

PRD v1.0.0

Team Name: *War Room Minions*

Product Name: *DermIQ*

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Problem Statement

A global gap exists in the availability of dermatology services, often leading to delayed or misdiagnosed conditions. Early diagnosis of skin cancer is critical for positive outcomes and survival, but lack of access to screening prevents detection at treatable stages. Without convenient, affordable skin checks, cancers like melanoma can advance to later stages before being caught, greatly reducing treatment options and chances of remission.

Problem Summary: Many individuals worldwide lack timely access to dermatology services, exacerbating skin conditions and affecting overall health.

Solution Summary: We propose an AI-powered dermatology app that streamlines skin condition evaluation, offering tailored treatments and expert referrals, all from one place.

Assumptions

- We will assume in our target market there isn't a direct equivalent to the Health Insurance Portability and Accountability Act (HIPAA) of the U.S. While we will always prioritize user data privacy and security, we will ignore regulatory constraints specific to patient health information.
- We are operating under the presumption that we will be publicly launching our solution. As such, all design, development, and strategic decisions will align with a proactive go-to-market approach.

Business Case

- The mHealth app sector is witnessing robust growth on a per capita basis
 - mHealth apps show strong Global scarcity in dermatology experts has led to prolonged wait times for patients¹.
 - One in five Americans will develop skin cancer in their lifetime².
 - Echoing this trend toward digital health solutions, mHealth Apps Market size is projected to reach USD 861.40 billion in 2030. This growth represents an impressive CAGR of 40.2% during the forecast period, 2023-2030, showing a strong trend towards digital health solutions³.

- User feedback from current dermatologist journey survey (5 people)
 - Patient sentiment: “Finding an available dermatologist can take weeks, if not months.”
 - Doctor sentiment: “There exists a need for immediate screening to prioritize cases and manage patient load.”
 - Both of these sentiments are presumed to hold true on a broader scale than initially observed.

Target Segment

Focusing on individuals residing in areas with constrained dermatological access, characterized by:

1. **Proximity concerns:** A physical distance exceeding 40 miles to the nearest healthcare provider.
2. **Financial hurdles:** Elevated service costs.
3. **Quality constraints:** Subpar quality of available services.

We will start with the target segment because:

1. **These roles have a robust *problem fit*.** The challenges faced by this group align strongly with our solution, addressing multiple pain points simultaneously.
2. **Impact will be the greatest.** Intervening in these areas can bring about the most significant change. Improved access and quality of dermatological care can drastically alter health outcomes, potentially reducing the incidence of advanced skin conditions and improving the overall quality of life for these individuals.

Defining Success

North Star Metric: Number of Early-stage Detrimental Conditions Detected.

Success of this project over our scoped timeline would be **1** person detecting an early stage detrimental condition.

Pain Points

We initially want to discover and validate that our solution and problems are realistic, which positively moves the success criteria.

Here are the pain points to address in MVP:

Pain Points to address	Hypothesis on Impact
Lack of timely access to dermatologists.	Preliminary diagnoses will reduce the need to frequent the dermatologist for basic consultation.
Inaccurate self-diagnosis or reliance on generic online information (such as Web MD).	Novel approach of collecting multiple forms of patient data will make diagnosis more reliable.
High costs associated with dermatology visits.	Would reduce initial consultation costs, attracting cost-conscious users

MVP Solution Alignment

Features

ID	Use Case	Actor	Precondition	Trigger	Success Scenario	Link
Feature 1: User Setup						
1.1	Standard user login via Google OAuth	User	The user has an gmail account and is on the login page of the app.	The user wants to access their account to use our app's features.	A user with valid credentials can successfully login and is redirected to the app's homepage. A user with invalid credentials is unable to login.	https://github.com/Skin-Oracle/DermIQ/issues/20
1.2	Metadata Collection Form	User	It is the first time the user is logging on	The user is logging on for the first time	System presents a guided form, prompting the user to input relevant metadata such as age, sex, medical history, and other specified data fields.	https://github.com/Skin-Oracle/DermIQ/issues/21
1.3	Metadata Storing	System	The user has filled out the metadata collection form	The user has click the submit button on the form	System stores the metadata securely, linking it to the user's account for future reference. The user is directed to the home page.	https://github.com/Skin-Oracle/DermIQ/issues/22
Feature 2: Deep Learning Skin Condition Analysis						
2.1	Uploading a skin photo for analysis	User	The user is on the homepage of the app	User wants to check a skin area for potential skin conditions	A photo gets uploaded to the app's analysis system. A confirmation message appears, indicating that the photo has been successfully uploaded and is awaiting analysis.	https://github.com/Skin-Oracle/DermIQ/issues/7
2.2	Creating a diagnoses	System	User has uploaded a skin photo and their metadata is available.	System has a new skin photo for analysis.	System retrieves the user's metadata + photo and runs it through the DLS. The primary output provides the relative likelihood categories.	https://github.com/Skin-Oracle/DermIQ/issues/18

