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Counting blood cells with OpenCV - python

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ABSTRACT :

The objective of this paper is to determine the RBC and WBC count using Digital Image Processing (DIP) from blood smear images captured through a compound microscope. This study proposes a method to digitally analyze the image of blood cells and calculate the RBC and WBC counts from these microscopic images. The method involves plane extraction, edge detection, and morphological filling operations. Circular Hough transform is applied for RBC counting, while boundary detection is used for WBCs. Blood cells, including white, red, and platelets, play crucial roles in the immune system by fighting infections, transporting oxygen, and aiding in clot formation. Accurate counting of these cells typically requires laboratory procedures. This study aims to develop codes for accurate cell counting using images, providing an accessible solution.The automated system includes a graphical user interface and a database system to store user records.

Keywords: Circular Hough transform, Digital Image Processing, WBCs, Platelets.

INTRODUCTION :

Digital Image Processing (DIP) has emerged as a transformative field within Computer Science Engineering, with significant applications in various domains, including medicine. DIP leverages computer algorithms to perform sophisticated processing on digital images, profoundly impacting modern society and scientific research. In the medical field, digital images are pivotal for diagnosing and monitoring various health conditions. Traditionally, blood samples are analyzed in laboratories using a series of substrates and manual techniques, which, although effective, can be time-consuming and require specialized equipment and expertise.

In the proposed method, a Biomedical-Computer Science interdisciplinary approach is used to enhance the efficiency and accuracy of blood cell analysis. This involves applying a stain to a blood sample, capturing its image, and then processing it using advanced software techniques. This method aims to produce immediate results, thus bypassing the lengthy traditional procedures. The haemocytometer, a device conventionally used for counting blood cells, requires manual counting and visual inspection under a microscope. This manual process can lead to errors and is labor-intensive, highlighting the need for a more automated and precise solution. Automating blood cell counting through digital image processing offers significant advantages. By using image analysis software, red blood cells (RBCs), white blood cells (WBCs), and platelets can be accurately counted from blood smear images captured via a compound microscope. This automation not only reduces the potential for human error but also speeds up the analysis process, providing quick and reliable results. This technological advancement is particularly beneficial for healthcare facilities, enabling faster diagnosis and treatment planning. The ability to digitally process and analyze blood samples can greatly enhance the overall efficiency and effectiveness of medical diagnostics.

LITERATURE SURVEY :

Literature Survey [1] This study presents a digital image processing (DIP) technique to count red blood cells (RBC) and white blood cells (WBC) from blood smear images captured through a microscope. Using Circular Hough transform for RBCs and boundary detection for WBCs, the method achieves an accuracy of 91% for RBC counts and 85% for WBC counts, demonstrating a significant advancement in automated blood cell counting. [2] This research introduces a DIP-based method for blood cell counting, utilizing Circular Hough Transformation to achieve 90% accuracy for RBC counts. For WBC and platelet counting, the study employs texture-based classification, achieving a remarkable 100% accuracy, indicating the robustness and precision of the proposed approach. [3] This paper describes an automatic method for counting RBCs using spectral images, incorporating advanced algorithms to improve accuracy. The initial technique achieves a high level of precision, and after further refinement with improved algorithms, the method reaches an impressive 98% accuracy, showcasing the potential of spectral imaging in medical diagnostics. [4] This work presents an improved methodology for counting blood cells, focusing on overcoming the challenge of overlapping cells. By employing morphological watershed transformation and regional maxima computation, the study achieves high accuracy in counting RBCs, WBCs, and platelets, offering a reliable solution for accurate blood cell analysis in complex scenarios. [5] This review examines various automated blood cell detection and counting methodologies, highlighting their strengths and limitations. The study identifies key areas for future research to enhance accuracy and reliability in blood cell counting, emphasizing the importance of continuous innovation in this critical aspect of medical diagnostics. [6] This research proposes a computer-aided system for classifying RBCs into 11 categories using image processing techniques. By applying the K-Medoids algorithm and granulometric analysis, the method effectively differentiates between various RBC types, aiding in the diagnosis of blood disorders with improved accuracy and efficiency. [7] This paper introduces a Raspberry Pi-based system for analyzing blood cell images, utilizing HSV thresholding and connected component labeling for cell counting. The proposed method achieves 90% accuracy in counting RBCs, WBCs, and platelets, demonstrating its potential as a cost-effective and portable solution for blood analysis, especially in resource-limited settings.

