Recognition And Classification Of Malaria Plasmodium Diagnosis

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Abstract

Most of the diseases are caused due to the blood. Malaria is one of those diseases. Malaria is a life threatening disease and so rapid, accurate diagnosis is required to control the disease. There are various techniques to diagnose malaria of which manual microscopy is considered to be the bullion standard. However due to the number of steps required in manual assessment, this diagnostic method is time consuming (leading to late diagnosis) and prone to human error.

In this paper an algorithm is implemented to identify the types of plasmodium through their color and shape. This technique can recognize the existence of malaria parasite within seconds and thus can replace the usual methods of finding of malaria in biomedical applications and medical science. The proposed method can automatically diagnose the plasmodium presence using the algorithm mentioned which consumes less time and man power as compare to usual methods.

1. Introduction

According to the World Health Organization (WHO),malaria causes approximately nearly million deaths and over 250 million infections every year. and is caused by parasites of the genus Plasmodium, of which Plasmodium falciparum contributes 98% of deaths [1].

The protozoan parasites transmitted by the Anopheles mosquito from one person to another causes Malaria. In humans, the parasites (called sporozoites) travel to the liver,where they mature and release another form, the merozoite.[2]. The infection is caused by minute parasitic protozoa of the genus Plasmodium, which infect human liver cells first,then the red cells, and then the insect hosts alternatively.

The detection techniques today include manual laboratory identification by visual scrutiny of the infected blood slides.
Although there are advanced methods of diagnosis [3], manual microscopy of blood films on slides is still considered to be the gold standard.Manual microscopy has advantage over other.techniques in that it is both sensitive and specific. Manual microscopy is carried out by examining thin blood films on slides under the microscope and reporting the percentage of parasitaemia (i.e. number of infected red blood cells (iRBCs) for over 100 microscopic fields).

Some of the problems of manual microscopy can be Overcome by exploring computer based, specifically image-based, diagnostic methods. The aim of this study is to outline a semi-automatic diagnosis method based on image processing and one that provides a reliable and consistent solution. The literature contains descriptions and details of several computer vision or imagebased algorithms [4-6]. However, most of these algorithms are supervised and complex, that is they need manual intervention or calibration. Considering the high fatality rate and huge volumes of samples that need to be analysed we need a sensitive, practical and robust method with minimum human intervention. In this context, computer based diagnosis can help in the rapid, accurate and consistent identification of true malaria cases, ensuring that only those patients with malaria are treated.Recent research has suggested that the shape of the affected red blood cells can be detected using the 2D moments of the image of the infected cell[7].

In this paper ,a method to distinguish the parasites using Various approaches , like thresholding,edge detection and blob detection to classify the plasmodium which makes to detect more accurate as compared to prediction done using usual manual process.

2. MALARIA PARASITES

There are 4 main types of malaria parasite that infect humans: Plasmodium vivax, Plasmodium malariae, Plasmodium ovale, and Plasmodium falciparum [7].

A.Plasmodium Vivax

Plasmodium vivax can be of different forms such as- Rings,Trophozoites, Schizonts and gametocytes. Vivax rings have large chromatin dots and cytoplasm can become ameboid as they develop, size 2.5 µm. Trophozoites have compact cytoplasm and a large chromatin dot. P. vivax gametocytes are round to oval with scattered brown pigment and may almost fill the RBC. A slide containing Plasmodium vivax is shown in Fig. 1.

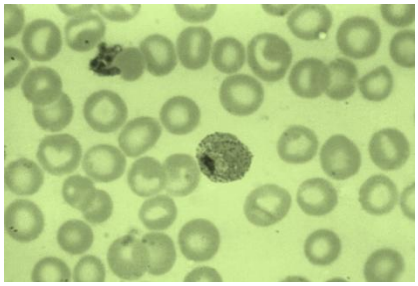


Figure. 1 Plasmodium Vivax

B.Plasmodium Ovale

Plasmodium Ovale is also present in four forms: Rings, Trophozoites, Schizonts and gametocytes in which rings have sturdy cytoplasm and large chromatin dots 6.2 µm. Trophozoites have sturdy cytoplasm, large chromatin dots, and can be compact to slightly irregular 2.5 µm. The schizonts have 6 to 14 merozoites with large nuclei, clustered around a mass of dark-brown pigment. The gametocytes are round to oval and may almost fill the red blood cells. Pigment is brown and coarser in comparison to P. vivax. A slide containing Plasmodium ovale is shown in Fig.2.