2.3	Saving the diagnoses		The system has completed analysis of the user's skin photograph.	Diagnosis results are ready to be shared with the user.	System saves the diagnosis results securely in the user's history, and notifies them the DLS results were saved.	https://github.com/Skin-Oracle/DermIQ/issues/19
Feature 3: Structured NLP Feedback on DLS Analysis						
3.1	Extracting DLS Analysis Results	System	The system has completed the skin condition analysis using the DLS.	Analysis results from the DLS are ready for interpretation.	System extracts the primary and secondary outputs of the DLS analysis. System formats the results in a manner suitable for prompt engineering, ensuring all relevant data points are captured.	https://github.com/Skin-Oracle/DermIQ/issues/23
3.2	Prompt Engineering to generate an NLP Analysis		The system has extracted and formatted the DLS analysis results.	System needs to translate the DLS results into a structured and comprehensible feedback for the user.	System injects the DLS analysis results into a pre-designed NLP prompt. The NLP model interprets the prompt and formulates a coherent, structured, and user-friendly response.	https://github.com/Skin-Oracle/DermIQ/issues/24
3.3	Presenting NLP feedback to user		The system has obtained the structured feedback from the NLP model.	System is ready to share the feedback with the user.	System presents the NLP-generated feedback to the user in a clear, user-friendly format.	https://github.com/Skin-Oracle/DermIQ/issues/25
3.4	Chat log interaction	User	The system has presented the NLP-generated feedback to the user.	The user has further questions or concerns for the feedback presented.	User initiates a chat interaction within the application and system formulates a response. The chat log keeps a history of the interaction for the user to reference back to or continue the conversation.	https://github.com/Skin-Oracle/DermIQ/issues/26
Feature 4: Connecting the User with a Skin Specialist						
4.1	User Expresses Desire for Specialist Consultation	User	The user has received the NLP-generated feedback and wishes for further professional insight.	User selects the option to connect with a skin specialist. (button to the right of the chat log.)	User navigates to a section dedicated to specialist consultations. The system provides options to search for specialists based on the DLS output.	

4.2	Booking an Appointment with a Specialist		User has clicked on the “connect with a specialist” button.	User chooses to book an appointment.	TBD	
4.3	TBD	TBD	TBD	TBD	TBD	

