# Deep Learning Approach to Identify Blood Group using Fingerprint

Mamatha G M
Department of Computer Science and Engineering, Ghousia College of Engineering, Ramanagaram, Karnataka, India, Affiliated to VTU Belagavi

Dr. T Venkatesh
Professor and R& D Head, Department of Computer Science and Engineering, Ghousia College of Engineering, Ramanagaram, Karnataka, India

**Abstract**
Blood group identification is essential for medical diagnosis, emergency treatment, and transfusion safety. Traditional serological testing requires blood samples, laboratory reagents, and trained personnel, which may not be accessible in time-critical or resource-limited environments. Recent research suggests a correlation between fingerprint ridge patterns and genetically inherited traits, including blood groups. This paper proposes a deep learning–based, non-invasive method for predicting a person's blood group using fingerprint images. Convolutional Neural Networks (CNNs) are trained on pre-processed fingerprint datasets to classify individuals into eight major blood groups (A, B, AB, O, Rh +/–). The approach aims to reduce dependency on invasive procedures and provide rapid, portable, and automated blood group identification. Experimental results show promising accuracy, demonstrating the feasibility of fingerprint-based biometric prediction.

**Keywords**— Fingerprint analysis, deep learning, CNN, blood group prediction, biometrics, dermatoglyphics.

## Introduction

Blood group determination plays a crucial role in modern healthcare, especially during emergencies, surgical procedures, and transfusion therapy. Traditional methods rely on serological testing, where blood samples are chemically analyzed to determine antigen–antibody reactions. Although accurate, these procedures require skilled technicians, reagents, laboratory facilities, and strict handling protocols, making them less feasible in remote environments or urgent care situations.

Recent studies indicate that fingerprint ridge morphology— shaped by genetic and prenatal developmental factors—may correlate with biological characteristics, including blood types. This observation opens the possibility of predicting blood group from non-invasive biometric data. Deep learning, particularly Convolutional Neural Networks (CNNs), has shown exceptional capability in identifying complex spatial features in images, making it suitable for analyzing fingerprint ridge patterns.

This research focuses on developing a deep learning model capable of extracting discriminative fingerprint features and predicting corresponding blood groups. The project leverages CNN architectures such as ResNet, VGG16, Alex Net, and LeNet to identify patterns that traditional statistical methods may miss. The reference study provided demonstrates the feasibility and workflow involved in fingerprint-based prediction systems, serving as a foundational inspiration for methodology design.


DOI: https://doi.org/10.67317/IJMSRT26JUL024

ISSN: 2584-2706

## II Literature Survey

Several methodologies have been explored in blood group detection, ranging from manual agglutination to automated machine learning-based systems.

### A. Traditional Blood Group Detection

The slide agglutination technique remains the gold standard but suffers from dependency on reagents, skilled technicians, and laboratory infrastructure. Manual interpretation also increases the risk of human error.

### B. Automated Image Processing Methods

Studies employing SIFT, ORB, and histogram- based processing show improved accuracy by detecting agglutination patterns in blood slides. However, these systems still require blood samples.

