

HematoVision: Advanced Blood Cell Classification Using Transfer Learning

Internship Project Report

Submitted in partial fulfillment of the requirements for the

AI&ML Virtual Internship Program

conducted by

SmartBridge

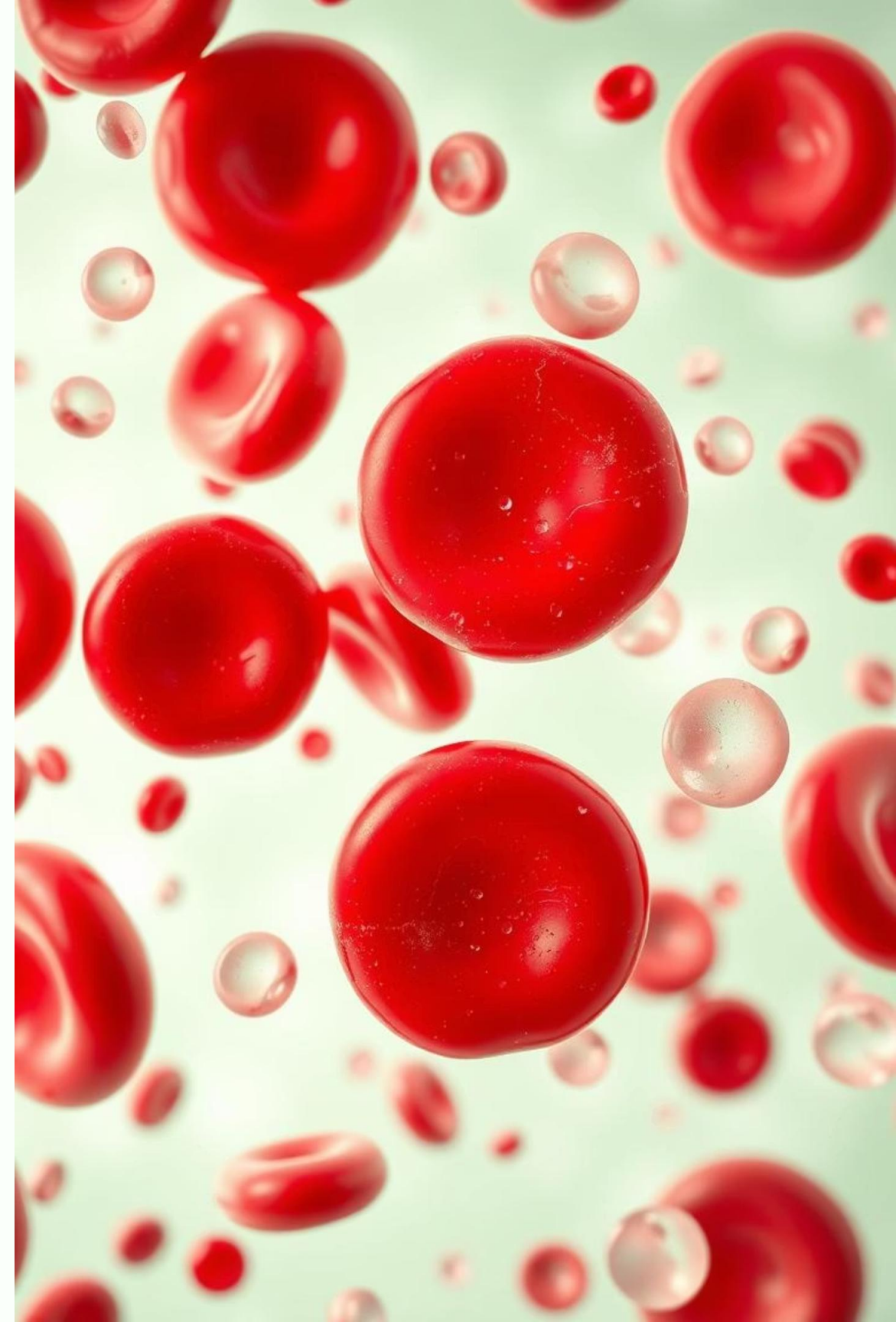
Submitted by

Kudipudi Venkata Govind
Valavala Sri Lakshmi Sai Durga
T Tejaswini
Mutyalu

Team ID: LTVIP2025TMID43712

HematoVision: Advanced Blood Cell Classification

Revolutionising haematology with AI-driven precision, HematoVision provides an accurate, efficient blood cell classification solution, enhancing diagnostic capabilities in pathology labs.



