Automated AI-augmented Approach to Psoriasis Lesion Detection And Accurate Scaling Severity Evaluation

Project ID: 24-25J-210

Project Proposal Report

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23 August 2024

DECLARATION

I declare that this is my own work, and this proposal does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by any other person except where the acknowledgement is made in the text.

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2024/8/20

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ACKNOWLEDGEMENT

I would like to extend my sincere thanks to everyone who supported me in carrying out a research project in my 4th year. First and foremost, I would like to acknowledge and give my warmest thanks to my research project supervisor, Mr. Samadhi Rathnayake, for his consistent support throughout this journey and for being a great advisor as well by providing useful feedback. In the same light, I am very thankful for considering my co-supervisor, Dr. Junius Anjana; without him, this work would not have been of great quality as it is today. I would like to extend my sincere thanks to the CDAP panel for their guidance and coordination throughout our final year research project.
External supervisors Dr. Saman Gunasekara and Dr. Kasun Nayanakantha for their valuable expertise and guidance in fine-tuning the work motivation of this project and giving valuable domain knowledge regarding this project.

Finally, I would like to thank our team leader, Gimmana M.R.M., for his leadership and for keeping everything coordinated and well-guided, as well as other group members who supported me throughout my research project.

Finally, I am grateful for the support of family and friends; their belief in my ability helps keep me motivated. Their faith in me has brought us to a successful finish line and allowed me to achieve my goals.

ABSTRACT

Psoriasis is a chronic skin disease characterized by rapid multiplication and shedding of skin cells. It causes patches/scaly patches on knees, elbows, or different parts of the body, increasing redness with inflammation. Scaling severity is an important factor that must be accurately identified and assessed prior to management or treatment of scoping dermatoses. Based on the current clinical assessment, the scale has five severity levels for scaling severity. While current clinical assessments can be challenging, they are also subjective, and an ADL classification can help reduce these challenges as well. In this research, we present an AI-assisted system that works with images uploaded online to identify psoriasis localization and scale severity with high levels of accuracy and speed through machine learning and computer vision methods. These real-time insights intersect between classic clinical evaluation and modern data-driven analytics, all to fully automate this process. Through this method, the doctor and the patient can get the assessment of the severity of the psoriasis scale.

By using this system regularly, the patient can progress based on the severity level based on the historical records of the system. If validated in future studies, this new approach will better characterize skin symptoms and expedite the diagnostic experience for patients to ensure faster, more convenient care.

Keywords – Psoriasis, Scaling severity, Machine learning, AI, Lesion detection.

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LIST OF ABBREVIATIONS

Abbreviation	Description
ML	Machine Learning
AI	Artificial Intelligence
ADL	Activates of Daily Living
BoVWs	Bag of Visual Words
CNN	Convolutional Neural Network
XAI	Explainable AI
PASI	Psoriasis Area and Severity Index
DNN	Deep Neural Network

1. INTRODUCTION

Psoriasis is a skin disorder whereby there is fast production of skin cells, which leads to thick, scaly patches. Varying in severity, size, and distribution, proper diagnosis and assessment have become the significant predictor variables for effective therapy and management. Traditionally, the severity of the scaling of psoriasis has been assessed using the PASI score, which is subjective, very time-consuming, and greatly dependent on the expertise of healthcare professionals. This demand thus rises for methods that are more homogeneous and automated to help improve diagnosis and treatment planning in terms of accuracy and efficiency.

In this regard, an automated AI-enhanced approach to detecting the lesions of psoriasis and a precision scaling severity rating system would be helpful. It uses state-of-the-art machine learning and computer vision techniques to analyze uploaded images of psoriasis lesions for the identification of affected areas and continuous evaluation of the severity of the scale efficiently. This not only reduces the reliance on traditional clinical assessments but also allows insights based on real-time data from these automated approaches.

This system closes the gap between subjective clinical assessments and objective, technology-based analysis, offering patients and healthcare providers a much more accessible and scalable solution. Because it is based on real-time processing, it would be able to provide instant insights, facilitate quicker decision-making, and improve management for psoriasis cases.

Figure 1. 1 Psoriasis Affected Area

1.1 Background Literature

Psoriasis is a chronic, at times disabling inflammatory skin disease that presents a diagnostic challenge and is difficult to assess for its severity. Conventionally, the diagnosis of psoriasis was based on subjective visual examinations by dermatologists. There are inconsistencies and delays associated with this approach because the accuracy of diagnosis will depend on the expertise of the dermatologist and the visual examination criteria used. It therefore requires diagnostic tools that are objective, effective, cost-efficient, and able to be used both in clinical settings and remote environments.

Figure 1. 2 Psoriasis Affected Hand

Recent deep learning and machine learning developments have opened new opportunities for automated yet accurate skin lesion analysis in medical imaging. Among these, Convolutional Neural Networks have emerged as one of the most powerful tools for bringing about a highly accurate diagnosis in psoriasis cases. CNNs are able to automate psoriasis classification and need highly exact evaluation for the severity of the disease, which overcomes subjectivity and variability of traditional methods.

Innovative applications, such as "DermaScope AI," are empowered with the power of these technologies. Equipped with deep machine learning algorithms, they are able to analyze skin images in order to make the diagnostic process faster, easier, and more accessible. Especially in regions featuring a lack of access to dermatological expertise, this is of immense importance in the improvement toward more objective and efficient diagnostic practices in dermatology.

1.2 Literature Survey

One of the first methods for identifying psoriasis-affected skin areas using advanced image analysis techniques belongs to Arunkumar and Jayanna [1]. The approach differentiates between affected and healthy skin through color features, hence an objective diagnostic tool that limits reliance on subjective visual inspection. This will be great progress in the diagnosis of psoriasis and provides ground for more accurate and reliable assessments.

