International Research Journal on Advanced Engineering and Management
https://goldncloudpublications.com
https://doi.org/10.47392/IRJAEM.2025.0241

e ISSN: 2584-2854
Volume: 03
Issue: 04 April 2025
Page No: 1488 - 1492

Platelet Detection System Using Image

Shweta Patil[1], Nikita Zambare[2], Nirbhay Mohite[3], Koena Samaddar[4]
[1]Associate professor, Dept. of Computer Science and Business System, Bharati Vidyapeeth (Deemed to be University), Navi Mumbai, Maharashtra, India.
[2,3,4]B. Tech Student, Dept. of Computer Science and Business System, Bharati Vidyapeeth (Deemed to be University), Navi Mumbai, Maharashtra, India.
Email ID: *shweta.patil@bvucoep.edu.in[1], nikitazambare2003@gmail.com[2], mohitenirbhay@gmail.com[3], ksamaddar2@gmail.com[4]*

Abstract
Accurate identification and counting of platelets are essential for diagnosing and monitoring various medical conditions, including thrombocytopenia and thrombocytosis. Traditional manual counting methods, such as using a hemocytometer, are time-consuming, prone to human error, and require skilled professionals. To address these issues, this study proposes an automated Platelet Area System that uses image processing and machine learning techniques. The system analyzes high-resolution blood smear images from the BCCD dataset, which are preprocessed to enhance quality and isolate platelets from other blood cells. Leveraging YOLOv8 a state-of-the-art object detection model the system accurately detects and counts platelets, ensuring reliable and precise results. Furthermore, the framework is integrated into an intuitive web interface, allowing healthcare professionals and researchers to upload images and receive automated platelet counts in real time. This solution offers a rapid, versatile, and efficient alternative to manual counting, improving diagnostic accuracy while reducing labor and time requirements. Ultimately, by automating platelet detection, the framework holds the potential to significantly enhance healthcare workflows and support better clinical decision-making.

Keywords: *Platelet Detection, Deep Learning, YOLOv8, Image Processing, Automated Counting, Healthcare Diagnostics, Blood Smear Analysis, BCCD Dataset.*

1. Introduction
Platelets play a vital role in blood clotting and wound healing, making accurate counting essential for diagnosing conditions such as thrombocytopenia, thrombocytosis, leukemia, and dengue fever. Traditional methods like manual counting and automated analyzers face limitations manual approaches are time-consuming and prone to errors, while automated devices are costly and often inaccessible in resource-limited settings. To overcome these challenges, we propose an automated Platelet Detection System that leverages deep learning and image processing techniques. The system employs the YOLOv8 model for real-time, high-precision platelet detection using images from the Blood Cell Count and Detection (BCCD) dataset. Image preprocessing techniques further enhance detection accuracy, and a user-friendly web interface allows healthcare professionals to upload blood smear images for fast platelet counting. This deep learning-based solution offers improved accuracy, reduced human error, faster diagnostics, and cost-effective scalability. It supports early detection of blood disorders, facilitates timely treatment decisions, and enhances healthcare efficiency. However, challenges such as image variability, overlapping cells, and the need for optimized computational resources must be addressed for effective clinical adoption.

2. Background and Related Work
Conventional methods for platelet detection include manual microscopy, where specialists count platelets under a microscope. This approach is time-

International Research Journal on Advanced Engineering and Management
https://goldncloudpublications.com
https://doi.org/10.47392/IRJAEM.2025.0241
e ISSN: 2584-2854
Volume: 03
Issue: 04 April 2025
Page No: 1488 - 1492

consuming, error-prone, and often impractical in resource-limited settings. Automated hematology analyzers provide high accuracy through optical or impedance-based techniques, but they are expensive and not widely accessible. Advancements in deep learning particularly using Convolutional Neural Networks (CNNs)—have enabled automated platelet detection in microscopic images, significantly improving both accuracy and efficiency. Transfer learning with pre-trained models like ResNet and MobileNet enhances performance on smaller datasets, while YOLOv8 enables real-time detection and effectively handles challenges such as overlapping cells and image noise. These AI-driven methods offer cost-effective and reliable solutions for clinical laboratories and medical research, bridging the gap between accuracy and accessibility.

3. Problem Statement

Accurate platelet counting is critical for diagnosing disorders such as thrombocytopenia and thrombocytosis. Traditional methods—manual counting and automated analyzers—have notable limitations: manual counting is slow and prone to error, while automated systems are costly and often inaccessible in low-resource settings. Delays in platelet detection can lead to serious health complications, including bleeding, blood clots, and extended hospital stays. To overcome these challenges, automated deep learning systems using Convolutional Neural Networks (CNNs) and real-time models like YOLOv8 provide fast, accurate, and cost-effective platelet detection. This approach minimizes human error, enables early diagnosis, and enhances patient care globally.

