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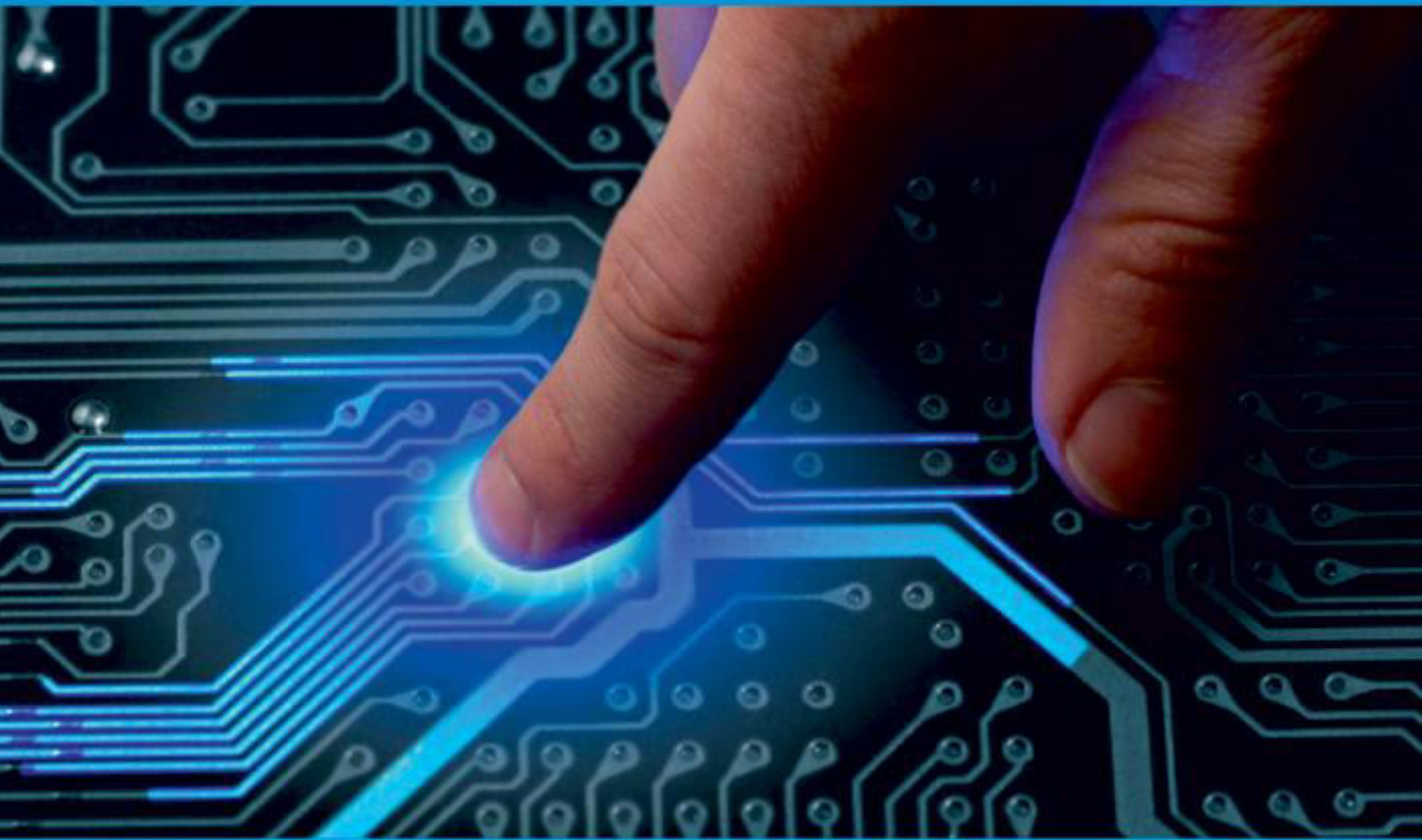

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Determination and Classification of Human Blood Cells and Types Using Sift Transform and Ensemble Learning Classifier

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ABSTRACT: Determining of blood types is very important during emergency situation before administering a blood transfusion. Presently, these tests are performed manually by technicians, which can lead to human errors. Determination of the blood types in a short period of time and without human errors is very much essential. A method is developed based on processing of images acquired during the slide test. The image processing techniques such as thresholding and morphological operations are used. This paper based on literature survey of different types of blood group determination method. The developed automated method determines the blood type using image processing techniques. Also we discuss the methodology & advantages of human blood group determination using SIFT, SVM classifier. The developed method is useful in emergency situation to determine the blood group without human error.

