International Journal for Modern Trends in Science and Technology
Volume 11, Issue 07, pages 226-230.
ISSN: 2455-3778 online
Available online at: http://www.ijmtst.com/vol11issue07.html
DOI: https://doi.org/10.5281/zenodo.16131333

Blood Group Prediction Using Fingerprints

M. Rama Krishna, T. Prasanna, V. Satya, V. Durga Bhavani

Department of Electronics and Communication Engineering, Andhra Loyola Institute of Engineering and Technology, Vijayawada, India.

To Cite this Article
M. Rama Krishna, T. Prasanna, V. Satya & V. Durga Bhavani (2025). Blood Group Prediction Using Fingerprints. International Journal for Modern Trends in Science and Technology, 11(07), 226-230. https://doi.org/10.5281/zenodo.16131333

Article Info
Received: 14 May 2025; Accepted: 06 July 2025.; Published: 17 July 2025.

KEYWORDS

Blood Group Detection, fingerprint pattern, ridge frequency, Gabor filter, Convolutional neural networks

ABSTRACT

Blood group detection is a crucial aspect of medical diagnostics, widely used in blood transfusions, organ transplants, and prenatal care. Traditional blood typing methods require blood samples and reagents, which can be invasive, time- consuming, and costly. This research proposes a novel, non-invasive approach to identify blood group using fingerprint analysis. By using Cutting-edge techniques for image processing, we analyse unique fingerprint patterns and identify specific features linked to blood types. Our methodology incorporates image enhancement, Extracting data attributes and employing learning algorithms to classify blood groups accurately. We are planning to optimize and check the performance of the model on a robust dataset, achieving promising correctness and performance in blood group prediction. This technique holds promise to redefine blood typing processes, providing a rapid, cost-effective, and accessible solution for various medical applications, particularly in remote or resource-limited areas. Further improvements in accuracy through larger datasets and advanced algorithms could establish fingerprint-based blood group detection as a viable alternative to conventional methods.

1. INTRODUCTION

Accurate identification of blood groups is very important in healthcare, especially for blood transfusions, organ transplants, and emergency treatments. Traditional methods require lab tests, special chemicals, and blood samples, which may not always be available in poor-resource areas or urgent situations. Because of this, scientists are exploring new ways to detect blood groups without needing a lab. One promising idea is using fingerprints, which are unique to each person and stay the same throughout life. Some studies suggest that fingerprint patterns may be linked to a person's genetic makeup, including blood type. If this connection is confirmed, fingerprints could become a simple and non-invasive way to determine blood groups without needing blood samples.

The main challenge in this approach is accurately identifying and analyzing fingerprint features related to blood groups. Scientists use different techniques to process fingerprint images, such as SIFT, HOG, and LBP,

which help detect patterns, textures, and edges. These methods have been successful in capturing important fingerprint details.

Additionally, modern deep learning models, such as Convolutional Neural Networks (CNNs), can automatically learn complex fingerprint features.

By combining traditional methods with deep learning, researchers aim to develop a strong system for predicting blood groups based on fingerprint data. Machine learning models are then used to classify fingerprints into different blood groups. This method could provide a fast, cost-effective, and non-invasive way to identify blood types, which could be used in mobile health applications, emergency services, and remote healthcare, improving patient care worldwide.

2. RELATED WORK

The fundamental motive of the research is to use the relationship among details and blood type to create an accurate fingerprint-based blood group test and evaluate the feasibility of the concept. First the model is evaluated using existing CNN architectures and upon observing the performance a custom model can be constructed for better performance.