4. Literature Survery

Preprocessing techniques play a critical role in enhancing the quality of microscopic blood smear images prior to platelet detection. A 2020 study explored methods such as contrast enhancement, noise reduction, and histogram equalization to improve image clarity. While these techniques significantly enhance visual quality, they do not fully resolve segmentation issues—particularly in cases where platelets overlap or form clusters, making accurate detection challenging [1]. Thresholding and edge detection have also been investigated for platelet segmentation. A 2017 study introduced gradient-based edge detection techniques to differentiate platelets from the background. Although these methods accelerate the counting process, they struggle with densely packed or overlapping cells, leading to under-segmentation or over-segmentation errors [2]. Similarly, a 2016 study used histogram-based thresholding, applying pixel intensity histograms to separate platelets from other blood components. However, its performance diminishes under low-contrast conditions, making it less effective in images captured under inconsistent lighting [3]. Morphological operations have been widely adopted to improve segmentation accuracy. A 2015 study implemented techniques such as dilation, erosion, and opening-closing operations to fill gaps and reduce noise in segmented images. While effective, these techniques require careful parameter tuning—misconfiguration can result in over-segmentation (identifying non-platelet objects) or under-segmentation (missing platelets) [4]. Automated object detection and feature extraction methods have also been explored to enhance platelet classification. A 2016 study on object labeling assigned unique identifiers to detected platelets, reducing manual counting errors. However, segmentation challenges especially with overlapping platelets remain a significant hurdle [5]. A 2021 study focused on feature extraction techniques, using shape, texture, and size to differentiate platelets from red and white blood cells. When combined with machine learning models such as Support Vector Machines (SVMs), Decision Trees, and k-Nearest Neighbors (k-NN), classification accuracy improved. Nevertheless, similar-shaped cells and platelet clusters can still lead to misclassifications, affecting overall accuracy [6]. Deep learning, particularly through Convolutional Neural Networks (CNNs), has transformed platelet detection. A 2023 study demonstrated that CNN-based models outperform traditional image processing methods by learning intricate spatial patterns within blood smear images. CNNs offer greater accuracy and robustness, making them well-suited for medical applications. However, these models require large, annotated datasets for training and pose computational challenges for real-

International Research Journal on Advanced Engineering and Management
https://goldncloudpublications.com
https://doi.org/10.47392/IRJAEM.2025.0241
e ISSN: 2584-2854
Volume: 03
Issue: 04 April 2025
Page No: 1488 - 1492

time clinical deployment [7].

5. Proposed System

The Platelet Detection System is an advanced tool that leverages machine learning and computer vision to quickly and accurately identify and count platelets in blood smear images. It assists healthcare providers in making faster, more accurate diagnoses of platelet-related conditions, enabling early detection and improved treatment decisions. Designed for ease of use, the system can be effectively adopted by healthcare facilities of all sizes, enhancing diagnostic speed and overall patient care management.

