PROJECT SYNOPSIS (ETCS 460)

On

MEDCUREAI: SKIN DISEASE DETECTION AND TREATMENT SUSCEPTIBILITY

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In

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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 produce many types of cancers. Image processing is used to detect those diseases by using various methods like feature extraction, segmentation, filtering, etc [3].

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 [2]. 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 [2], 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 anddetecting 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, 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 diseaseand 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 [3]. 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 [11].

In this, 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 [5].

1.2 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.

Chapter 2: Literature Survey

A literature review of a major project involves examining existing research, publications, and scholarly works relevant to the project's topic, objectives, and scope. It aims to provide a comprehensive overview of the current state of knowledge, identify gaps, trends, and controversies, and establish a theoretical framework or conceptual basis for the project.

Here's an outline of key components typically included in the literature review:

1. 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.

2. 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 thispaper, 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 ofclassification is about 90%.

3. 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

Chapter 3: Objectives

The objectives of skin disease detection and treatment susceptibility revolve around effectively identifying skin conditions and determining the most appropriate treatment options based on individual factors. Here are some specific objectives:

1. **Early Detection**: Detecting skin diseases at an early stage is crucial for prompt treatment and prevention of complications. Early detection can prevent the progression of certain conditions and improve treatment outcomes.

2. **Accurate Diagnosis**: Ensure accurate diagnosis of skin diseases through various methods such as clinical examination, imaging techniques, and laboratory tests. Accurate diagnosis is fundamental for selecting the most effective treatment strategy [12].

3. **Classification and Typing**: Proper classification and typing of skin diseases help in understanding their underlying causes, pathophysiology, and prognosis. This information is essential for determining appropriate treatment approaches.

4. **Identification of Susceptibility Factors**: Identify factors that contribute to an individual's susceptibility to certain skin diseases, including genetic predisposition, environmental factors, lifestyle choices, and underlying health conditions.

5. **Personalized Treatment Plans**: Develop personalized treatment plans tailored to the specific needs of each patient, considering factors such as disease severity, patient preferences, comorbidities, and treatment susceptibility.

6. **Relevant Clinic Recommendation**: Suggest the clinics nearest to the patient’s location on the basis of relevant diseases making it easy for anyone who wants to cure their disease with proper treatment.

7. **Efficacy and Safety**: Evaluate the efficacy and safety of various treatment options, including medications, topical therapies, phototherapy, and surgical interventions, to ensure optimal outcomes with minimal adverse effects.

Chapter 4: Feasibility Study

Feasibility study is a comprehensive assessment conducted to evaluate the practicality, viability, and potential success of undertaking a significant endeavor. This study aims to analyze various aspects of the project to determine whether it is technically, financially, operationally, and environmentally feasible. The feasibility study serves as a crucial decision-making tool for stakeholders, enabling them to assess the project's merits, identify potential risks and challenges, and make informed decisions about proceeding with the project.

Here's an outline of key considerations for such a feasibility study:

1. **Market Analysis**:

- Identify the target market for the web application, including geographic regions, demographics, and user segments such as patients, researchers, and public health agencies.

- Evaluate the demand for skin disease detection and treatment susceptibility tools, considering factors such as prevalence of skin diseases, healthcare infrastructure, and technological adoption.

2. **Competitive Landscape**:

- Analyze existing skin disease detection solutions, including web-based applications, mobile apps, and traditional diagnostic methods [15].

- Assess competitors' strengths, weaknesses, pricing models, features, and market positioning to identify opportunities and potential areas for differentiation.

3. **Technical Feasibility**:

- Evaluate the technical requirements for developing and maintaining the web application, including software development, hosting infrastructure, data security, and scalability.

- Determine the feasibility of integrating machine learning algorithms, image processing techniques, and other advanced technologies for accurate detection and susceptibility assessment.

4. **Financial Feasibility**:

- Estimate the initial investment required for developing the web application, including software development costs, infrastructure expenses, licensing fees, and regulatory compliance.
- Project the revenue potential based on subscription models, freemium offerings, advertising, or partnerships with healthcare providers, pharmaceutical companies, or research institutions.
- Conduct a cost-benefit analysis to assess the return on investment (ROI) and determine the viability of the business model.

