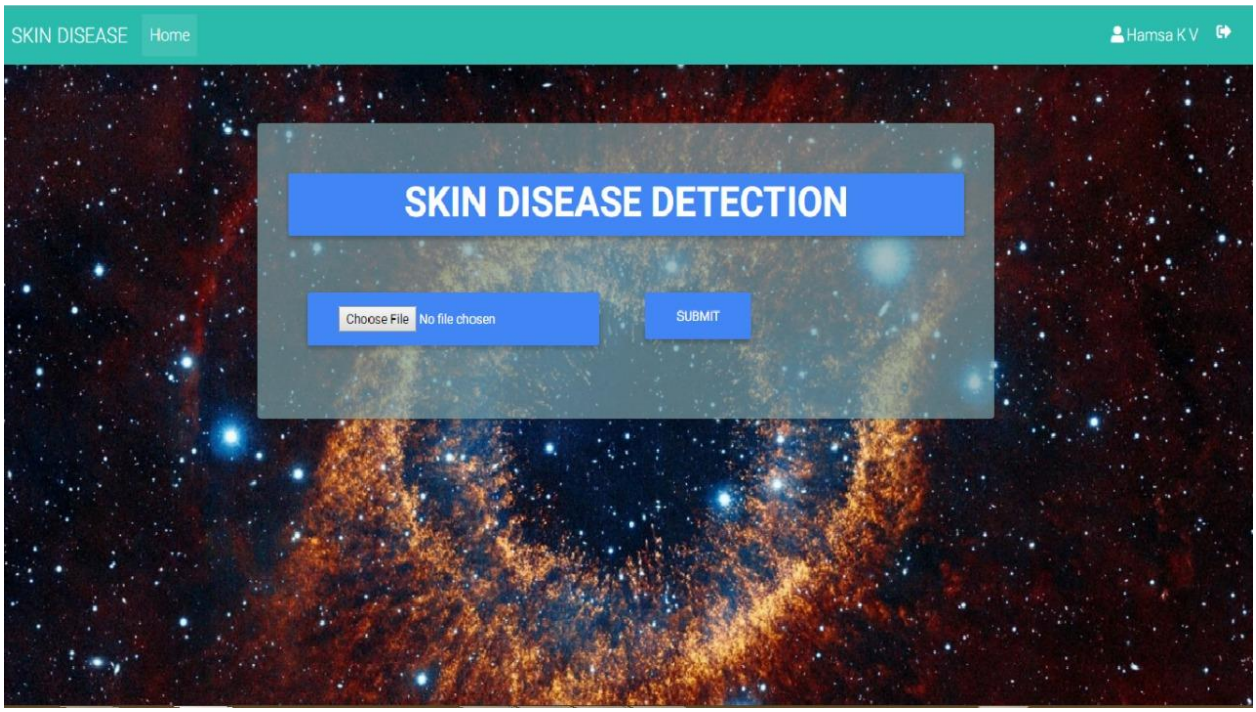

Fig 6.7 : home page

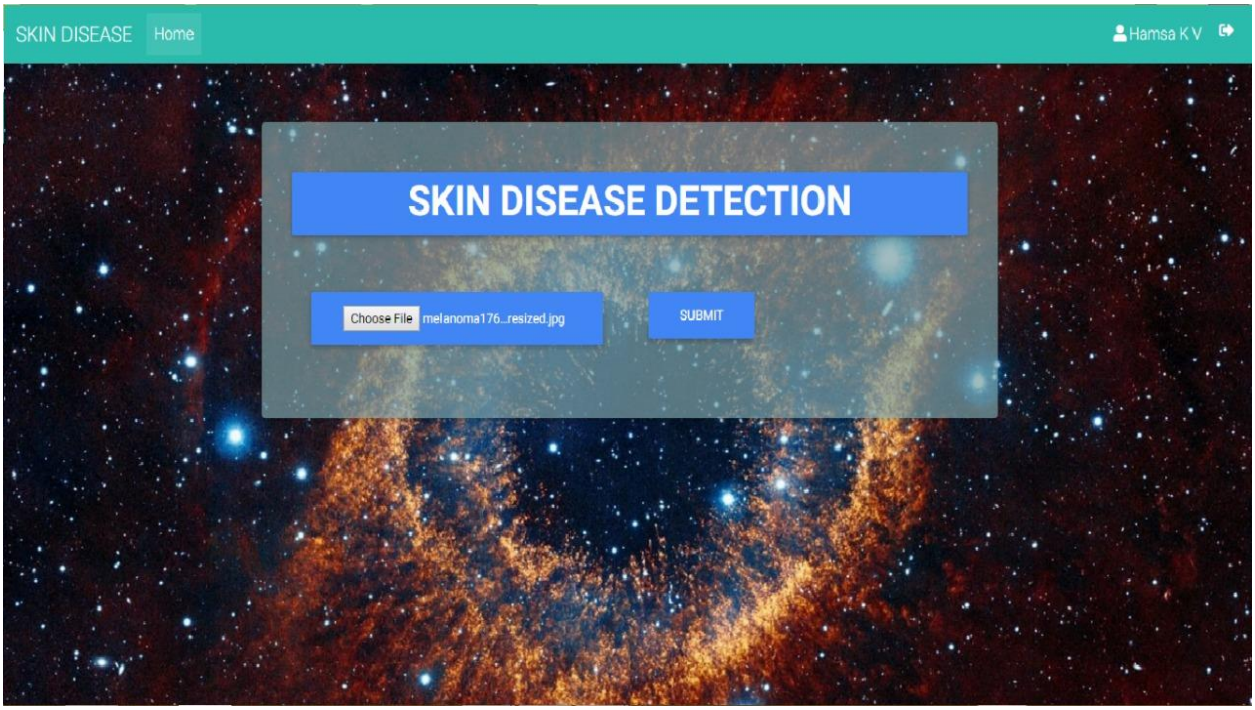

Fig 6.8: image files attachment

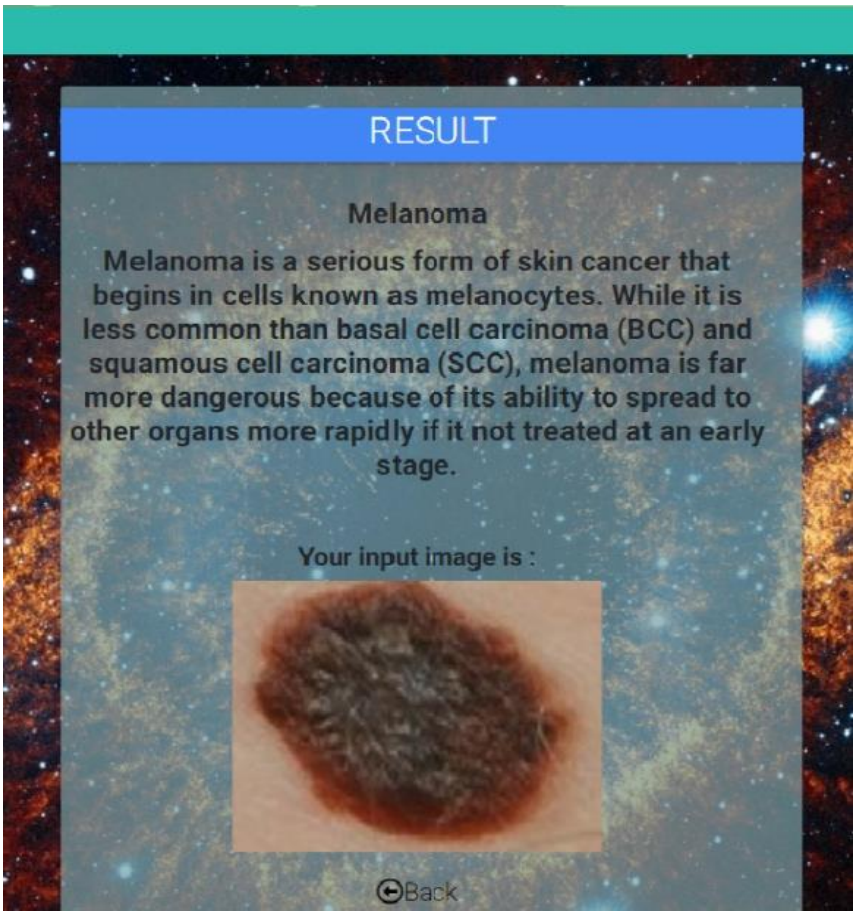

Fig 6.9: Melanoma output

Melanoma, the most serious type of skin cancer, develops in the cells (melanocytes) that produce melanin — the pigment that gives your skin its color. Melanoma can also form in your eyes and, rarely, inside your body, such as in your nose or throat.