George et al. [2] proposed a novel fully automatic severity scale assessment of psoriasis by fusing local texture and color descriptors with machine learning classifiers. The model presented by the authors has very high precision in evaluating the severity of psoriasis and hence will be a very important tool not only for clinical application but also in research. Their approach further increases the accuracy of severity classification by effectively fusing the texture and color information, thus providing a path to undertake finer and more objective assessments of psoriasis.

Vincent and Jayasingh [3] presented a detail review of image processing techniques used in the detection and classification of psoriasis. It discusses different methodologies, including image preprocessing, segmentation, and feature extraction methods, in their analysis. Most of their review talks about the development of more effective models for the detection of psoriasis by assimilation of lessons learned from different techniques. This outlines the future scope of studies and improvement areas.

Syu et al. [4] proposed a deep neural network-based methodology for psoriasis detection that made use of convolutional layers for extracting multilevel features from images of the skin. Their model considerably improves accuracy in psoriasis detection by providing a detailed analysis of the symptoms of this illness. This step makes clear the prospect that deep learning techniques will achieve higher diagnostic precision and more actionable results than conventional diagnosis techniques.

Roslan et al. [5] investigated CNN performance in classifying different types of psoriasis. Their findings have demonstrated that CNNs are efficient in differentiating various conditions of psoriasis at a high degree of accuracy, hence it justifies the implementation of deep learning models in clinical practice. Therefore, high accuracy by CNN shows potential to improve diagnosis reliability and efficiency in the management of psoriasis.

It brings into bold relief the major step forward toward making a diagnosis of psoriasis with the use of machine learning, and further development of image processing techniques. Further development and improvement of these techniques are critical to the establishment of more accurate, faster, and more objective tools for the management of psoriasis, which will benefit not only health providers but also patients themselves.

1.3 Research Gap

Traditionally, psoriasis detection, segmentation, and scaling severity assessment rely on manual clinical evaluations; for example, the Psoriasis Area and Severity Index is time-consuming, subjective, and often prone to inter-observer variability. Although several recent works have tried to integrate image processing with machine learning to seek better diagnosis and severity assessment in psoriasis, there is much research to be done to develop fully automated and real-time systems handling psoriasis lesion variability in skin tone, severity, and patient demographics.

A huge bulk of existing works were in specific aspects either of psoriasis detection or its feature extraction. For example, some works used the RGB color model to allow differentiation between healthy skin and psoriasis-affected skin, while others used the BoVWs model with superpixels in an attempt to estimate the scale severity. Unfortunately, most of these methods lack the robustness to deal with such diversity and complexity of psoriasis presentations. Moreover, classification and segmentation with DNNs and CNNs were already done by and, whereas most of these techniques ignore multi-scale analysis or forget to consider the spatial distribution of scales in rating the severity of scaling.

What seems to be lacking in this area of research is, technically speaking, one well-grounded system integrating state-of-the-art deep learning models like CNNs with methods of XAI, targeting the latter to be more transparent and interpretable for a clinician. In addition, the investigation concerning the application of multi-scale superpixel clustering techniques for the analysis of scales distribution and their clustering does not exist and could give more detailed and accurate information regarding scaling severity.

The study is seeking to fill those gaps by designing a fully functional system capable of automatically detecting psoriasis lesions and evaluating their severity by enhancing the robustness with new techniques for extracting advanced features. Externally, explainable AI will ensure transparency regarding how decisions are made within the system, and multi-scale superpixel clustering will improve the accuracy of scaling severity analysis for its application as a more reliable tool in the clinic. The following work is focused on the above-mentioned innovations to help bridge existing gaps in psoriasis detection and severity assessment for the improvement of patient outcomes and clinical workflows.

Feature / Gap	**[1]**	**[2]**	**[3]**	**[4]**	**Proposed Solution**
Implement Cutting-Edge Deep Learning Models	**No**	**No**	**Yes**	**Yes**	**Yes**
Integrate ExplainableAI Methods	**No**	**No**	**No**	**No**	**Yes**
Improve Robustness	**No**	**Yes**	**Yes**	**No**	**Yes**
Develop Multi-scale Superpixel Clustering Techniques	**No**	**No**	**No**	**No**	**Yes**
Analyze the distribution and clustering of scales	**No**	**No**	**No**	**No**	**Yes**
Integrated system	**No**	**No**	**No**	**No**	**Yes**
Report generation for assessment	**No**	**No**	**No**	**No**	**Yes**
Progress Evaluation	**No**	**No**	**No**	**No**	**Yes**

Table 1. 1 Comparison of the features addressed by the previous research studies

2. RESEARCH PROBLEM

Psoriasis is a very common skin disorder that affects millions of people worldwide. Psoriasis is characterized by scaly, inflamed patches on the skin. The illness is so complex that in every case, it manifests differently and changes its course, making the diagnosis and treatment rather a problem. Conventionally, detection, segmentation, and rating of the severity of scaling in psoriasis are done by manual clinical assessments, such as the Psoriasis Area and Severity Index. Such techniques, in spite of their wide application, are mostly time-consuming, subjective, and dependent upon the skills of clinicians; therefore, the assessments vary.

As a result of this, fast-developing technologies in machine learning and computer vision open up a great deal of opportunities for the improvement of precision, efficiency, and reliability regarding psoriasis detection, lesion segmentation, feature extraction, and scaling severity assessment. However, accurate identification of several subtypes of psoriasis lesions, particularly on skin types and conditions that have subtle or variable scaling, is still elusive for most automated systems today. Further, while several advances in the application of ML to medical image analysis have been realized, most models are non-optimized for real-time and scalable applications; this significantly limits their generalized use in clinical practice.

In this direction, the present study seeks to develop a fully automated system with the capacity for effective lesion detection related to psoriasis, the segmentation of corresponding skin areas, the extraction of meaningful features, and scoring scaling severities from digital images by using state-of-the-art machine learning methodologies. This work is intended to provide an investigation into the use of deep learning architectures with state-of-the-art feature extraction techniques and real-time image processing in a practical form, with the aim of enhancing performance in psoriasis detection. On top of that, it will further investigate how far higher explainability in the system would truly make clinicians enable better trust and accept AI-based tools for managing psoriasis.

