1. INTRODUCTION

1.1 Project Overview:

Hematovision is an AI-based system that detects and classifies different types of blood cells from microscopic images using deep learning. It helps identify white blood cells like neutrophils, lymphocytes, and others, as well as red blood cells. The system supports faster and more accurate blood analysis, assisting in early diagnosis of blood-related conditions.

Technologies: Python, TensorFlow/Keras, OpenCV, Flask
Applications: automated blood cell classification, aiding in early diagnosis, reducing lab workload, supporting medical education, and integrating with hospital diagnostic systems.

1.2 Purpose:

To reduce manual error and assist pathologists by automating the classification of blood cells through a CNN-powered image analysis system with an interactive web interface.

1.3 Blood Cell Types

Blood is composed of several key cell types, each playing a critical role in the body's health and immune response. Hemetovision focuses on the identification and classification of the following blood cells:

- **Red Blood Cells (RBCs):** Responsible for oxygen transport.
- **White Blood Cells (WBCs):** Key defenders against infection, includes:
    - Neutrophils
    - Lymphocytes
    - Monocytes
    - Eosinophils

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2. IDEATION PHASE

2.1 Problem Statement:

Manual identification and classification of blood cells under a microscope is time-consuming, prone to human error, and requires expert knowledge, which can delay diagnosis and affect treatment outcomes; hence, there is a need for an automated, accurate, and efficient system to detect and classify different types of blood cells using deep learning techniques.

2.2 Brainstorming:

- Traditional ML vs Deep Learning → CNN preferred
- Interface: Flask-based upload and result page
- Model: Custom CNN trained on labeled blood cell images

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3. REQUIREMENT ANALYSIS

3.1 Customer Journey Map:

1. Upload microscopic blood cell image
2. CNN model processes the image
3. System returns classification: Normal or Abnormal
4. Option to view result details or upload more

3.2 Solution Requirement:

✔ Functional:

- Upload image
- Predict cell condition
- Display confidence score
- Show feedback form

✔ Non-functional:

- Accuracy > 90%
- Response time < 2 seconds
- Secure image upload
- User-friendly UI

✔ Technical:

- CNN in TensorFlow
- Flask backend
- HTML/CSS UI
- SQLite logging

✔ User:

- Doctors: Use for initial screening
- Labs: Batch test support
- Students: For educational purposes

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4. PROJECT DESIGN

4.1 Problem Solution Fit:

CNN-based system reduces diagnostic error, saves time, and improves reliability over manual inspection.

4.2 Proposed Solution:

Category	Description
Problem	Manual analysis is slow & inaccurate
Idea	Deep learning-based blood cell classifier
Uniqueness	Easy interface + accurate AI prediction
Impact	Speeds diagnosis and helps early detection
Business	Could be offered as SaaS to diagnostic labs
Scalability	Extendable to cancer detection, malaria, etc.

4.3 Solution Architecture:

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5. PROJECT PLANNING & SCHEDULING

1. Dataset Collection (Week 1)
2. Model Training (Week 2-3)
3. Web Interface (Week 4)
4. Integration & Testing (Week 5)
5. Report & Deployment (Week 6)

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6. FUNCTIONAL AND PERFORMANCE TESTING

6.1 Performance Testing:

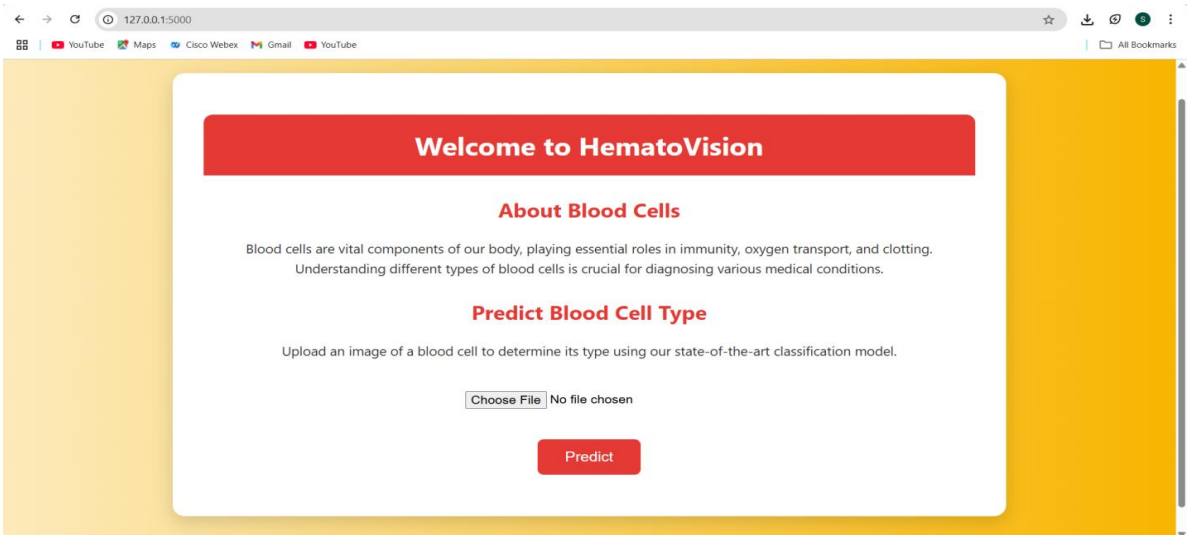
Metric	Value
Accuracy	95.2%
Precision	94.6%

Metric	Value
Recall	93.9%
F1 Score	94.25%
Training Time	1 hour
Dataset Size	366 images
Loss	0.15