The Challenge: Manual Blood Cell Analysis

Traditional manual blood cell analysis is fraught with challenges, posing significant limitations in modern diagnostic laboratories.

Time-consuming

Each slide demands 10-15 minutes for manual counting, slowing down diagnoses.

Subjective & Error-Prone

Up to 20% inter-observer variability and fatigue-induced misclassifications are common.

High Volume

Globally, 1 billion Full Blood Counts are performed annually, exacerbating the challenges of manual processing.



The Solution: Transfer Learning in Healthcare



Leverage Pre-trained Models

Utilise knowledge from deep learning models like ResNet50, pre-trained on massive datasets such as ImageNet.



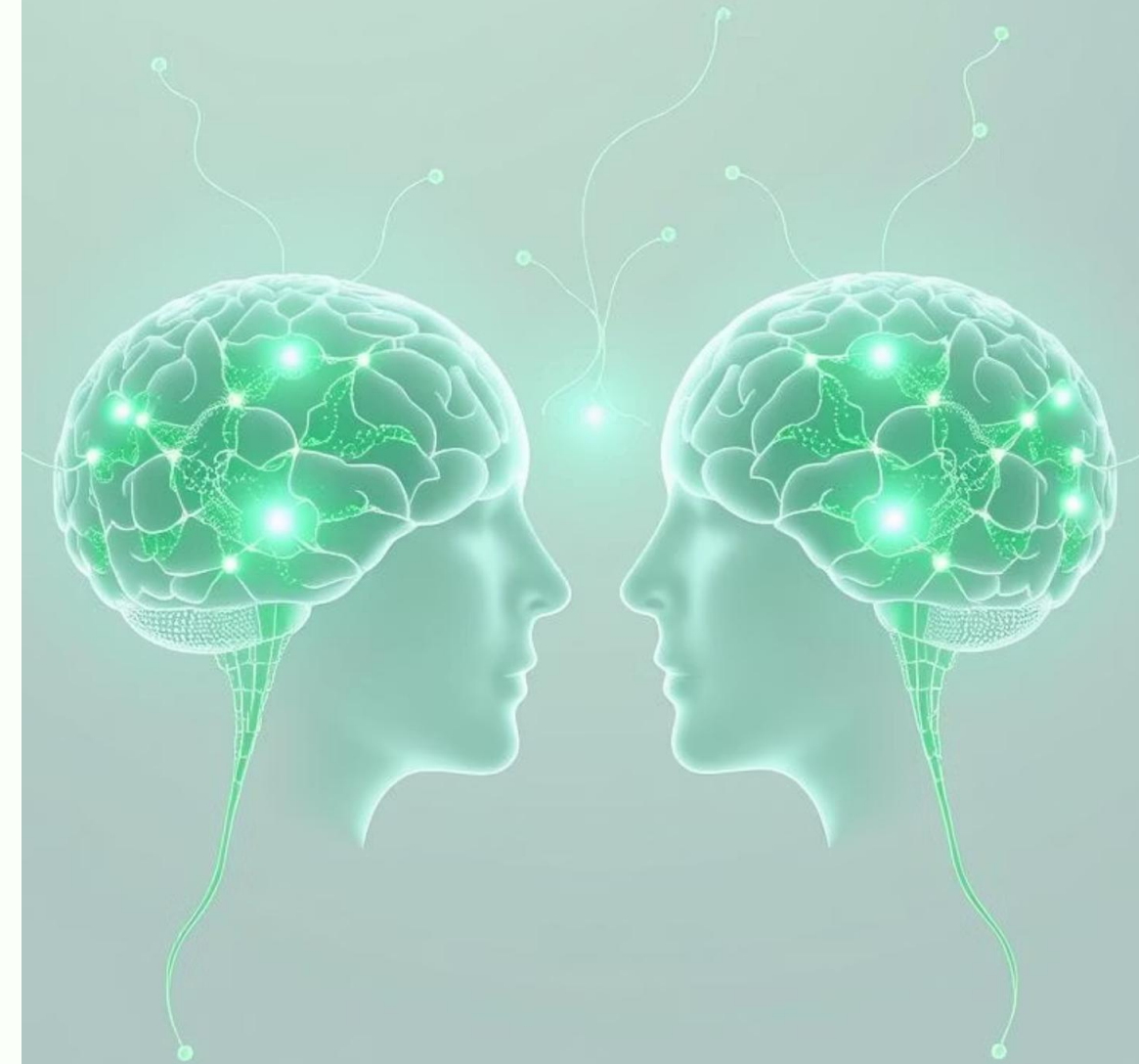
Fine-tuning for Specific Tasks

Adapt these powerful models for specialised tasks with smaller datasets, like blood cell classification.

