HematoVision: Advanced Blood Cell Classification Using Transfer Learning

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Abstract

HematoVision is an AI-based system designed for advanced blood cell classification using transfer learning techniques. The project aims to assist medical diagnosis by automatically classifying different types of blood cells from microscopic images. By leveraging pre-trained deep learning models, the system achieves high accuracy while reducing training time and computational cost.

Introduction

Blood cell classification plays a vital role in detecting diseases such as leukemia, anemia, and infections. Traditional manual analysis by hematologists is time-consuming and prone to human error. HematoVision uses Artificial Intelligence and Machine Learning, particularly Transfer Learning, to automate and improve the accuracy of blood cell detection and classification.

Objectives

1. To develop an intelligent system for blood cell image classification. 2. To use transfer learning for improving model performance. 3. To reduce manual effort in medical image analysis. 4. To achieve high accuracy in classifying WBC, RBC, and Platelets.

Methodology

The HematoVision project follows a structured methodology including data collection, preprocessing, model selection, training, and evaluation. A Kaggle blood cell dataset is used for training. Images are resized, normalized, and augmented to enhance model performance. Transfer learning models such as MobileNetV2 or ResNet50 are used as the base model, and custom classification layers are added for blood cell classification.

Tools and Technologies Used

• Python • TensorFlow & Keras • Jupyter Notebook (Anaconda) • OpenCV • Kaggle Dataset • Transfer Learning Models (MobileNetV2/ResNet50)

System Architecture

The system architecture consists of input blood cell images, preprocessing module, feature extraction using a pre-trained CNN model, classification layer, and output prediction of blood cell types. Transfer learning helps in extracting deep features without training the model from scratch.

Results and Discussion

The model shows high accuracy in classifying different blood cell types. Transfer learning significantly improves performance compared to traditional CNN models. The system is efficient, fast, and suitable for real-time medical image classification applications.

Conclusion

HematoVision demonstrates how Artificial Intelligence and Transfer Learning can revolutionize medical diagnostics. The project successfully classifies blood cells with high accuracy and reliability. In the future, the system can be extended with real-time microscope integration and deployment in hospitals for automated diagnosis.

Future Scope

Future enhancements include integrating cloud-based diagnosis, improving dataset diversity, and deploying the model as a web or mobile application for healthcare professionals.