5. **Operational Feasibility**:

- The operational feasibility assesses whether the proposed solution can be effectively implemented and integrated into existing workflows and systems.

6. **User Acceptance and Usability**:

- Conduct user surveys, interviews, or focus groups to gather feedback on the proposed features, user interface design, and usability of the web application.
- Evaluate user acceptance, preferences, and willingness to pay for the proposed solution, considering factors such as ease of use, accessibility, and perceived value.

Chapter 5: Need and Significance

The need and significance of a major project can vary depending on its nature, scope, and objectives. However, in general, major projects fulfill several important purposes and contribute to various aspects of society, economy, and human well-being.

1. Early Intervention: Detecting skin diseases early allows for timely intervention, which can prevent progression to more severe stages, minimize complications, and improve treatment outcomes. Certain skin conditions, if left untreated, can lead to serious health consequences.

2. Quality of Life: Skin diseases can significantly impact an individual's quality of life, causing discomfort, pain, psychological distress, and social stigmatization. Effective detection and treatment susceptibility assessment can alleviate symptoms, improve appearance, and enhance overall well-being.

3. Public Health Impact: Skin diseases contribute to a significant burden on public health systems worldwide. Detecting and managing these conditions efficiently can reduce healthcare costs associated with prolonged treatments, hospitalizations, and disability.

4. Prevention of Complications: Certain skin diseases, if not adequately managed, can lead to complications such as secondary infections, scarring, disfigurement, and even systemic complications. Identifying susceptibility factors and tailoring treatment plans can mitigate these risks.

5. Personalized Medicine: Every individual may respond differently to various treatments due to genetic, environmental, and lifestyle factors. Understanding treatment susceptibility allows healthcare providers to tailor personalized treatment plans for each patient, optimizing efficacy and minimizing adverse effects.

6. Improved Healthcare Access: Effective skin disease detection and treatment susceptibility assessment can enhance healthcare access for individuals, including underserved populations who may face barriers to accessing specialized dermatological care.

7. Advancements in Technology: Technological advancements, such as artificial intelligence, imaging techniques, and molecular diagnostics, have revolutionized the field of dermatology, enabling more accurate and efficient detection, diagnosis, and treatment susceptibility assessment of skin diseases [11].

8. Psychological Well-being: Skin diseases not only affect physical health but also have psychological implications, including anxiety, depression, and

low self-esteem. Prompt detection and effective treatment can alleviate psychological distress and improve self-confidence.

9. Research and Innovation: Research into skin disease detection contributes to the development of novel diagnostic tools, therapeutic agents, and preventive strategies, ultimately advancing the field of dermatology and improving patient care **[1]**.

In conclusion, the need for skin disease detection and treatment susceptibility is crucial for promoting individual health, public health, and overall well-being. By addressing these needs, healthcare systems can provide more effective and personalized care to individuals affected by skin diseases, leading to better outcomes and improved quality of life.

Chapter 6: Intended User

The intended users of the skin disease detection and treatment susceptibility web application can include various stakeholders involved in different aspects of skin disease management and care delivery. Here are the potential intended users:

1. Patients: Individuals concerned about their skin health, experiencing symptoms, or seeking information about skin diseases and their treatment options can use the web application to perform self-assessment, access educational resources, and find guidance on seeking professional medical advice.

2. Healthcare Professionals: Dermatologists, general practitioners, nurses, physician assistants, and other healthcare providers can utilize the web application as a tool for assisting in the diagnosis, treatment, and monitoring of skin diseases. They can input patient data, view diagnostic recommendations, and access treatment guidelines based on the application's outputs [13].

3. Researchers: Scientists and researchers in dermatology, public health, and related fields may use the web application to access data and insights on skin disease epidemiology, treatment outcomes, and susceptibility factors for conducting research studies, clinical trials, or epidemiological investigations.

4. Medical Educators: Educators and trainers in medical schools, residency programs, and continuing medical education courses can integrate the web application into their curriculum to teach students and healthcare professionals about skin diseases, diagnostic methods, and treatment strategies [5].

5. Public Health Agencies: Public health professionals and policymakers responsible for population health management and disease surveillance can leverage the web application to monitor skin disease trends, identify high-risk populations, and develop targeted interventions and prevention programs.

