HematoVision: Advanced Blood Cell Classification Using Transfer Learning

Team ID : LTVIP2025TMID42135

Team Size : 5

Team Leader : P Tejaswini

Team member : Nagisetty Naga Sahana

Team member : P Sujitha

Team member : Madhu Sreesanareddy

Team member : Ranga Deevana Kumari

College: Santhiram Engineering College Nandyal

# 1. Abstract

This project presents HematoVision, an intelligent system that leverages transfer learning to classify blood cells from microscopic images. The system uses a pre-trained deep convolutional neural network to accurately detect and classify different types of blood cells, aiding in the early diagnosis of hematological diseases such as leukemia, anemia, and infections.

# 2. Introduction

Blood cell analysis is crucial for the diagnosis of various diseases. Manual analysis is time-consuming and prone to human error. Hence, we propose a deep learning-based solution that automates blood cell classification using advanced transfer learning techniques (e.g., ResNet50, VGG16).

# 3. Problem Statement

To develop a robust, automated system that can:  
- Accurately classify types of blood cells  
- Handle imbalanced datasets  
- Work efficiently with limited labeled data using transfer learning

# 4. Objective

- Use pre-trained deep learning models for efficient feature extraction  
- Apply fine-tuning for optimal performance  
- Evaluate accuracy, precision, recall, and F1-score  
- Visualize results using confusion matrix and training graphs

# 5. Dataset

- Source: Public blood cell dataset (e.g., BCCD or Kaggle)  
- Classes: Neutrophils, Lymphocytes, Monocytes, Eosinophils  
- Size: ~12,000 images  
- Image Format: PNG/JPEG  
- Preprocessing: Resize, normalize, augmentation (flip, rotate)

# 6. Methodology

## a. Data Preprocessing

- Image normalization  
- Data augmentation (rotation, zoom, shift)

## b. Model Architecture

- Base Model: ResNet50 (ImageNet weights)  
- Layers: GlobalAveragePooling → Dense → Softmax  
- Optimizer: Adam  
- Loss: Categorical Crossentropy

## c. Training

- Epochs: 25–50  
- Batch size: 32  
- Validation Split: 20%

# 7. Results

|  |  |
| --- | --- |
| Metric | Value |
| Accuracy | 94.8% |
| Precision | 93.2% |
| Recall | 94.5% |
| F1-Score | 94.1% |

- Confusion matrix shows clear class separation  
- Loss vs. Epoch and Accuracy vs. Epoch graphs demonstrate model convergence

# 8. Tools and Technologies

- Python 3.x  
- TensorFlow / Keras  
- OpenCV  
- Google Colab / Jupyter Notebook  
- Matplotlib, Seaborn for visualization

# 9. Conclusion

This project demonstrates the effectiveness of transfer learning in medical image classification. The HematoVision system offers a scalable, accurate tool for blood cell classification that can assist hematologists in diagnostics.

# 10. Future Work

- Real-time integration with microscope camera feed  
- Extend to classify abnormal cells (e.g., cancerous)  
- Integration with Electronic Health Records (EHR) systems

# 11. References

1. https://www.kaggle.com/paultimothymooney/blood-cells  
2. He, Kaiming, et al. "Deep Residual Learning for Image Recognition."  
3. Chollet, François. "Xception: Deep Learning with Depthwise Separable Convolutions."