5.1 Key Features

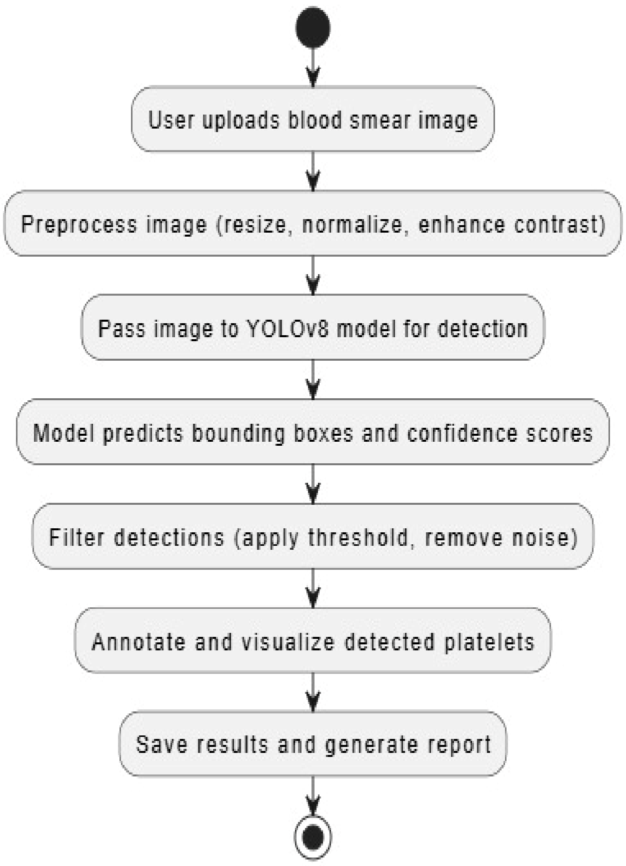


Figure 1 Flowchart of Platelet Detection System using Images

The Platelet Detection Framework uses deep learning to analyze high-resolution blood smear images, ensuring accurate identification and counting of platelets. It classifies platelet levels as normal, low, or high, while also assessing platelet quality. Designed with a user-friendly interface, the system is accessible via both web and mobile platforms, making it adaptable to various healthcare environments. Real-time results provide instant diagnostic feedback, enabling timely medical decisions. The deep learning model continuously improves its accuracy as more data is processed, adapting even to rare platelet disorders. Additionally, the system offers clinical recommendations, including suggestions for further testing, treatment options, or specialist referrals based on the analysis. Figure 1 shows Flowchart of Platelet Detection System using Images.

5.2 Algorithm

The platelet detection framework follows a structured process designed for efficiency and accuracy. It begins with acquiring a blood smear image in formats such as PNG or JPEG. The image is then preprocessed resized, normalized, and enhanced to improve the visibility of platelets. Next, the YOLOv8 deep learning model processes the image, extracting features and predicting bounding boxes around platelets along with confidence scores. To maintain high accuracy, the system filters out low-confidence or noisy detections. Detected platelets are visualized with bounding boxes, allowing for manual verification if needed. Finally, the system generates a detailed report summarizing the results, including the platelet count and bounding box coordinates. This automated approach provides fast, reliable platelet detection, supporting accurate medical diagnostics.

5.3 Model

The platelet detection framework utilizes YOLOv8 (You Only Look Once, version 8), a high-precision, real-time object detection model. Specifically, it employs the lightweight YOLOv8n.pt (Nano version) for efficient performance on limited-resource systems. The model is trained on labeled blood smear images over five epochs, with an input size of 416×416 pixels, using either Adam or SGD optimizers. To ensure accurate detection, the model incorporates multiple loss functions box loss, class loss, and Distribution Focal Loss (DFL). During inference, the system leverages ONNX Runtime for optimized execution, predicting bounding boxes around platelets and assigning confidence scores.

International Research Journal on Advanced Engineering and Management
https://goldncloudpublications.com
https://doi.org/10.47392/IRJAEM.2025.0241
e ISSN: 2584-2854
Volume: 03
Issue: 04 April 2025
Page No: 1488 - 1492

Post-processing techniques, including confidence thresholding and annotation, further refine the results, enhancing the clarity and accuracy of detected platelets. This improves the reliability of medical image analysis and supports more accurate diagnostics. Figure 2 shows Output.

6. Results

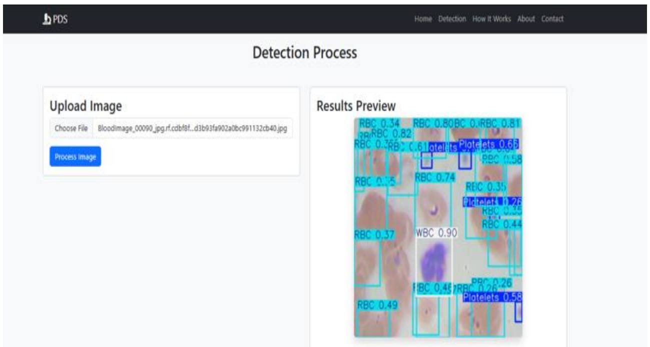
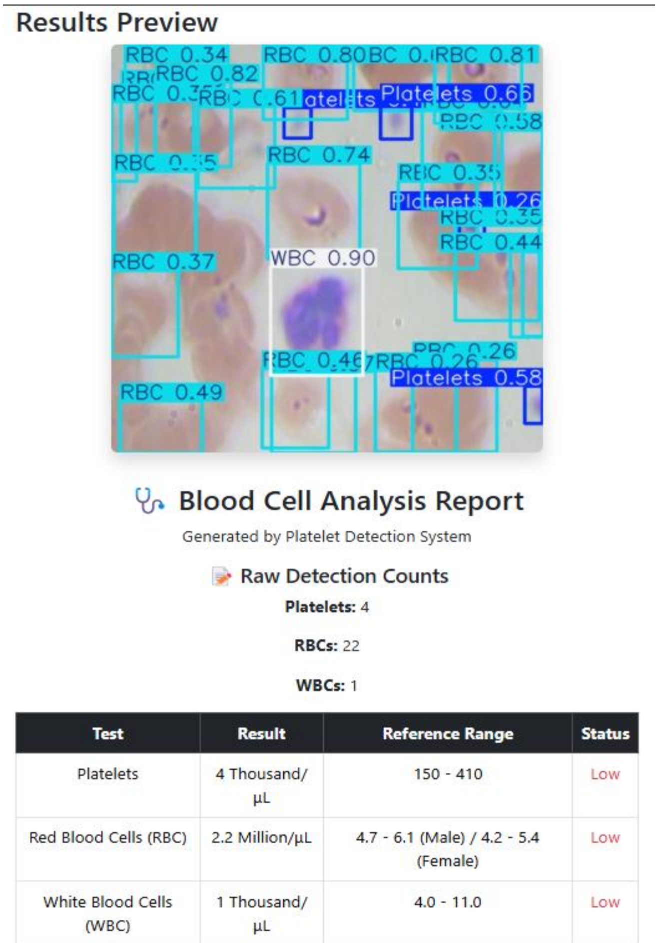