6. Pharmaceutical and Biotechnology Companies: Companies involved in developing dermatological drugs, therapies, and diagnostics can use the web application to gather insights into the prevalence of specific skin diseases, treatment patterns, and unmet medical needs to inform their research and development strategies.

7. Telemedicine Providers: Telemedicine platforms and services may integrate the web application into their platforms to facilitate remote

consultations and decision support for dermatological conditions, enabling healthcare providers to deliver virtual care efficiently and effectively.

8. Healthcare Administrators: Administrators in healthcare organizations, clinics, and hospitals can utilize the web application to monitor skin disease management metrics, track patient outcomes, and allocate resources based on population needs and service utilization patterns.

By catering to these diverse user groups, the skin disease detection and treatment susceptibility web application can serve as a comprehensive resource for promoting early detection, personalized treatment, and improved management of skin diseases, ultimately leading to better patient outcomes and enhanced public health.

Chapter 7: Proposed 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.7.1

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

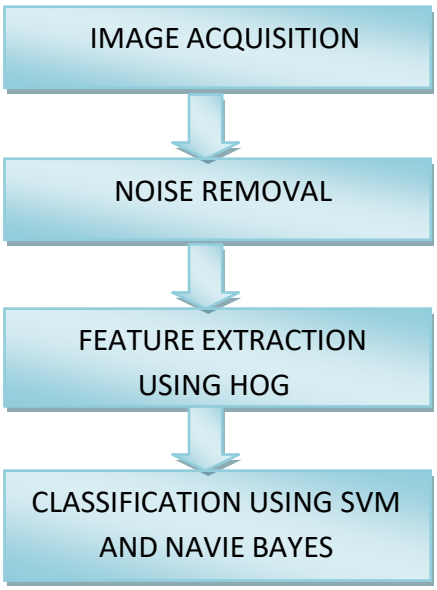

Figure 7.1: Methodology

- **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 illustratedin the upcoming sections.

Chapter 8: Requirement Specification

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.

8.1 Hardware Specification

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 : 1 GB.
- Any desktop / Laptop system with above configuration or higher level.

8.2 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 Languages	:	Python3
Front-End	:	HTML, CSS
Back-End	:	Javascript
Framework	:	Flask
Libraries	:	Numpy, Tensorflow
System tool	:	VS code

Chapter 9: 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.

9.1 Use Case Diagram:

A use case diagram is a graphical representation of the interactions between actors (users or external systems) and a system, focusing on the system's functionality from the perspective of its users.

