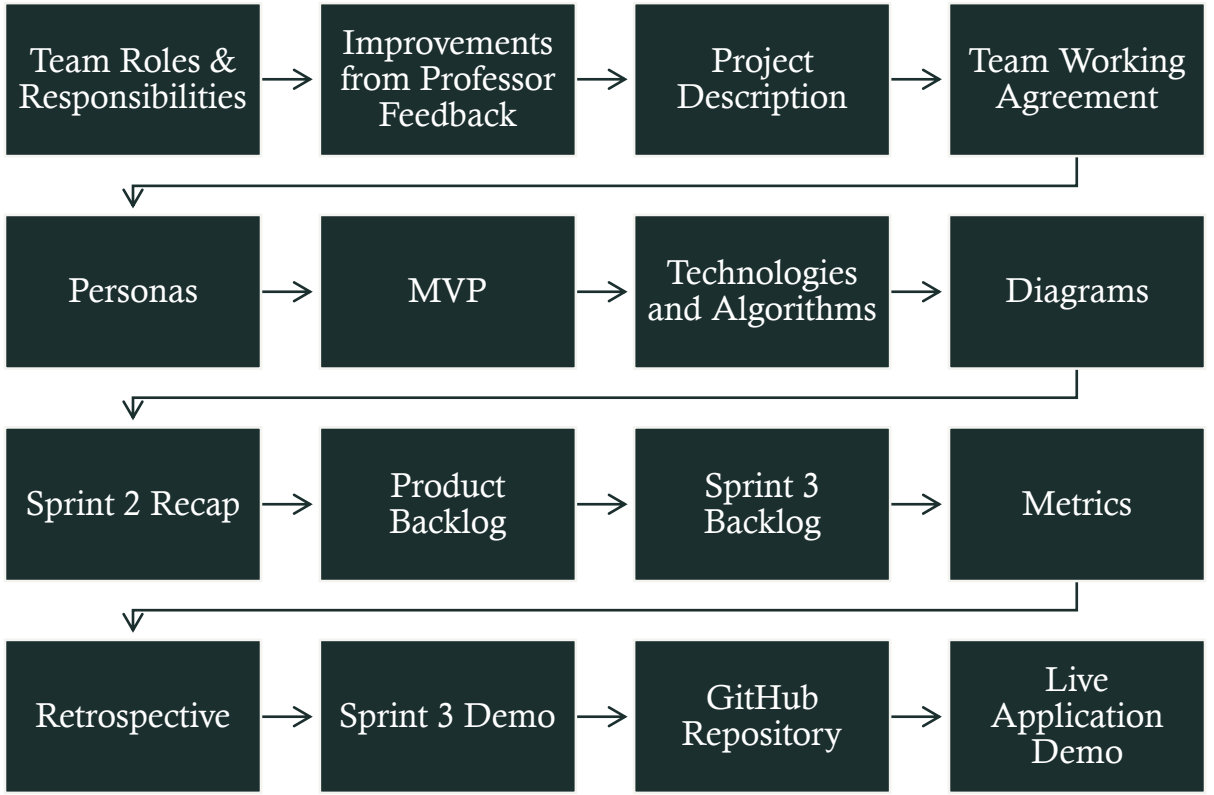
IMAGEMEDIX

By Team 5 The Minions

Sprint 3

AGENDA


Team Roles & Responsibilities
Improvements from Professor Feedback
Project Description
Team Working Agreement
Personas
MVP
Technologies and Algorithms
Diagrams
Sprint 2 Recap
Product Backlog
Sprint 3 Backlog
Metrics
Retrospective
Sprint 3 Demo
GitHub Repository
Live Application Demo

TEAM MEMBERS – MACHINE LEARNING

Vaishnavi Chandrasekar

Christiana Heden Kothuru

Deepika Mothkuri

Greeshma Kenche

TEAM MEMBERS – BACKEND

Yucong Hu

Lingyi Luan

TEAM MEMBERS – FRONTEND

Yash Bhanubhai Panchani

Rameez Ahmed Shaik

IMPROVEMENTS

- Conduct proper sprint planning before starting the sprint.
- Submit the burndown chart in the correct format on the wiki page.
- Add a recap summary of the previous sprint in the presentation.
- Correct wording issues in user stories (e.g., "Appealing landing" in US-01).
- Add an average line to the team velocity chart.
- Include API slides in the sprint presentation.
- Add every improvement point mentioned in the professor's feedback to the next sprint PPT slides.

PROBLEM STATEMENT

- Many healthcare facilities face challenges in diagnosing pneumonia and brain tumors quickly and accurately, often due to limited access to specialists and high workloads. Current solutions typically require separate systems to analyze different types of medical images. This leads to inefficiencies in diagnosis and delays in providing critical care. There is a need for an automated system that can efficiently classify medical images and provide preliminary diagnoses to support healthcare professionals in making timely decisions.

PROJECT DESCRIPTION

Project Name:	**ImageMedix**
Team:	The Minions
Project Description:	For **healthcare professionals** who **need to diagnose pneumonia and brain tumors efficiently**, the **Dual-Stage Medical Image Classification System** is a **two-step image analysis tool** that **automatically classifies medical images as lung X-rays or brain MRIs and provides a diagnosis**. Unlike **separate diagnostic systems that handle only one type of image**, our application **streamlines diagnosis by analyzing both image types within a single system, saving time and improving diagnostic accuracy**.
Benefit Outcomes:	• **Faster Diagnosis:** Automates image classification and diagnosis, reducing the time needed for manual analysis. • **Improved Accuracy:** Provides consistent and reliable preliminary diagnoses, minimizing human errors. • **Resource Optimization:** Assists medical facilities with limited access to specialists, enabling quicker and more informed decisions.
Github Link:	https://github.com/htmw/2025S-The-Minions/wiki

Team Working Agreement - The Minions

1. **Responsibilities:**
   - Each member is responsible for completing their tasks on time and maintaining the quality of their work.
   - Members must inform the group if they encounter any blockers that could delay the project.
2. **Communication:**
   - We will use common platforms like WhatsApp, Discord, or email for quick communication and updates.
   - Weekly meetings will be scheduled to review progress and discuss tasks.
3. **Meeting Attendance:**
   - All members are expected to attend scheduled meetings unless there are unavoidable circumstances.
   - Absentees should catch up on meeting notes to stay informed.
4. **Collaboration:**
   - All members are expected to contribute to their assigned roles (frontend, backend, machine learning).
   - Teamwork will be encouraged by helping each other when someone faces challenges or needs feedback.
5. **Deliverables:**
   - Each sprint will include presentations and documentation updates as required.
   - Work will be reviewed by peers to ensure quality before submission.
6. **Code and Documentation:**
   - Code should follow basic best practices for readability and functionality.
   - Documentation (tech papers, wikis) will be updated regularly by the respective team members.
7. **Decision-Making:**
   - Major decisions will be made collectively during meetings.
   - In case of disagreements, majority voting will determine the final decision.
8. **Conflict Resolution:**
   - Conflicts will be discussed openly during meetings, with all members encouraged to share their views.
   - If unresolved, the issue will be escalated to the **professor** for guidance.

Team Members
Chandrasekar Vaishnavi
Hu Yucong
Kenche Greeshma
Kothuru Christiana Heden
Luan Lingyi
Mothkuri Deepika
Panchani Yash Bhanubhai
Shaik Rameez Ahmed

TEAM WORKING AGREEMENT

PERSONAS

Dr. James Patel (Radiologist)

- **Age:** 45
- **Occupation:** Senior Radiologist at a metropolitan hospital
- **Background:** Over 20 years of experience in diagnostic imaging, specializing in lung and brain disorders. Known for mentoring junior doctors in radiology.
- **Goals:** To reduce the time spent analyzing large volumes of medical images while maintaining high diagnostic accuracy.
- **Challenges:** Overloaded with image analysis requests and administrative duties, leading to delays in diagnosis and increased stress.
- **How the System Helps:** Automates initial image classification and diagnosis, allowing Dr. Patel to prioritize critical and complex cases efficiently.

PERSONAS

Dr. Suzen Chen (General Practitioner)

- **Age:** 38
- **Occupation:** General Practitioner at a rural healthcare clinic
- **Background:** Has served in underserved regions for over a decade, often working without the immediate support of medical specialists. Committed to improving healthcare access in remote areas.
- **Goals:** To provide fast, accurate diagnoses for patients despite limited access to specialists.
- **Challenges:** She m ust handle a wide variety of cases on her own, making it difficult to diagnose complex conditions such as brain tumors and pneumonia accurately.
- **How the System Helps:** The AI system offers reliable preliminary diagnoses for brain and lung conditions, helping Dr. Chen make timely and informed treatment decisions.

PERSONAS

Dr. Raj Aryan (Healthcare Director)

- **Age:** 50
- **Occupation:** Director of a large hospital chain in India
- **Background:** A visionary healthcare leader who has overseen the expansion of multiple hospitals across the country. Inspired by challenges faced in rural and semi-urban healthcare delivery.
- **Goals:** To improve diagnostic efficiency, reduce patient wait times, and implement AI-based healthcare solutions across all branches.
- **Challenges:** Delays in diagnosis caused by a shortage of skilled radiologists, leading to overcrowded hospitals and slow patient care.
- **How the System Helps:** The automated system accelerates diagnosis processes across multiple hospitals, enabling faster and more efficient patient care, particularly in resource-constrained facilities.

