Project Design Phase
Solution Architecture

Date	19 February 2026
Team ID	LTVIP2026TMIDS40157
Project Name	HematoVision: Advanced Blood Cell Classification Using Transfer Learning
Maximum Marks	4 Marks

Solution Architecture:

HematoVision bridges the gap between manual blood cell diagnosis and AI-powered automated classification by integrating deep learning technologies into healthcare workflows.

The solution architecture is designed to:

- Identify the best technological approach (Transfer Learning with CNNs).
- Define system structure and workflow for stakeholders.
- Provide scalable and deployable AI-based diagnostic support.
- Ensure efficient model training, validation, and deployment**.**

1. Overall System Architecture

The system follows a layered architecture:

Layer 1: Data Acquisition

- Blood smear images captured using digital microscope.
- Dataset of 12,000 annotated images.
- Categories:
    - Eosinophils
    - Lymphocytes
    - Monocytes
    - Neutrophils

Layer 2: Data Preprocessing

- Image resizing (e.g., 224x224 pixels).
- Normalization.
- Data augmentation (rotation, flipping, zoom).
- Train-test split.

Layer 3: Model Layer (Core AI Engine)

- Pre-trained CNN Model (Transfer Learning).
- Replace final classification layers.
- Fine-tuning on blood cell dataset.
- Performance evaluation using:
    - Accuracy
    - Precision
    - Recall
    - F1-score

The model helps in supporting early detection of diseases such as:

- Leukemia
- Anemia

Layer 4: Prediction & Output Layer

- Upload blood smear image.
- Model predicts cell type.
- Generates classification result.
- Displays confidence score.
- Report generation.

Layer 5: Deployment Layer

- Web-based interface (Flask / Streamlit).
- Cloud deployment (optional for scalability).
- Integration with hospital systems.
- API support for telemedicine platforms.

2. Data Flow Architecture

1. User uploads blood cell image.
2. Image undergoes preprocessing.
3. Processed image is fed into CNN model.
4. Model performs classification.
5. Output is generated with prediction label + probability.
6. Result stored in database (optional).
7. Report shared with healthcare professional.

3. Technology Stack

- Programming Language: Python
- Framework: TensorFlow / Keras
- Model: Pre-trained CNN (ResNet / MobileNet / VGG)
- Deployment: Flask / Streamlit
- Cloud (Optional): AWS / GCP

4. Key Architectural Features

- Modular design (easy upgrades).
- Scalable for large datasets.
- Extendable to additional blood disorders.
- Cloud-ready architecture.
- Real-time inference capability.

5. Future Architectural Enhancements

- Integration with live microscope feeds.
- Automated abnormal cell detection.
- Multi-disease classification model.
- Mobile application interface.
- Full SaaS-based AI diagnostic platform.

Example - Solution Architecture Diagram:

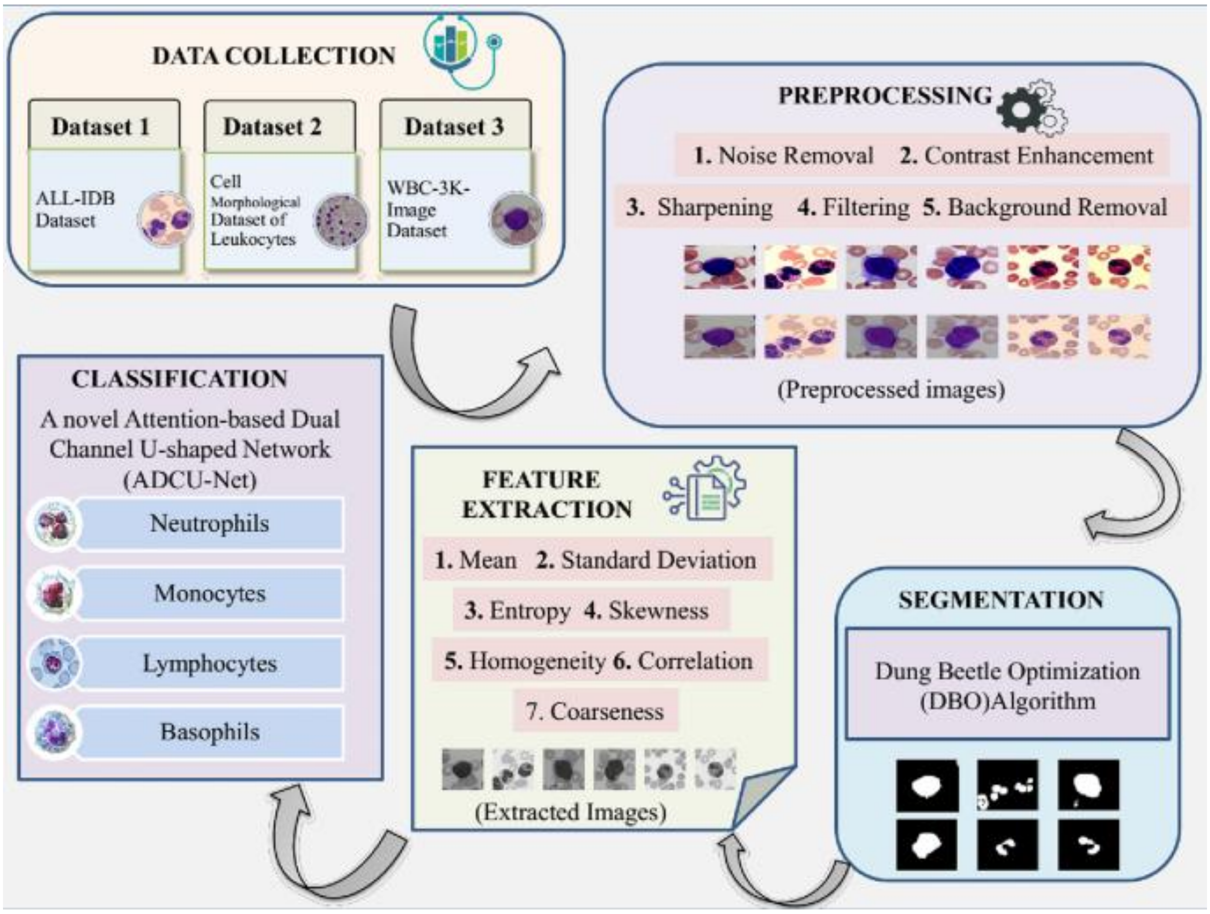

Figure 1: Architecture and data flow of HematoVision: Advanced Blood Cell Classification Using Transfer Learning.