III. PROPOSED SYSTEM

The proposed system includes a graphical user interface (GUI) using Tkinter and a blob detection algorithm for image processing. The SimpleBlobDetector in OpenCV is used to detect and filter blobs based on color, size, and shape parameters. The system architecture consists of modules for data collection, preprocessing, model implementation, GUI framework, and prediction.

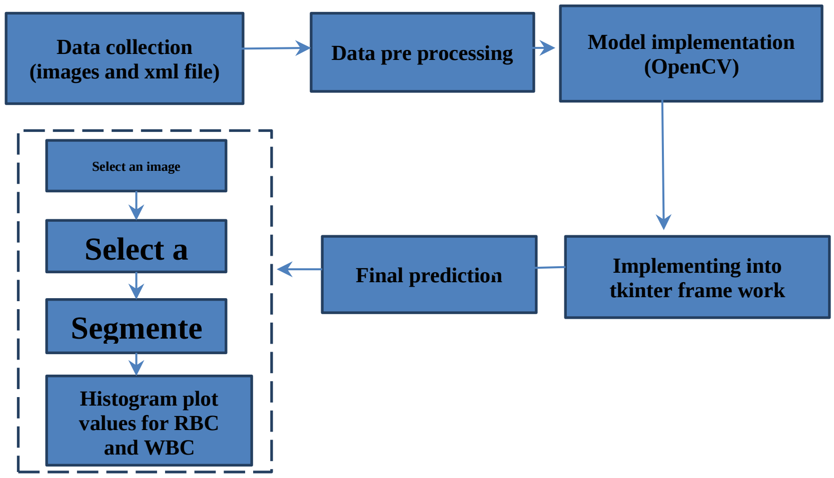


Figure 1: System Architecture of the proposed system

3.1 IMPLEMENTATION

Our project constituted of the below modules,

- Data Collection
- Preprocessing
- Model Implementation
- Tkinter Frame Work
- Prediction

1. DATA COLLECTION

From those patterns, you build predictive models using machine learning algorithms that look for trends and predict future changes.The main purpose of data collection is to gather information in a measured and systematic manner to ensure accuracy and facilitate data analysis.

2. PRE PROCESSING

Information pre-processing could be a portion of information mining, which includes changing crude information into a more coherent organize. Data preprocessing may be a information mining method which is utilized to convert the crude information in a valuable and effective format. Steps Included in Information Preprocessing: Data cleaning

3. MODEL IMPLEMENTATION

Using OpenCV for image processing and analysis to identify and count blood cells.

4. TKINTER FRAME WORK

Creating a GUI application for user interaction.

5. PREDICTION

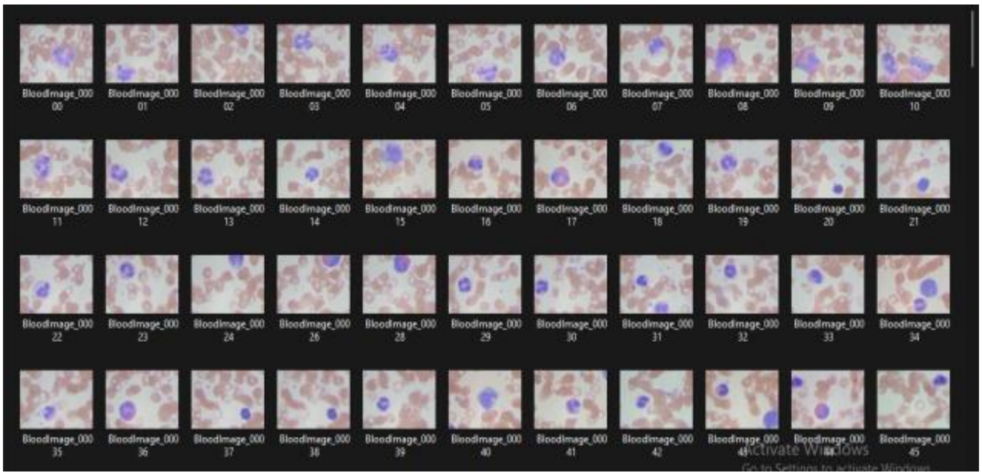
Finding the white blood cells, red blood cell.In the given dataset we are finding the white blood cells and red blood cells.