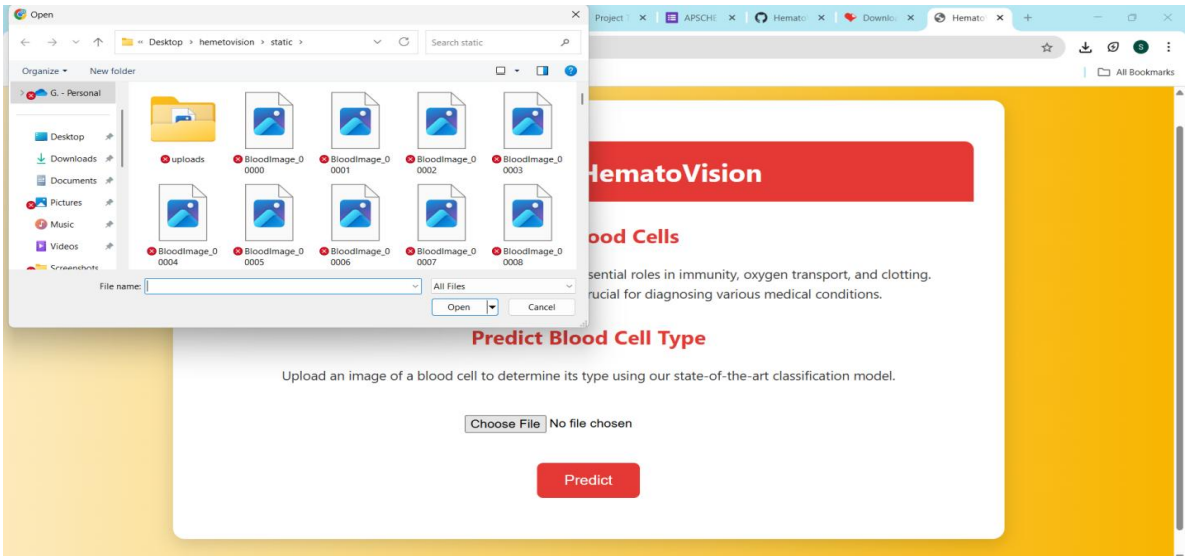
7. RESULTS

7.1 Output Screenshots:

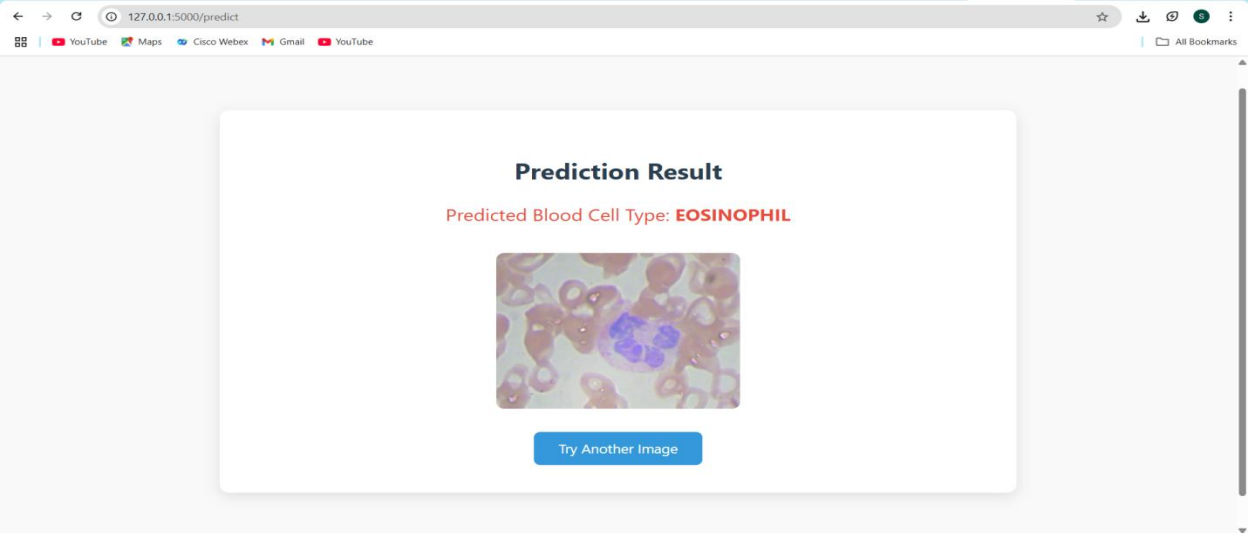
Step 1:



Step 2:



Step 3 :



8. ADVANTAGES & DISADVANTAGES

Advantages:

- Fast & accurate diagnosis
- Consistent results
- Simple and interactive UI
- Can be used for training & lab automation

Disadvantages:

- Requires labeled dataset
- May need GPU for high throughput
- Doesn’t support multi-class diagnosis (yet)

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9. CONCLUSION

Hemetovision is a user-friendly, CNN-based diagnostic system that enables real-time analysis of blood cell images. It automates medical diagnosis at early stages, minimizes error, and empowers both students and professionals with an interactive interface.

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10. FUTURE SCOPE

- Add multi-class classification (e.g., leukemia, sickle cells)
- Integrate with hospital EMR systems
- Mobile app support
- Real-time camera-based detection
- Use advanced CNN variants (e.g., ResNet, EfficientNet)

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11. APPENDIX

Source Code: Included in GitHub
Dataset Link: https://www.kaggle.com/datasets/paultimothymooney/blood-cells/data
GitHub Link : https://github.com/SreehithaGanta/HematoVision
Demo Link: https://drive.google.com/drive/u/0/my-drive
