Detection and Classification of Malaria Parasites Using Digital Image Processing

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Abstract - *Malaria is an infectious disease caused by a parasite that belong to the* genus *Plasmodium that are able to invade human blood cell. Method is using digital image processing to indicate the parasite in image and classify the type of the parasite present in the blood cell. The feature extraction technique is used to obtain the blood cells and parasites from the image. The pattern recognition algorithm is used to determine the type of the parasite. The result is obtained in less time with higher efficiency. This method improves the detection of malarial parasite and helps in diagnosis.*

Key Words: **Malaria parasite, Plasmodium, Feature Extraction, Classification, Patter Recognition**
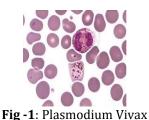
1.INTRODUCTION

Malaria is a disease caused by parasites that are spread to people by the affected mosquitoes. Malaria is preventable and curable disease, malaria is diagnosed by the examining blood sample of the patient under the microscope, the blood drop is spread in to cover glass and it is stained. This stained blood smear is observed under the microscope. The malaria parasite takes blood cell as a host and it evolves and affects other blood cell this cause anemia. The healthy blood cell gets invaded by the parasite. To examine the blood sample and identify the parasite one should expert and should have knowledge about the parasites. There are many different kinds of parasite the most commonly known four species of Plasmodium have long been recognized to infect humans in nature they are - P. falciparum, P. vivax, P. ovale, P. malariae.

1.1 Plasmodium Falciparum

 P. falciparum, is responsible for death of peoples affected by the malaria, this parasite spread rapidly and affect all the normal blood cells. It is the most common species. In the gametocyte stage this parasite turns blood cell in to crescent shape

1.2 Plasmodium Vivax

 P. vivax, is a second most common species. This parasite can be dormant in live showing no symptoms. The affected blood cell becomes larger in size than a normal blood cell and large number of merozoites present in it.

Fig -1: Plasmodium Vivax

1.3 Plasmodium Ovale

 P. ovale is less dangerous compared to plasmodium falciparum. It is found in west Africa and Philippines. It has a round and large gametocyte cells, a granular appearance as well as Schuffner's dots will be visible in affected cell.
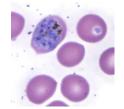

Fig -2: Plasmodium Ovale

1.4 Plasmodium Malariae

 P. malariae, is not dangerous as other parasite it causes fever for few days, if untreated remains last long. This will be round shape in coarse granular appearance and contains merozoites.
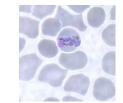
Fig -3: Plasmodium Malariae

2. METHODOLOGY

This method involves several processes namely; image acquisition, preprocessing, feature extraction, parasite detection and classification as shown in Fig. 4.
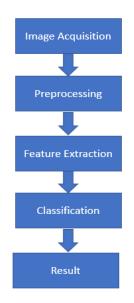

Fig -4: Block Diagram

2.1 Image Acquisition

The blood smear images can be acquired from the digital microscope which can be connected to the personal computer as shown in Fig. 5.

Fig -5: Image Acquisition

2.2 Image Preprocessing

This step is to make the acquired images suitable for the following processes, there are three main reason for image preprocessing. One is to resizing the image to have uniform size for all the image. Secondly to reduce the noise and third is to enhance the image contrast as shown in fig. 6(b).

All the images are converted from RGB to greyscale image as shown in fig. 6(a) to reduce the processing time and reduce complexity.

Then the grayscale images are converted in to binary image as shown in fig. 6(c) which contains only black and white color which helps in finding the objects using their boundary region.

Finally, the image is complimented in which the image is inverted binary image is obtained.
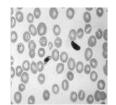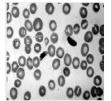

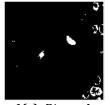**Fig -6(a)**: Grayscale Image

Fig -6(b): Enhanced Image

Fig -6(c): Binary Image

2.3 Feature Extraction

Feature extraction is transforms the higher dimensional data to the fewer dimensions so that it reduces the amount of resource required to describe the larger data. It reduces the complexity in analyzing the larger data which requires large amount of memory and computation power. It constructs the combination of variables in such a way that it reduces the resource usage and also describes data with sufficient accuracy. It also checks for the redundant data and transformed in to reduced features. The relevant information from the input data is found using feature

selection and then obtained using feature extraction, using this data we can perform any operation this will be same as the input data. In image data, we get transform and get the required data these data are called features.

Here GLCM (gray level co-occurrence matrix) is used for feature extraction, it is a statistical method which examine the textures of the input image. The texture analysis finds the spatial relationship between pixels. Several statistics are derived using the graycoprops function, these statistics gives information about the texture. The co-occurrences matrix is formed by finding the number of instance in which the pixels appear in the image. The image pixels data will be obtained to perform pattern recognition as shown in Fig. 7.

Fig -8: Feature Extraction

2.4 Classification

k-nearest neighbor algorithm is used to classify the type of the parasite. In the gametocyte stage of the parasite which changes the shape of the blood cell each parasite will change the blood cell in to some irregular shape. Using this k-nearest neighbor we can find the pattern and classify the type of the parasite present in the blood cell.
The large set of images are used as a data set for training and the data set are grouped based on their types which give pattern to each group so it will determine the parasite based on the available data set.
The feature extraction data are used to examine the image pixels and find the pattern in it. This algorithm uses the neighbor pixels to find which group does the pixel belongs by the number of votes by the neighbor pixel in each group. Here we use this algorithm to classify the parasite type based on the shape of the affected cell. Each parasite changes the shape of the cell at the gametocyte stage and it contains merozoites in it. Using this algorithm, the parasite can be classified based on the features extracted, these data will provide the information about the image which will be help full in performing analysis based on those features.
The affected cell and the parasite will be detect using the feature extraction and the type of the parasite will be determined using the k- nearest neighbor algorithm.
The result will be displayed as show in Fig. 8.

Fig -8: Detection and classification

3. CONCLUSIONS

The system effectively analyses the image and detect the parasite and classify the type of the parasite. The images were collected from different sources. The feature was extracted from the image and used to detect the parasite and find the type of the parasite using the pattern recognition algorithm.

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