It has identified the need for an automatic, efficient, and accurate system to support health care providers in providing more accurate diagnosis and treatment plans for patients suffering from psoriasis and, hence, achieving better outcomes.

3. RESEARCH OBJECTIVES

3.1 Main Objective

This study is aimed at developing a novel, completely automated AI-augmented system able to detect, segment, and offer an accurate scaling severity assessment of psoriasis lesions from digital images. By using state-of-the-art deep learning techniques along with computer vision methodologies, the system developed shall improve the accuracy and efficiency of diagnosis and scaling severity evaluation in psoriasis by transcending the inefficiencies of conventional manual assessment.

On this front, state-of-the-art machine learning models, including convolutional neural networks and explainable AI methods, will be integrated into the system so that it is transparent and reliable for clinical application. At the same time, multiscale superpixel clustering methods will be applied to investigate scale distribution and clustering for further raising the accuracy of scaling severity assessment. This comprehensive approach is likely to fill the missing link between clinical evaluations and real-time data-driven insights, hence offering a strong solution to healthcare providers and patients managing the condition of psoriasis.

It will also provide the capacity for monitoring the developing course of psoriasis over time, thus allowing treatment plans that are tailored to the severity and distribution of the scales. This research aims to ameliorate patient outcomes, smoothen clinical workflows, and improve the general management of psoriasis with new AI-based solutions such as automation.

Figure 3. 1 Scaling Severity Levels

3.2 Sub Objective

Sub-objectives that have been identified to achieve the main objective are:

Sub Objective 1: Develop an Advanced Detection and Segmentation Model

The objective of this sub-goal will be to develop a strong AI model that accurately detects and segments lesions of psoriasis from digital images. State-of-the-art deep learning algorithms, such as Convolutional Neural Networks, will be powered for the identification of exact skin areas affected by the condition and will form the basis for the further scaling of severity assessments.

Sub Objective 2: Perform Detailed Feature Extraction from Psoriasis Lesions

Critical features from the lesions to enhance diagnosis are extracted in this sub-objective. Through advanced image processing, the system will look for features such as texture, color variations, and scale patterns in order to gather all lesion characteristic details with respect to giving relevant clues for the scaling severity evaluation.

Sub Objective 3: Comprehensive Psoriasis Scaling Severity Classification

The sub-objective looks to classify the severity of scaling in psoriasis based on the extracted features. The proposed system will use machine learning classifiers and sort scaling severity into different degrees, such as mild, moderate, or severe, thereby giving a detailed explanation of the condition of the patient that would be useful for treatment decisions.

Sub Objective 4: Develop an Enhanced Scaling Severity Measurement System

Off this class model is the sub-objective, which emphasizes the improvement of precision in the measurements for scaling severity. This system is intended to provide reliability in results with regards to the scaling distribution and its severity for clinical use by using inputs from multi-scale superpixel clustering techniques and advanced metrics.

Sub Objective 5: Monitoring Psoriasis Scaling Severity Progress

A final sub-objective of the project was to provide a system capable of monitoring, on a real-time basis, changes in scaling severity over time. It should capture and analyze periodic updates, providing how clinicians can consider treatment efficacy, and make informed adjustments, all to improve the long-term management of psoriasis.

4. METHODOLOGY

The development of the AI-powered "DermaScope" for Psoriasis detection and severity assessment goes through a systemic methodology in order to obtain an accurate and user-friendly tool for both mobile and desktop platforms. The stages of this methodology are outlined as follows.

In the first phase, a comprehensive dataset of high-quality clinical images of psoriasis patients will be collected. The images will include very diverse stages of psoriasis, including those drawn from publicly available datasets, featuring very wide patient demographics: skin tone, lighting conditions, and severities of the disease. This would present the intrinsic robustness and generalizability within the model.

After data collection, rigorous preprocessing for image standardization will be done before training a model. Resizing of the images, normalizing the pixel values, and data augmentation with rotation, flipping, and color change will thus be performed. These augmentations will, therefore, create variations representative of the real world and enhance model generalization capacity on new images.

After this, an advanced machine-learning model of skin disease detection and segmentation is implemented. The state-of-the-art machine learning algorithms used are Random Forests, Support Vector Machines and Hierarchical Boosting to train the model to analyze clinical images with features that define psoriasis. Its training is repeated, and feature selection, cross-validation, and parameter tuning are performed at regular intervals to ensure the model's performance in recognition tasks and to ensure its accuracy.

After training the recognition and segmentation model, the system has a detailed module for feature extraction. Some key injury characteristics that are important in assessing disease severity include: The extracted features are then used to classify the severity of the scale as mild, moderate or severe concerning clinical standards and predefined criteria.

To improve the accuracy of the system, a multi-scale superpixel clustering technique will be used in this research work. The distribution and clustering of scales will be evaluated and a detailed assessment of scale severity will be provided. The system should come with metrics that quantify scale uniformity and dispersion, which would provide a complete measure of scale severity, and hence an accurate clinical assessment.

There will also be real-time monitoring of the psoriasis severity progression over time in "DermaScope AI." This functionality will help healthcare providers track a patient's continuous response to treatment and make data-driven changes in the care plan. The full reports of disease progression, such as improvement or

deterioration, will be summarized according to periodic assessments. Furthermore, predictive analytics will be applied to project recovery rates and will be used for projecting future trajectories of diseases.

Further, users will have the ability to create and manage, for each patient, a detailed profile. In this respect, the system would indicate an extensive history of psoriasis severity, treatment responses, and longitudinal tracking of disease progression. Each time assessment results are available, the system will automatically update each profile, hence providing continuous dynamic views to healthcare professionals of a patient's condition. Such continuous monitoring will make it possible for treatment plans to be tailored for the particular needs of each patient.

