

Solution Requirements: HematoVision

Field	Value
Date	19 Feb 2026
Team ID	LTVIP2026TMIDS66121
Project Name	Advanced Blood Cell Classification Using Transfer Learning
Maximum Marks	4 Marks

1. Introduction

This document outlines the solution requirements for the HematoVision project, an AI-powered system for advanced blood cell classification. It details the functional and nonfunctional requirements necessary for the successful development and deployment of the system, drawing upon insights from the project overview, model analysis, and user stories.

2. Functional Requirements

Functional requirements define what the system must do. For HematoVision, these include:

2.1 User Management

- **FR1.1 User Registration:** The system shall allow new users to register an account using their email and password.
- **FR1.2 Social Media Registration:** The system shall allow users to register using their Facebook or Gmail accounts.
- **FR1.3 User Login:** The system shall allow registered users to log in using their credentials.

- **FR1.4 Password Recovery:** The system shall provide a mechanism for users to recover forgotten passwords.

2.2 Image Upload and Management

- **FR2.1 Image Upload:** The system shall allow users to upload blood cell images in supported formats (e.g., JPEG, PNG).
- **FR2.2 Image Validation:** The system shall validate uploaded images to ensure they meet specified criteria (e.g., file size, format, resolution).
- **FR2.3 Secure Storage:** The system shall securely store uploaded images temporarily for processing.
- **FR2.4 Image Deletion:** The system shall automatically delete uploaded images after processing and result delivery.

2.3 Blood Cell Classification

- **FR3.1 Image Preprocessing:** The system shall preprocess uploaded images (e.g., resizing, normalization) before feeding them to the classification model.
- **FR3.2 Cell Type Classification:** The system shall classify blood cell images into predefined categories (e.g., Eosinophil, Lymphocyte, Monocyte, Neutrophil).
- **FR3.3 Classification Confidence:** The system shall provide a confidence score for each classification result.
- **FR3.4 Model Integration:** The system shall integrate a pre-trained machine learning model for blood cell classification.

2.4 Result Presentation

- **FR4.1 Result Display:** The system shall display the classification results to the user, including the predicted cell type and confidence score.
- **FR4.2 Visual Feedback:** The system shall provide visual feedback on the classified image, potentially highlighting the classified areas or displaying bounding boxes.
- **FR4.3 Historical Results (Future):** The system may provide a feature to view past classification results.

3. Non-Functional Requirements

Non-functional requirements specify how the system performs a certain function. For HematoVision, these include:

3.1 Performance

- **NFR1.1 Response Time:** The system shall classify an image and display results within 510 seconds, depending on image size and server load.
- **NFR1.2 Scalability:** The system shall be scalable to handle an increasing number of concurrent users and image uploads.
- **NFR1.3 Throughput:** The system shall be capable of processing at least X images per minute (where X is a defined metric based on expected usage).

3.2 Security

- **NFR2.1 Data Privacy:** The system shall ensure the privacy and confidentiality of user data and uploaded images.

- **NFR2.2 Authentication:** The system shall implement secure user authentication mechanisms.
- **NFR2.3 Authorization:** The system shall ensure that users can only access their own data and functionalities.
- **NFR2.4 Data Encryption:** All data transmitted between the client and server shall be encrypted using industry-standard protocols (e.g., HTTPS).

3.3 Usability

- **NFR3.1 User-Friendly Interface:** The system shall provide an intuitive and easy-to-use interface for image upload and result viewing.
- **NFR3.2 Accessibility:** The system shall adhere to accessibility guidelines to ensure usability for users with disabilities.
- **NFR3.3 Error Handling:** The system shall provide clear and informative error messages to users.

3.4 Reliability

- **NFR4.1 Uptime:** The system shall maintain an uptime of 99.9%.
- **NFR4.2 Data Integrity:** The system shall ensure the integrity of all processed data and classification results.
- **NFR4.3 Fault Tolerance:** The system shall be designed to gracefully handle failures and recover from unexpected errors.

3.5 Maintainability

- **NFR5.1 Modularity:** The system architecture shall be modular to facilitate easy updates and maintenance of individual components.

- **NFR5.2 Code Quality:** The codebase shall adhere to high coding standards, be well documented, and easily understandable.
- **NFR5.3 Testability:** The system components shall be testable to ensure proper functionality and facilitate regression testing.

3.6 Portability

- **NFR6.1 Platform Independence:** The web application shall be accessible from various operating systems and web browsers.
- **NFR6.2 Technology Stack:** The system shall be built using widely supported and open source technologies to ensure future compatibility and ease of deployment.

4. Technical Requirements

Technical requirements specify the technology stack and infrastructure needed.

- **TR1.1 Programming Language:** Python (for backend and machine learning).
- **TR1.2 Web Framework:** Flask.
- **TR1.3 Machine Learning Framework:** TensorFlow/Keras.
- **TR1.4 Frontend Technologies:** HTML, CSS, JavaScript.
- **TR1.5 Database (Optional for future):** SQLite or PostgreSQL for user accounts and historical data.
- **TR1.6 Deployment Environment:** Cloud-based platform (e.g., AWS, Google Cloud, Azure) for scalability and accessibility.

5. Conclusion

This Solution Requirements document provides a comprehensive overview of the necessary functional, non-functional, and technical requirements for the HematoVision project. Adhering to these requirements will ensure the development of a robust, efficient, and userfriendly blood cell classification system that meets the needs of pathologists and healthcare professionals.