MVP

Core Features	
Two-Step Image Analysis	Classifies medical images as either lung X-rays or brain MRIs.
	Provides automated diagnosis for pneumonia and brain tumors.
Automated Diagnosis System	Uses machine learning models to detect abnormalities.
	Outputs a diagnostic result with confidence scores.
Unified Platform	Supports both lung X-rays and brain MRIs in a single system.
	Eliminates the need for separate diagnostic tools.
User-Friendly Interface	Simple image upload functionality for healthcare professionals.
	Displays classification results and diagnosis in an intuitive format.
Performance Metrics	Ensures **accuracy** through AI-driven predictions.
	Optimized for **faster diagnosis** to reduce manual analysis time.
Basic Report Generation	Generates a preliminary diagnostic report.
	Includes confidence levels and possible next steps for further medical review.

TECHNOLOGIES

Frontend: React.js

- Used to create a user-friendly interface that allows healthcare professionals to upload and view medical images easily.

Backend: Node.js (API), Flask (Model Inference), MongoDB

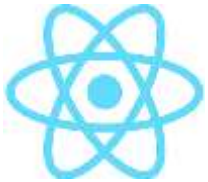
- **Node.js:** Handles API requests and manages communication between the frontend and backend services.
- **Flask:** Supports model inference by running machine learning models for image classification and diagnosis.
- **MongoDB:** Stores user data, images, and diagnostic results, enabling secure and scalable data management.

Machine Learning:

- Built using **PyTorch** and trained on datasets for lung X-rays and brain MRIs.

Cloud Infrastructure:

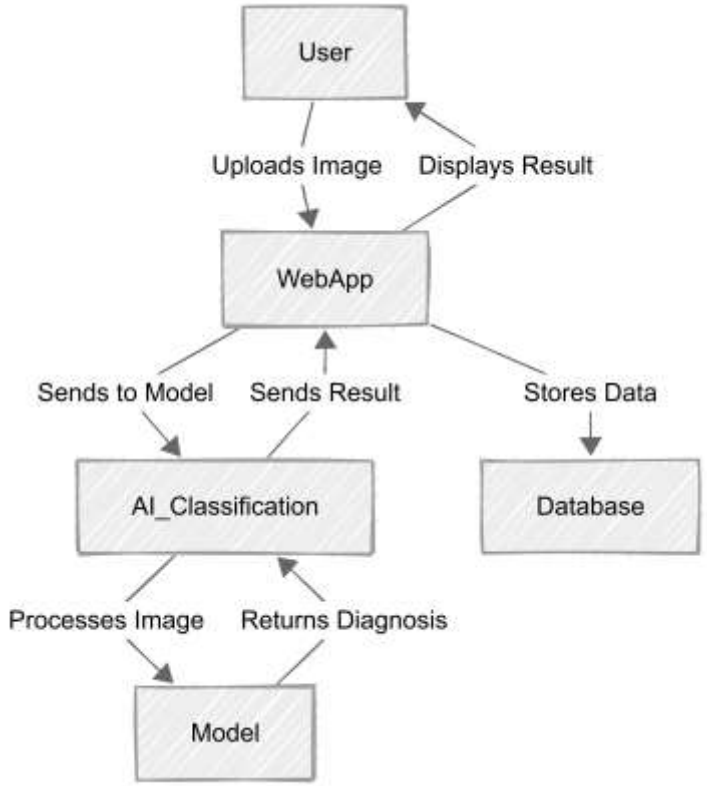
- Deployed using **AWS.**

ALGORITHMS

The system uses two core algorithms based on pre-trained deep learning models. A **ResNet** model, fine-tuned on a dataset of medical images, is used to classify whether the uploaded image is a lung X-ray or a brain MRI. Depending on the classification result, the system proceeds to a second stage. For lung X-rays, a **fine-tuned EfficientNet** model detects and classifies pneumonia into normal, viral, or bacterial categories by analyzing lung patterns. For brain MRIs, the same EfficientNet model is used to detect and classify brain tumors into glioma, meningioma, or no tumor by identifying abnormalities in brain structures. These models provide high accuracy and efficiency, ensuring reliable diagnoses for both image types.