The exact cause of all melanomas isn't clear, but exposure to ultraviolet (UV) radiation from sunlight or tanning lamps and beds increases your risk of developing melanoma. Limiting your exposure to UV radiation can help reduce your risk of melanoma.

The risk of melanoma seems to be increasing in people under 40, especially women. Knowing the warning signs of skin cancer can help ensure that cancerous changes are detected and treated before the cancer has spread. Melanoma can be treated successfully if it is detected early.

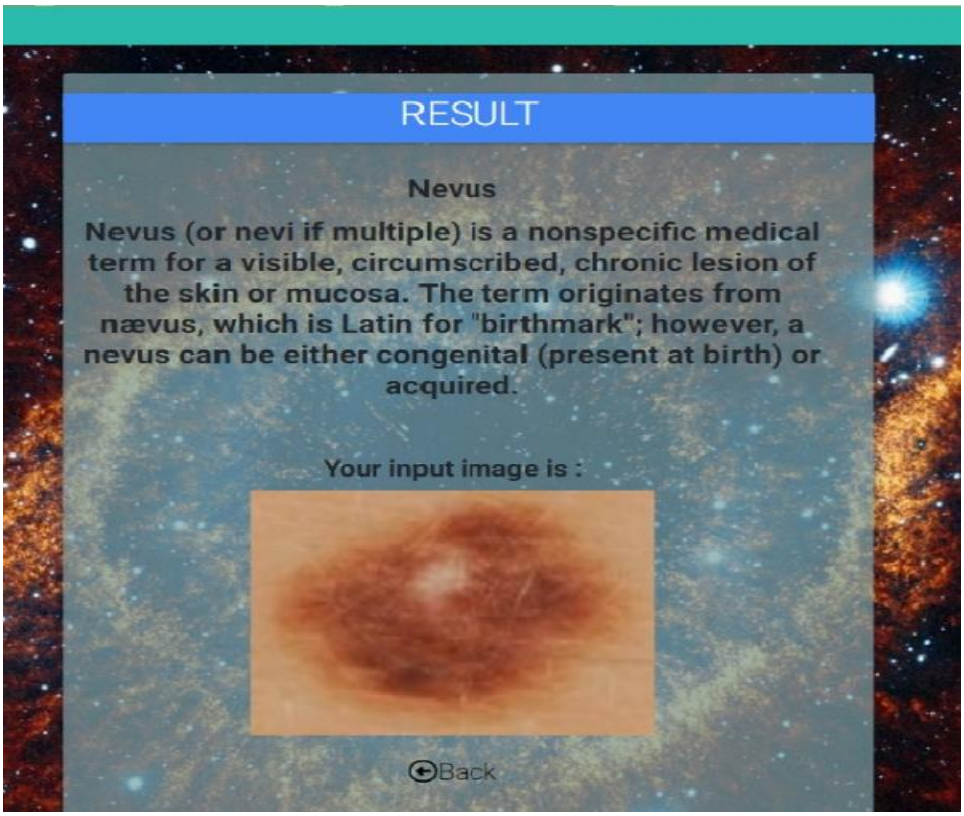

Fig 6.10: nevus output

An epidermal nevus (plural: nevi) is an abnormal, noncancerous (benign) patch of skin caused by an overgrowth of cells in the outermost layer of skin (epidermis). Epidermal nevi are typically seen at birth or develop in early childhood. Affected individuals have one or more nevi that vary in size.

There are several types of epidermal nevus that are defined in part by the type of epidermal cell involved. The epidermis is composed primarily of a specific cell type called a keratinocyte. One group of epidermal nevi, called keratinocytic or nonorganoid epidermal nevi, includes nevi that involve only keratinocytes. Keratinocytic epidermal nevi are typically found on the torso or limbs. They can be flat, tan or brown patches of skin or raised, velvety patches. As affected individuals age, the nevi can become thicker and darker and develop a wart-like (verrucous) appearance. Often, keratinocytic epidermal nevi follow a pattern on the skin known as the lines of Blaschko. The lines of Blaschko, which are normally invisible on skin, are thought to follow the paths along which cells migrate as the skin develops before birth. Keratinocytic epidermal nevi are also known as linear epidermal nevi or verrucous epidermal nevi, based on characteristics of their appearance.