I. INTRODUCTION

Before the blood transfusion it is necessary to perform certain tests. One of these tests is the determination of blood type and this test is essential for the realization of a safe blood transfusion, so as to administer a blood type that is compatible with the type of receiver. There is certain emergency situation which due to the risk of patient life, it is necessary to administer blood immediately.

The tests currently available require moving the laboratory, it may not be time enough to determine the blood type and is administered blood type O negative considered universal donor and therefore provides less risk of incompatibility. However, despite the risk of incompatibilities be less sometimes occur transfusion reactions that cause death of the patient and it is essential to avoid them, administering blood based on the principle of universal donor only in emergencies . Thus, the ideal would be to determine the blood type of the patient even in emergency situations and administering compatible blood type from the first unit of blood transfusion.

Secondly, the pre-transfusion tests are performed manually by technician's analysts, which sometimes lead to the occurrence of human errors in procedures, reading and interpreting of results. Since these human errors can translate into fatal consequences for the patient, being one of the most significant causes of fatal blood transfusions is extremely important to automate the procedure of these tests, the reading and interpretation of the results. Blood group is classification of blood based on the presence or absence of inherited antigenic substances on the surface of red blood cells. These antigens may be proteins, carbohydrates, glycoproteins or glycolipids depending on the blood group system. The ABO system is the most important blood group system in human blood transfusion.

The associated anti-A and anti-B antibodies are usually immunoglobin M. Rh blood group system is the second most significant blood group system in a human blood transfusion with currently 50 antigens. The most significant Rh antigen is the D antigen.Blood transfusion is generally the process of receiving blood products into one's circulation intravenously. Transfusions are used for various medical conditions to replace lost components of the blood. Early transfusions used whole blood but modern medical practice commonly uses only components of the blood such as RBCs, WBCs, plasma, clotting factors and platelets. India faces blood deficit of approximately 30-35% annually. The country needs around 8 to 10 million units of blood every year but manages a measly 5.5 million units on top of it 94% of blood donation in the country made by men while women contribute only 6%.

There is a scope for determining blood types and the software developed using image processing techniques. The slide test consist of the mixture of one drop of blood and one drop of each reagent, anti-A, anti-B, and anti-D, being the result interpreted according to the occurrence or not of agglutination. The agglutination reaction means that occurred reaction between the antibody and the antigen, indicating the presence of the antigen appropriate. The

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combination of the occurrence of agglutination, or non-occurrence, determines the blood type of the patient [2]. Thus, the software developed based in image processing techniques allows, through an image captured after the procedure of the slide test detect the occurrence of agglutination and consequently the blood type of the patient.

II. LITERATURE REVIEW

Thejashwini M et. al. [9] talked about the system which utilize image processing schemes to detect and count the RBC's and WBC's using corresponding digital images. Acharjee et. al. [14] presented a semi-automated image processing system to detect the shape of RBC based on Hough Transformation with the specific diameter.

Maji et. al. [15] presented an automated method for counting and characterizing Red Blood cells using mathematical morphology. Gonzalez-Hidalgo et. al. [16] proposed an image processing system for Red Blood cell cluster separation for use in sickle cell disease based on the concept of K-curvature for determining points of interest.