Usability will be taken care of by making "DermaScope AI" very user-friendly, so that any healthcare professional, regardless of their skill level, can navigate through the system with relative ease. The machine learning model, severity assessment framework, and patient profile system will be integrated into one platform during the design phase. Large-scale usability testing will be conducted to refine the interface and make it intuitive for meeting all the requirements of the end users.

Finally, testing of the system will be done after all of its components have been integrated to assess the accuracy, reliability, and robustness in many diverse clinical settings. In this respect, areas for improvement will be identified through feedback from the test users to have the tool working in practice to produce consistent and reliable results. Any kinks will at this stage be ironed out, and the system iterated upon to meet clinical standards.

Finally, the prototype will be launched as "DermaScope AI" for further testing in simulant clinical environments of real-world use. This phase will log real-world data on the performance of the tool, which will further enable the final adjustments before its broad adoption. The goal will be for "DermaScope AI" to become a trusted and widely used tool in dermatology, especially for diagnosing psoriasis and scaling severity. It will ultimately improve patient outcomes if clinicians are provided with the correct method of assessing severity to help inform better treatment decisions.

4.1 System architecture diagram

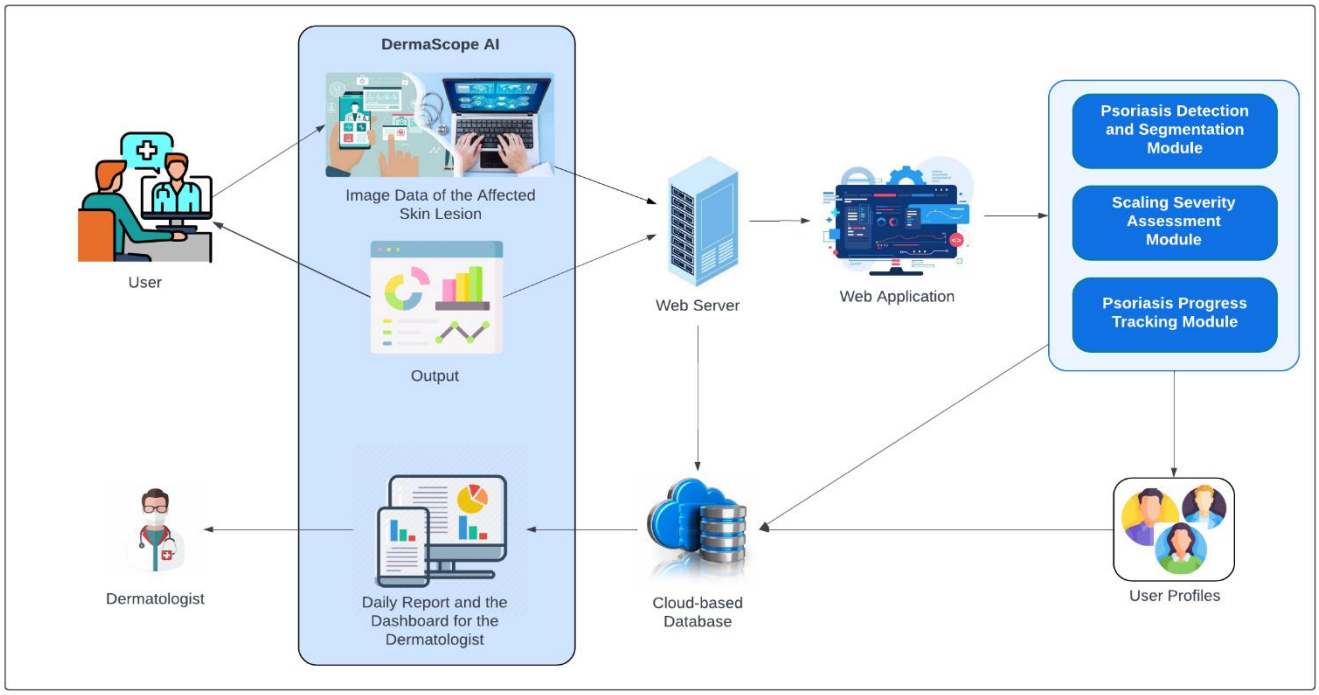

Figure 4. 1 Overall Component System Diagram

All-inclusive AI has developed the architecture of "DermaScope AI" with the potential to accurately detect, segment, and assess scaling severity due to psoriasis. In a nutshell, the user uploads an image of the affected skin lesion, and the core of the "DermaScope AI" system receives that image. The Psoriasis Detection and Segmentation module shall identify and automatically segment the psoriasis lesions in the uploaded image. After segmentation, there is the purpose of focusing on the scaling present in the skin to carry out a Scaling Severity Assessment concerning psoriasis. These findings get processed and saved against a web application on a server-side and help in having real-time communication between the AI system and the web interface.

All data of the patient, along with the reports that will be generated, are securely backed up in a cloud-based database for safe storage and management. It shall also have the User Profiles option where the details regarding the condition of the patient, his diagnosis, and his progression history shall be kept. The Psoriasis Progress Tracking Module continually monitors the patient's condition over time. It updates the profile with

new data and displays all status information in detail. This functionality allows changes to the treatment plan of a patient at any time by a health care provider.

The "DermaScope AI" system has generated a dashboard where daily diagnostic reports are shown to the dermatologists for informed decision-making on treatment. Dermatologists get detailed reports in real time on the dashboard, while the web application works as a user interface for the patient to view his progress and his updated profile. This would increase the accuracy and objectivity of psoriasis detection and, finally, scaling severity assessment. "DermaScope AI" provides patients and health professionals with measurable tools for better management of the disease.