ARCHITECTURE DIAGRAM



CONTEXT DIAGRAM

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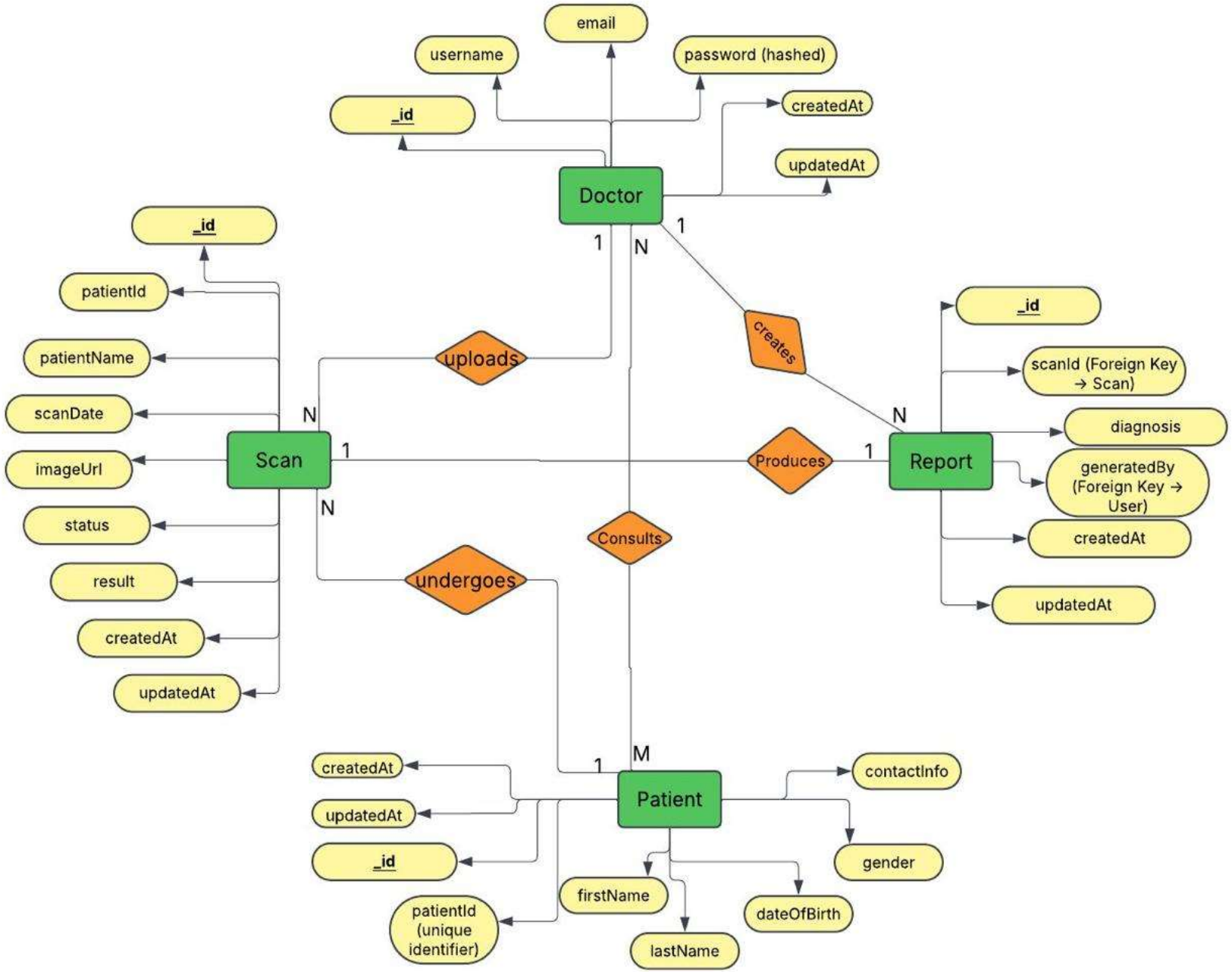
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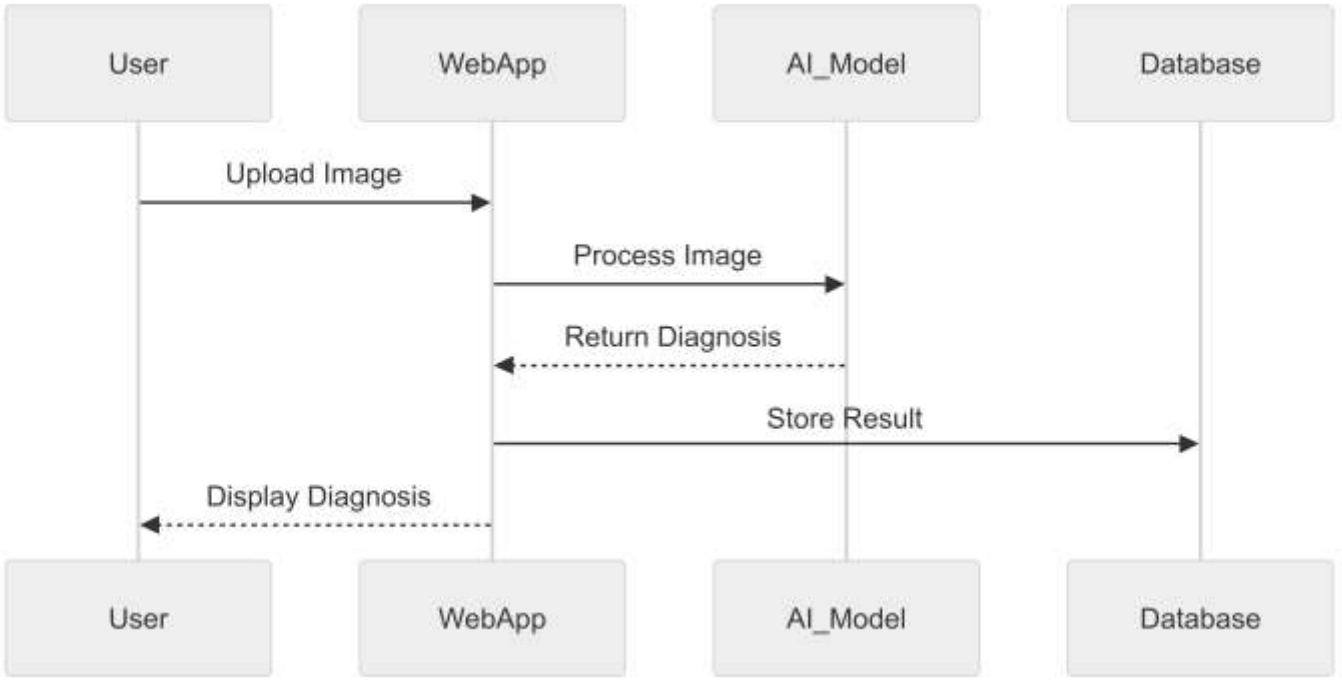
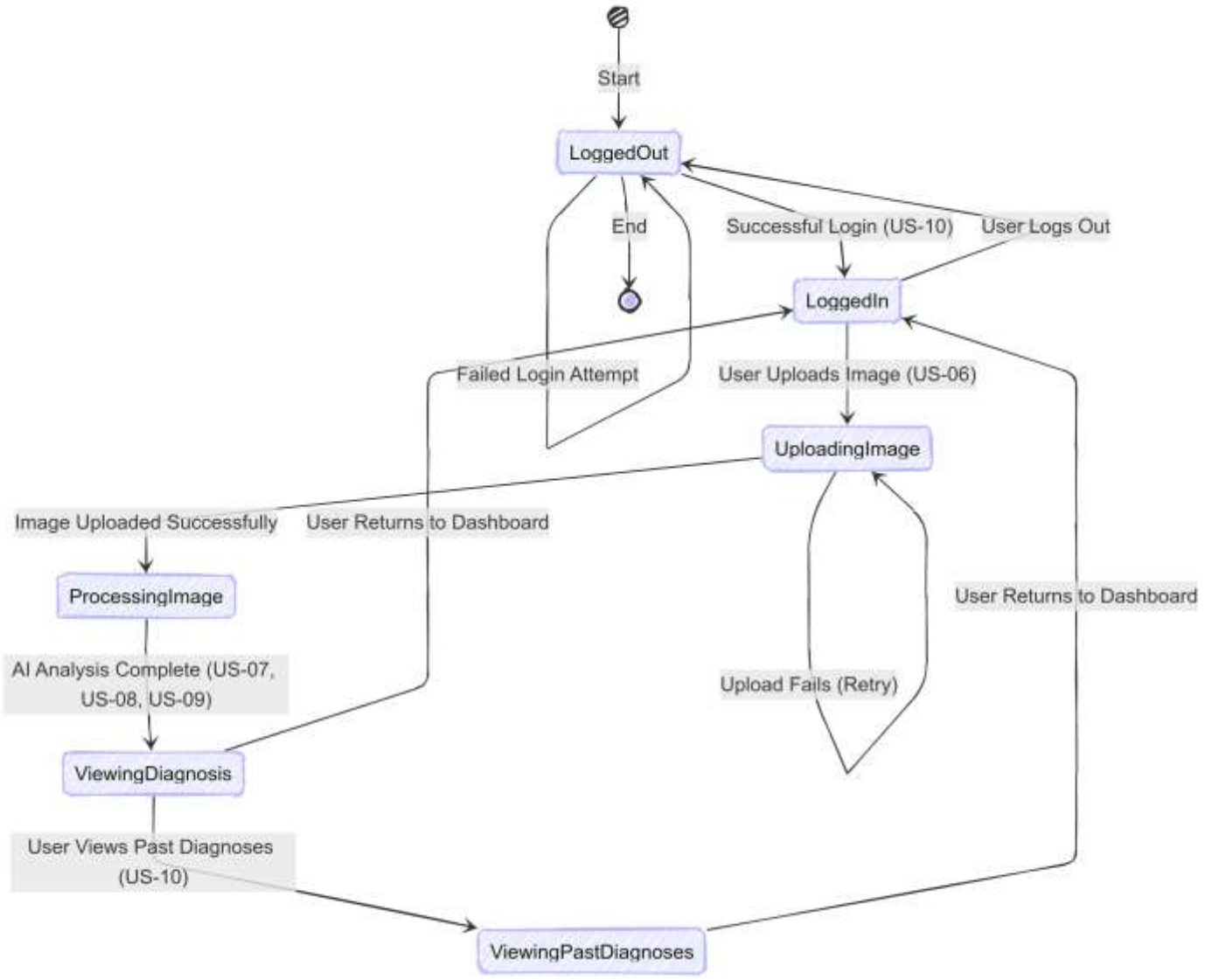
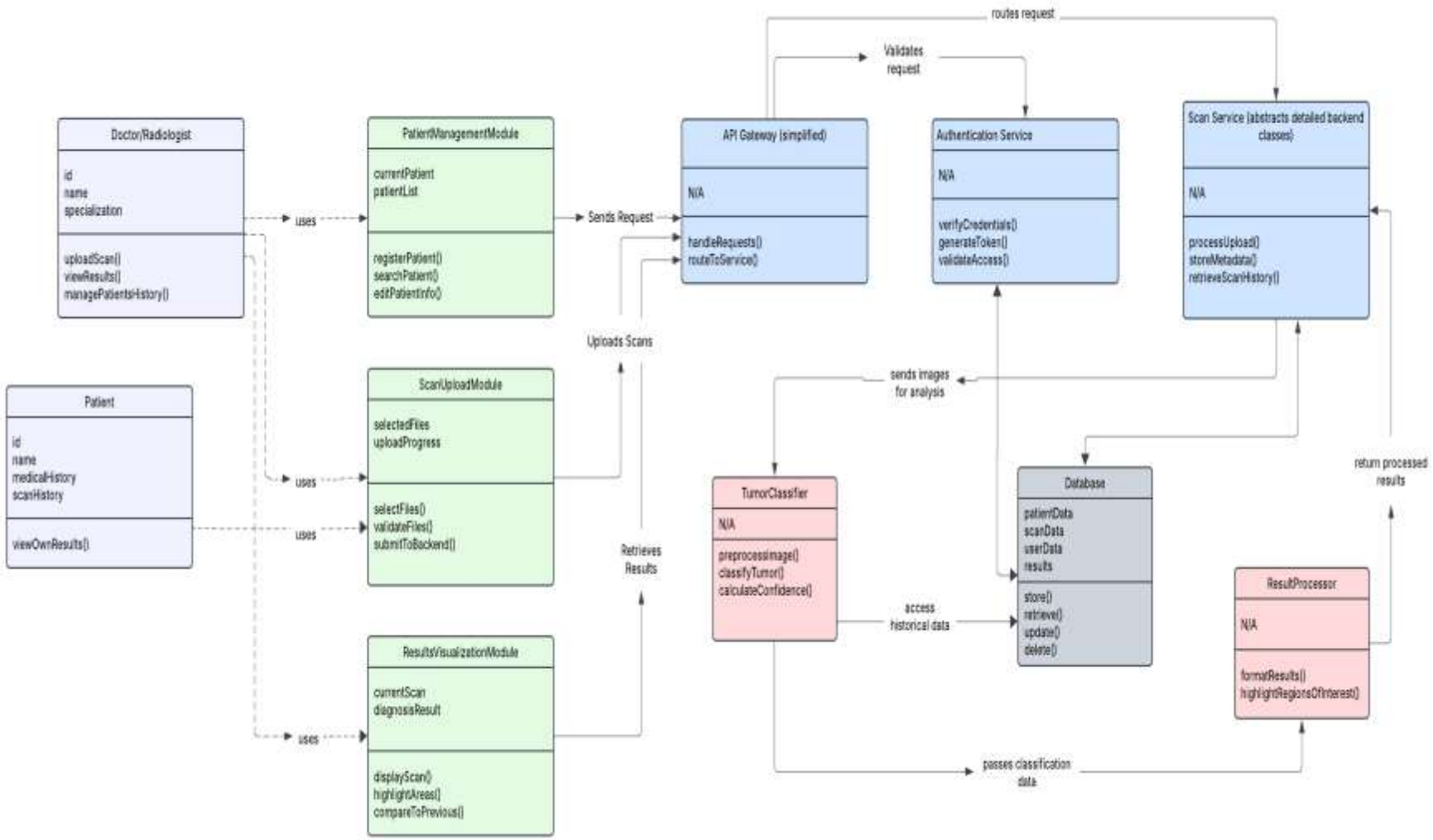
SEQUENCE DIAGRAM





STATE DIAGRAM

CLASS DIAGRAM



SPRINT 2 RECAP

In Sprint 2, we implemented image upload, automatic AI diagnosis, and results storage features. User authentication and backend API integration were completed. Carried-over stories from Sprint 1, like static UI and simple upload, were finalized. Sprint 2 successfully delivered critical system functionality, moving closer to a fully operational platform.