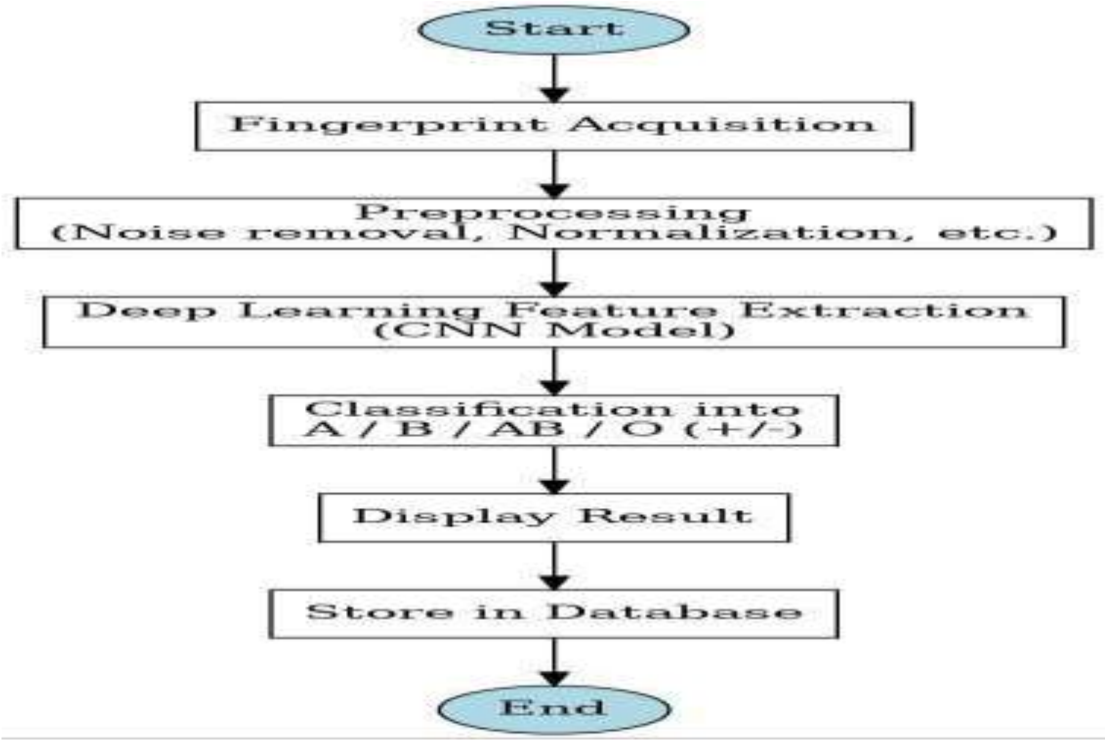
### C. Deep Learning-Based Biomedical Classification

CNNs have revolutionized medical imaging by learning hierarchical features without manual engineering. They excel in classification tasks involving fingerprints, X- rays, and histopathology.

### D. Fingerprint-Based Blood Group Prediction

Recent research indicates that fingerprint ridge flow, texture, and minutiae patterns may correlate with ABO/Rh blood groups. Deep learning methods outperform traditional dermatoglyphic analysis by automatically capturing subtle ridge variations. Several studies highlight fingerprint-based classification using CNNs with promising results. The reference document includes multiple works that confirm the viability of CNN-driven blood group prediction.

## Methodology




The proposed system follows a structured pipeline comprising fingerprint acquisition, preprocessing feature extraction, model training, classification, and result visualization.


DOI: https://doi.org/10.67317/IJMSRT26JUL024

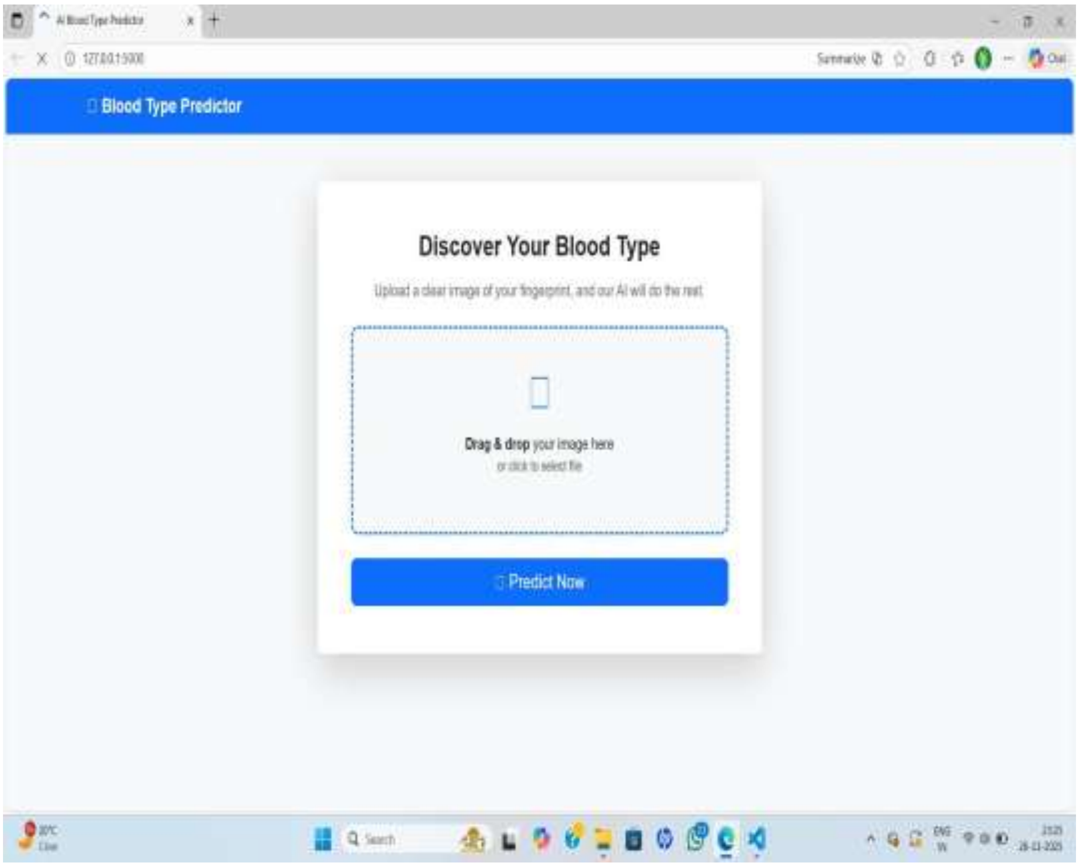
### E. Fingerprint Acquisition
Fingerprint images are captured using digital sensors or derived from publicly available datas ets. High- resolution images ensure proper ridge visibility and reduce preprocessing burdens