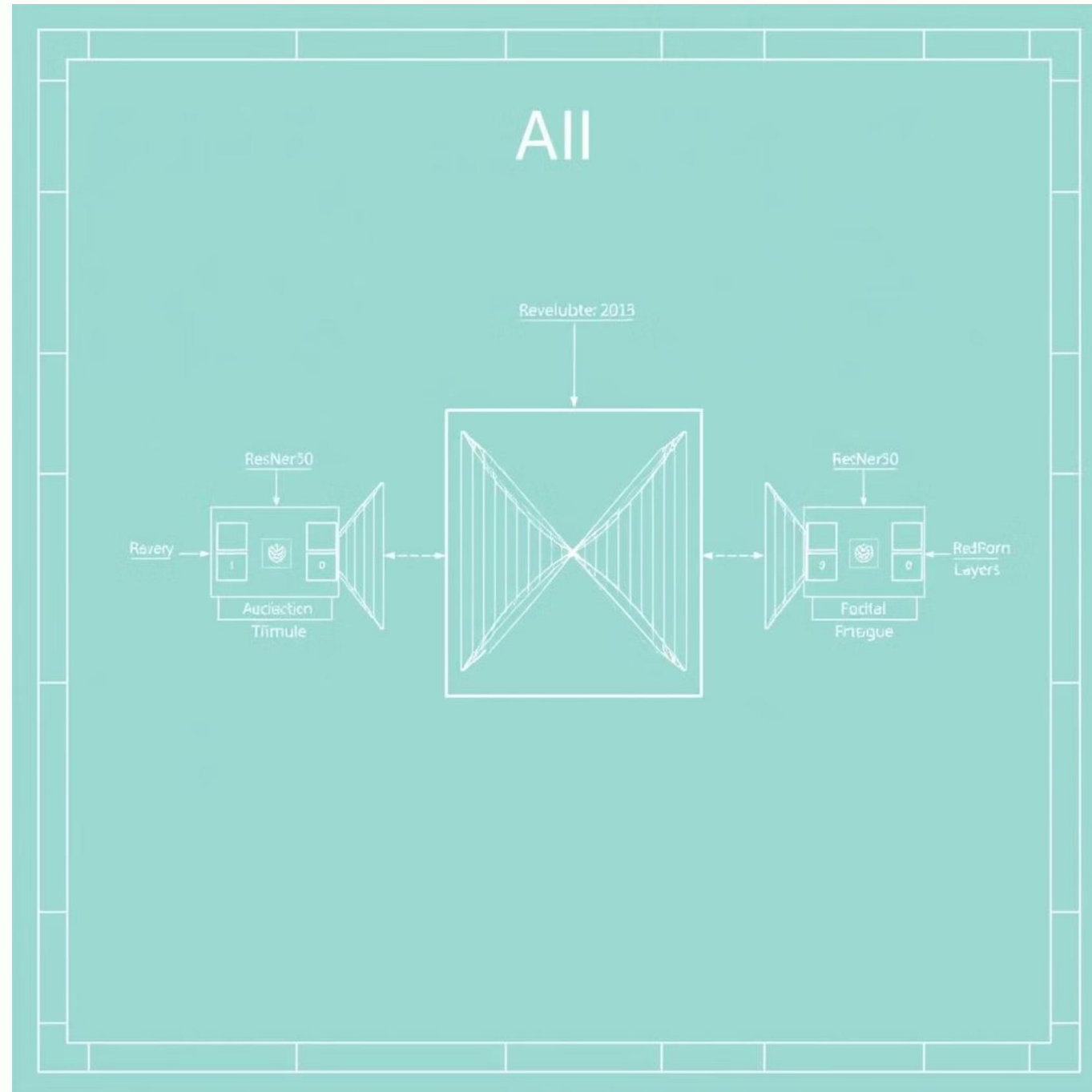


Accelerated Training

Significantly reduces training time and data requirements, while improving model generalisation.



HematoVision: Our AI Architecture



HematoVision employs a sophisticated AI architecture designed for optimal performance in blood cell classification.

Hybrid CNN Model

Utilises a fine-tuned ResNet50 as a robust feature extractor.

Custom Classification Head

Specifically engineered for identifying 8 distinct leukocyte types.

Optimised for Blood Smears

Designed for precise analysis of peripheral blood smear images.

Tech Stack

Built with TensorFlow and Keras on Python 3.9.

Data & Methodology

Dataset Acquisition

Leveraged the publicly available PBC_dataset, comprising over 17,000 high-quality blood cell images.

Data Augmentation

Applied rotation, flipping, and zooming to the dataset to enhance model robustness and generalisation.

Training Environment

Model trained on an NVIDIA V100 GPU for 100 epochs, utilising the Adam optimizer for efficient convergence.

Validation Protocol

Rigorous validation performed on a held-out set, representing 20% of the total dataset, to ensure unbiased evaluation.



Performance & Validation Results



Overall Accuracy

Achieved across all identified blood cell types.



F1-Score

Exceeded for Neutrophils, Lymphocytes, and Monocytes, indicating high precision and recall.



Analysis Speed

Performs full slide analysis in under 5 seconds.



Accuracy Improvement

Outperforms traditional image processing methods.

Clinical Impact & Benefits



Faster Diagnosis

Reduced turnaround time by 85%, accelerating patient care.



Enhanced Accuracy

Decreased misclassification errors by 92%, leading to more reliable results.



Resource Optimisation

Frees up 35% of lab technician time, improving efficiency.



Standardisation

Eliminates inter-observer variability, ensuring consistent and dependable results.



Future Development & Scalability

Expansion to Rare Cell Types

Plans include extending capabilities to identify rare conditions like blast cells in leukaemia.

LIS Integration

Seamless integration with existing Laboratory Information Systems (LIS) for streamlined workflows.

Cloud-Based Deployment

Transition to a cloud platform for broader accessibility and enhanced scalability.

Real-time Analysis

Developing capabilities for point-of-care diagnostics, offering immediate insights.

Why HematoVision is Crucial



HematoVision is a UK-based innovation poised for global impact, transforming haematology diagnostics with AI, driving efficiency, precision, and cost savings, and supporting earlier, more confident clinical decisions.



Conclusion: The Future of Diagnostics

HematoVision represents a significant leap forward in blood cell analysis, enabling faster, more accurate patient care. Join us in revolutionising medical diagnostics for a healthier future.

THANK YOU