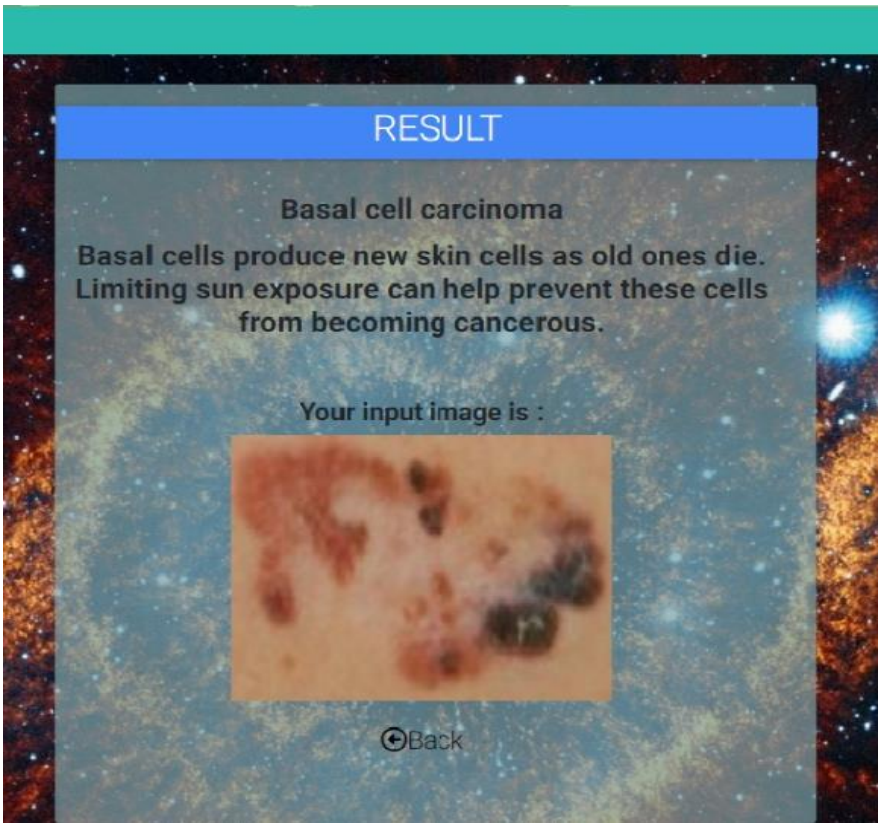

Fig 6.11: Basel cell carcinoma output

Basal cell carcinoma is a type of skin cancer. Basal cell carcinoma begins in the basal cells — a type of cell within the skin that produces new skin cells as old ones die off.

Basal cell carcinoma often appears as a slightly transparent bump on the skin, though it can take other forms. Basal cell carcinoma occurs most often on areas of the skin that are exposed to the sun, such as your head and neck.

Most basal cell carcinomas are thought to be caused by long-term exposure to ultraviolet (UV) radiation from sunlight. Avoiding the sun and using sunscreen may help protect against basal cell carcinoma.

CONCLUSION AND FUTURE WORK

Detection of skin diseases is avery important step to reduce death rates, disease transmitrions and development of the skin disease. Clinical procesdures to detect skin diseases are very expensive and time consuming. Image processing techniques helps to build automated screening system for dermatology at an initial stage. The extraction of features plays a key role in helping to clacify skin diseases.

In this reaseach the method of detection was designed by using pre trained SVM abnd navie bayas. In conclusion, we must not forget that this research has an effective role in the detection skin diseases in soudhi Arabia because it has very hot weather for the presence oh=f weather: thses indicate =s that skin diseases are widw spread. The reaserch supports medical efficiency in soudhi Arabia.

Future enhancement

Futuree scopes of improment in present methodologies are

1. A common model should be adopted for the identification of all types of skin disesases
2. Support for muiltilingualism to develop user-freidlyness.
3. To expand the muilti platform capability throuth an introduction to ios compatability.

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