### F. Dataset Preparation
Images are manually categorized into eight folders corresponding to the eight blood groups. Quality checks remove blurred or incomplete fingerprints. The dataset is then divided into training, validation, and testing sets.

### G. Image Preprocessing
Preprocessing ensures uniformity and clarity of fingerprint images:
- Grayscale conversion
- Noise reduction using Gaussian/median filters
- Contrast enhancement
- Ridge segmentation and cropping
- Normalization of pixel intensity

## IV. Results and Discussion
The proposed Deep Learning Approach to Identify Blood Group Using Fingerprint was implemented using a Flask- based web interface that interacts with the trained CNN model. The results demonstrate the complete workflow of the system—from startup, image upload, to final prediction. The key execution outputs are shown and discussed below.

### A. System Startup Interface




When the system is launched, the user is presented with a clean and intuitive homepage. This graphical interface allows users to upload fingerprint images for blood group prediction. The interface is minimal, easy to navigate, and optimized for fast user interaction.

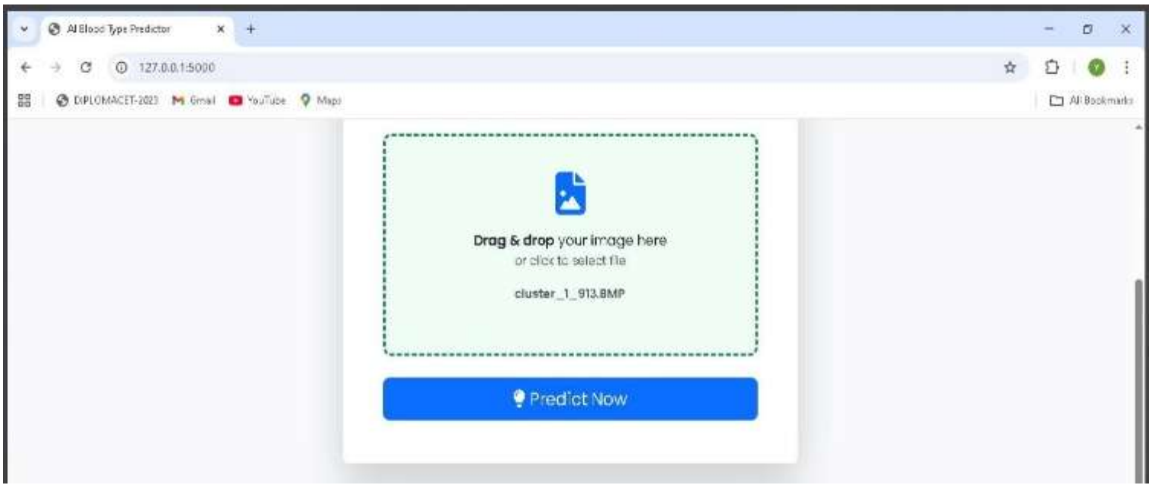

DOI: https://doi.org/10.67317/IJMSRT26JUL024

**Discussion:**

The startup screen provides a drag-and-drop input field where users can upload fingerprint images in formats suchas JPG, PNG, or BMP. The design is intentionally kept simple to support non-technical healthcare workers or operators in field-level situations.

### B. ImageUploadandInputHandling

Upon selecting a fingerprint image, the interface displaysthe name of the uploaded file, confirming successful input. This ensures that the correct image has been selected before initiating the prediction process.




