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Detection of Blood Deficiency Diseases through Robust Red Blood Cell Count Extraction

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ABSTRACT: This paper deals with the detection of diseases that are caused due to any alteration in the count of blood components like Red Blood Cells, White Blood Cells, Blood Platelets. When it comes to alteration in the count there can be two ways, either the count will be below the normal count or above the normal count i.e,undercount and over count. The paper begins by identifying the blood component, extracting it and finding its count. Concepts of Machine learning and Digital image processing techniques are combined and used for processing the pathological image. The DIP techniques are used in the preprocessing of images and the ML algorithms in segregating the cells and count extraction.

KEYWORDS: Preprocessing, Digital Image Processing, Count extraction, Machine Algorithm.

I. INTRODUCTION

Red blood cells carry fresh oxygen throughout the body. This is important for our health. Hemoglobin is the protein inside red blood cells. It carries oxygen. Red blood cells also remove carbon dioxide from your body, transporting itto the lungs for you to exhale. Red blood cells are made in the bone marrow. They typically live for about 120 days, and then they die. They are round with a flattish, indented center, like doughnuts without a hole. Similarly the other components have their own functions and characteristics. With the special characteristics of these cells, each cell is identified and extracted, however it undergoes various procedures/techniques before it is identified and extracted. Based on the number of cells extracted, the count is determined and compared to the normal count to find if it is under count or over count. Increase/Decrease in counts for each of these components may lead to various disease like sickle cell anaemia, Fanconianaemia, Pernicious anaemia, polycythemia and also heart failures. Currently, several manual and laboratory methods are used to predict such diseases, however this paper deals with the usage of digital imageprocessing and machine learning algorithm for better accuracy and time efficiency.

II. METHODOLOGY

The pathological images of blood cell samples undergoes various processes such as Preprocessing, overlapped cell extraction, overlapped count extraction and component count extraction, wherein overlapped cell and count extraction is done to segregate the component of interest alone. Digital image processing is a method used for segmenting the picture into various parts to be broken down so that there solution increases and there by enhances us making the counting more efficient .There are two segmenting methods local and global, where local is used for focusing on a specific region of the image while the other is used for segmenting the whole image which is used.



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Figure 1: Project Architecture

III ALGORITHM

SEGMENT 1

STEP1: Image captured from the haemocytometer is processed into digital image

STEP2: Undergoes his to gram based image segmentation processing to partition into non-overlapping region.

STEP3:WB Cregionis selected to highlighted as region of interest.

STEP4: The specified region of interestis converted into another colour toliminaten further step.

STEP5:Usingcolourthreshold function in MATLAB WBC's count is extracted.



Figure2: WBC Extraction

SEGMENT II

STEP1: After removing WBC the image is read again and undergoes grayscale conversion.

STEP2: The image is then enhanced again and again to make it more precise in viewing.

STEP3: Binarized so as to make available for morphological operations.

STEP4: Morphological operations helps to extract overlapped cells present one under another with the help of enhancement being done repeatedly.



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STEP 5: Theoverlapped cells countis calculated and extracted separately.



Figure 3: Overlapped cell count extraction

SEGMENT III

STEP1: Upon the extraction of overlapped cells the exact RBC count has to be extracted.

STEP2: The image is again given as binarized input image to under go further enhancement.

STEP3: Applying XOR operation helps in finding total RBC count and also overlapped cells count.

STEP4: With these two extracted counts the exact RBC countin a blood in calculated.

STEP5:With the help of ML algorithm ,the RBC count gets compared with the data bases updated already and infer the result as specified under conditions in program.



IV. EXPERIMENTAL RESULTS

ORIGINAL IMAGE:

This is the pathological image. This image is read by the haemocytometer. This image is obtained with high resolution and undergoes various segmentation process that uniquely helps to identify and classify between the bloodcells.



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INPUT IMAGE:

This is the output displayed after the reading of input image by the module and is converted into gray colored using gray scale conversion method in Matlab.

ENHANCED IMAGE:

Enhancement of image is the processing step where the noise present in the image and background is the removed again and again dilating the image through morphological operations and make it more precise for further prediction of counting and binarizing the input image.

BINARIZEDINPUT IMAGE:

Binarization of image is required for increasing the pixels of the image that is the final step in preprocessing stage. The binarized image is said to have more resolution after gray scale conversion. Thresholding is a type of image segmentation, where we change the pixels of an image to make the image easier to analyze.

WBC EXTRACTION:

In this step the binarized image is being used to separate the white bloodcells using certain threshold level that it can be exclude during the count calculation of red blood cells.

WBCBINARIZATION :

The extracted image is being binarized separately to be removed as it is not the cell of interest.

EXTRACTEDOVERLAPED:

There would be certain cells underlying the visible Red blood cells and is necessary to calculate those cells also for predicting the exact count of the image. Hence, the count for overlapped cells is obtained by inserting threshold level that is obtained by trial and error of the sample images that White blood cells have.

RBCCOUNTEXTRACED:

This is the final image that is with the highest resolution and shows a great difference for Red blood cells and gives the count of overall Red blood cells present. Also from the value obtained from the overlapped cells we will subtract the value and find the level of class at which the image lies. It is classified into three types: normal, below normal and above normal, wherein Normal is greater than 4.5 to less than 5.5, Below normal less than 4.5 and Abovenormalgreaterthan5.5.



Figure 5: Original Image



Figure6: Input Image



Figure7:Enhanced Image



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Figure8:Binarized Input



Figure9:WBC Extraction



Figure10:WBCExtraction



Figure11:Extracted Overlapped



Figure13:Result:Normal



Figure12:RBCCount



Figure14:Result:Anabolic Steroids

V. CONCLUSION

The principal objective of the paper is to provide an automated method using enhancement, segmentation and classification of the image to determine the blood component's count and to predict the disease caused if there is any alterations. Hence the Cell's count is extracted and the disease is classified based on the count, using Digital Image Processing Techniques and Machine Learning algorithms.



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