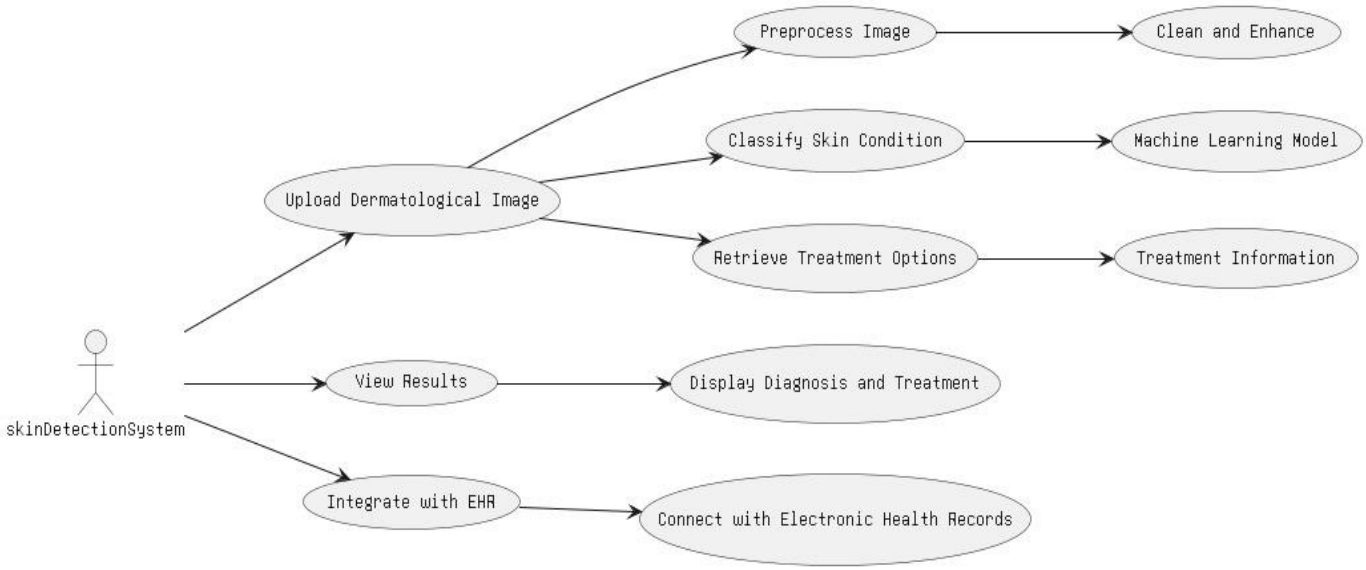

Figure 9.1.1: Use Case Diagram

9.2 Class Diagram:

A class diagram is a type of diagram in the Unified Modeling Language (UML) that represents the structure of a system by showing the classes of objects, their attributes, methods, relationships, and constraints.

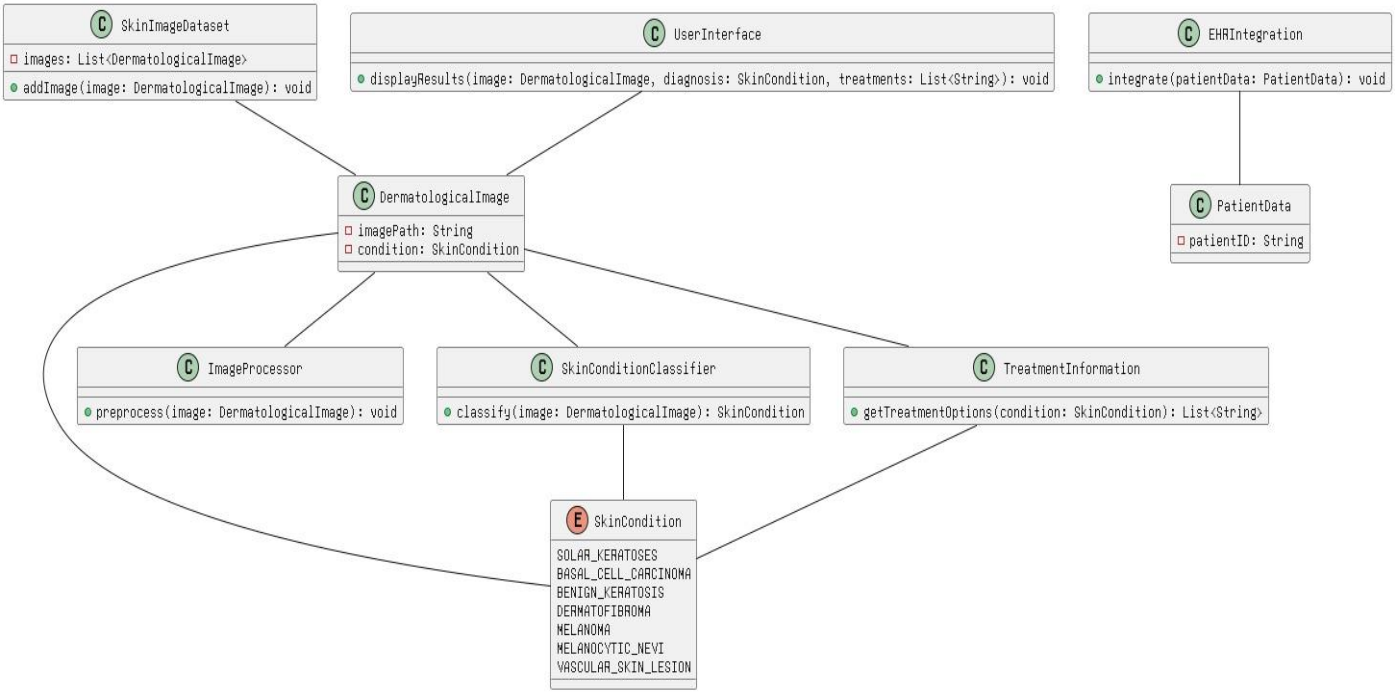

Figure 9.2.1: Class Diagram

9.3 Data Flow Diagram

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 todispatch to report.