PRODUCT BACKLOG

ID	Sprint	User Story / Technical Story (TS)	Acceptance Criteria	Story Points (SP)
US-01	Sprint 1	As a visitor, I want a landing page so I can understand the system at a glance.	- Page includes: header, project description, call-to-action button, and demo preview section. - Styling is consistent and visually engaging. - Page renders correctly on desktop and mobile browsers.	3
US-02	Sprint 1	As a doctor/patient, I want an intuitive navigation menu so I can easily access different sections of the website.	- Navbar includes working links to: Home, Upload, Results, and About. - Navbar is fixed and responsive on all devices.	2
US-03	Sprint 1	As a patient, I want a simple image upload interface so I can easily upload my medical images.	- Upload button allows file selection. - Image preview shown after selection. - Frontend only; no backend submission required.	3
US-04	Sprint 1	As a mobile user, I want a responsive design so I can access the site on mobile devices.	- All pages adjust layout for screen sizes (mobile, tablet, desktop). - No overlapping or broken UI components.	2

PRODUCT BACKLOG

ID	Sprint	User Story / Technical Story (TS)	Acceptance Criteria	Story Points (SP)
US-05	Sprint 1	As a patient, I want to see a static results page so I understand how the diagnosis will be displayed.	- Results page includes placeholders for image, diagnosis summary, and doctor notes. - Static dummy data is displayed correctly.	2
TS-01	Sprint 1	As a developer, I want to set up the frontend framework and project structure so that the development is scalable.	- React project is initialized. - Routing for all planned pages is configured. - Folder structure follows best practices.	2
TS-02	Sprint 1	As a developer, I want to implement UI components for buttons, inputs, and cards.	- Reusable styled components (Button, Input, Card) are created. - Components are tested and documented.	3
US-06	Sprint 2	As a doctor, I want to upload an image and get it processed so I can receive a diagnosis.	- User can select and upload images. - Image is stored in the backend database. - Upload confirmation shown.	5

PRODUCT BACKLOG

ID	Sprint	User Story / Technical Story (TS)	Acceptance Criteria	Story Points (SP)
US-07	Sprint 2	As a doctor, I want my medical image to be analyzed automatically so I can receive a diagnosis.	- Uploaded image is sent to AI model. - Model returns a classification (e.g., Normal, Pneumonia, Tumor). - Backend handles processing.	8
US-08	Sprint 2	As a patient, I want to see my diagnosis displayed clearly so I can understand the results.	- Diagnosis result is shown on a result page. - Diagnosis includes label and confidence score. - UI is readable and visually clean.	3
US-09	Sprint 2	As a patient, I want my diagnosis results to be stored so I can access them later.	- Diagnosis results and images are saved in the database. - Patient ID is linked to diagnosis entries.	5
US-10	Sprint 2	As a patient, I want basic account authentication so I can securely log in and access my past diagnoses.	- Users can register and log in. - Passwords are encrypted. - Auth token/session is implemented. - Authenticated users can access their data.	5

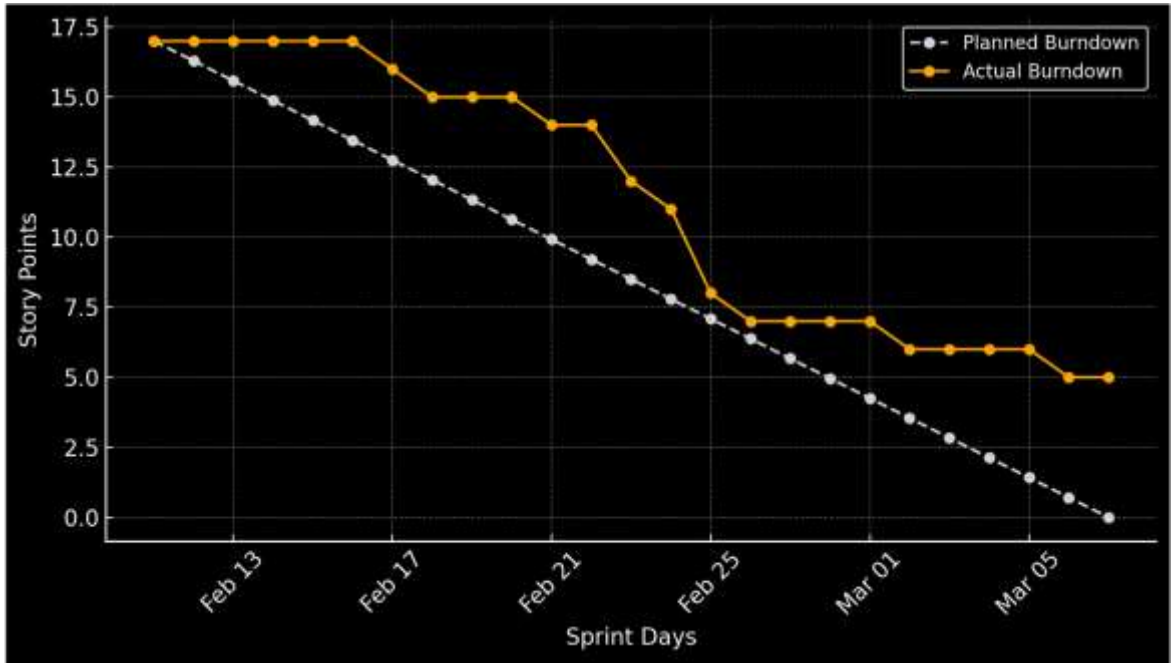
PRODUCT BACKLOG

ID	Sprint	User Story / Technical Story (TS)	Acceptance Criteria	Story Points (SP)
TS-03	Sprint 2	As a developer, I want to set up a backend API for image processing so that the system can analyze uploaded images efficiently.	- Flask/Django API accepts image uploads. - Routes for upload and prediction exist. - Image is processed and response returned.	8
TS-04	Sprint 2	As a developer, I want to connect the frontend with the backend API so that data flows seamlessly between the client and server.	- Frontend sends requests to backend API. - Data from API is shown on the frontend. - Error states are handled.	5
US-11	Sprint 3	As a patient, I want my diagnosis report to be downloadable so I can share it with doctors.	- Diagnosis results can be exported as a downloadable PDF. - PDF includes patient info, image, diagnosis, and date.	5
US-12	Sprint 3	As a patient, I want a faster processing time so I don't have to wait long for results.	- AI model processes images in under 2 seconds. - Response time tested on at least 10 different inputs.	8

PRODUCT BACKLOG

ID	Sprint	User Story / Technical Story (TS)	Acceptance Criteria	Story Points (SP)
US-13	Sprint 3	As a doctor, patient, or admin, I want role-based access (doctor, patient, admin) so I can have personalized features.	- Users have roles (doctor, patient, admin). - Role-based dashboards and permissions implemented. - Unauthorized access blocked.	5
US-14	Sprint 3	As a patient, I want the system to be highly accurate so I can trust the diagnosis.	- AI model reaches ≥90% accuracy on validation set. - Accuracy is documented and verified through testing.	8
US-15	Sprint 3	As a patient, I want to access my health data quickly so I can get the information I need without delays.	- The system delivers data with minimal load time. - Optimized backend queries and efficient frontend rendering. - Performance tested across common devices and networks.	5
TS-05	Sprint 3	As a developer, I want to implement logging and error handling so that system failures can be monitored and resolved efficiently.	- System logs backend/frontend errors. - Admin receives error notifications or logs are stored for debugging. - Critical failures are caught and don't crash the app.	3

SPRINT SUMMARY



- **Sprint 1 Completed User Stories/Tasks:**
  - US-01: As a visitor, I want a landing page so I can understand the system at a glance. (3 SP)
  - US-02: As a doctor/patient, I want an intuitive navigation menu to access different sections. (2 SP)
  - US-03: As a patient, I want a simple image upload interface. (3 SP)
  - US-04: As a mobile user, I want a responsive design. (2 SP)
  - US-05: As a patient, I want to see a static results page. (2 SP)
  - TS-01: As a developer, I want to set up the frontend framework. (2 SP)
  - TS-02: As a developer, I want to implement reusable UI components. (3 SP)

SPRINT SUMMARY

- **Sprint 2 Completed User Stories/Tasks:**
- US-06: As a doctor, I want to upload an image and get it processed. (5 SP)
- US-07: As a doctor, I want my medical image analyzed automatically. (8 SP)
- US-08: As a patient, I want to see my diagnosis displayed clearly. (3 SP)
- US-09: As a patient, I want my diagnosis results stored for later access. (5 SP)
- US-10: As an admin, I want basic account authentication. (5 SP)
- TS-03: As a developer, I want to set up a backend API for image processing. (8 SP)
- TS-04: As a developer, I want to connect the frontend with the backend API. (5 SP)

