HematoVision: Advanced Blood Cell Classification Using Transfer Learning

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Abstract

HematoVision is a deep learning-based project designed to classify blood cells into four main categories: eosinophils, lymphocytes, monocytes, and neutrophils. Leveraging transfer learning, the system aims to aid medical professionals in early diagnosis and classification of blood-related conditions. This report outlines the project's development, from dataset collection and preprocessing to the deployment of a user-friendly web interface.

Introduction

Blood cell classification is an essential task in medical diagnostics. Manual analysis is time-consuming and prone to human error. HematoVision automates this process using deep learning and transfer learning techniques, offering quick and accurate classification through a web-based interface.

Objective

To build a reliable and efficient blood cell classification system using deep learning, capable of distinguishing between eosinophils, lymphocytes, monocytes, and neutrophils through transfer learning models.

Methodology

1. Data Collection and Preprocessing
2. Model Selection and Training using Transfer Learning (e.g., MobileNetV2)
3. Evaluation using Accuracy and Loss Metrics
4. Integration with Flask for web interface
5. Deployment and User Testing

System Architecture

The architecture consists of five layers:
1. Data Layer – Image dataset
2. Processing Layer – Image preprocessing, resizing
3. Model Layer – Transfer Learning using pre-trained CNN
4. Application Layer – Flask Web App
5. Output Layer – Prediction Display to User

Dataset Description

The dataset used includes thousands of labeled images of four blood cell types: eosinophils, lymphocytes, monocytes, and neutrophils. Images are balanced and preprocessed to a uniform size of 224x224 pixels. Data augmentation is applied to improve model generalization.

Model – Transfer Learning

Transfer learning leverages pre-trained models like MobileNetV2. We fine-tune the model's top layers on our dataset. This approach speeds up training and improves accuracy, especially when the dataset size is moderate.

Results and Screenshots

The model achieved over 90% validation accuracy. The web interface allows users to upload an image and receive instant predictions. Screenshots of the UI and predictions can be found in the demo video and GitHub repository.

Conclusion

HematoVision successfully demonstrates the potential of deep learning and transfer learning in medical diagnostics. The web interface makes it accessible for healthcare professionals and researchers alike.

Future Scope

1. Expand to detect more blood cell types and diseases.
2. Integrate real-time microscope feed analysis.
3. Host as a mobile app or integrate with hospital systems.
4. Improve model accuracy with more annotated data.

References

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