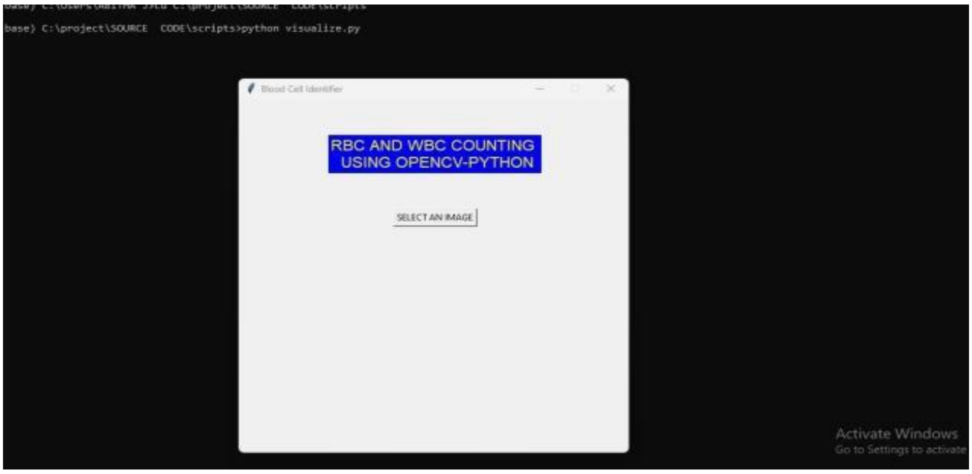
RESULTS AND DISCUSSION :

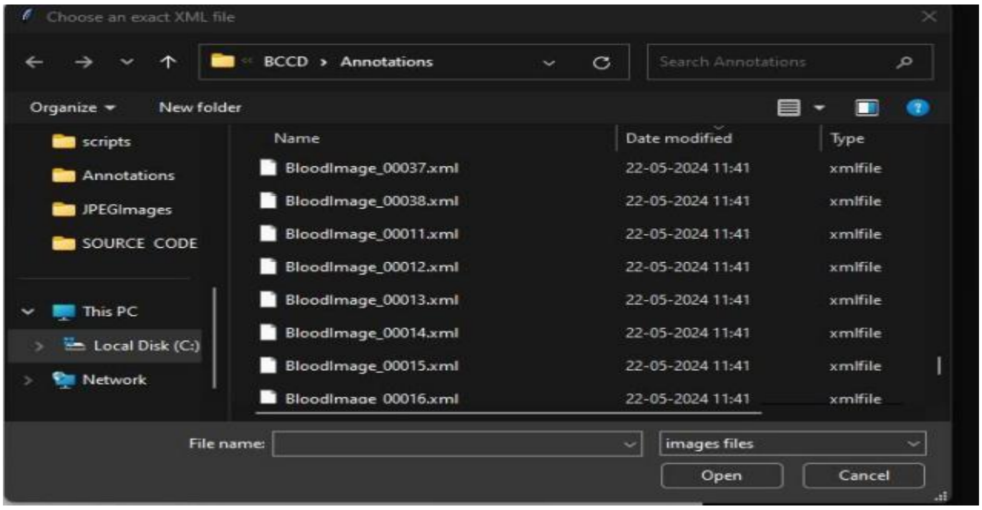
Testing ensures software meets requirements and user expectations without unacceptable failures. Various tests, including unit, functional, acceptance, and integration testing, validate different aspects of the software. Comprehensive testing strategies ensure accurate performance, correct input-output handling, and proper system interaction.

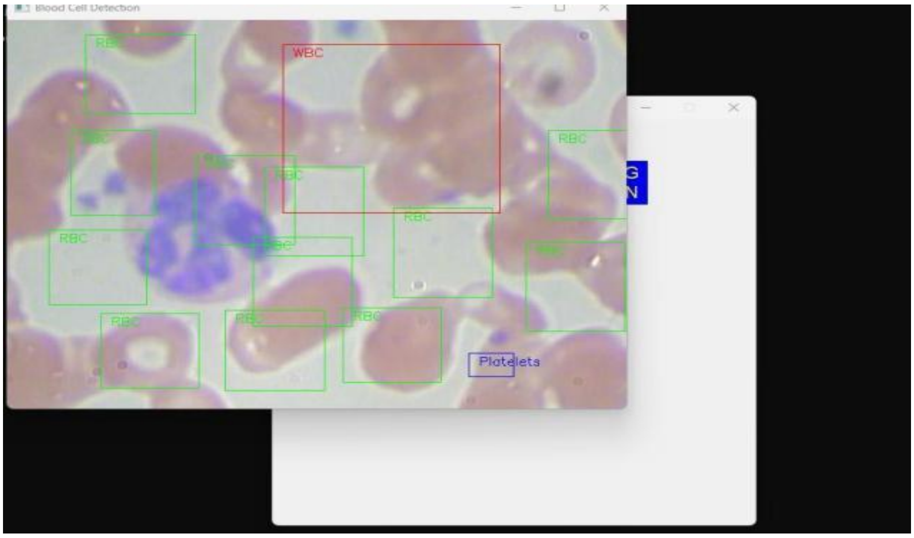
CONCLUSION :