SPRINT 3 BACKLOG

ID	Sprint	User Story / Technical Story (TS)	Acceptance Criteria	Story Points (SP)
US-11	Sprint 3	As a patient, I want my diagnosis report to be downloadable so I can share it with doctors.	- Diagnosis results can be exported as a downloadable PDF. - PDF includes patient info, image, diagnosis, and date.	5
US-12	Sprint 3	As a researcher, I want a faster processing time so I don't have to wait long for results.	- AI model processes images in under 2 seconds. - Response time tested on at least 10 different inputs.	8
US-13	Sprint 3	As a system admin, I want role-based access (doctor, patient, admin) so I can have personalized features.	- Users have roles (doctor, patient, admin). - Role-based dashboards and permissions implemented. - Unauthorized access blocked.	5
US-14	Sprint 3	As a doctor, I want the system to be highly accurate so I can trust the diagnosis.	- AI model reaches ≥90% accuracy on validation set. - Accuracy is documented and verified through testing.	8
US-15	Sprint 3	As a patient, I want to access my health data quickly so I can get the information I need without delays	- The system delivers data with minimal load time. - Optimized backend queries and efficient frontend rendering. - Performance tested across common devices and networks.	5
TS-05	Sprint 3	As a developer, I want to implement logging and error handling so that system failures can be monitored and resolved efficiently.	- System logs backend/frontend errors. - Admin receives error notifications or logs are stored for debugging. - Critical failures are caught and don't crash the app.	3

SPRINT 3 TEST CASES

ID	Test Case Description	Expected Result	Actual Result	Pass/Fail
US-11-TC01	Verify that diagnosis reports can be downloaded as a PDF.	PDF download prompt appears; file contains patient info, diagnosis image, diagnosis results, and date.	Diagnosis PDF downloads successfully with all required information.	Pass
US-12-TC01	Measure image processing time across multiple inputs.	Images processed in under 2 seconds for at least 10 different test inputs.	All images processed under 2 seconds during testing.	Pass
US-13-TC01	Verify that users have assigned roles (doctor, patient, admin) upon login or registration.	Role is correctly assigned and stored in the system.	User roles assigned correctly upon registration and login.	Pass
US-13-TC02	Verify role-based dashboard visibility.	Doctor sees doctor dashboard, patient sees patient dashboard, admin sees admin dashboard.	Appropriate dashboards displayed based on user role.	Pass
US-13-TC03	Attempt unauthorized access (e.g., patient tries to access admin features).	Access is denied with proper error/message.	Unauthorized access attempts were blocked with proper error messages.	Pass
US-14-TC01	Validate AI model accuracy on validation set.	Accuracy ≥90% achieved, documented, and verified.	Model achieved 91% accuracy during validation testing.	Pass

SPRINT 3 TEST CASES

ID	Test Case Description	Expected Result	Actual Result	Pass/Fail
TS-05-TC01	Trigger a backend error and check if it is logged properly.	Error is recorded in the system logs without crashing the app.	Backend errors logged successfully without system crash.	Pass
TS-05-TC02	Trigger a frontend error and ensure it is logged appropriately.	Frontend error captured and stored/logged without application crash.	Frontend errors captured and logged correctly.	Pass
TS-05-TC03	Simulate a critical failure and verify system stability and notification/logging behavior.	Critical error is caught gracefully; admin notified, or issue stored for debugging without crashing the entire system.	Critical failures handled smoothly and logged for admin review.	Pass

SPRINT 3 STORIES COMPLETED

ID	User Story / Task (TS)	Story Points (SP)
US-11	As a patient, I want my diagnosis report to be downloadable so I can share it with doctors.	5
US-12	As a researcher, I want a faster processing time so I don't have to wait long for results.	8
US-13	As a system admin, I want role-based access (doctor, patient, admin) so I can have personalized features.	5
US-14	As a doctor, I want the system to be highly accurate so I can trust the diagnosis.	8
US-15	As a patient, I want to access my health data quickly so I can get the information I need without delays	5
TS-05	As a developer, I want to implement logging and error handling so that system failures can be monitored.	3

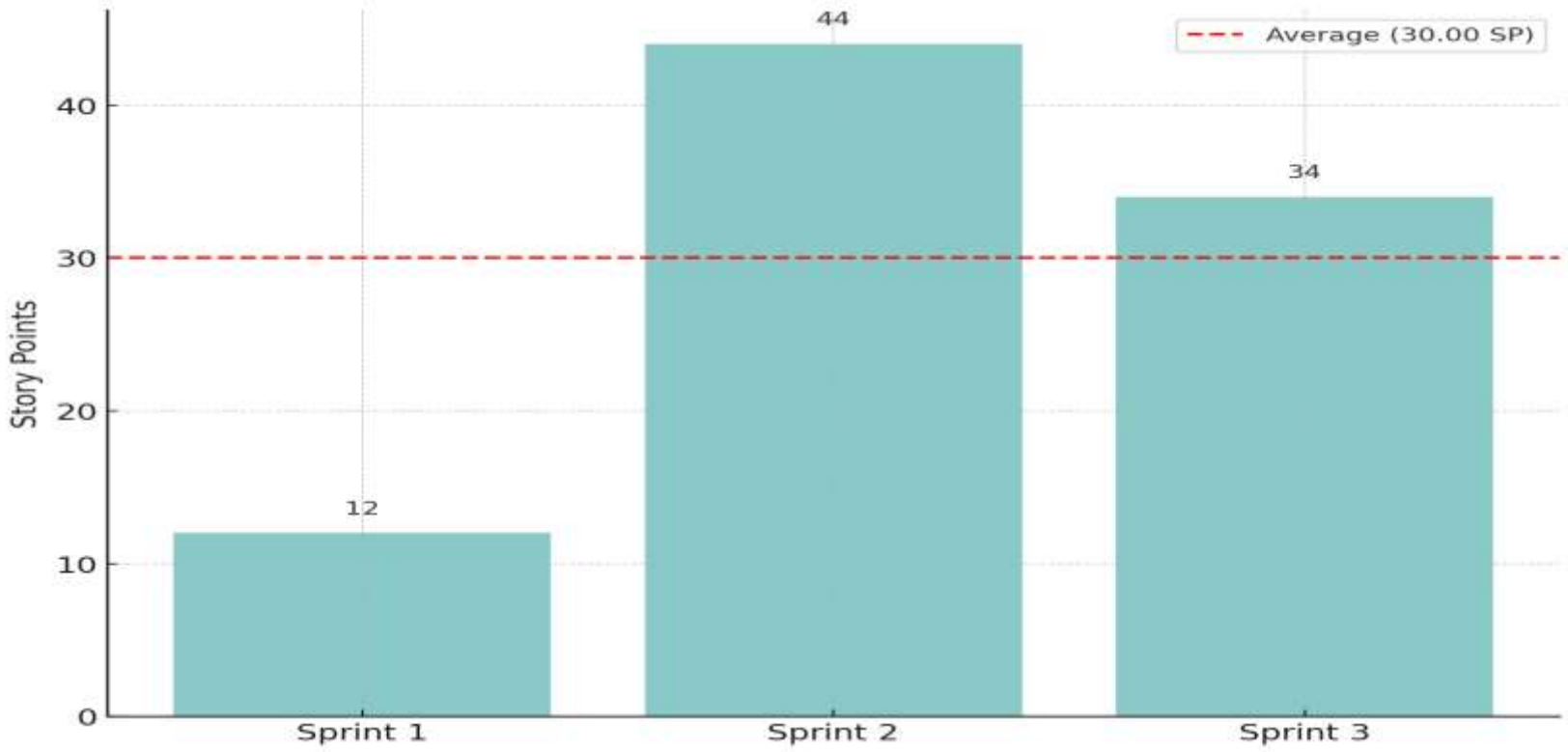
Total Story Points: 34

METRICS

- **Team Velocity**
  Total Story Points Completed: **34 SP**
  Team Velocity: **34 SP**
- **Completed/Committed Ratio**
  Total Story Points Committed: **34 SP**
  Total Story Points Completed: **34 SP**
  Completed/Committed Ratio: **(34/34) = 100%**

- **Average Completed/Committed Ratio**: Sprint 1: 70.59%
  - Sprint 2: 100%
  - Sprint 3: 100%
  - Average = (70.59 + 100 + 100) / 3 = 90.20%

