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Detection of Malarial Parasite in Blood Using Image Processing

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ABSTRACT

Malaria is a serious disease for which the immediate diagnosis is required in order to control it otherwise it leads to death. Microscopes are used to detect the disease and pathologists use the manual method due to which there is a lot of possibility of false detection. This project removes the human error while detecting the malarial parasites in blood sample using image processing. A general framework to perform detection of malarial parasite, which includes image preprocessing, extracting infected blood cells, morphological operation and highlighting the infected cells is described. This methodology may serve as a rapid diagnostic tool for malaria, even where the expert in microscopic analysis may not be available.

Keywords: Human error, Detection, Extracting and Highlighting infected cells.

1. INTRODUCTION

Malaria is a life-threatening parasitic disease, caused by the protozoan parasites of the genus Plasmodium and is transmitted through the bite of a female Anopheles mosquito. Inside the human body, the parasite undergoes a complex life cycle in which it grows and reproduces. During this process, the red blood cells (RBCs) are used as hosts and are destroyed afterwards. Hence, the ratio of parasite-infected cells to the total number of red blood cells called parasitaemia can be used as a measure of infection severity and is an important determinant in selecting the appropriate treatment and drug dose. Malaria is a serious global disease and a leading cause of morbidity and mortality in tropical and sub-tropical countries. It affects between 350 and 500 million people and causes more than 1 million deaths every year. There were an estimated 190311 million clinical episodes of malaria. It becomes the 5th cause of death from infectious diseases worldwide in low income countries. Yet, malaria is both preventable and curable. Rapid and accurate diagnosis which enables prompt treatment is an essential requirement to control the disease. Currently, clinical diagnosis primarily utilizes microscopy to study the prepared blood smears. However, evaluation of smears is arduous and time consuming, especially in situations where large numbers of samples require reliable analysis. Hence, it is important to develop an automated image analysis that is able to identify the uninfected and infected RBCs in a blood smear image.

2. GOAL OF THIS RESEARCH WORK

The biggest detraction of microscopy, namely its dependence on the skill, experience and motivation of a human technician, is to be removed. Used with an automated digital microscope, which would allow entire slides to be examined, it would allow the system to make diagnoses with a high degree of certainty. It would also constitute a diagnostic aid for the increasing number of cases of imported malaria in traditionally malaria-free areas, where practitioners lack experience of the disease.

3. FOREMOST OBJECTIVES

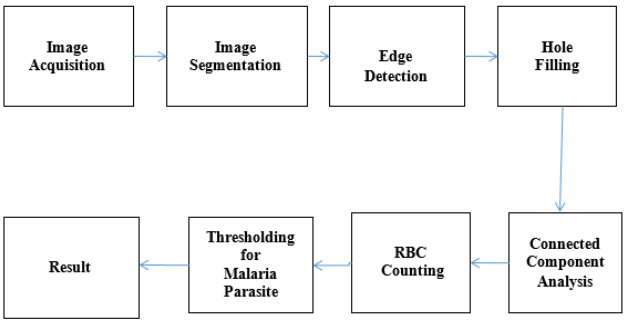
The objective of the project is to develop a fully automated image classification system to positively identify malaria parasites present in thin blood smears, and differentiate the species. The algorithm generated will be helpful in the area where the expert in microscopic analysis may not be available. The effort of the algorithm is to detect presence of parasite at any stage. One of the parasites grows in body for 7 to 8 days without any Symptoms. So if this algorithm is incorporated in routine tests, the presence of malarial parasite can be detected Automatic parasite detection has based on color histograms.

4. TEST ALGORITHM & SYSTEM ARCHITECTURE

The design is essentially an image classification problem, and thus takes the form of a standard pattern recognition and classification system. It consists of five stages:

1. Image Acquisition
2. RBC Extraction
3. Edge Detection
4. Binary Image
5. RBC Counting
6. Thresholding
7. Parasite Extraction

5. BLOCK DIAGRAM



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1 Image Acquisition

The input images of Giemsa stained blood smears are selected from the database Library. Images are of different shape and sizes. Images show high variations in intensity, contrast color tone, etc.

2 Image Preprocessing

The pre-processing block is designed, to remove unwanted effects from the image and to adjust the image as necessary for further processing. The microscopic input image is converted from RGB to gray scale to reduce the processing time. RGB to gray conversion is done by averaging all the three components i.e. R, G and B which results in gray scale.