Lou et. al. [17] presented a system for counting of red blood cells using different techniques like Hyperspectral image segmentation, Border incomplete cell clearance and classify them using SAM & SVM to generate two dimensional monochrome image. Kolhatkar et. al. [18] surveyed different segmentation techniques for detection and counting of blood cells using image segmentation. Several other works have also been reported in this area using K-means clustering [19], feature extraction by boundary descriptors [20] and geometric features [21]. Currently, low effectiveness, low speed of cell counting systems, high cost and complexity are the prime shortcomings of the already existing techniques. So there is utmost need to develop a system that can detect and count the Red Blood cells to evaluate the health of the person and to diagnose the diseases like anemia, leukemia etc. with high speed and low cost. In proposed work, some of the technologies that are being used for counting of cells have also been analysed so as to conclude the best appropriate method that can be put into practice to surmount the disadvantages of existing systems

Mazalan et. al. [2] compared the two algorithms for counting of blood cells using Hough Transformation and by measuring minimum & maximum radius of blood cells. Patil et. al. [3] proposed a formula for counting of WBC's and RBC's from blood images using gray thresholding.

Maitra et. al. [4] talked about different image processing techniques to count the red blood cells using magnification factor and dilution factor. Jambhekar [5] studied about how to classify the different shapes of blood cells using artificial neural network. Mahmood et. al. [6] talked about hough transformation for detecting and extracting the red blood cells based on the geometric features to detect the centre of the circle.

Gupta et. al. [7] put forward a technique for automatic segmentation of lesion using adaptive thresholding. Sahastrabuddhe et. al. [8] reviewed different segmentation algorithms and image post-processing techniques like morphological functions, feature extraction and border removing for cell counting based on labeling the connected components.

III. EXISTING SYSTEM

Improvement of Accuracy of Human Blood GroupsDetermination using Image processing Techniques,it is very crucial to determine human blood groups in an emergency situation. **But according to current system, the detection procedure is very slow**. At present, **human blood groups are determined manually through plate test procedure.** It consists of blood collection and mixing with specific reagents in order to determine the blood agglutination. The results are checked **microscopically**. In this paper, the main objective is to present a methodology to determine human blood groups using image processing techniques.

Counting and examination of blood cells manually by microscope is tedious, time intense and entails a lot of technical expertise. Hence arises a need to come across for automated blood cell detection and counting system that can facilitate physician for diagnosing diseases in fast and efficient way.

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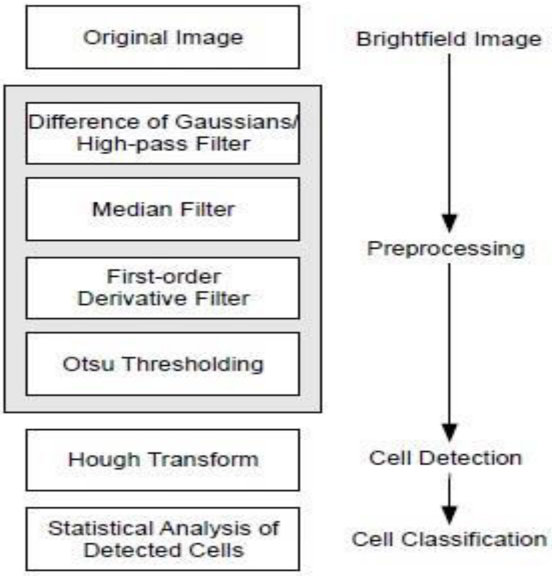
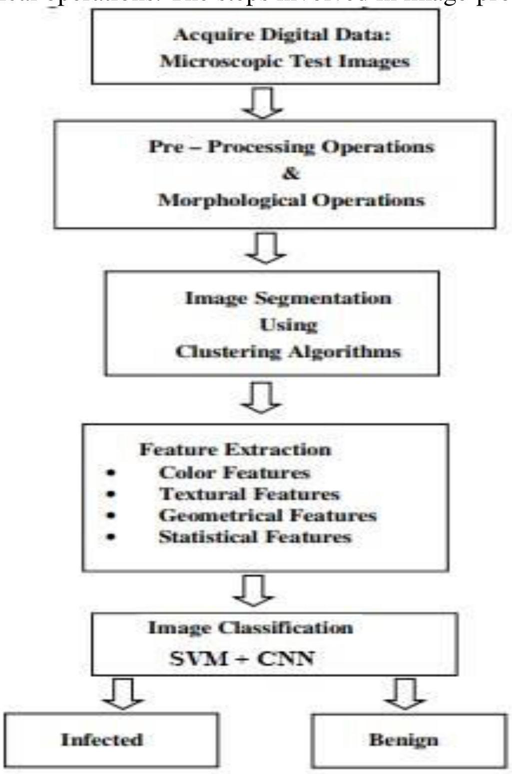


