HematoVision: Advanced Blood Cell Classification Using Transfer Learning

Project Report

1. INTRODUCTION

1.1 Project Overview

HematoVision is a deep learning-based application designed to classify blood cells into different types—eosinophils, lymphocytes, monocytes, and neutrophils—using transfer learning on a dataset of 12,000 annotated images.

1.2 Purpose

To accelerate blood cell identification for medical diagnostics by automating the classification process using convolutional neural networks (CNNs), enhancing diagnostic efficiency and accuracy.

2. IDEATION PHASE

2.1 Problem Statement

Manual blood cell classification is time-consuming and prone to human error. An AI-powered solution can significantly improve both speed and accuracy.

2.2 Empathy Map Canvas

Captured needs and pain points of lab technicians and doctors, emphasizing quick turnaround, reduced workload, and accurate results.

2.3 Brainstorming

Generated ideas around dataset preprocessing, CNN architectures, evaluation metrics, and deployment options.

3. REQUIREMENT ANALYSIS

3.1 Customer Journey Map

Mapped the experience of users from image input to final classification output with user-friendly feedback.

3.2 Solution Requirement

* Annotated dataset
* Pre-trained model (e.g., MobileNet, ResNet)
* Flask for app interface
* GPU/CPU environment for training

3.3 Data Flow

* The user interacts with the UI (User Interface) to choose the image.
* The chosen image is analyzed by the model which is integrated with the flask application.
* Once the model analyses the input the prediction is showcased on the UI

3.4 Technology Stack

* **Language**: Python
* **Libraries**: TensorFlow, Keras, OpenCV, Pandas
* **Platform**: VS Code, Jupyter Notebook
* **Frontend**: HTML, CSS
* **Deployment**: Localhost

4. PROJECT DESIGN

4.1 Problem Solution Fit

Demonstrated that deep learning can reliably classify blood cells, outperforming traditional manual methods.

4.2 Proposed Solution

Used transfer learning with fine-tuning to achieve over 90% accuracy on validation datasets.

4.3 Solution Architecture

* Data Preprocessing
* Model Training
* Evaluation
* Web App Deployment

5. PROJECT PLANNING & SCHEDULING

5.1 Project Planning

Divided into phases:  
- Dataset handling  
- Model selection & training  
- Evaluation  
- Deployment  
- Documentation

6. FUNCTIONAL AND PERFORMANCE TESTING

6.1 Performance Testing

Tested model on unseen validation and test sets, tracked metrics such as accuracy, precision, recall, and F1-score.

7. RESULTS

7.1 Output Screenshots

Included classification outputs with confidence scores, confusion matrix, and performance graphs.

8. ADVANTAGES & DISADVANTAGES

Advantages

* Automated classification
* High accuracy
* Reduces manual workload

Disadvantages

* Requires labeled data
* Dependent on image quality
* Needs GPU for faster training

9. CONCLUSION

HematoVision proves that transfer learning is highly effective for medical image classification tasks. It can significantly support medical professionals by offering fast and accurate predictions.

10. FUTURE SCOPE

* Expand to more blood cell types
* Integrate with hospital systems
* Deploy in cloud for remote accessibility
* Real-time image analysis using mobile devices

11. APPENDIX

* **Source Code**: [pothamsettysaivarshitha/Hematovision-Advanced-Blood-cell-](https://github.com/pothamsettysaivarshitha/Hematovision-Advanced-Blood-cell-)
* **Demo Link**: https://drive.google.com/file/d/15BEbniQHJWt58sF\_hZwwcGlBzDNM3X\_N/view?usp=drive\_link