3 Image Smoothing

Smoothing is often used to reduce noise within an image or to produce a less pixilated image. Most smoothing methods are based on low pass filters. Smoothing is also usually based on a single value representing the image, such as the average value of the image or the middle (median) value. The simplest approach is neighbor-hood averaging, where each pixel is replaced the average of the by value pixels contained in some neighborhood about it.

4 Thresholding

Thresholding is the simplest method of image segmentation. From a grayscale image, thresholding can be used to create binary images.

Image Segmentation

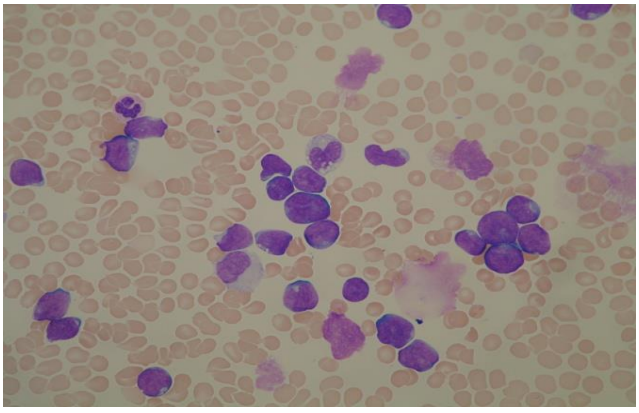
1) The purpose of image segmentation is to partition an image into meaningful regions with respect to a particular application.

2) The segmentation is based on measurements taken from the image and might be Gray-level, colour, texture, depth or motion.

5 Dilation

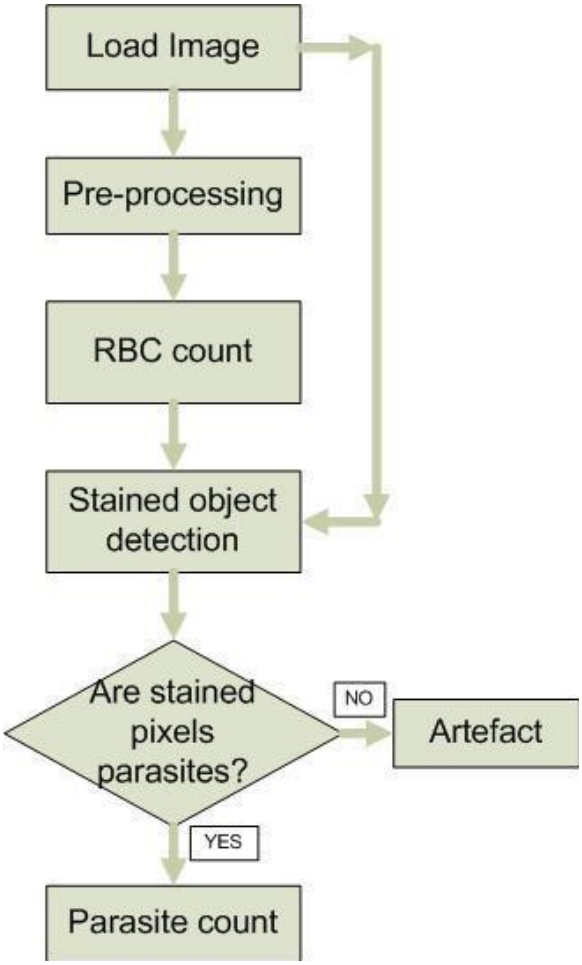
Dilation is one of the two basic operators in the area of mathematical morphology, the other being erosion. It is typically applied to binary images, but there are versions that work on grayscale images. The basic effect of the operator on a binary image is to gradually enlarge the boundaries of regions of foreground pixels. Thus areas of foreground pixels grow in size while holes within those regions become smaller.

6. MALARIA IDENTIFICATION



Now there exists a ring shape malaria parasite on RBCs. These parasites are having shape like a ring and the ring is generally of blue color.

7. FLOW CHART



8. CONCLUSION

In this project one novel approach for detection of a malarial parasite called plasmodium is proposed. This system is cheaper than other malarial test kit. This system does not require any special technical skills. So, this can be used by the people of remote places with very basic level of education. It may reduce the probability of wrong treatment which happens due to non-availability of diagnosis systems in remote and economically backward areas. The system in a robust manner so that it is unaffected by the exceptional conditions and achieved high percentages of sensitivity, specificity, positive prediction and negative prediction values. And the extraction of red blood cells achieves a reliable performance and the actual classification of infected cells.

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