Here are the level 0, 1 and 3 below:

- **DFD (Level 0):**

This Level 0 DFD outlines the major components and interactions in the skin disease detection and treatment susceptibility system, considering the specified diseases, algorithms, and clinic recommendations.

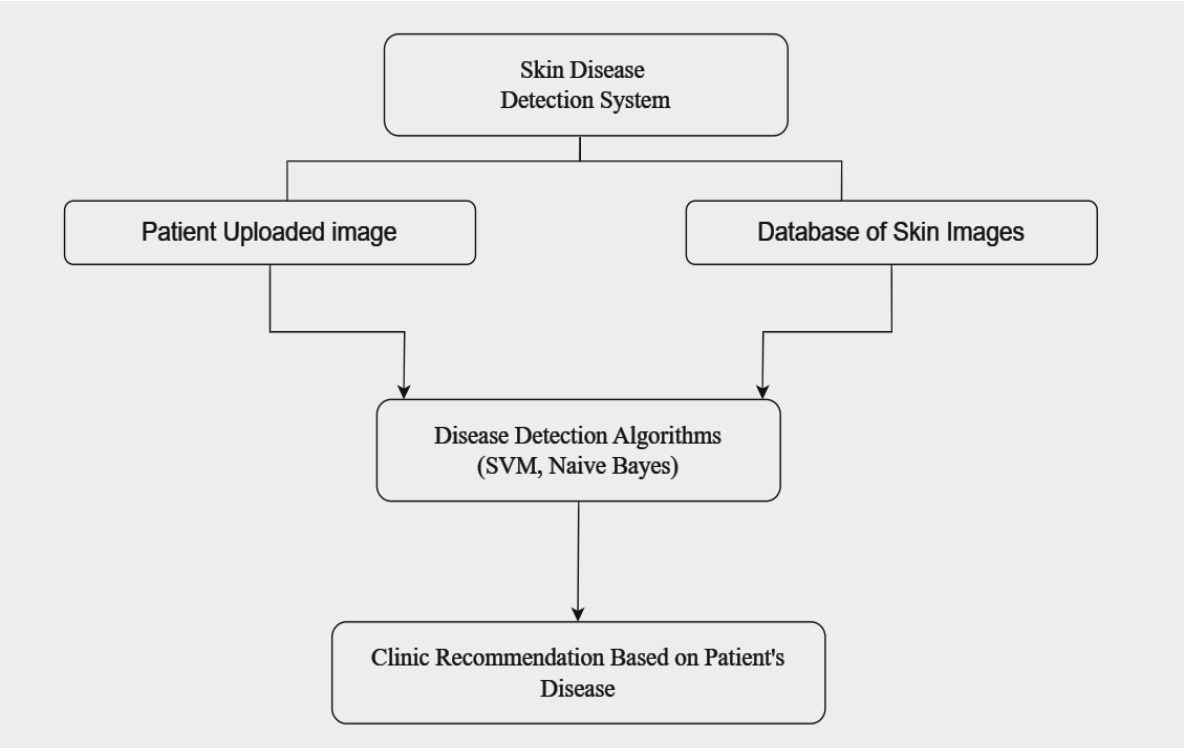

Figure 9.3.1: DFD (Level 0)

- **DFD (Level 1):**

This Level 1 DFD provides a more comprehensive view of the processes involved in skin disease detection and treatment susceptibility, focusing on the analysis of skin images for specific diseases using SVM and Naive Bayes algorithms.