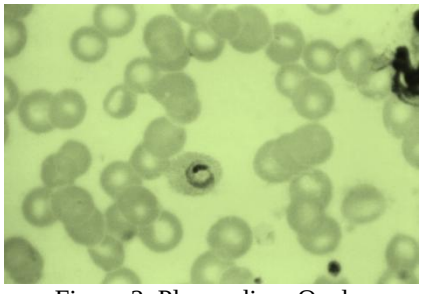


Figure.2. Plasmodium Ovale

C.Plasmodium Malariae

Plasmodium malariae is present in two forms- Rings and Trophozoites. Rings have sturdy cytoplasm and a large chromatin dot, size 6.5-7 µm and the Trophozoites has compact cytoplasm and a large chromatin dot. A slide containing Plasmodium vivax is shown in Fig.3.

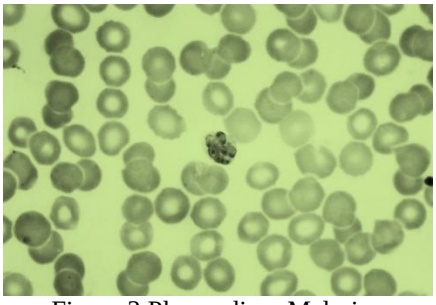


Figure.3.Plasmodium Malariae

D.Plasmodium Falcipuram

Plasmodium falcipuram is also present in the above four forms. P. falciparum rings have delicate cytoplasm and one or two small chromatin dots. Trophozoites are rarely seen in peripheral blood smears. Older, ring stage parasites are re-ferred to as trophozoites. The cytoplasm of mature trophozoites tends to be denser than in younger rings. Schizonts are seldom seen in peripheral blood. Gametocytes are crescent or sausage shaped. The chromatin is in a single mass (macrogamete) or diffuse (microgamete)as sown in Fig.4.

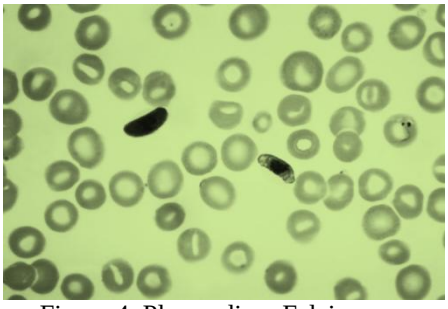


Figure.4. Plasmodium Falcipuram

Methodology:

Malaria parasite detection involves following steps: Threasholding, gray scale image conversion, binary image, edge detection algorithm, Tracing and labeling. Block diagram of system architecture is shown in Fig.5.

