

# HematoVision – Blood Cell Classification System

A Complete End-to-End Deep Learning & Web Application Project

## 1. Introduction

HematoVision is a deep learning-based web application designed to classify human blood cell images into four major categories: Eosinophil, Lymphocyte, Monocyte, and Neutrophil. This project demonstrates the complete lifecycle of a machine learning system, starting from dataset preparation to model training, evaluation, and deployment using Flask.

## 2. Objectives

- 1 To build a robust image classification model using MobileNetV2.
- 2 To understand dataset preprocessing and evaluation metrics.
- 3 To deploy the trained model as a user-friendly web application.
- 4 To create and maintain a clean project structure suitable for real-world deployment.

## 3. Dataset Description

The dataset used in this project is the Blood Cells Image Dataset obtained from Kaggle. It contains approximately 12,500 augmented microscopic blood cell images categorized into four classes. Each class is stored in a separate folder, making it suitable for image-based deep learning tasks.

## 4. Project Structure Creation

A clean and well-organized project structure was manually created before model training and deployment. This structure ensures maintainability, scalability, and clarity for both development and deployment stages.

```
blood_cell_project/
  app.py          # Flask application entry point
  blood_cell.h5    # Trained MobileNetV2 model
  dataset2-master/
    images/
    TRAIN/
      eosinophil/
      lymphocyte/
      monocyte/
      neutrophil/
  templates/
    home.html      # Upload image page
    result.html     # Prediction result page
  static/
  uploads/         # Uploaded images
```

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■■■ notebook/

■■■ BloodCell\_Training.ipynb

## 5. Model Architecture

MobileNetV2 was selected as the base model due to its lightweight architecture and strong performance in image classification tasks. Transfer learning was applied by freezing the base layers and adding custom fully connected layers for blood cell classification.

## 6. Training & Evaluation

The dataset was split into training, validation, and testing sets. Model performance was evaluated using accuracy, precision, recall, F1-score, and confusion matrix analysis. The trained model achieved an accuracy of approximately 89%.

## 7. Web Application Deployment

The trained model was integrated into a Flask web application. Users can upload a blood cell image through the web interface, and the application predicts the corresponding blood cell type in real time.

## 8. Conclusion

HematoVision successfully demonstrates the implementation of a full-stack machine learning project. By combining deep learning with a web-based interface, the system provides an intuitive and practical solution for blood cell classification. The structured approach followed in this project makes it suitable for academic and real-world applications.