According to present studies, the RBCs are classified in four types of abnormality, namely elliptocytes, echinocytes, tear drop cells and macrocytes. In this paper, technique has been introduced to count the RBCs automatically. In proposed work, images are classified on the basis of color, texture and morphology. Process of counting of cells is done into three parts: image processing including texture feature extraction using morphology, thresholding segmentation and counting of cells using Hough transformation.

IV. PROPOSED METHODOLOGY

The digital images of blood samples are obtained from the hospital/laboratory consisting of a color image composed of three samples of blood and reagent. These images are processed using image processing techniques namely color plane extraction, thresholding, morphological operations. The steps involved in image processing are shown in the Fig.1.



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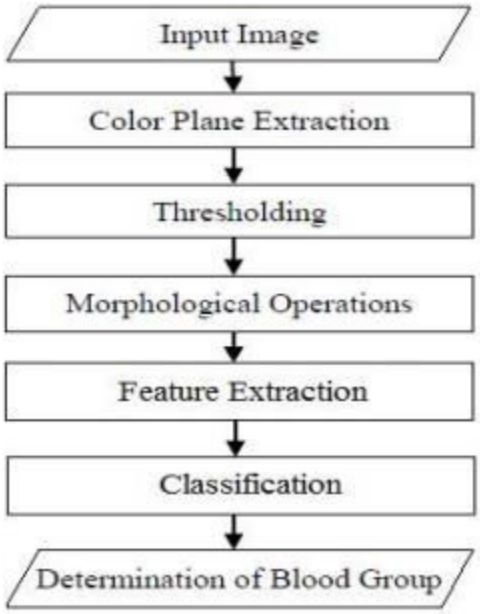
The proposed method consists of image acquisition followed by pre-processing and thereafter segmentation, feature extraction and counting of blood cells. The entire progression is initialized by acquiring the blood image, which is then transmitted to the further processing level then its thresholding image is generated for applying morphological functions thereafter, counting the total number of red blood cells. Input: Images of blood cells. Output: Count of Red Blood cells. Stepwise details of the proposed algorithm are as under: Algorithm: Step 1: Read the image from database. Quantize the image to make it compatible for processing.

Step 2: Segmentation based on thresholding has been used to segment the image in constituent objects based on some threshold criteria T. In this method, in order to extract objects from background each pixel in image is replaced by lowest pixel value if the intensity value of image f(u, v) is less than some threshold value T i.e. f(u, v) ≤ T, or a highest pixel value if the intensity value of image f(u, v) is more than the threshold value T i.e. f(u, v) > T. Thresh=T [u, v, p(u, v), f(u, v)] T(u, v) = 1, if f (u, v) > Thresh 0, if f (u, v) ≤ Thresh (8)

Step 3: Various morphological operations are applied on the output image from step 2, viz. median filtering, edge detection and erosion (as discussed in Section 2.3).

Step 4: Total number of red blood cells are calculated using Hough Transform (as discussed in Section 2.4) using following logic. If Then Gulpreet Kaur Chadha et al. / Procedia Computer Science 167 (2020) 769–778 775 Gulpreet Kaur Chadha/ Procedia Computer Science 00 (2019) 000–000 7 Calculate number of cells Else Reject.



Steps of Determination of Blood types using Image Processing

V. RESULT AND DISCUSSION

First, we will discuss the performance of the SVM model compared to the CNN-based approaches. Second, we mention how our approach is based on interpretable and explainable variables.