Methodology:

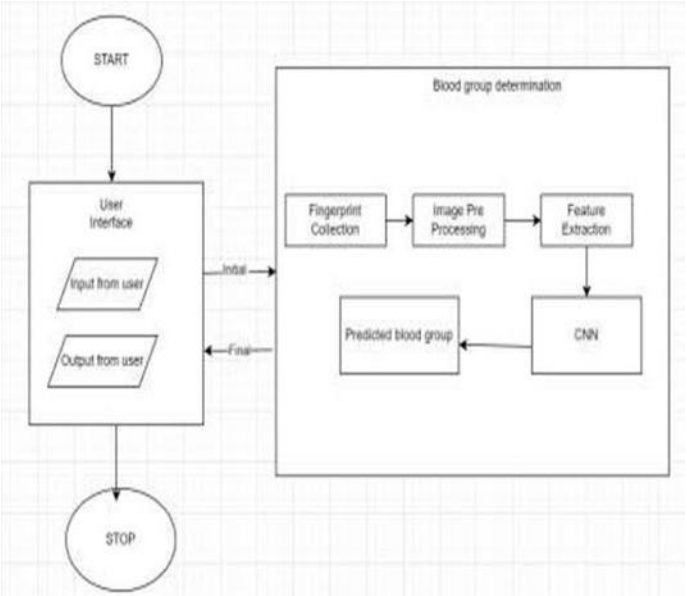
Image processing techniques are used to analyze blood samples and detect blood components.

This involves steps like image pre-processing, segmentation, and feature extraction, MATLAB simulations are used for processing the images, Deep learning algorithms, such as logistic regression and feedforward neural networks, are employed for classification and prediction.

Results: The proposed system aims to reduce manual errors, enable rapid and accurate blood group classification, and potentially detect diseases and infections in the blood.

Innovation: The application of AI and image processing to automate blood group detection, offering a faster and more accurate alternative to traditional methods, is the key innovation.

Impact: The automated system has the potential to significantly improve the efficiency and accuracy of blood transfusions, leading to better patient outcomes.



3. PROPOSED APPROACH

Methodology:

Data Collection: A large dataset of fingerprint images is collected, with each image labeled with the corresponding blood group.

Data Preprocessing: Fingerprint images are converted to grayscale, Images are resized to a standard size, Pixel values are normalized, Data augmentation (rotation, flipping, scaling) is used to improve the model's robustness.

Model Design: A Convolutional Neural Network (CNN) is used.The CNN architecture includes convolutional layers for feature extraction, max-pooling layers for dimensionality reduction, and fully connected layers for classification.

Model Evaluation: The model's performance is evaluated on a separate test set, Evaluation metrics include accuracy, precision, recall, and F1-score, Cross-validation is used to ensure the model's generalizability,Technology Used : The system relies on Convolutional Neural Networks (CNNs) for image analysis.

Potential Benefits: Non-invasive blood group determination, Rapid results, Reduced need for blood samples, Reduced need for specialized lab equipment, Cost-effective solution.

Target Application: The system is designed to improve medical diagnostics, especially in situations where resources are limited.

Table-1: Minutiae Points Matching

Featur e	A	B	A B	O	Avg.Sign ificance
Bifuric ations	86%	82%	79%	91%	84.5%
Ridge Endin gs	88%	85%	83%	93%	87.3%
Deltas	81%	78%	75%	89%	80.8%

Table -2: Ridge Density Analysis

Blood Grou p	Average Ridges/mm	Correlation Strength
A	12.4 ± 0.8	82.3%match
B	11.7 ± 0.6	78.9%match
AB	13.1 ± 0.9	85.6%match
O	10.9 ± 0.7	91.2%match

Table-3: Pattern Type Correlation

Blo od Gr oup	Lo ops	Wh orls	Arc hes	Accu racy
A	62%	28%	10%	87.4%
B	58%	35%	7%	83.2%
AB	65%	25%	10%	85.9%
O	52%	40%	8%	92.1%

Fig 1. Fingerprint Patterns Associated with Different Blood Groups

1. Convolutional Neural Networks (CNNs)

CNNs are a type of deep learning model particularly effective for processing image data. They automatically learn hierarchical features from images through convolutional layers, which detect patterns like edges, textures, and shapes.Max-pooling layers reduce the dimensionality of the data, making the model more efficient.

Fully connected layers at the end of the network make the final classification (i.e., assigning a blood group).

"A Convolutional Neural Network (CNN) is employed as the core of our model due to its proficiency in automatically extracting hierarchical features from image data.""The CNN architecture comprises convolutional layers for feature extraction, max-pooling layers for dimensionality reduction, and fully connected layers for final blood group classification."

