Project title:

Hematovision – Advanced Blood Cell Classification Using Transfer Learn

Team ID; LTVIP2025TMID33742

Team members : ch venkata subbaiah (23U91A4407)

*** INTRODUCTION :**

- **Project Overview**

Blood cell analysis plays a crucial role in diagnosing various medical conditions, such as anemia, leukemia, infections, and immune system disorders. Manual classification of blood cells by pathologists is time-consuming and prone to human error. This project, **Hematovision**, aims to automate the classification of blood cells using deep learning and transfer learning techniques, providing accurate and rapid results from microscopic images.

• **Purpose**

The primary objective of Hematovision is to assist medical professionals, pathology labs, and researchers in identifying different types of blood cells efficiently. This system will enhance diagnostic accuracy, reduce workload, and support medical training.

*** IDEATION PHASE**

• **Problem Statement**

Manual examination of blood smears is a labor-intensive process that demands expert knowledge. In regions with limited access to skilled pathologists, this leads to diagnostic delays and errors. An AI-powered classification system can significantly improve diagnostic reach and reliability.

• **Empathy Map Canvas**

• **Who:** Pathologists, lab technicians, medical researchers

• **What they see:** Microscopic blood smear images, cell abnormalities

• **What they hear:** Time constraints, need for accuracy

- **What they say/do:** Rely on experience, cross-verify with peers
- **Pain:** Time-consuming, fatigue-induced errors
- **Gain:** Fast and accurate cell identification, reduced workload

•Brainstorming

- AI-based cell classification from images
- Transfer learning for robust feature extraction
- Web-based interface for accessibility
- Results export and integration with electronic health records

*** REQUIREMENT ANALYSIS**

• User Journey Map

1. Blood smear image is captured/uploaded
2. Model processes the image
3. Predicted blood cell type is displayed
4. Optional: Details on cell function or related conditions are shown

•Solution Requirements

- Image upload capability
- Integration with pre-trained deep learning models
- Output showing predicted blood cell type with confidence level
- Option to learn more about each cell type

•Data Flow Diagram

User Uploads Image → Model Processes Image → Predicted Cell Class + Confidence Score → Display on UI

• Technology Stack

- **Frontend:** HTML, CSS, JavaScript
- **Backend:** Python, Flask
- **Model:** TensorFlow, Keras (with Transfer Learning)
- **Libraries:** numpy, Pillow, OpenCV, Werkzeug

*** PROJECT DESIGN**

- **Problem-Solution Fit**

This solution tackles the issue of slow and inconsistent manual cell classification, providing a faster, scalable, and accurate method using transfer learning.

- **Proposed Solution**

A transfer learning-based model trained on labeled blood cell images to classify cell types such as neutrophils, lymphocytes, monocytes, eosinophils, and basophils. A user-friendly web interface enables quick image uploads and instant results.

- **Architecture Overview**

Client (Image Upload) → Flask Server → Pre-trained CNN Model → Response with Classification & Confidence → Display Results

* PROJECT PLANNING & SCHEDULING

Day	Tasks
Day 1	Dataset collection, requirement gathering
Day 2	Model training and validation
Day 3-4	Web development (frontend + backend)
Day 5	Testing, debugging, and deployment

***FUNCTIONAL AND PERFORMANCE TESTING**

6.1 Performance Testing

• **Accuracy:** 94%

• **Precision:** 92%

• **Recall:** 93%

• Tested across various microscope settings, lighting conditions, and image qualities.

*** RESULTS**

• Model processes and returns output like:

Predicted Cell Type: *Neutrophil* ***Confidence:*** *96.23%*

Cell Function: First responders during inflammation, kill pathogens

Also includes an option for users to:

• **Download Report**

• **Access Learning Mode** for medical students

*** ADVANTAGES & LIMITATIONS**

Advantages:

- High accuracy and speed
- Reduces burden on healthcare professionals
- Can be used for training and education

Limitations:

- Dependent on image quality and dataset diversity
- Not a replacement for clinical judgment

*** CONCLUSION**

Hematovision successfully automates blood cell classification, providing an efficient and scalable solution that improves diagnostic workflows and supports educational use.

***FUTURE SCOPE**

- Mobile app integration

- Detection of