HISTORICAL TEAM VELOCITY



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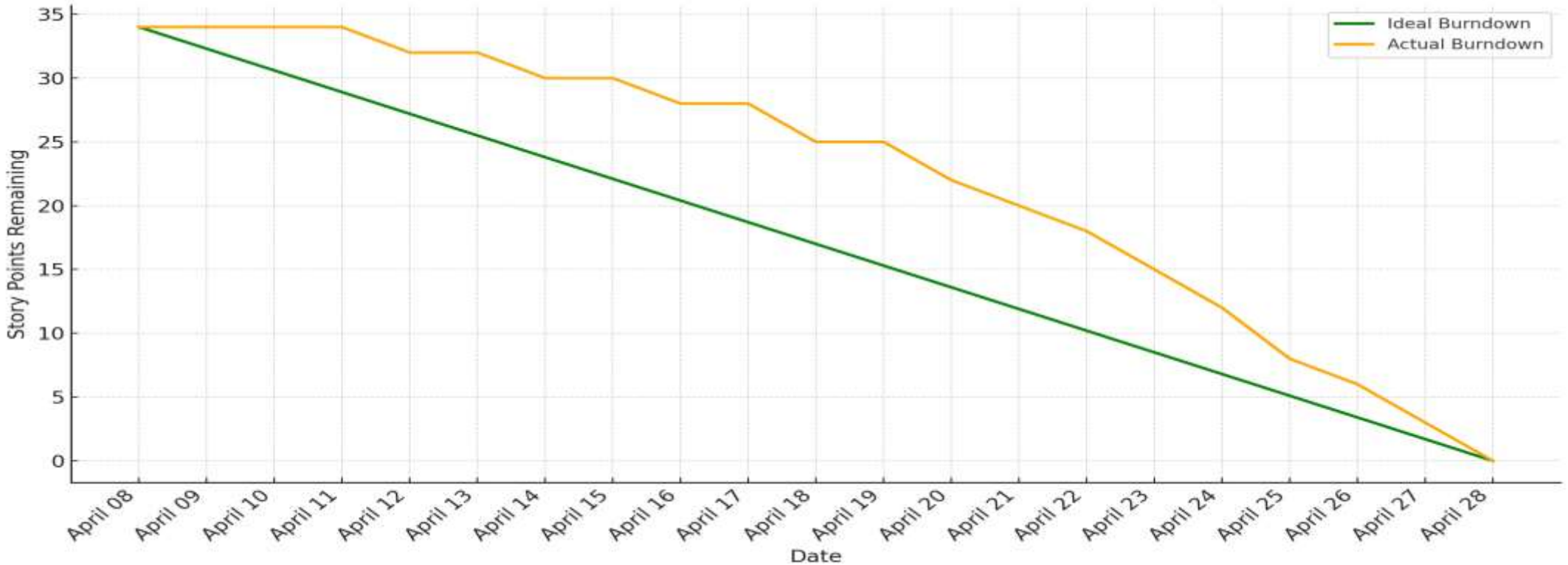

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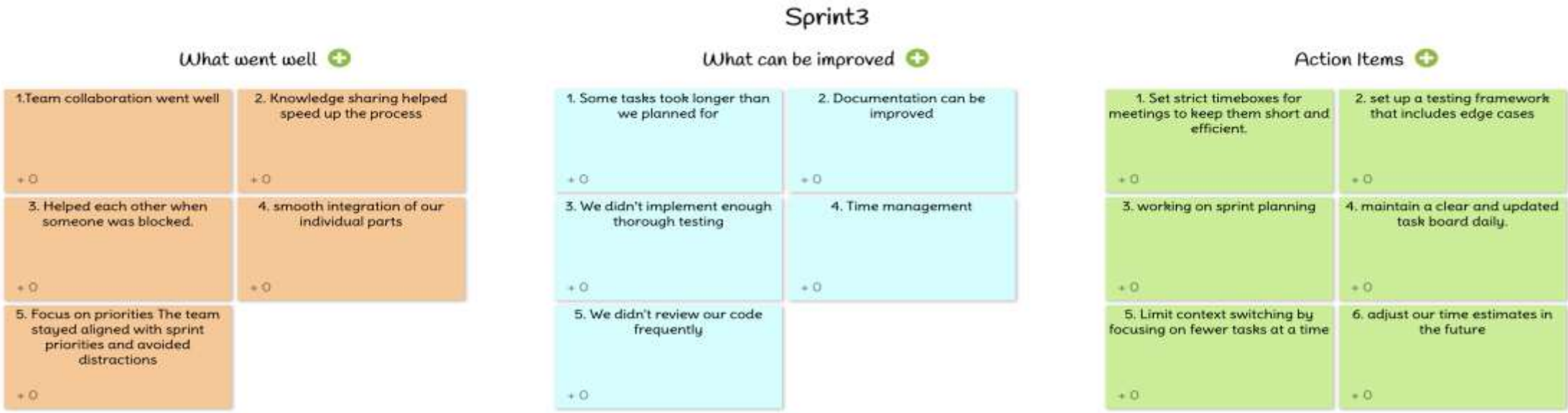
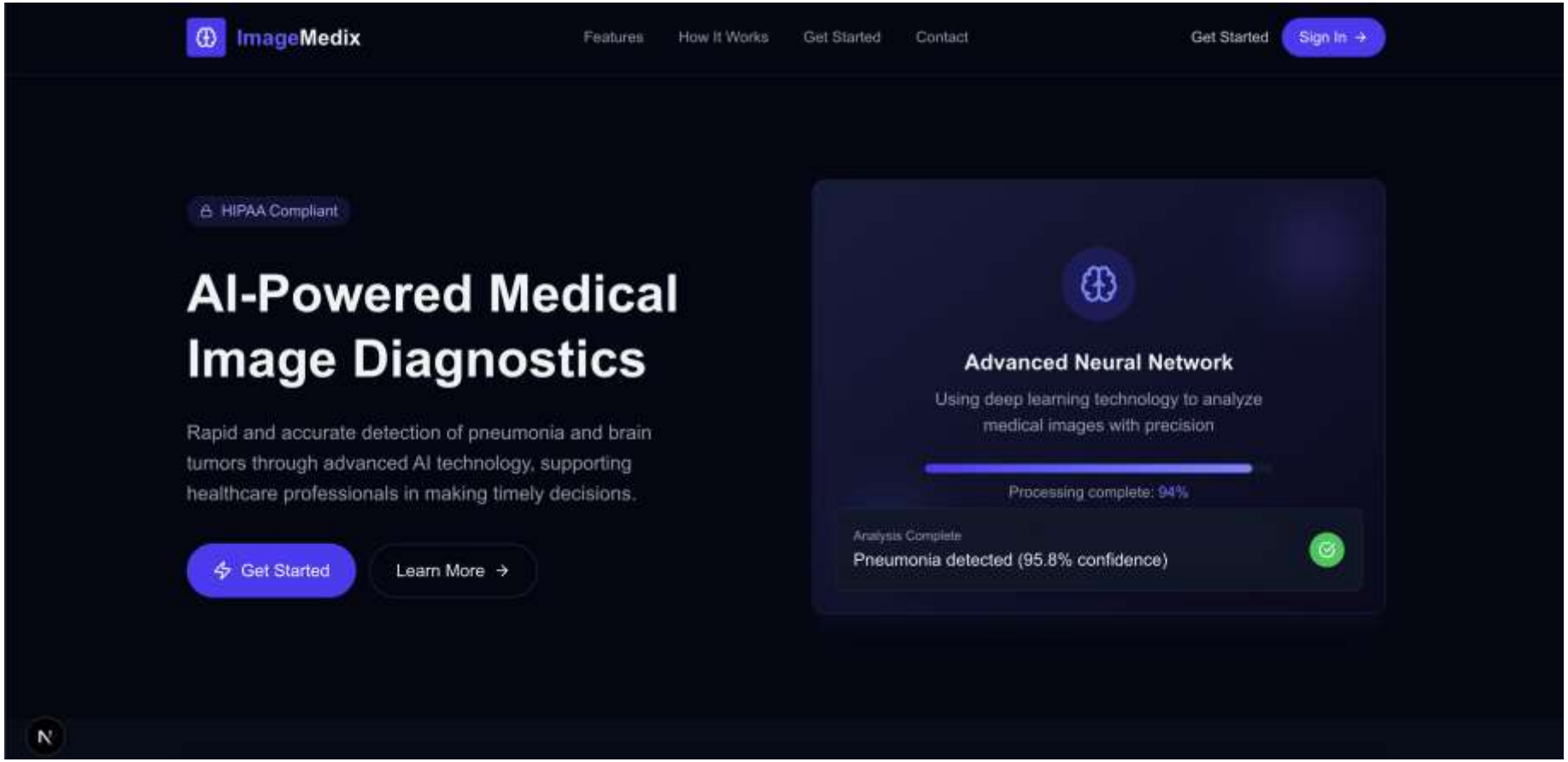
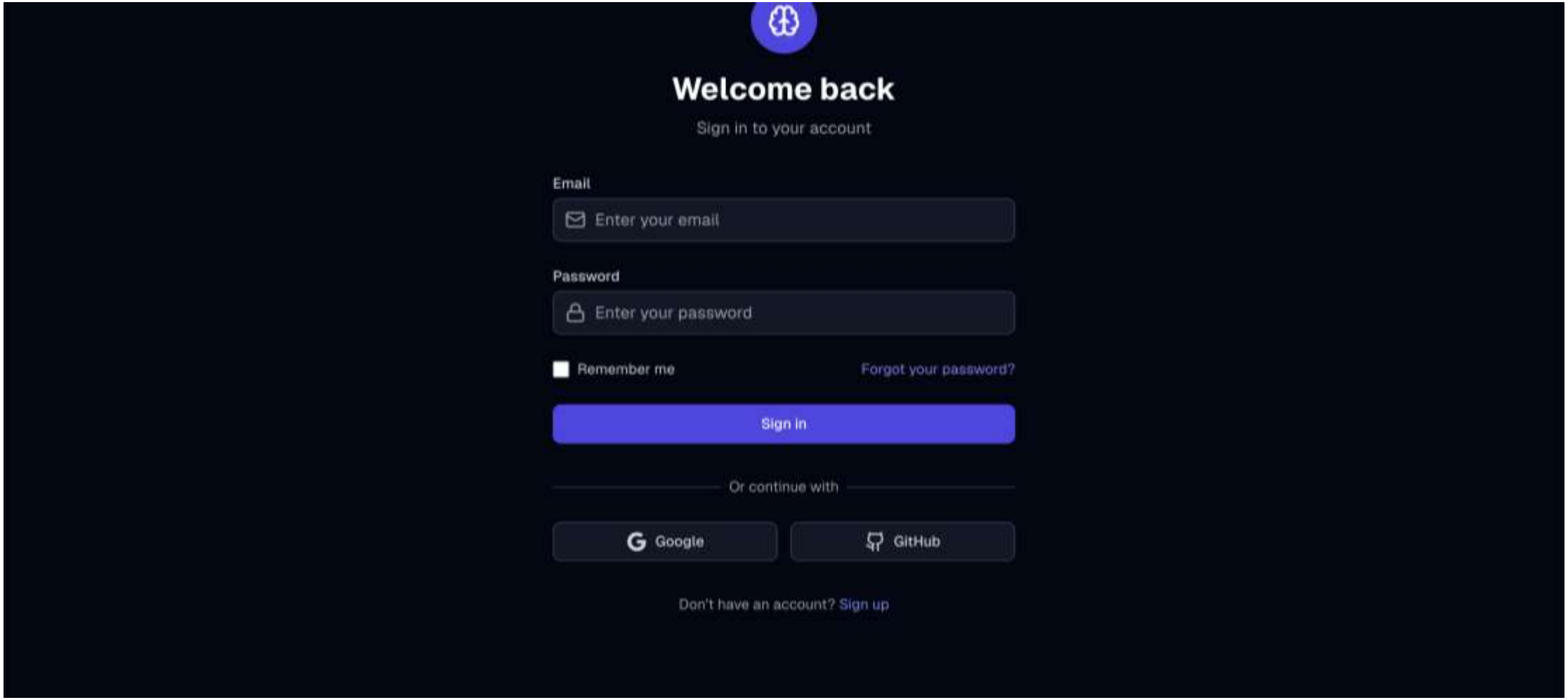