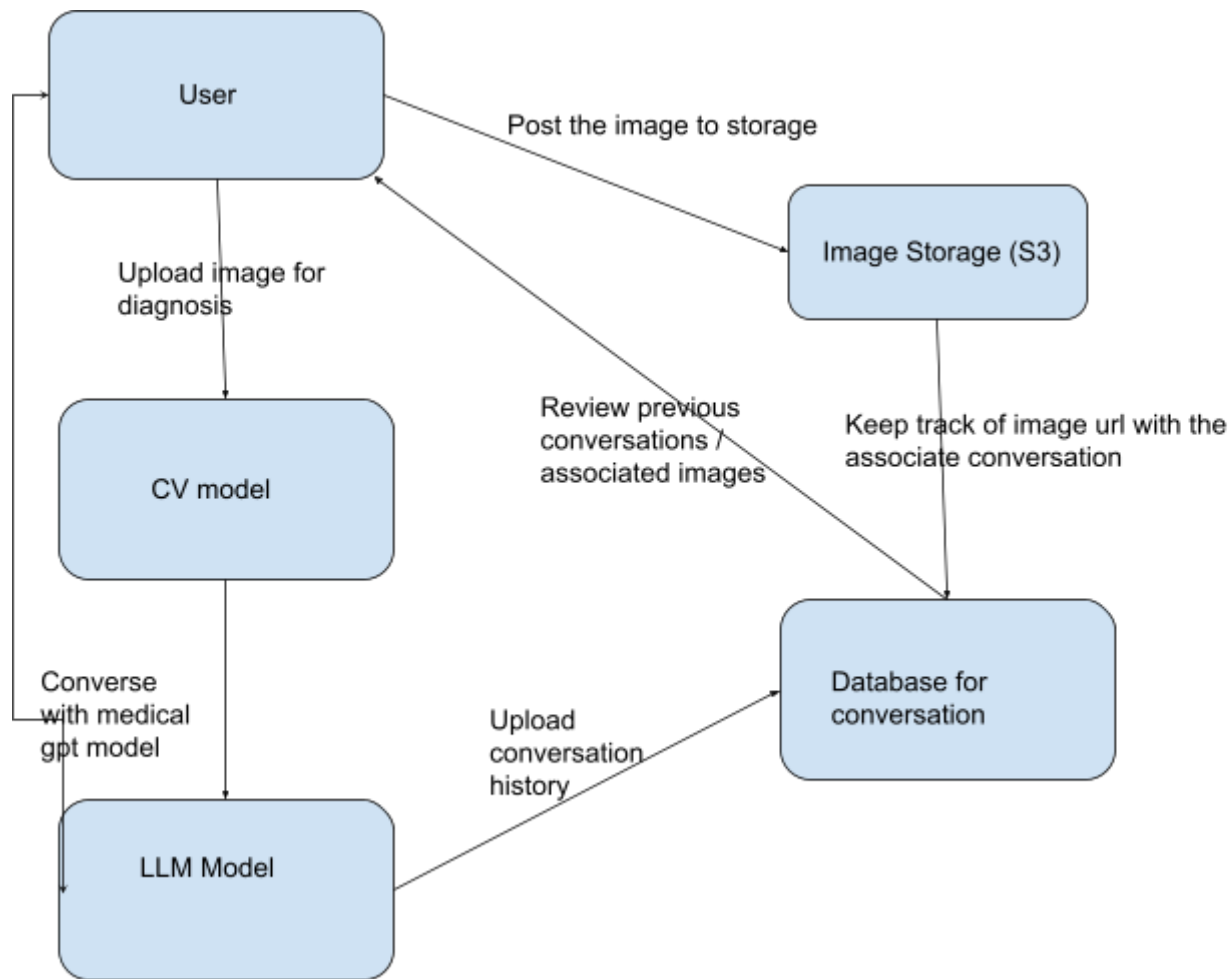
Error Scenarios

TBD

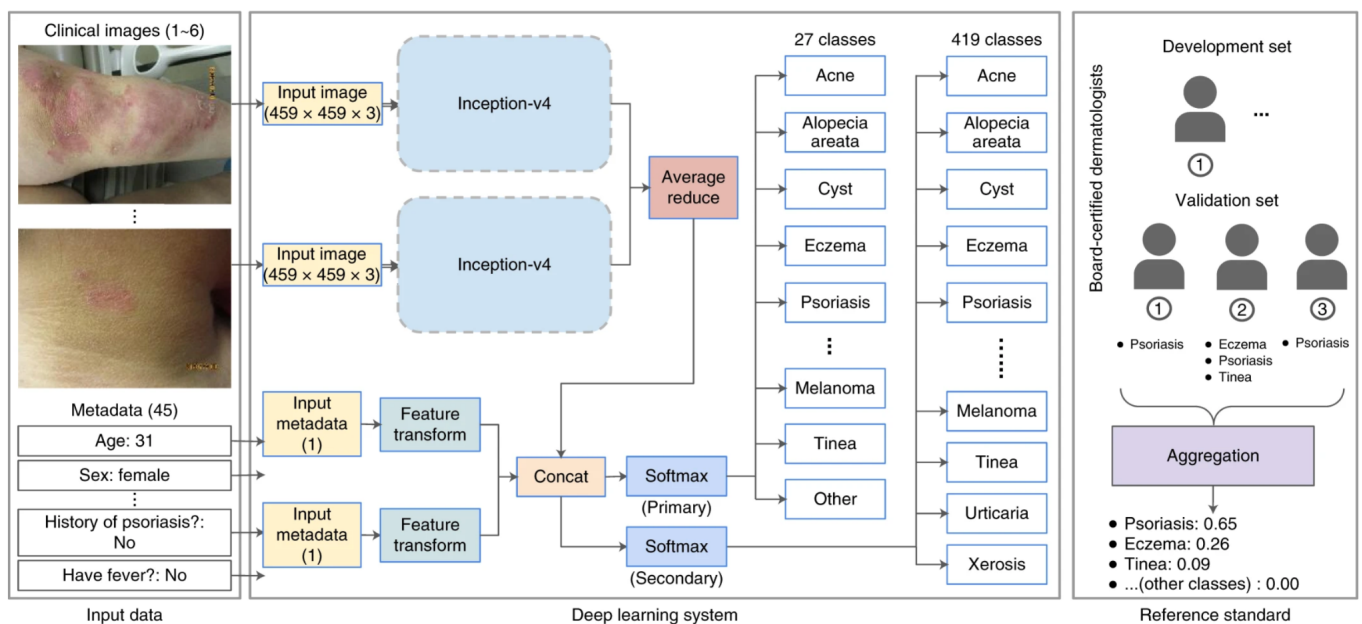
Risks

- The system might face scalability issues with an increasing volume of data managed.
- Data privacy concerns related to uploading personal medical images
- The system could produce false positives, which is lower risk, but also false negatives which could lead to mistrust or potential health risks.
 - This risk means our likeness should be represented as a gradient to the end user. We should have disclaimers in every NLP generated report