5. PROJECT REQUIREMENTS

5.1 Functional Requirements

- It should offer an accurate detection and segmentation of the psoriasis lesion according to a clinical image supplied by the user.
- The application should be able to demonstrate detailed feature extraction from the identified lesions relating to scaling associated with psoriasis.
- It should also be able to classify the severity of the scaling using any known scoring system and display the same on a user-friendly dashboard.
- The application shall generate user-specific reports that include details of the extent and other characteristics of their psoriasis, relating to the analyzed result.
- Finally, the application shall give treatment recommendations that shall be personalized for each user, depending upon the severity and the progression of his/her psoriasis.
- The application should be able to track the progress of psoriasis over time so that users and healthcare providers can assess the severity of scaling and treatment efficiency.
- The application shall allow real-time data input and image analysis to achieve faster processing and response times for the user.
- Data visualization tools shall be given so that users can further monitor the severity of psoriasis scaling and view progress over time with detailed charts and metrics.

5.2 Non-Functional Requirements

- **Reliability**

  Thus, the proposed system for detecting and assessing the severity of psoriasis is applied by healthcare professionals for the appropriate detection of this condition and assessment of its severity in patients. Hence, the reliability of the system has to be very high in order to provide accurate results and also be reliable. There could be a serious effect on the care of the patient if there are any faulty detections or assessments of the severity. It would undergo extensive testing to validate the results produced by the system to meet the clinical standards and get them verified from experts in dermatology.

- **Security**

It is going to deal with sensitive data of patients including their medical images and health records. The security regarding this data is a matter of paramount consideration. Tight security measures on data encryption methods, secure authentication methods, along with regular security audits, will be implemented in order to guarantee the privacy and protection of information of the patients.

- **Availability**

  The psoriasis detection system has to be on 24/7 and shall assist healthcare providers in the diagnosis and monitoring of patients at their convenience. High availability will ensure there is no downtime by means of server redundancy, load balancing, and system uptime monitoring.

- **Usability**

  A user-friendly interface will enable health professionals to navigate features easily, putting patient data and reviewing results without much problem. This involves clear instructions, intuitive design features, and comprehensive dashboards for making fast analyses. In addition, usability testing would be carried out to ensure that users can interact with the system efficiently, needing less training.

- **Scalability**

  As the psoriasis detection and severity assessment system grows, it needs to scale up, especially in a clinical setting, to meet the increasing demand. In this case, the architecture design will be done to deal with a fast-growing volume of patients and datasets without decreasing speed and performance. Cloud-based solutions and optimized code will be used to ensure the system remains fast, reliable, and efficient, even with increased network traffic and a large user base.

- **Performance**

  It should return fast response times in processing and analysis of clinical images. Uploading, processing, and generation of reports from images will optimize operations so that healthcare providers obtain accurate results on time to enable timely diagnosis and treatment recommendations.

5.3 Personal Requirements

- **Expert support in psoriasis and data science domains**

Interdisciplinary collaboration is very necessary for the development of "DermaScope AI," drawing on expertise from both dermatology and advanced data science fields. Primarily, there is a need for supervision under tutors with specialized knowledge on psoriasis since they will guide on the clinical features of the disease, specifically the scaling severity key to the system's effectiveness in the clinics. These medical experts will help ensure that the AI models very precisely replicate real-world clinic practices. Equally important will be technical mentorship in machine learning, image analysis, and the design of AI systems. Critical direction in all these regards will have to be provided by the main supervisor, co-supervisor, and members of the evaluation team to ensure that standards of data processing, model development, and algorithmic accuracy are of the highest order in the development of an AI. It is this combination of medical and technical guidance that forms the basis for the creation of a reliable and effective AI tool in the management of psoriasis.

- **Deep understanding of the intersection between psoriasis research and AI technologies**

Success in the research area depends on detailed knowledge about both psoriasis, in general, and the field of data science. Psoriasis, through its variable forms and manifestations, mainly in terms of scaling severity, demands careful attention to the clinical details of further impact, diagnosis, and treatment. Good knowledge of data science principles, machine learning algorithms, image preprocessing, and model evaluation, is, at the same time, essential. Such a two-fold expertise will guarantee that the 'DermaScope AI' system holds its status both as a validly medical and technically advanced system, aligning complex clinical psoriasis assessment with the state-of-the-art AI techniques. Melding both disciplines with the system in question will ultimately bring more accurate and actionable insights for the patients and their healthcare professionals.

5.4 Expected Test Cases

Testing for accuracy, reliability, and scalability in the development and implementation of "DermaScope AI" for psoriasis detection, scaling severity assessment, and monitoring will be rigorous. Below are the key test cases expected for this research project.

i. Image Uploading and Scaling Detection Test

Objective	To verify that the system accurately accepts, processes, and analyzes the uploaded images for psoriasis scaling detection.
Test Case	Images should be uploaded in different formats like JPEG and PNG, and in different resolutions, with different levels of scaling. Verify that the system preprocesses these images for scaling feature extraction.
Expected Outcome	The system should upload, preprocess, and analyze images for scaling features without any errors.

Table 5. 1 Test case 1

ii. Psoriasis Scaling Segmentation Test

Objective	validates that the system is accurate in detecting and segmenting scaling-affected areas in psoriasis images.
Test Case	A set of test images with known scaling regions is used. The output, after segmentation, would be compared against ground truth annotations.
Expected Outcome	This approach correctly identifies, and segments scaling areas with a high degree of accuracy and corresponds with the ground truth.

Table 5. 2 Test case 2

iii. Scaling Severity Classification Test

Objective	To assess the system's ability to accurately classify the severity of scaling in psoriasis patients.
Test Case	Input images that represent diverse scaling severities → mild, moderate, and severe and evaluate if the system makes these classifications.
Expected Outcome	The system must categorize the scaling severity accurately against predefined categories and should be following clinical guidelines.