APPLICATION SCREENSHOTS




Welcome back
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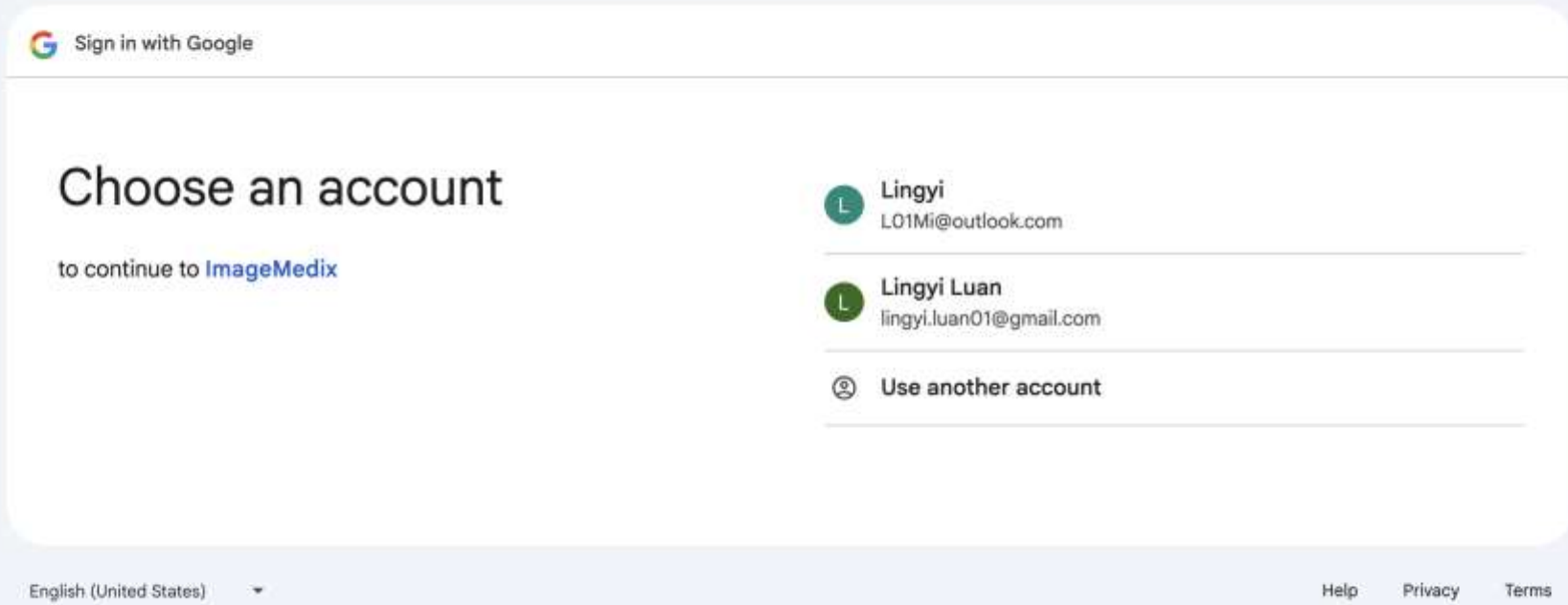
Remember me
Forgot your password?
Sign in
Or continue with
Google
GitHub
Don't have an account? Sign up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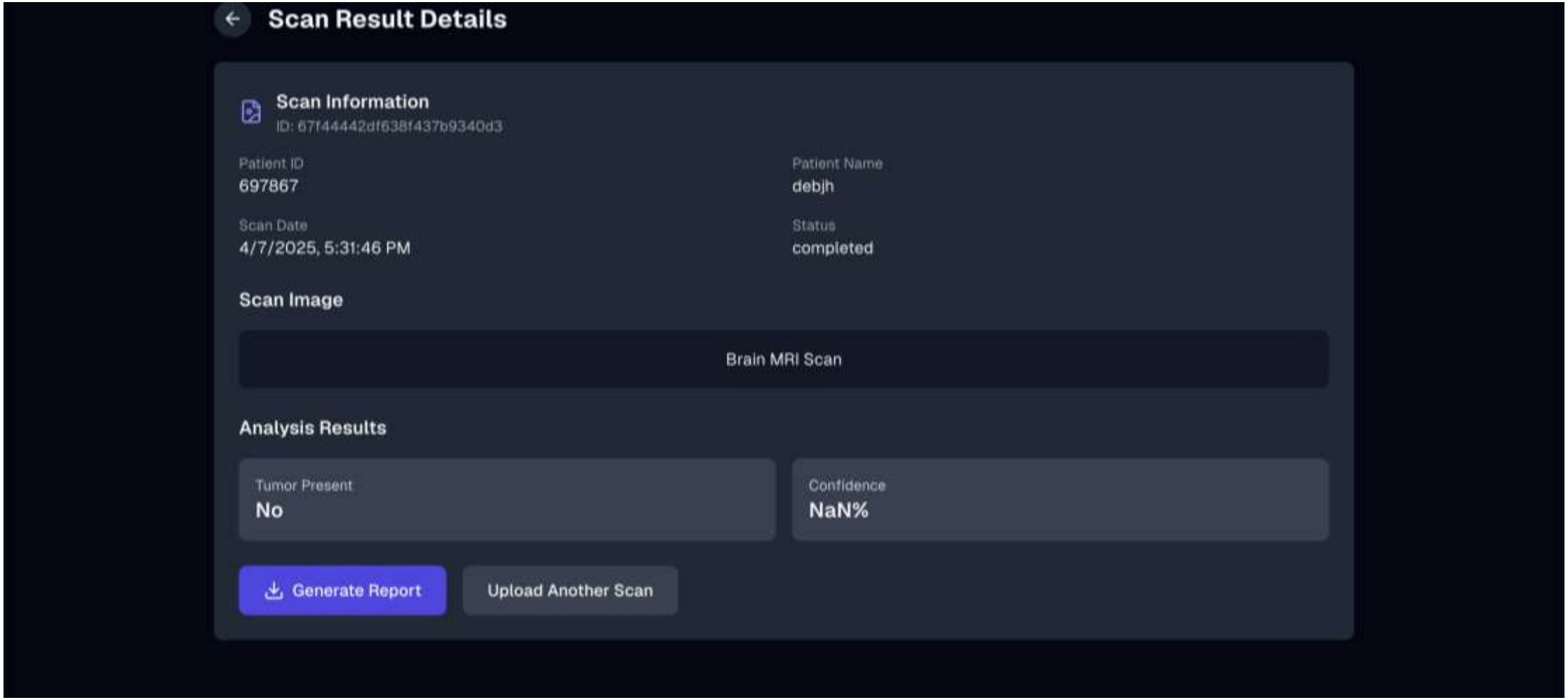
Help
Privacy
Terms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completed
Scan Image
Brain MRI Scan
Analysis Results
Tumor Present
No
Confidence
NaN%
Generate Report
Upload Another Scan

Brain Tumor Classification Report

Generated on: 4/7/2025
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Scan Information