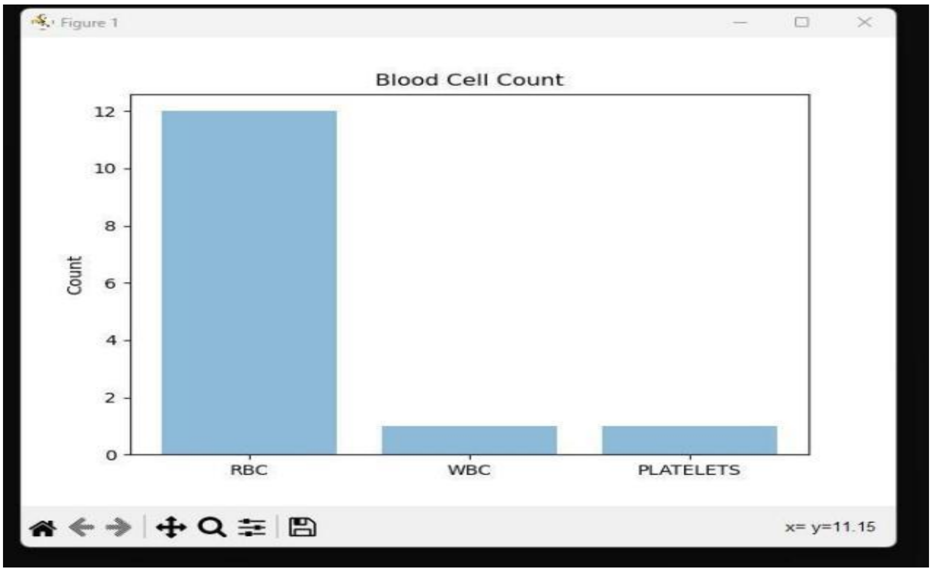
The ABCCS method provides accurate RBC and WBC counting using image processing techniques, improving time and cost efficiency compared to conventional methods. The proposed system performs well in segmentation and counting, with results validated against expert-determined ground truth. Future work could extend the system for platelet counting and detailed WBC classification.

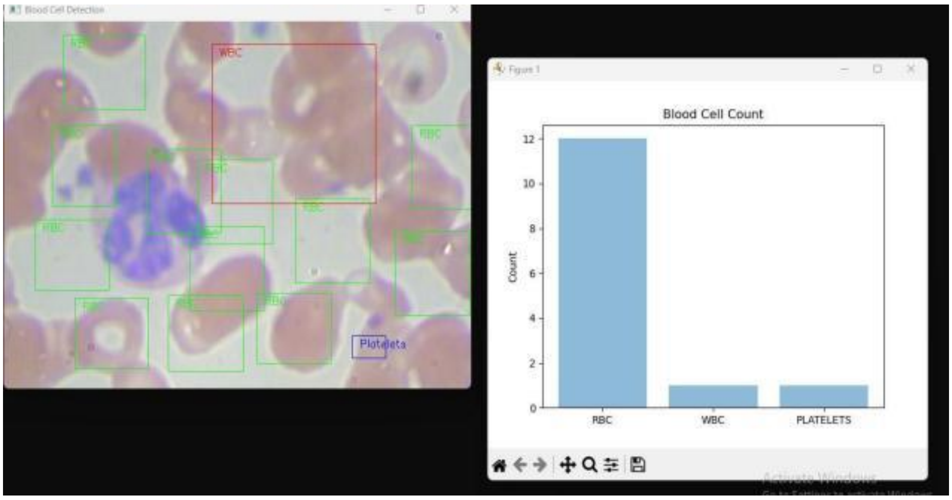












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