Figure 2 Output



Test	Result	Reference Range	Status
Platelets	4 Thousand/ µL	150 - 410	Low
Red Blood Cells (RBC)	2.2 Million/µL	4.7 - 6.1 (Male) / 4.2 - 5.4 (Female)	Low
White Blood Cells (WBC)	1 Thousand/ µL	4.0 - 11.0	Low

Figure 3 Output

Conclusion

The Platelet Recognition System leverages advanced deep learning techniques to accurately and efficiently count platelets in blood samples, replacing traditional manual and error-prone methods. Figure 3 shows Output. By analyzing high-resolution microscopic blood smear images using Convolutional Neural Networks (CNNs) and object detection models like YOLOv8, the system delivers superior reliability, speed, and accuracy in platelet identification.

References

[1]. D. Cruz et al., "Assurance of blood components (WBCs, RBCs, and Platelets) check in infinitesimal pictures utilizing picture handling and examination," 2017IEEE 9th Universal Conference on Humanoid, Nanotechnology, Data Innovation, Communication and Control, Environment and Administration (HNICEM), Manila, Philippines, 2017, pp. 1-7, doi: 10.1109/HNICEM.2017.8269515.

[2]. V. B. Inchur, L. S. Praveen and P. Shankpal, "Usage of Blood Cell Tallying Calculation utilizing Computerized Picture Preparing Procedures," 2020 Worldwide Conference on Later Patterns on Gadgets, Data, Communication & Innovation (RTEICT), Bangalore, India, 2020, pp. 21-26, doi: 10.1109/RTEICT49044.2020.9315603.

[3]. K. Roy, R. Dey, D. Bhattacharjee, M. Nasipuri and P. Ghosh, "A mechanized framework for platelet division utilizing histogram-based thresholding," 2016 2nd Universal Conference on Progresses in Computing, Communication, & Computerization (ICACCA) (Drop), Bareilly, India, 2016, pp. 1-7, doi: 10.1109/ICACCAF.2016.7749000.

[4]. A R. Dey, K. Roy, D. Bhattacharjee, M. Nasipuri and P. Ghosh, "A mechanized framework for portioning platelets from infinitesimal pictures of blood cells," 2015 Worldwide Symposium on Progressed Computing and Communication (ISACC), Silchar, India, 2015, pp. 230-237, doi: 10.1109/ISACC.2015.7377347.

International Research Journal on Advanced Engineering and Management
https://goldncloudpublications.com
https://doi.org/10.47392/IRJAEM.2025.0241
e ISSN: 2584-2854
Volume: 03
Issue: 04 April 2025
Page No: 1488 - 1492

[5]. P. Kaur, V. Sharma and N. Garg, "Platelet tally utilizing picture preparing," 2016 3rd Universal Conference on Computing for Economical Worldwide Advancement (INDIACom), Unused Delhi, India, 2016, pp. 2574-2577.
[6]. H. Mayrose, N. S, G. M. Bairy, H. Edwankar, S. Belurkar and K. Saravu, "Computer Vision Approach for the location of Thrombocytopenia from Infinitesimal Blood Spread Pictures," 2021 IEEE Worldwide Conference on Hardware, Computing and Communication Innovations (CONECCT), Bangalore, India, 2021, pp. 1-5, doi: 10.1109/CONECCT52877.2021.9622688.
[7]. HemaSri, Allaparthi & Sreenidhi, Mopuru & Chaitanya, Valluru & Vasanth, Gamidi & Murali Mohan, Vutukuru & Satish, T. (2023). Location of RBCs, WBCs, Platelets Number in Blood Test by utilizing Profound Learning. 47-51. 10.1109/ ICSCDS56580. 2023. 10105115.