

# 1. INTRODUCTION

## 1.1 Project Overview

HematoVision is an AI-powered application under the CleanTech initiative that applies transfer learning for blood cell image classification. By using pre-trained convolutional neural networks (CNNs), HematoVision efficiently identifies cell types like eosinophils, lymphocytes, monocytes, and neutrophils, based on a dataset of 12,000 annotated images.

## 1.2 Purpose

The main purpose of HematoVision is to enhance the accuracy and speed of blood cell classification in diagnostic, remote, and educational settings. It minimizes manual errors and reduces the burden on pathologists, improves healthcare accessibility in remote areas, and provides practical learning tools for students.

# 2. IDEATION PHASE

## 2.1 Problem Statement

Manual classification of blood cells is labor-intensive, time-consuming, and subject to human error. With growing demand and limited specialists, there is a pressing need for an automated, scalable, and accurate classification solution.

## 2.2 Empathy Map Canvas

- **Think & Feel:** Pathologists feel overburdened; patients worry about delayed diagnoses.
- **Hear:** Clinicians demand faster lab results.
- **See:** Diagnostic labs are overwhelmed.
- **Say & Do:** Professionals seek AI support tools.
- **Pain:** Slow results, human errors.
- **Gain:** Faster, accurate diagnosis.

## 2.3 Brainstorming

Ideas included:

- Manual vs. automated classification.
- CNN-based transfer learning.
- Deployment via web/telemedicine platforms.
- Interactive learning for students.

# 3. REQUIREMENT ANALYSIS

### 3.1 Customer Journey Map

Stage	User Action	Experience
Diagnosis	Uploads blood cell image	Fast and accurate result
Consultation	Views analysis remotely	Accessible expert insight
Training	Uploads images for feedback	Engaged learning

### 3.2 Solution Requirement

- Dataset with clear image labeling
- Pre-trained CNN architecture
- Cloud/web interface for usability
- Minimal computation cost

### 3.3 Data Flow Diagram

User Input → Preprocessing → CNN Model (Transfer Learning) → Classification → Output/Report

### 3.4 Technology Stack

- **Language:** Python
- **Libraries:** TensorFlow/Keras, OpenCV, Streamlit
- **Platform:** Local or cloud deployment (Heroku/GCP)
- **Dataset:** Publicly available blood cell images (Kaggle)

## 4. PROJECT DESIGN

### 4.1 Problem Solution Fit

The problem of slow and inaccurate blood cell diagnosis is addressed through AI automation, reducing manual workload while improving precision.

### 4.2 Proposed Solution

A web-based tool that classifies uploaded blood cell images using a fine-tuned CNN model trained via transfer learning.

### 4.3 Solution Architecture

- **Frontend:** Streamlit Interface
- **Backend:** Python Flask or FastAPI API
- **Model:** CNN with transfer learning (ResNet, VGG)
- **Storage:** Cloud/Local Database

## 5. PROJECT PLANNING & SCHEDULING

### 5.1 Project Planning

Week	Task
1	Dataset collection & preprocessing
2	Model selection & baseline training
3	Apply transfer learning
4	Model evaluation & optimization
5	Develop UI and integrate model
6	Testing and validation
7	Final deployment & documentation

## 6. FUNCTIONAL AND PERFORMANCE TESTING

### 6.1 Performance Testing

- **Accuracy:** > 90% on validation set
- **Precision/Recall:** Analyzed per class
- **Speed:** Real-time prediction (under 1 second)

## 7. RESULTS

### 7.1 Output Screenshots

(Screenshots of the UI showing upload interface, classified image output, and logs of prediction accuracy)

## 8. ADVANTAGES & DISADVANTAGES

### Advantages

- High accuracy with low training cost
- Real-time diagnosis
- Scalable to mobile/edge devices

### Disadvantages

- Needs high-quality images
- May require retraining with new data variations

## 9. CONCLUSION

HematoVision demonstrates the effective use of transfer learning in transforming medical image classification. It streamlines diagnostic workflows, supports remote health services, and enhances educational practices.

## 10. FUTURE SCOPE

- Expand to include abnormal blood cell types
- Integrate with hospital information systems (HIS)
- Develop mobile app for edge use cases

## 11. APPENDIX

- **Source Code:** Available at [GitHub – HematoVision](#)
- **Dataset:** Download from [GitHub – Blood Cell Images](#)