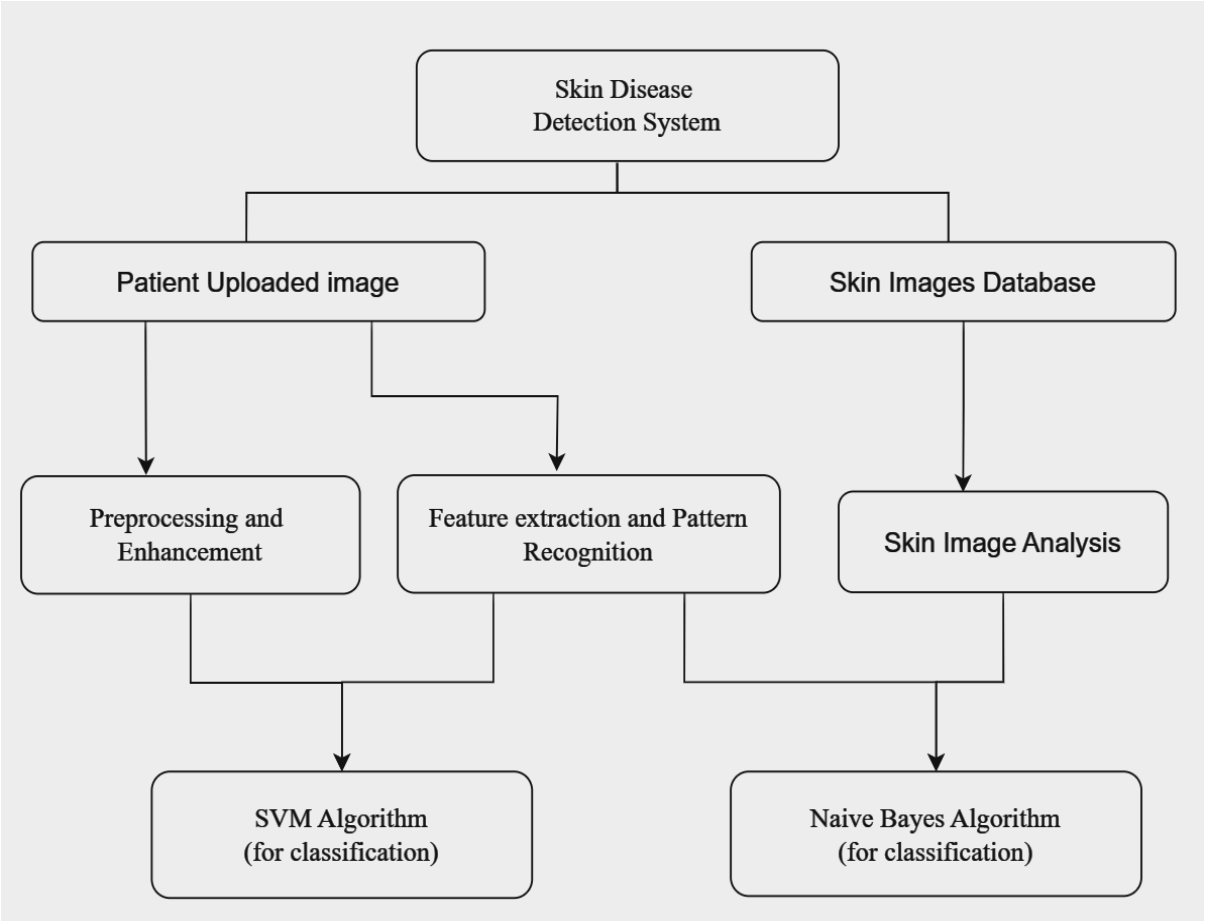

Figure 9.3.2: DFD (Level 1)