High Level Architecture



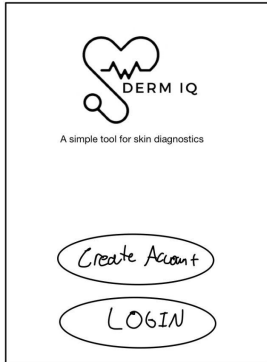
The CV Model



From ⁴

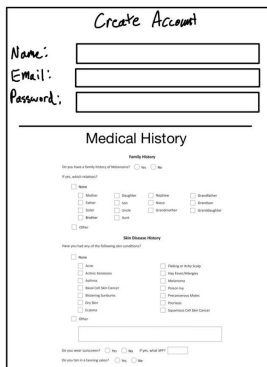
Low Fidelity Mockup

Start
(log-in)
page

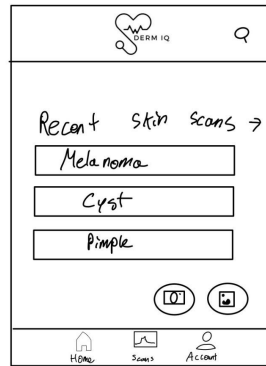


1

Medical
history
page

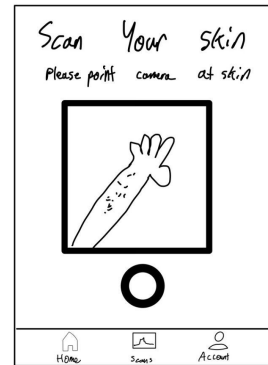


Home
page



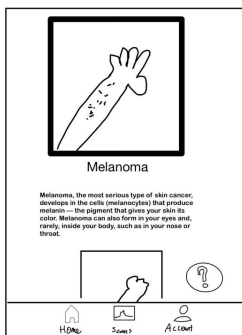
3

Scan
page



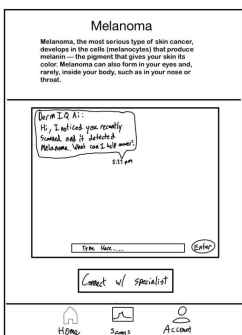
4

Result Page



5

Chat log



6

Other Metrics to Consider

Metric Name	Description
Our North Star	see defining success section
User Follow-up Rate	Percentage of users who, after receiving a notification of a potential detrimental condition, follow up in the app or system to learn more or take the next step
Time to Treatment Saved	The time delta between diagnoses and treatment for detrimental skin conditions
Net promoter score	Measures user satisfaction and the likelihood of users recommending the app to friends, family, or colleagues (loyalty).
False positive rate	How many times the system might incorrectly identify a condition as detrimental when it's benign

MVP Release

Phase	Goal	Success Criteria	Duration
Internal testing	Validate the basic functionality, identify bugs with dogfooding, and	No critical bugs, all features work as intended, and feedback is collected, prioritized, and resolved.	12 weeks

	ensure the system's stability with the new features.		
Focus group testing	Collect feedback from 50 target users on usability and functionality.	Positive feedback on usability, functionality, and qualitative surveys.	
Beta test	Release to target users. Collect metrics and system performance.	<ol style="list-style-type: none"> 1. A positive outcome for all metrics (see other Metrics To Consider) 2. System scales appropriately with increased load. 	6 weeks
Public Release	Release to all target users and evaluate defined metrics.		Ongoing
Post Release	Continuously monitor the user engagement metrics and collect feedback on the features based on real-world usage.	Sustained engagement metrics collect feedback for post-MVP and positive responses in NPS survey	

THIS indicates a duration beyond the scope of the CS189A/B capstone and is not possible with legal considerations.

Appendix

Additional Notes

We intend to iterate and develop this document and our product specification as development continues.

Technologies Employed

- Frontend + Mobile
 - Expo
 - React Native
- Backend
 - FastAPI
- Deep Learning System
 - Tensorflow
 - Huggingface
- Cloud & Server Infrastructure
 - AWS EC2
 - AWS S3
 - AWS Amplify
- Authorization
 - Google OAuth
- Data Security
 - AWS IAM
- Virtual Communication
 - Twilio

Works Cited

- 1) <https://www.cbc.ca/radio/whitecoat/wait-times-dermatology-back-logs-avantderm-1.7006685>
- 2) <https://www.aad.org/media/stats-skin-cancer>.
- 3) <https://www.globenewswire.com/news-release/2023/09/14/2743083/0/en/mHealth-Apps-Market-Size-to-Surpass-USD-861-40-billion-by-2030-exhibiting-a-CAGR-of-40-2.html#:~:text=Pune%2C%20India%2C%20Sept.,40.2%25%20during%20the%20forecast%20period>
- 4) <https://www.nature.com/articles/s41591-020-0842-3#Sec2>