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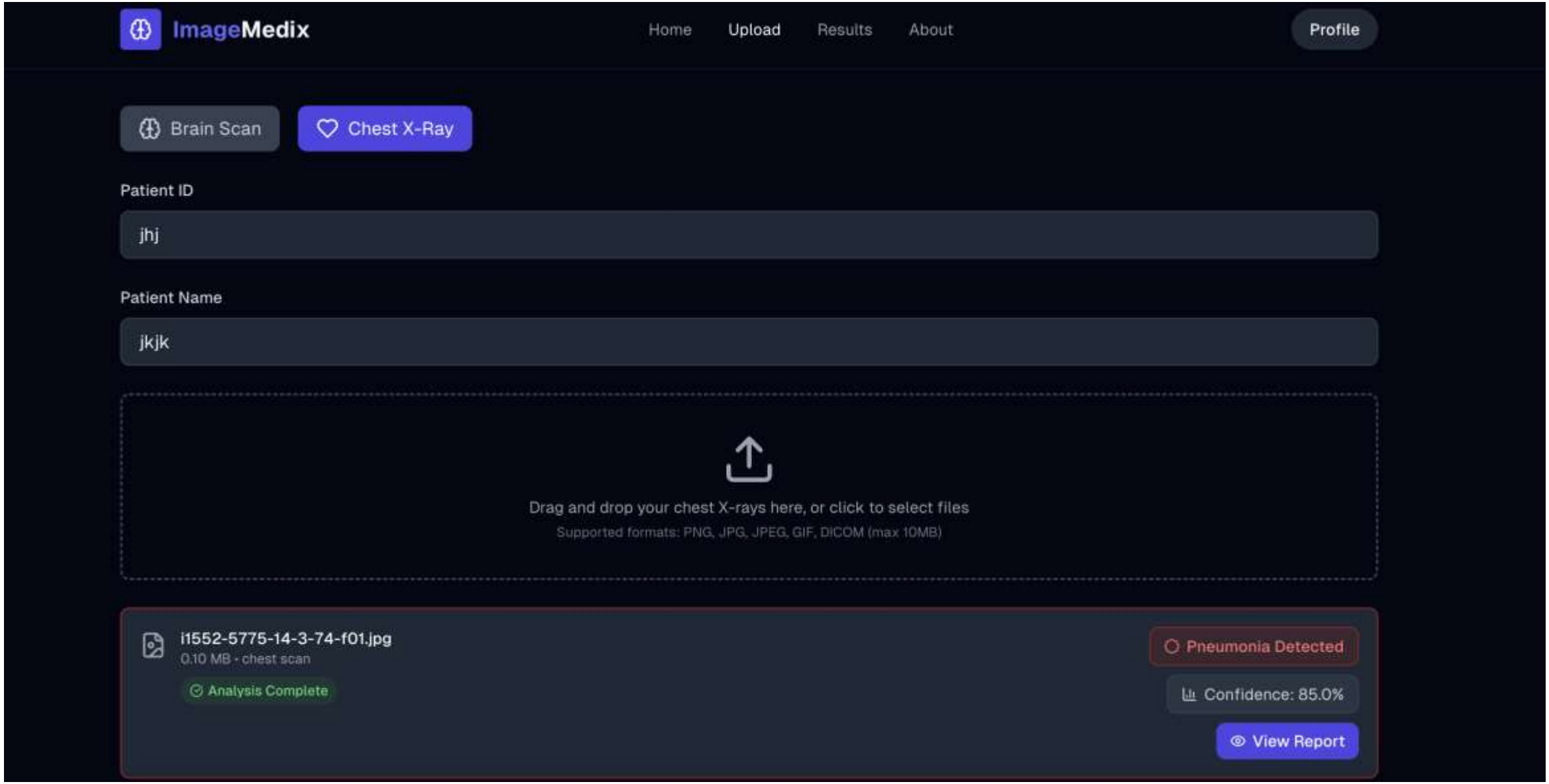
Doctor: Lingyi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Results
About
Profile
Brain Scan
Chest X-Ray
Patient ID
jhj
Patient Name
jkjk
Drag and drop your chest X-rays here, or click to select files
Supported formats: PNG, JPG, JPEG, GIF, DICOM (max 10MB)
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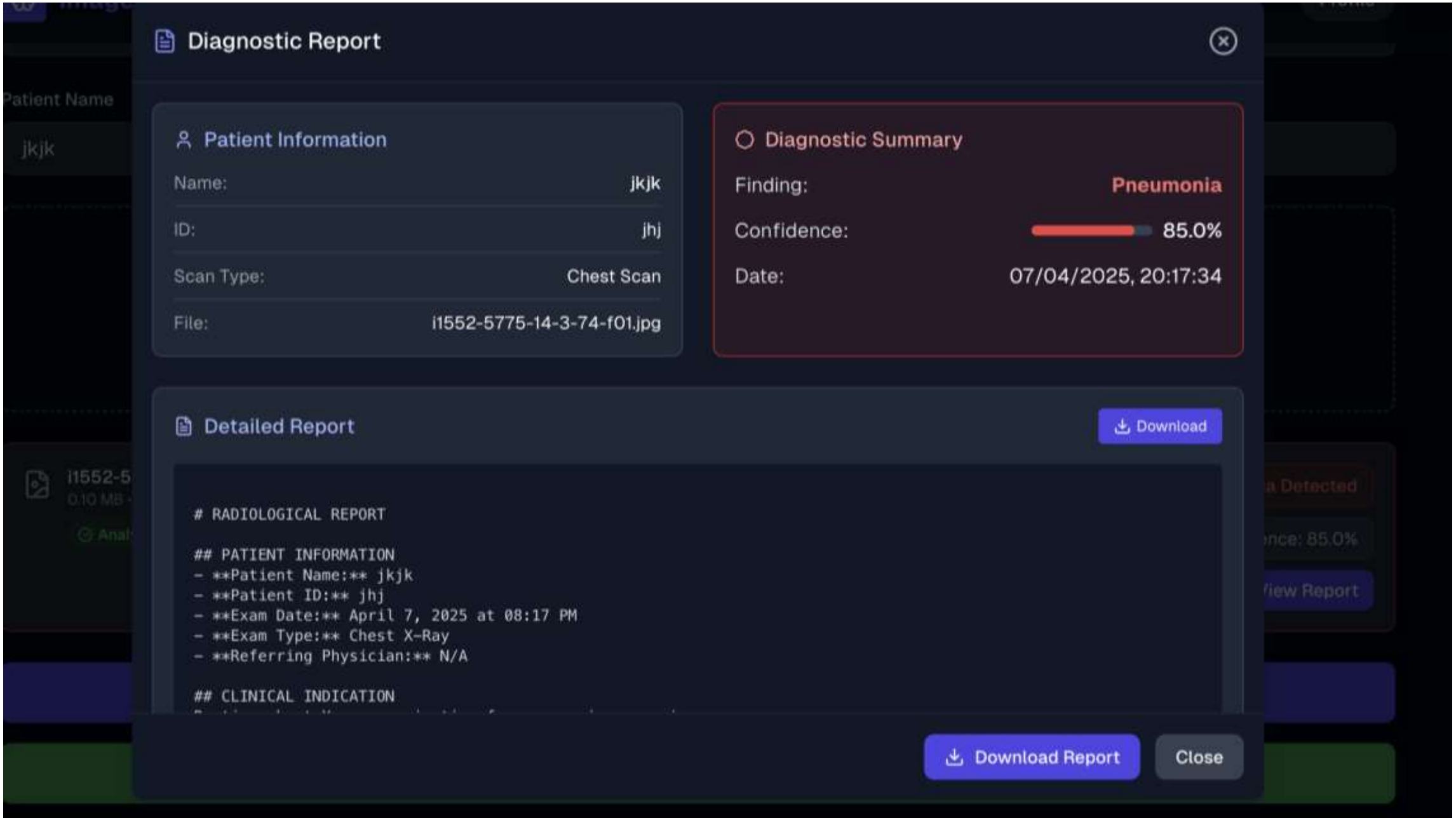
0.10 MB · chest scan
Analysis Complete
Pneumonia Detected
Confidence: 85.0%
View Report


Diagnostic Report
Patient Information
Name: jkjk
ID: jhj
Scan Type: Chest Scan
File: i1552-5775-14-3-74-f01.jpg
Diagnostic Summary
Finding: Pneumonia
Confidence: 85.0%
Date: 07/04/2025, 20:17:34
Detailed Report
Download
RADIOLOGICAL REPORT
PATIENT INFORMATION
- **Patient Name:** jkjk
- **Patient ID:** jhj
- **Exam Date:** April 7, 2025 at 08:17 PM
- **Exam Type:** Chest X-Ray
- **Referring Physician:** N/A
CLINICAL INDICATION
Download Report
Close

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History

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About

G Greeshma
kenche.greeshma@gmail.com

Logout

Scan History

Upload New Scan

Patient ID: 0123

Uploaded on May 5, 2025, 09:42 PM

Type: brain Status: completed

Diagnosis: Normal Brain
Confidence: 71.0%

Patient ID: 001

Uploaded on May 5, 2025, 09:51 PM

Type: chest Status: completed

Diagnosis: Normal Lungs
Confidence: 77.6%

KEY API ENDPOINTS

Authentication APIs:

GET /api/auth/google	-Google OAuth login
POST /api/auth/login	-Email/password login
GET /api/auth/me	-Get current user
POST /api/auth/register	-Register new user

KEY API ENDPOINTS

Scan Management APIs:

GET /api/scans	- Get all scans
POST /api/scans	- Upload new scan
GET /api/scans/:id	- Get scan by ID
GET /api/scans/:id/status	- Check analysis status
POST /api/scans/:id/report	- Generate PDF report

KEY API ENDPOINTS

ML Model APIs:

POST /api/brain/analyze	- Analyze brain MRI scan

WIKIPAGE LINK

https://github.com/htmw/2025S-The-Minions/wiki

APPLICATION DEMO

THANK YOU