- **DFD (Level 3):**

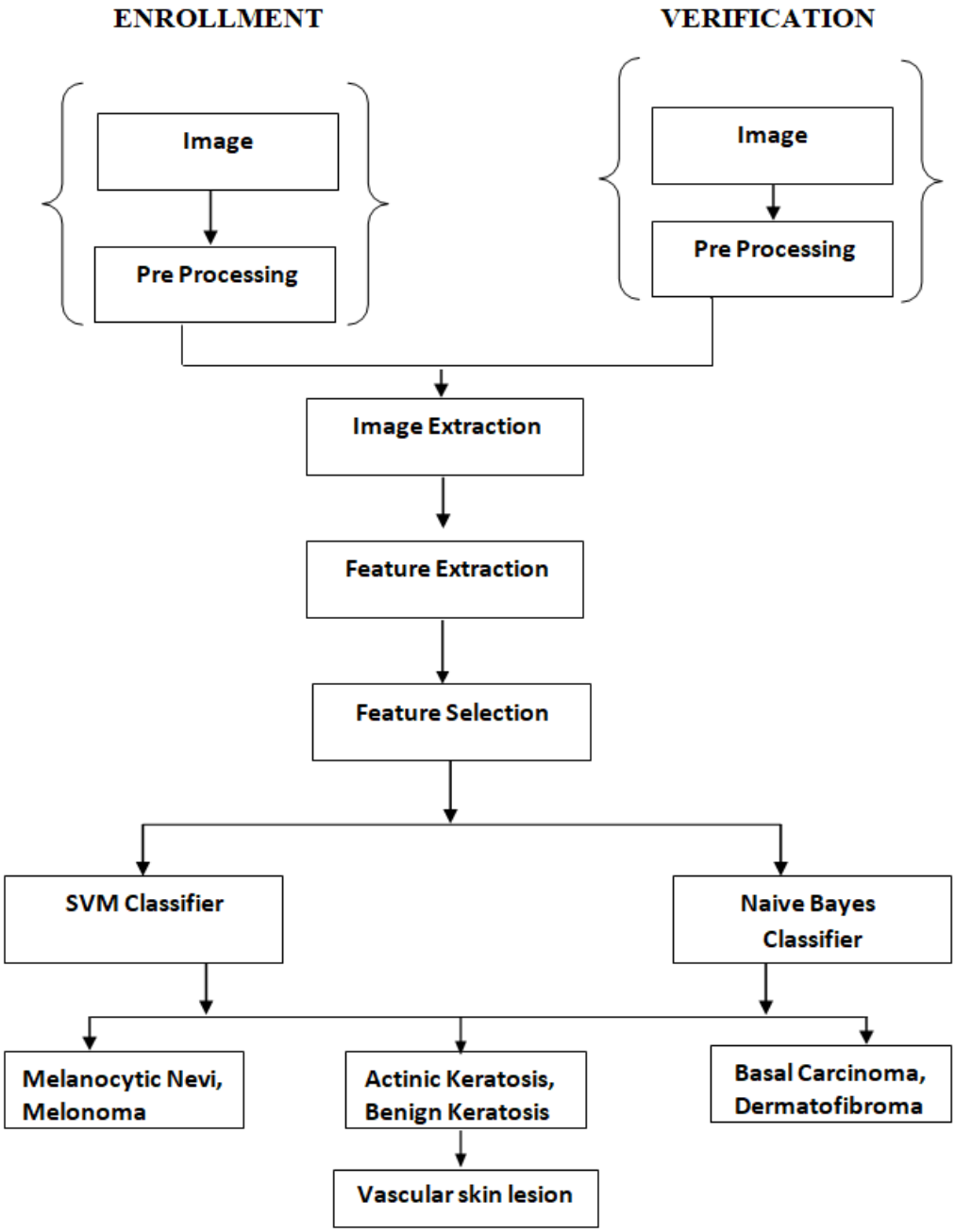

Figure 9.3.3: DFD (Level 3)

In Figure 9.3.3 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.

9.4 ER Diagram:

An Entity-Relationship (ER) diagram is a visual representation of the entities, attributes, and relationships within a system or database. It's commonly used during the design phase of database development to model the structure and behavior of the data.