Table 5. 3 Test Case 3

iv. User Progress Tracking Test

Objective	Ensures that changes in scaling severity are properly recorded in the system for any patient and that user profiles are updated concerning these changes over time.
Test Case	Simulate a sequence of patient assessments conducted over time. Verify the system keeps track of changes in scaling severity and profile updates.
Expected Outcome	The system shall track changes in scaling severity and update the profiles without loss of data.

Table 5. 4 Test case 4

v. Patient Monitoring and Reporting Test

Objective	To test the response accuracy of this system to measures that reflect the scaling severity monitor and at the same time generate a report for the patients and health offering providers.
Test Case	Simulate a set of patient interactions and assessments. Make sure that the application will generate good enough reports on scaling severity trends.
Expected Outcome	The system should generate an overall history, proofing the progression and condition of every patient.

Table 5. 5 Test Case 5

vi. Web Application Usability Test

Objective	Testing the usability of the web-based application interface for scaling severity assessment and patient monitoring.
Test Case	Test all interactivities, navigation, scaling reports, and patient dashboards on multiple devices, testing for usability.
Expected Outcome	The application should be responsive, navigable, and functional on devices; all features should work seamlessly.

Table 5. 6 Test Case 6

vii. System performance and scalability

Objective	The response time, load handling, and system performance in scaling assessments of severity must be done.
Test Case	Gradually add the number of users and scalability analysis tasks in order to stress the system. This is achieved by implementing quotas in the system to monitor volume and scaling of use.
Expected Outcome	An optimal system should perform with minimum response times under normal usage demands and scale appropriately to demands.

Table 5. 7 Test Case 7

6. COMMERCIALIZATION

The "DermaScope AI" introduction represents a breakthrough in taking the diagnosis and treatment of psoriasis in clinical practice to a new level. "DermaScope AI" is a new AI-based diagnostic tool that improves the quality of diagnosis not only day-to-day within a single healthcare facility but also across a great number of healthcare facilities, ensuring the correct treatment pathway and filling important critical gaps in dermatology that continue to hold back patient outcomes. Developed within this project, the innovative medical technology is now set for commercialization in the market of dermatology clinics and hospitals and among health care providers in the field of skin conditions, including psoriasis. Additionally, with the system being incorporated into telemedicine platforms, a wider coverage will be realized in those areas without easy access to advanced dermatological care.

A subscription-based model can then be implemented for the commercialization of "DermaScope AI." The healthcare institutions and health providers would subscribe to it in order to remain connected with diagnostic and management facilities. It would also provide periodic updates, technical support, and access to the latest developments in AI-driven dermatology solutions.

In this way, since precision medicine is gaining momentum, and the general trend in health care is entirely tilted toward personalization, "DermaScope AI" makes room for reshaping the dermatology landscape in an appropriate way. This is further advanced through targeted marketing drives, participation in medical conferences, partnering with key opinion leaders in healthcare, and publishing clinical case studies in order to prove its effectiveness in real life. If "DermaScope AI" can emphasize key benefits accruable to using the technology, it will go on to see its adoption across the healthcare industry and, thus, have an effect on patient care at large.

7. SOFTWARE SPECIFICATIONS

In the development, the "DermaScope AI" project will use a full-scale set of software tools and ensures the robustness, scalability, and security of technologies. Following are the detailed software specifications for the project.

Such specifications in building "DermaScope AI" give assurance of high standards in the three critical areas: performance, security, and usability. With these in place, this tool is made reliable for the diagnosis and management of atopic dermatitis in a clinical setting.

Programming languages	Python	Development of machine learning models and backend logic
	JavaScript	Development of the frontend.
	HTML / CSS	Structuring and styling the web application.
Frameworks	TensorFlow / Keras	Build, train, and deploy the model.
	Flask / Django	Backend development, API creation, and managing server-side operations.
	React.js	Frontend development.
Libraries	OpenCV	Image processing tasks.
	Pandas / Numpy	Data manipulation and analysis.
Database	Firebase	Securely store user profiles, progress reports, and analysis results
APIs	REST API	Communication between the frontend, backend, and the database.
Development environment	Visual Studio Code / PyCharm	Primary IDEs
	GitHub	Version controlling

Table 7. 1 Tools and technologies

8. WORK BREAKDOWN STRUCTURE

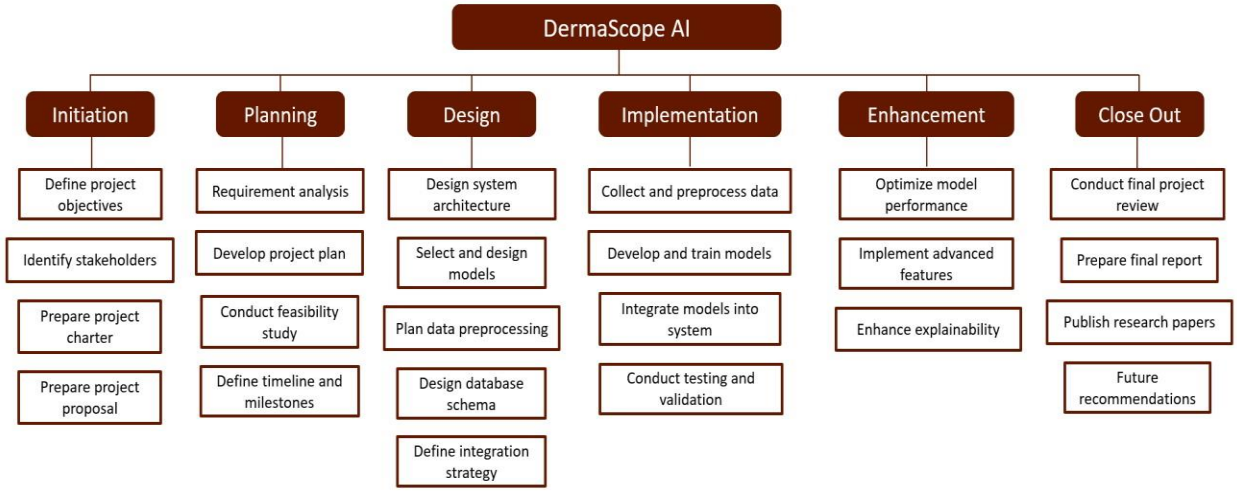

Figure 9 1 Work Breakdown.