**Discussion:**

Theinterfaceconfirmsfileacceptancevisuallyandtextually. This reduces the risk of incorrect image selection and enhances usability. The uploaded fingerprint is then automatically pre-processed, including resizing, noise removal, normalization, and ridge enhancement, beforebeing fed into the CNN model.

### C. PredictionPhase Case 1:

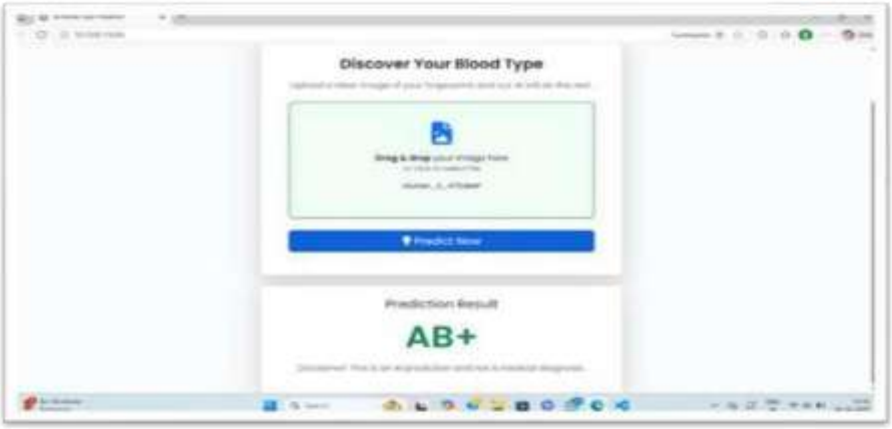
Once the image is uploaded, the user clicks the "Predict Now" button. The system processes the image through the trainedCNNmodel,whichextractsridge-basedfeaturesand classifies the fingerprint into one of the eight major blood groups (A+, A−, B+, B−, AB+, AB−, O+, O−).


**Discussion:**


DOI: https://doi.org/10.67317/IJMSRT26JUL024

When the prediction button is pressed, the backend model loads the required weights and processes the fingerprint image. The CNN evaluates texture patterns, minutiae distribution, ridge orientations, and other unique dermatoglyphic features to predict the blood group. The final predicted value is displayed instantly on the screen.

**Case 2:**




## Future Work

Further improvement of the system may involve:

- Developing a larger, more diverse fingerprint dataset
- Using advanced deep learning models like Vision Transformers
- Enhancing preprocessing with ridge-frequency and orientation analysis
- Implementing real-time mobile applications
- Introducing multimodal biometrics (fingerprint+ palmprint correlation)
- Reducing prediction latency using model quantization or edge AI acceleration

Additionally, statistical dermatoglyphic studies may help validate genetic correlations more extensively.

## Conclusion

This research demonstrates the feasibility of a deep learning–based, non-invasive blood group prediction system using fingerprint images. By employing CNN models, ridge patterns can be analyzed to extract discriminative features associated with various blood groups. Though the system is not intended to replace conventional serological testing, it offers a practical supplementary tool for emergency situations, rapid screening, and remote healthcare applications. With advancements in dataset quality, model accuracy, and optimized deployment, fingerprint-based blood group prediction can evolve into a reliable biomedical diagnostic aid.

## References

[1] A. Toma, N. Odeh, and F. Mohammed, “Automatic Blood Type Identification using Image Processing Techniques,” Sensors, 2021.
[2] M. K. Chandana, H. Mansi, “Medical Image Processing-Based Blood Group Detection,” IJRASET, 2021.
[3] Mehedi Talukdar et al., “Blood Group Determination using Statistical Image Analysis,” IJARCCE, 2015.
[4] S. M. Nazia Fathima, “Classification of Blood Type Images Using Machine Learning,” IJMLC, 2013.
[5] Enes Ayan, E. Yildirim, “Embedded Real-Time Blood Group Classification,” 2016.
[6] K. Dharani Sai et al., “CNN-Based Fingerprint Analysis for Blood Group Prediction,” 2025.
[7] A. T. Supreet et al., “Fingerprint-Driven Non- Invasive Blood Group Detection Using CNNs,” 2025.
[8] C. Nandhini et al., “Deep CNN Architecture for Fingerprint-Based Blood Group Detection,” 2025.


DOI: https://doi.org/10.67317/IJMSRT26JUL024