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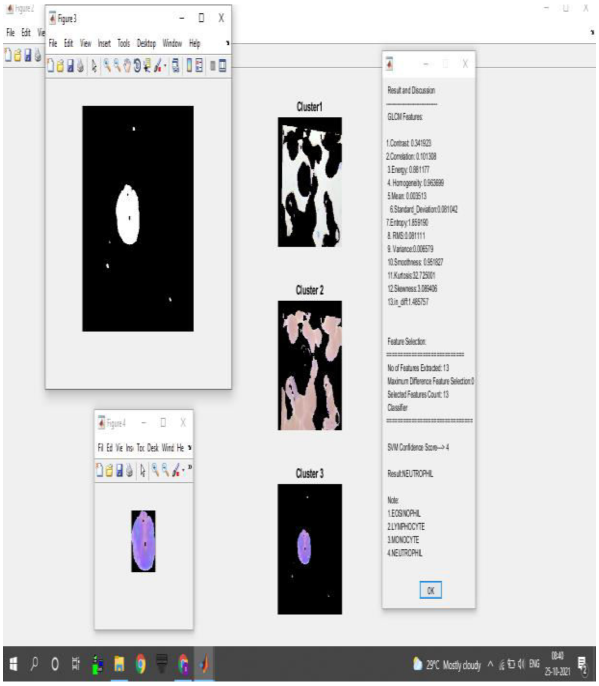
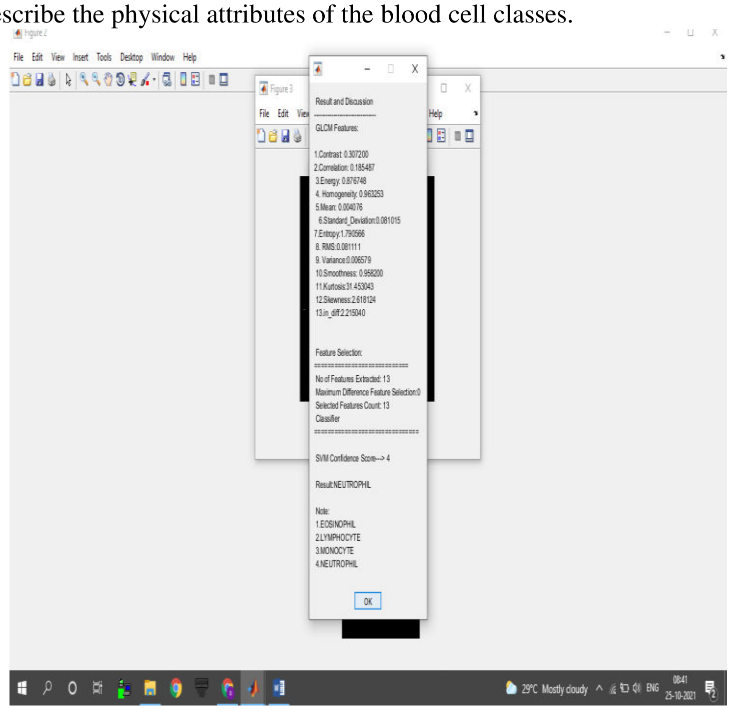


The solution presented is more interpretable since the features used in this model all have physical meanings. We also present a model that achieves nearly identical performance using only three variables. It is explainable since we are able to describe where RBCs, WBCs, and platelets reside in a 3D feature space. Since the variables have real-world interpretations, we can describe the physical attributes of the blood cell classes.