Work breakdown structure for "DermaScope AI" is defined through six critical stages: initiation, planning, design, implementation, enhancement, and closure. The initiation phase is where foundational work is done; project objectives would be established, stakeholders would be identified, and certain key documents like the project proposal and charter are prepared. While the planning phase is meant for defining requirements and feasibility studies, it contains the development of a minute project plan with timelines to achieve certain milestones. The design phase deals with system architecture, model methodologies, and data preprocessing strategies. It also defines interface protocols and technical guidelines for the smooth running of the development process.

In the implementation phase, project tasks are executed, covering all activities from data collection and model development to system integration. System testing and validation close this phase. The enhancement phase focuses on fine-tuning the model's performance regarding top-tier functionality and interpretability to make sure that the system comes up to scratch. Lastly, the closure phase comprises a final review, preparation of the report, and research publication; this makes the findings of the project available for later use. Each phase of the overall project has been carefully planned and managed to attain the goals set for it with this structured approach.

9. GANTT CHART

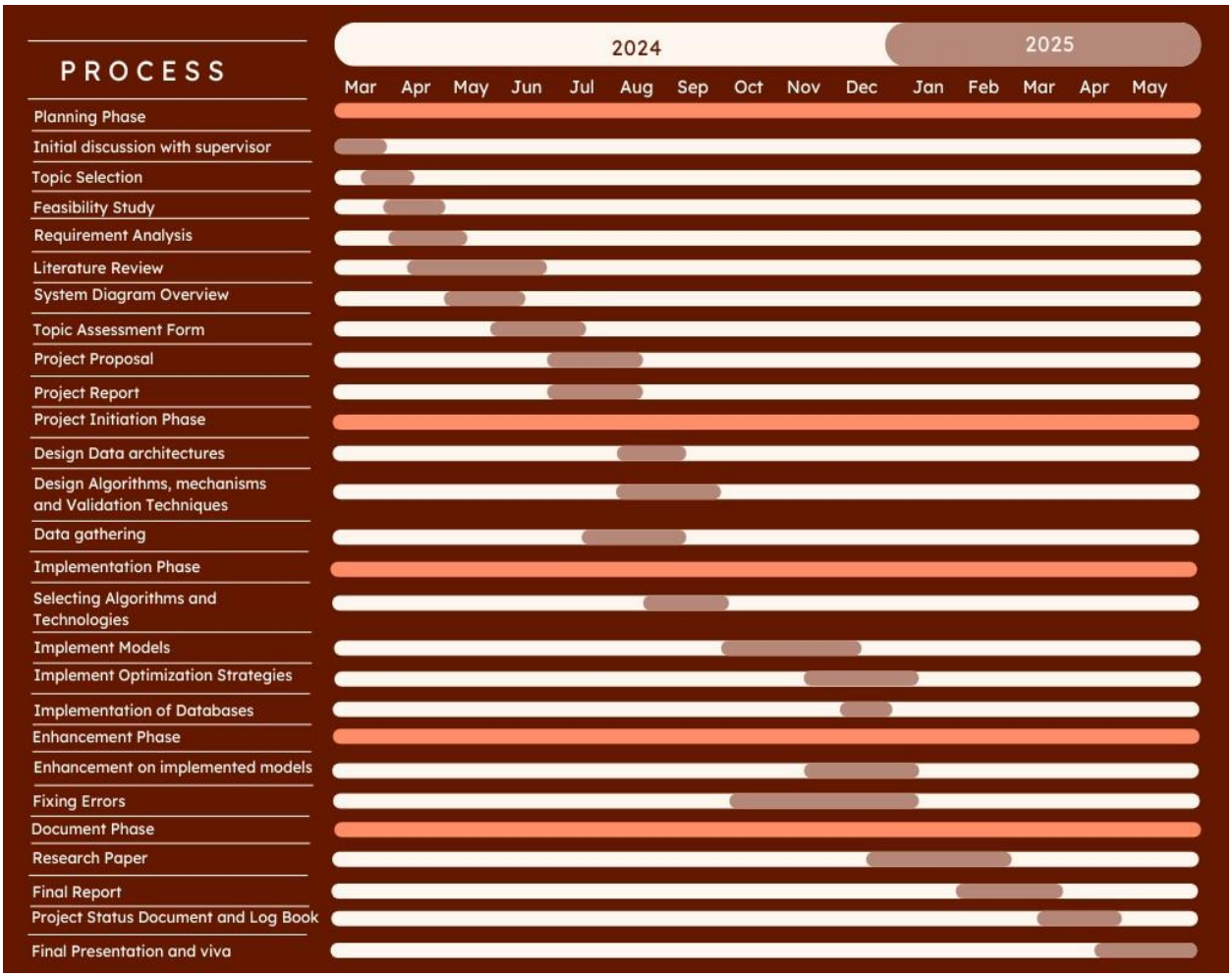

Figure 10. 1 Gantt Chart

The Gantt chart for "DermaScope AI" portrays activities from March 2024 to May 2025 and includes all the important phases and tasks involved in the project life cycle. Starting in March 2024, it featured initial discussions with the supervisor and the selection of a research topic. Following data collection and preparation, the project will enter an implementation phase during the late 2024 through early 2025 period. In this phase, algorithms will be chosen, models will be developed, and optimization strategies will be applied.System enhancement will be the last steps whereby all errors are ironed out, and improvements are done. Research papers are then prepared, and the final report is written. At this juncture, the project is concluded by giving the final presentation and viva in May 2025. The Gantt chart stands important in the fact that it gives a high-level overview to help in keeping all the tasks in sequence and running in a structured manner; this will make the research go through smoothly and as planned.