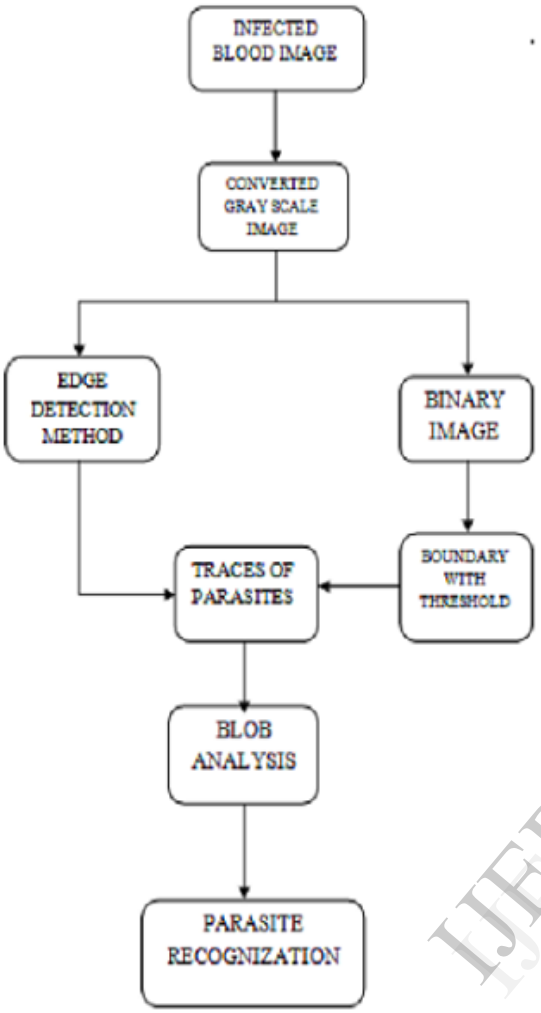


Fig.5.Block diagram

For further processing the image need to be converted to gray color, whereby the image,which was in true color previously having 24-bit depth, will get converted to gray color having 8-bit depth.After gray scale image it is used for two techniques ,first edge detection ,Second method is binary with Threasholding used for recognizing the objects and it Followed by tracing blob analysis for further enhancement of edges for identification of plasmodium.

Results and Discussion:

The experiment of malaria parasite detection when done by applying the algorithm on a simple PC using MATLAB 7, show the window 7as shown in figure 6. The window contains the buttons which facilitates to view the original stained image of slide, diagnose positive or negative malaria and the type of parasite causing the malaria .the original image in Fig. 6.

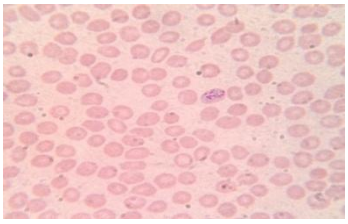


Figure6. Original slide image

Diagnosis of malaria is done by applying the Various Techniques and algorithm employing. Infected Blood image is used for conversion of gray scale is shown in fig,7.

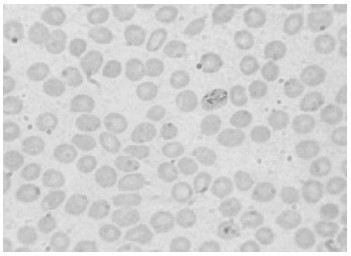


Figure7. Gray Scale image

There are two main methods to Recognize the infection causing plasmodium, First method edge detection ,here there are various edge techniques applied like sobel,logrithimic,perwitt.etc.Here image is applied for Sobel as shown below In Fig. 8.

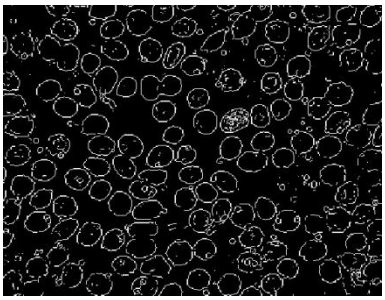
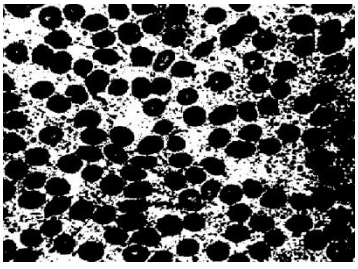


Figure.8.Sobel Edge detection

Second method is binary conversion with Threasholding fig.9. shown below



After that the images are used for blob analysis for identification of plasmodium .

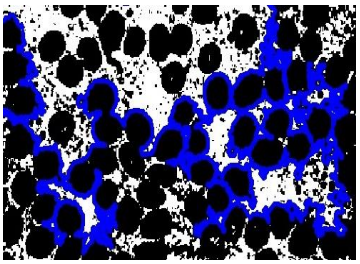


Figure10.Tracing of image

Finally the results were done using various methods which makes to detect more accurate as compared to prediction done using usual manual process.

Conclusion

The detection of Malaria parasites is done by using various methods like edge detection and blob analysis for identification and Recognition of plasmodium. This technique can detect the existence of malaria parasite within seconds and thus can replace the conventional methods of detection of malaria in biomedical applications and medical science. The proposed method can automatically diagnose the parasite's presence using the algorithm mentioned which consumes less time and man power as compare to conventional methods.

References

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