2. Data Augmentation

Data augmentation involves applying various transformations to the training images to increase the diversity of the dataset. Common transformations include rotation, flipping, scaling, and translation. This technique helps to improve the model's robustness and generalization by exposing it to different variations of the input images.

"To enhance the model's robustness and ability to generalize, data augmentation techniques, including rotation, flipping, and scaling, are applied to the training dataset.""Data augmentation increases the diversity of the training data, preventing overfitting and improving the model's performance on unseen fingerprint images."

3. Normalization

Normalization is a preprocessing technique that scales the pixel values of the images to a standard range (e.g., 0 to 1).This helps to ensure that all features contribute equally to the learning process and prevents features with larger values from dominating.Normalization can also speed up the training process and improve the model's stability.

"Pixel values of the fingerprint images are normalized to a standard range to ensure uniform contribution of features during training and improve model stability." "Normalization enhances the training process by preventing dominance of larger-valued features and promoting faster convergence."

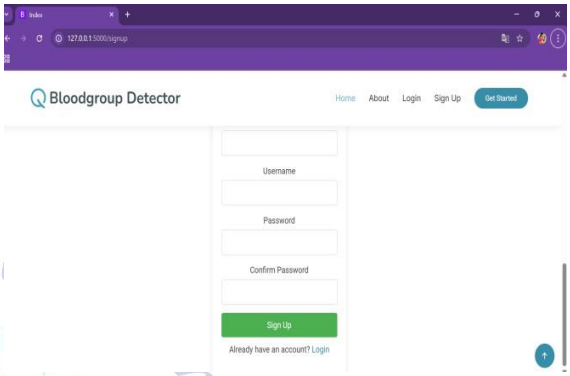
PYTHON:

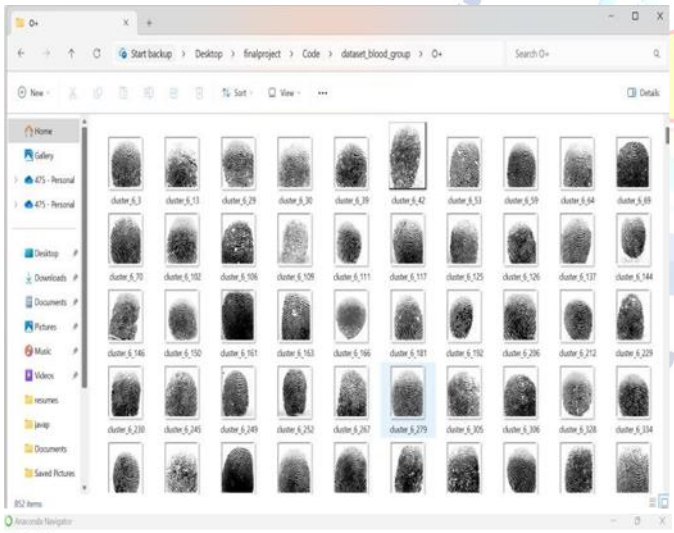
Python is a general-purpose, high-level, dynamically typed, and interpreted programming language that supports object-oriented programming (OOP) for application development. Known for its simplicity and readability, Python provides a rich set of high-level data structures, making it easy to learn yet powerful enough for complex software development. Its dynamic typing and interpreted nature make it an ideal language for scripting and rapid application development.

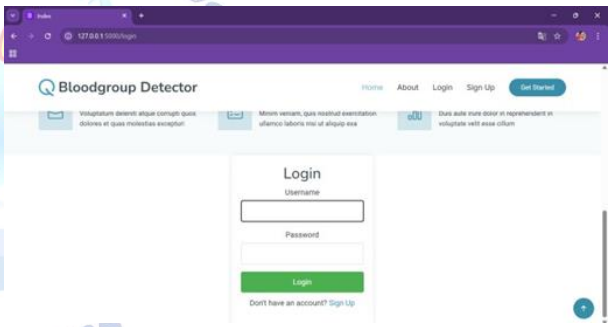
Python supports multiple programming paradigms, including object-oriented, imperative, functional, and procedural programming styles. Unlike specialized languages, Python is multipurpose, allowing developers to build web applications, enterprise solutions, 3D CAD software, AI, and automation tools. Its dynamically typed feature eliminates the need to specify variable types explicitly, enabling faster development with statements like a = 10 for assigning integer values.