10. CONCLUSION

Research with "DermaScope AI" into the diagnosis and severity of psoriasis will dramatically revolutionize dermatological care. The innovatively devised machine-learning tool coupled with advanced image analysis presents a solution to the problems of inconsistent and subjective diagnoses of psoriasis. "DermaScope AI" intends to make the process of diagnostic evaluations in the clinic standard, and with that, there comes a precise and detailed evaluation of the severity of psoriasis that is going to upgrade the premises of treatment and patient outcomes.

The project also makes a quantum leap in the application of AI to dermatology by putting the most advanced technology into the hands of clinicians for integration into daily practice. "DermaScope AI" can offer a scalable solution and is thus appropriate for any kind of healthcare setup; this will give further incentive to wide machine learning applications in diagnosing dermatological diagnostics. Although at a development stage, this project provides a breakthrough in the management of psoriasis, which has the potential to improve care to patients all over the world.

11. REFERENCES

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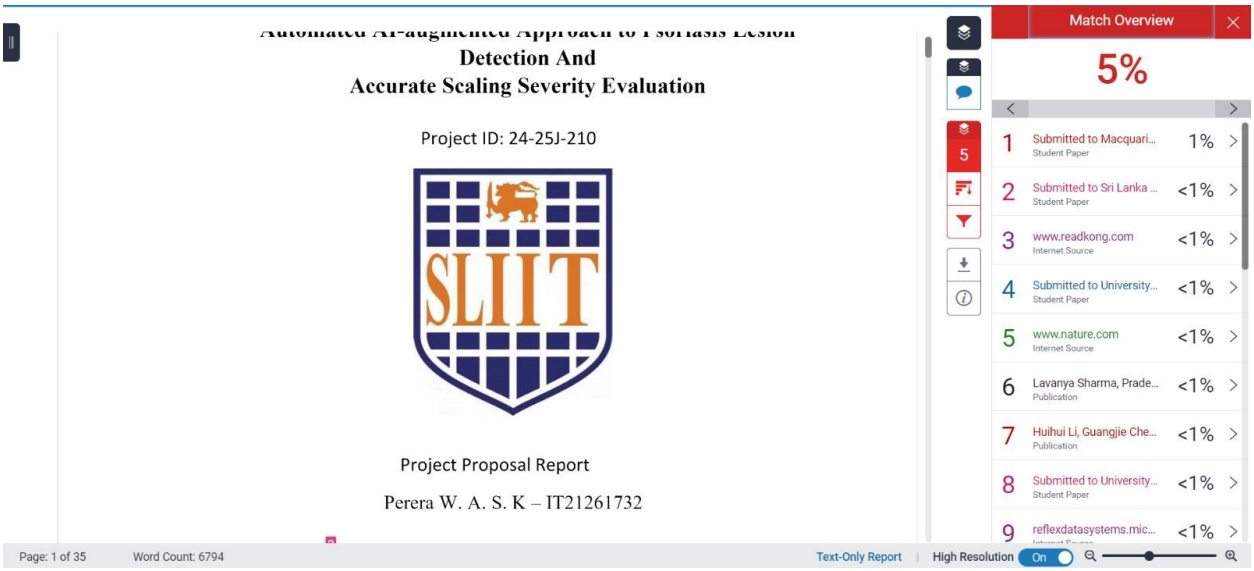
12. APPENDICES

Figure 13. 1 Application Logo



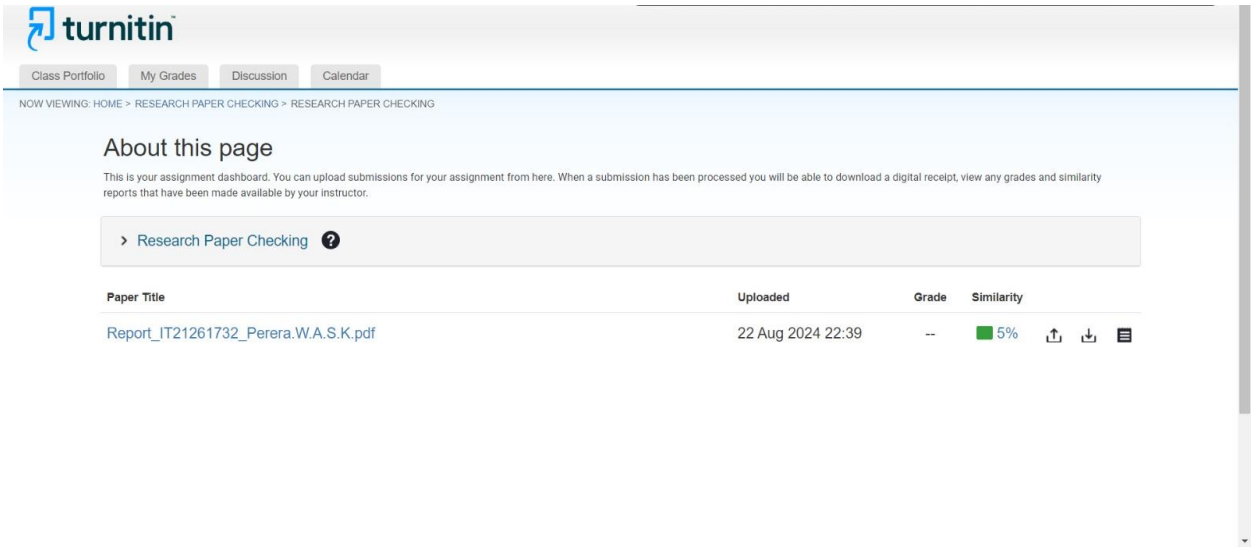


Figure 13. 2 Turnitin Similarity