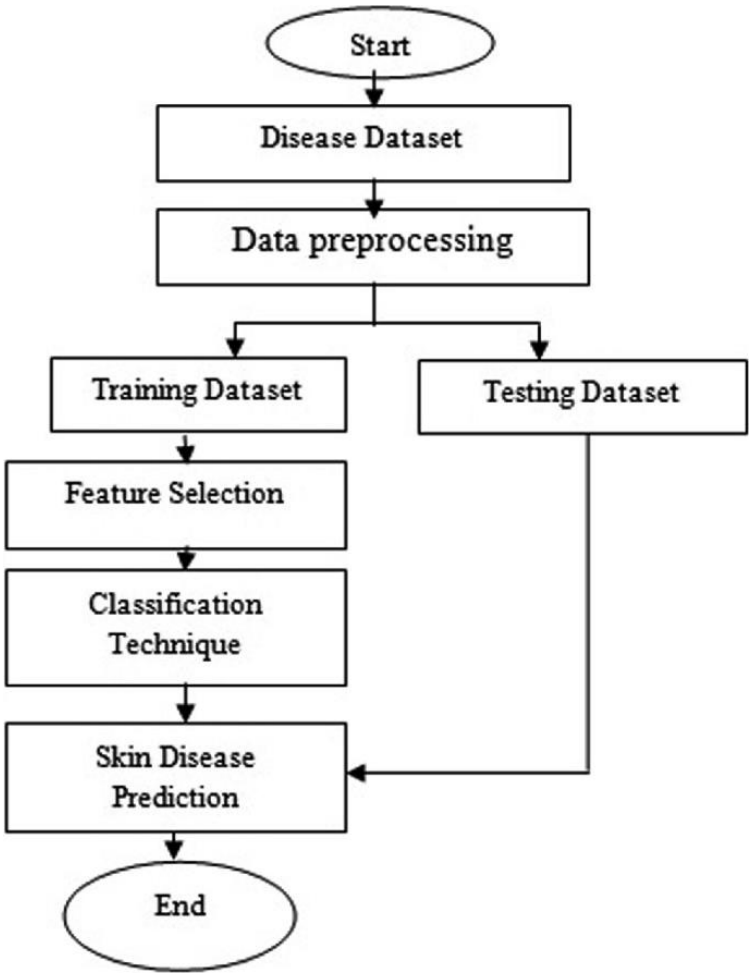

Figure 9.4.1: E-R Diagram

9.5 Gantt Chart:

A Gantt chart is a type of bar chart that illustrates a project schedule. It shows the start and finish dates of the various elements of a project. The horizontal axis represents time, typically broken down into days, weeks, or months, while the vertical axis represents the tasks that make up the project. Each task is represented by a bar whose length corresponds to the duration of the task, and its position on the timeline indicates when it starts and ends.

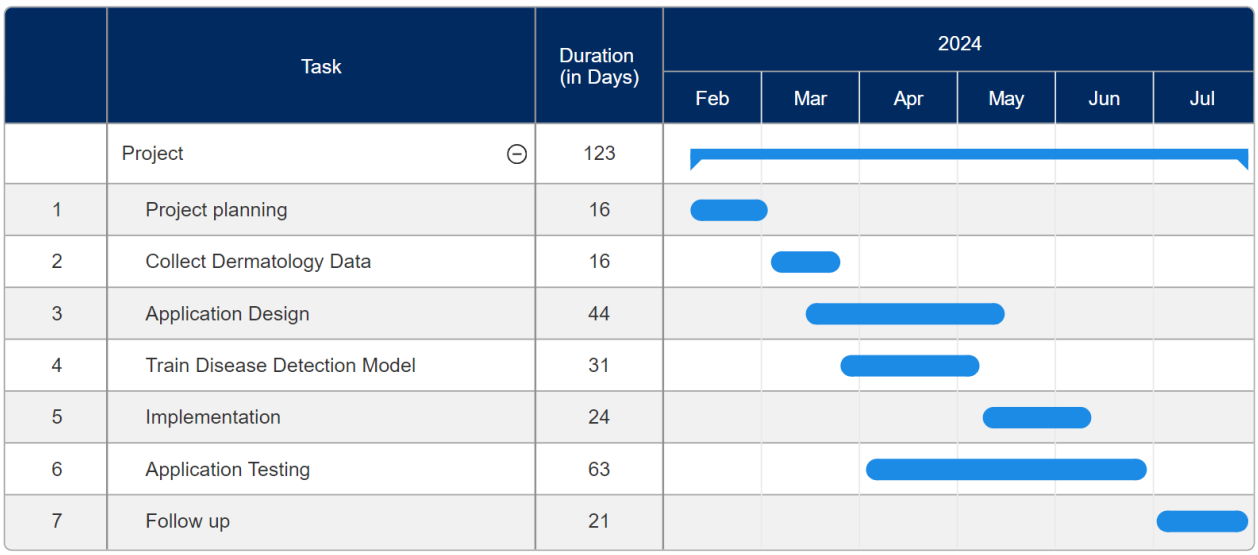

Figure 9.5.1: Gantt Chart

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