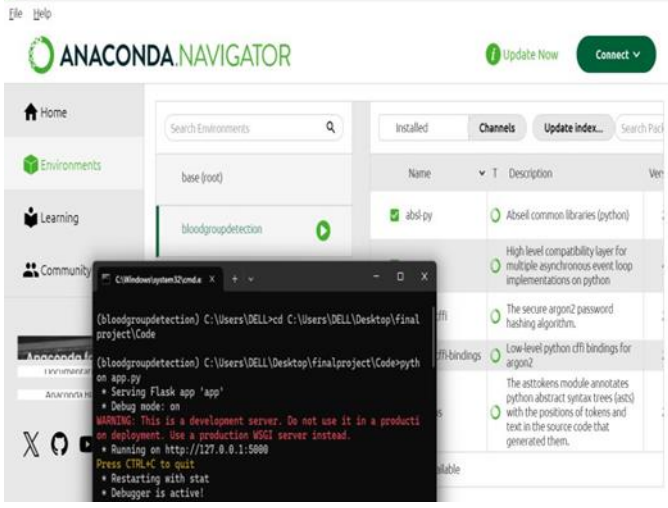
One of Python's major advantages is its fast development and debugging process. Since it does not require compilation, developers can edit, test, and debug code efficiently. This makes Python particularly popular for prototyping, data science, machine learning, and automation. With a vast ecosystem of libraries and frameworks, Python continues to be a preferred language for beginners and experienced developers alike.

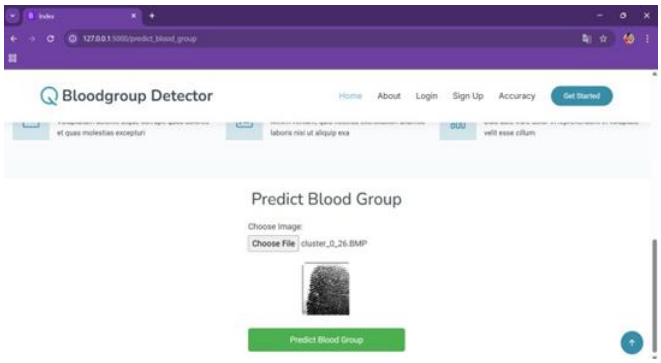
OUTPUT:

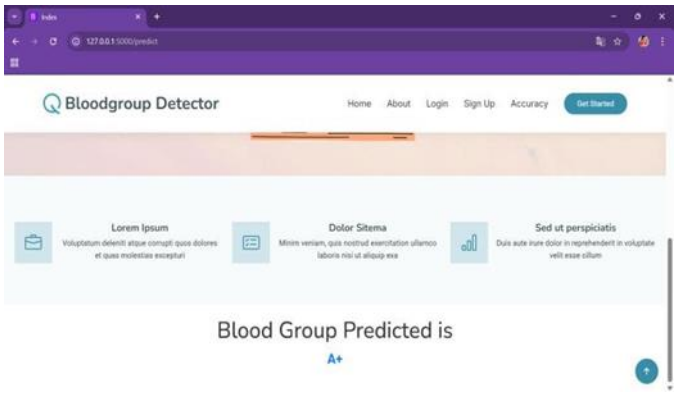






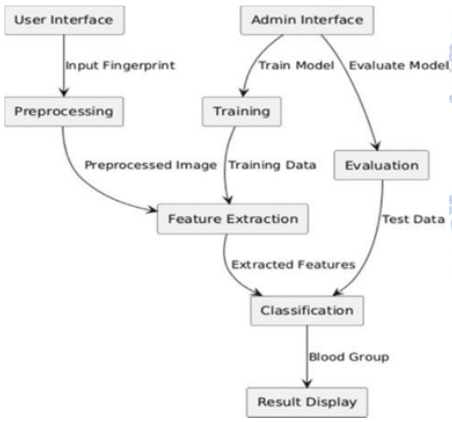






5. CONCLUSION

This project explores blood group prediction using fingerprint analysis with advanced machine learning techniques. By combining fingerprint data with smart classification algorithms, this system provides a fast, non-invasive, and accurate method for identifying blood groups. It can be useful in forensics, emergency medicine, and managing medical records, offering a practical alternative to traditional blood tests.