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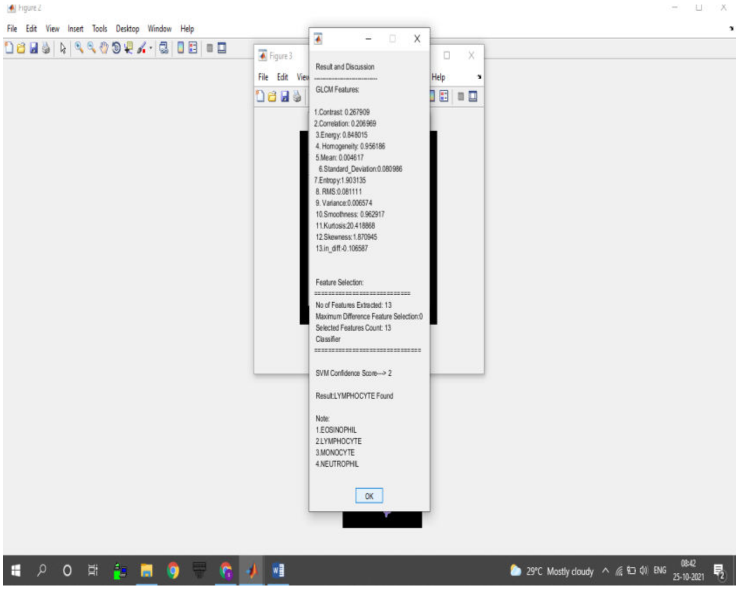

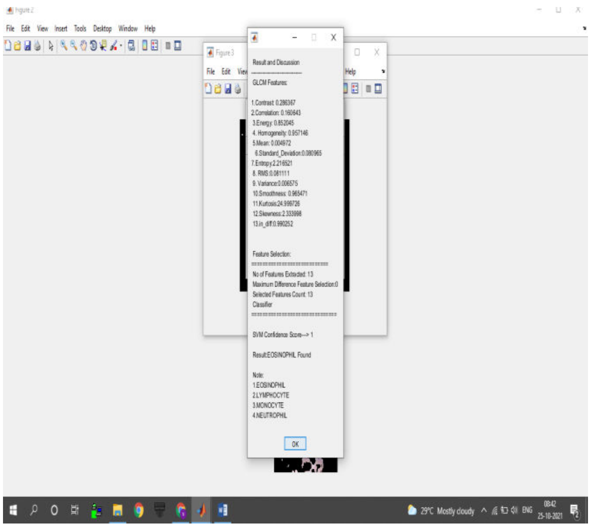

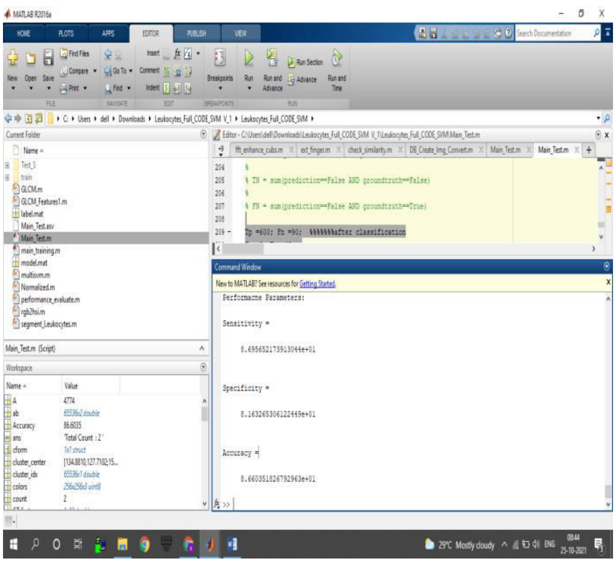

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VI. CONCLUSION AND FUTURE WORK

Machine learning becomes an essential technique for modeling the human process in many disciplines, especially in the medical field, because of the high availability of data. One of the essential disease detectors is the blood analysis; as it contains many parameters with different values that indicates definite proof for the existence of the disease. The machine learning algorithm accuracy depends mainly on the quality of the dataset; for this reason, a high-quality dataset is collected and verified from expert physicians. This dataset is used for training the classifiers for obtaining high accuracy. We tested several classifiers and achieved accuracy up to 98.16% which realize the research objective, which is helping the physicians to predict the blood diseases according to general blood test. The future work will focus on testing the proposed data set using different deep learning algorithms to compare between classical and deep learning approaches in this research area. Furthermore, an online Internet of Things (IOT) application will be implemented to collect and test more blood data.

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