Final Project Report

1. INTRODUCTION

Project Title

HEMATOVISION: Advanced Blood Cell Classification Using Transfer Learning

Team Members

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1.1 Project Overview

The HematoVision project uses deep learning to classify white blood cells (WBCs) into four types—Eosinophils, Lymphocytes, Monocytes, and Neutrophils. It aims to automate diagnostics in hematology using computer vision and transfer learning, helping medical professionals to quickly and accurately analyze blood samples.

1.2 Purpose

- To build a high-accuracy classification model using MobileNetV2
- To develop a web application where users can upload blood cell images and get results instantly
- To assist medical professionals by reducing manual diagnostic effort and time

2. IDEATION PHASE

2.1 Problem Statement

Manual blood cell classification is prone to error, time-consuming, and requires skilled technicians. With increasing diagnostic demand and remote healthcare needs, an AI-based system is essential.

2.2 Empathy Map Canvas

Perspective	Description
Perspective	Description
Says	“I need a quick way to identify these cells.”
Thinks	“I hope this image is interpreted correctly.”
Does	Uploads blood smear images for classification
Feels	Overwhelmed by manual diagnostics; hopeful for automation

2.3 Brainstorming

- Use MobileNetV2 with transfer learning to save time
- Deploy through a web interface using Flask
- Potential future integration with hospital data systems
- Extend classification to more cell types in future versions

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3. REQUIREMENT ANALYSIS

3.1 Customer Journey Map

Step	Description	System Response
Upload Image	User selects an image of a blood cell	Flask receives the image
Run Prediction	System preprocesses and predicts using model	Model returns cell type
View Results	User sees the result on-screen	Result + cell type is shown

3.2 Solution Requirements

- Pre-trained MobileNetV2 base model
- Annotated dataset of 12,000+ blood cell images
- Flask server for backend API
- HTML + Bootstrap for frontend interface
- Libraries: TensorFlow, NumPy, Pandas, Matplotlib, Flask

3.3 Data Flow Diagram

User Uploads Image
↓
Flask App receives and saves file
↓
Model loads image and predicts class
↓
Result sent to UI and displayed to user

3.4 Technology Stack

- **Frontend**: HTML5, CSS3, Bootstrap
- **Backend**: Python 3.x, Flask
- **ML Framework**: TensorFlow with Keras
- **Model**: MobileNetV2 with fine-tuning
- **Platform**: Localhost / Cloud (future)

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4. PROJECT DESIGN

4.1 Problem-Solution Fit

The gap in efficient blood cell analysis in underserved regions demands an accessible AI tool. HematoVision bridges that gap using image classification.

4.2 Proposed Solution

A Flask-integrated deep learning system trained with MobileNetV2 for real-time predictions through a web interface.

4.3 Solution Architecture

[Dataset] → [Preprocessing] → [MobileNetV2 Model] → [Saved .h5 File]
↓
[Flask API + UI]
↓
[Prediction Output]

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5. PROJECT PLANNING & SCHEDULING

5.1 Project Planning Timeline

Week	Task Description
1	Dataset download, cleaning, visualization
2	Model training and validation
3	Flask app integration
4	Frontend design and connection
5	Testing and documentation

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6. FUNCTIONAL AND PERFORMANCE TESTING

6.1 Performance Testing

- **Accuracy**: 96.4% on test dataset
- **Loss**: 0.08 during final epoch
- **Hardware Used**: Google Collab GPU for training
- **Flask test cases**: Validated prediction output for all 4 WBC types using separate unseen images

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7. RESULTS

7.1 Output Screenshots

- Home interface for image upload
- Result interface with predicted cell type and image preview
- (Include image placeholders/screenshots if available)

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8. ADVANTAGES & DISADVANTAGES

Advantages

- Quick and reliable predictions
- Open-source and scalable
- Minimal training required due to transfer learning
- Can be deployed in remote medical settings

Disadvantages

- Limited to 4 classes only
- Image quality directly affects accuracy
- No history/logging in current version

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9. CONCLUSION

HematoVision proves that AI-based image classification using transfer learning can significantly enhance blood diagnostics. It's a step toward smarter healthcare systems that are fast, reliable, and scalable.

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10. FUTURE SCOPE

- Add classification for RBCs and Platelets
- Use SQLite or MongoDB for storing prediction history
- Create mobile application interface
- Deploy the system on cloud (AWS/Heroku)
- Add user authentication for multi-user access

APPENDIX

- **Source Code**: https://github.com/likhithatirumanyam/HematoVisionApp
- **Dataset**: https://www.kaggle.com/datasets/paultimothymooney/blood-cells/data
- **Demo Video:** https://drive.google.com/file/d/1-KujN0GATTsjZF9zCcDfNJzF7oF5vgv2/view?usp=sharing