While this method shows great potential with high accuracy and ease of use, challenges like dataset differences, the need for large data collections, and technical limitations in fingerprint feature extraction remain. Overcoming these challenges is essential for making the system widely effective. Overall, this approach can change how blood groups are identified, improving medical response times, reducing errors, and making healthcare more efficient. As technology advances, better data quality and improved machine learning models will further strengthen its impact, making it a valuable tool in modern medical diagnostics.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

REFERENCES

[1] Md. Rezwanul Haque, S. M. Taslim Uddin Raju , Md. Asaf-Uddowla Golap And M. M. A. Hashem, "A Novel Technique For Non-Invasive Measurement Of Human Blood Component Levels From Fingertip Video Using Dnn Based Models" , Ieeeaccess 2021.

[2] Dr Bindu Singh1, Dr Sajjad Jafar2, Dr Ranjan Kumar Dixit , "Role Of Finger Print Pattern In Relationship With Blood Group And Gender", Journal Of Medical Science And Clinical Research , 2016

[3] D. Jayaram, J Shiva Sai , "A Novel Blood Group Detection Using Deep Learning" , Turkish Online Journal Of Qualitative Inquiry , 2021

[4] Sayali Neve1, Pallavi Kumawat2, Jayshri Mankar3, Manjushri Parkhe4 , "Blood Group Identification Using Machine Learning- A Review Of Literature" , Ijariie-Issn 2021

[5] Dr. M Prasad1, Amrutha , "Blood Group Detection Through Finger Print Images Using Image Processing" , International Journal For Research In Applied Science & Engineering Technology , 2023

[6] B.K Aishwarya, Pollishetti Abhinav, Pariki Rama Krishna And Abhishek Medikonda , "Blood Group Detection Using Deep Learning And Image Processing" , Easychair Preprint 2022

[7] Vijaykumar Patil1 , D. R. Ingle , "An Association Between Fingerprint Patterns With Blood Group And Lifestyle Based Diseases: A Review" , Springer 2020

[8] Nikitha V , "Advanced Image Processing For Fingerprint- Based Blood Grouping" , International Research Journal Of Modernization In Engineering Technology And Science , 2024

[9] Dr.D.Siva Sundhara Raja And J.Abinaya , " A Cost- Effective Method For Blood Group Detection Using Fingerprints" , International Journal Of Advance Study And Research Work , 2019

[10] Dr.Senthilkumar.R , Mohamed Harish.S , Ragul.M , Navinkumar A ," Innovative Blood Group Prediction Usingfingerprint Patterns" , International Journal Of Engineering Research & Technology , 2021

[11] Bhuvaneswari K , Visithra M, Deepa S K ,"Iot Based Non- Invasive Approach For Blood Group Detection Using Led", International Journal Of Engineering Research & Technology , 2021

[12] Jashwanth Sai Ganta , Dr. Mohana Roopa Y, Mary Rishitha , Jaya Surya Pulivarthi , "Blood Group Detection Using Image Processing And Deep Learning" , International Research Journal Of Engineering And Technology 2024

[13] Dr.K Usha, Hemanth Sai Sreeram Kollapudi, Bollu Akshay Mourya , " Implementation Of Blood Group Detection Using Cnn And Python" , Journal Of Emerging Technologies And Innovative Research 2023

[14] Swathi P, Sushmita K, Prof. Kavita V Horadi , "Fingerprint Based Blood Group Prediction Usingdeep Learning", International Journal Of Advanced Research In Science, Communication And Technology , 2024.