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# 🧬 HematoVision: Advanced Blood Cell Classification Using Transfer Learning

\*\*HematoVision\*\* is a deep learning-powered web application designed to classify microscopic images of blood cells into one of four categories:

\* 🔴 \*\*Eosinophil\*\*

\* 🟢 \*\*Lymphocyte\*\*

\* 🟡 \*\*Monocyte\*\*

\* 🔵 \*\*Neutrophil\*\*

This intelligent diagnostic tool leverages \*\*Transfer Learning\*\* with \*\*MobileNetV2\*\* to deliver high-accuracy predictions in real-time, wrapped in a clean and intuitive \*\*Flask\*\*-based web interface.

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## 🚀 How It Works

1. \*\*📤 Upload\*\* a microscopic image of a blood cell.

2. \*\*🔍 The model\*\* processes the image using deep learning.

3. \*\*📈 You get\*\* the predicted class along with a preview of the uploaded image.

This makes HematoVision an ideal assistant for biomedical learners, educators, and early-stage researchers.

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## ⚙️ Features

\* ✅ Real-time image classification

\* ✅ Built-in preprocessing pipeline with OpenCV

\* ✅ Lightweight model (MobileNetV2) for quick inference

\* ✅ Web interface with smooth UX and visual feedback

\* ✅ Base64 image embedding for fast, secure previews

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## 🛠️ Tech Stack

| Layer | Technologies Used |

| ------------- | ------------------------------------------ |

| \*\*Model\*\* | TensorFlow / Keras with MobileNetV2 |

| \*\*Backend\*\* | Python, Flask |

| \*\*Image Ops\*\* | OpenCV for image preprocessing |

| \*\*Frontend\*\* | HTML5, CSS3 (light theme with stunning UI) |

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## 📁 Project Structure

```bash

HematoVision/

├── app.py # Main Flask application

├── Blood Cell.h5 # Pretrained MobileNetV2 model (~60MB)

├── requirements.txt # Project dependencies

├── static/ # Uploaded image storage

└── templates/ # HTML templates

├── home.html # File upload and landing page

└── result.html # Prediction result display page

```

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## 💻 Run Locally

You can run this project easily on your local system. Just follow these steps:

### 1️⃣ Clone the Repository

```bash

git clone https://github.com/pedadasaikrishna/HematoVision-Advanced-Blood-Cell-Classification-Using-Transfer-Learning-by-LTVIP2025TMID44712

cd HematoVision-Advanced-Blood-Cell-Classification-Using-Transfer-Learning-by-LTVIP2025TMID44712

```

### 2️⃣ Create a Virtual Environment (Optional but recommended)

```bash

python -m venv venv

venv\Scripts\activate # On Windows

# source venv/bin/activate # On macOS/Linux

```

### 3️⃣ Install the Required Packages

```bash

pip install -r requirements.txt

```

### 4️⃣ Start the Flask App

```bash

python app.py

```

Then open your browser and go to:

🔗 [http://127.0.0.1:5000](http://127.0.0.1:5000)

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## 📸 Sample Output

> 🧠 The application shows the predicted blood cell type alongside the uploaded image, providing instant visual confirmation.

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## 👨‍🔬 Future Enhancements

\* Integration with mobile camera input

\* Batch image classification

\* Confidence score visualization

\* CSV download for prediction logs

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## 🙌 Acknowledgements

Thanks to the open-source community for datasets, MobileNetV2 pretrained weights, and Flask ecosystem.

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