

IDENTIFICATION OF MALARIA PARASITES IN CELLS USING OBJECT DETECTION

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Abstract - In this multimedia world, it is important to ensure that you offer the best of visually appealing images. Every small and large object are to be analyzed and to make the best efforts to ensure that all the objects in images are detected with higher precision adhere to the professional standards in the evolution of images. Malaria is a disease caused by a parasite known as plasmodium and this parasite is transmitted by the bite of an infected mosquito. The laboratory practitioner may lack in knowledge about malaria and the practitioner may fail to detect the parasites when examining blood smears under the microscope. In the existing system, images of infected and non-infected erythrocytes are acquired, pre-processed, relevant features extracted from them and eventually diagnosis was made based on the features extracted from the images. The accuracy and the speed of the detection are low and consume more time, so it is not much suitable for real time detection. To address this challenge, the proposed system can identify different types of parasites using object detection. The classifier used in this system is faster R-CNN which is more accurate in determining the results and reduces the computation time. The microscopic images of the cells are used to identify the presence of malaria parasites using image processing techniques. Type of parasite species and their stages can be detected. Thus, the system helps the laboratory practitioner identify the parasites faster and reduces the misdiagnosis of malaria which may considerably minimize the number of deaths occurred.

Key Words: object detection, image processing, malaria parasite, faster R-CNN, laboratory.

1. INTRODUCTION

Malaria is a disease caused by a plasmodium parasite and they are transmitted by the bite of an infected mosquito. The malaria's severity varies based on the different type of species of plasmodium. The parasite is transmitted to humans by mosquitoes and it affects the people severely. People infected with malaria normally feel very sick and they can be identified by various other symptoms like high fever and shaking chills. Each year, approximately 210 million people are infected with malaria, and about 440,000 people die from the disease. The practitioner may lack experience in knowledge about malaria and fail to detect the parasites when examining blood smears under the microscope. When image processing is used as a method in object detection, it helps to perform some operations on an image,

in order to get a good quality version of the image or it supports to extract information that are useful. Nowadays, image processing is among rapidly growing technologies where it forms core research area within engineering and computer science disciplines too. To address the challenge of false detection of malaria parasite by the practitioner, the microscopic images of the cells are used to identify the presence of malaria parasites using image processing techniques. The system is trained with the images of infected cells. Identification is based on the uploaded microscopic images.

1.1 MALARIA PARASITES

Malaria parasite can be classified into various types and stages. They are as follows:

Table -1: Types of parasites and their stages

Types	Stages			
P.falciparum	Ring	Trophozoite	schizont	gametocyte
P.vivax	Ring	Trophozoite	schizont	gametocyte
P.malariae	Ring	Trophozoite	schizont	gametocyte
P.ovale	Ring	Trophozoite	schizont	gametocyte

2. PROPOSED SYSTEM

The proposed system can identify the different types of the parasites using a modern neural network library like Tensor Flow. The images of the cells are classified as infected and non-infected and these images are labeled which are used as datasets. The classifier used in this system is faster R-CNN. The identification of the cells is highlighted with the boxes containing the percentage of accuracy. The level of infection is identified based on the stages of infected cells and reports to the user. The classifier used in this system is faster R-CNN which is more accurate in determining the results and reduces the computation time. Detecting malarial parasites and at the same time distinguishing it from similar patterns. Naming and stages of malarial parasites are done.

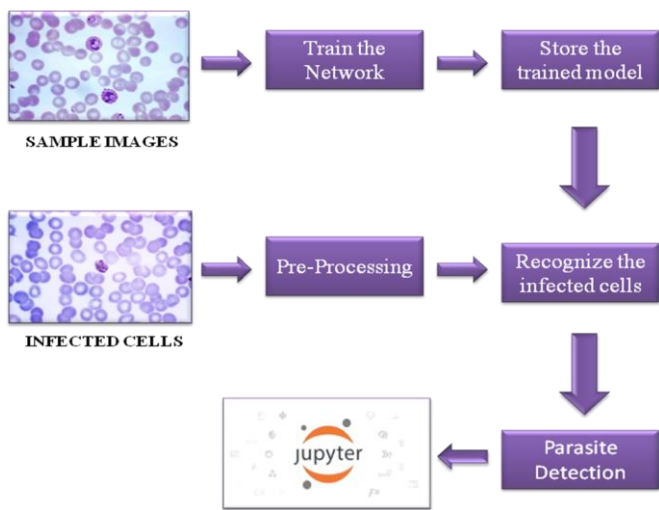


Fig -1: Architecture Diagram

3. IMPLEMENTATION

The efficiency of detecting malaria parasites is implemented using object detection which is done with the help of tensorflow. The datasets for training the neural network is collected and they are labeled based on their types and stages of the parasite. Thus the training models are generated by the faster R-CNN using the labeled images given for training. The infected cells are identified based on the inference graph generated as a result of trained model. The training can be monitored with the help of tensorboard. Various image processing activities are carried out because the image may have low brightness, contrast and to remove unwanted objects and noise from the image to segment into meaningful regions. Pre-processing methods used to increase a new value of brightness in output image. The different pre-processing methods like normalization, filtering, image plane separation etc. are used. The detected parasites are presented as an output in jupyter with the boundary boxes displaying the type of parasite, stages and the level of accuracy.

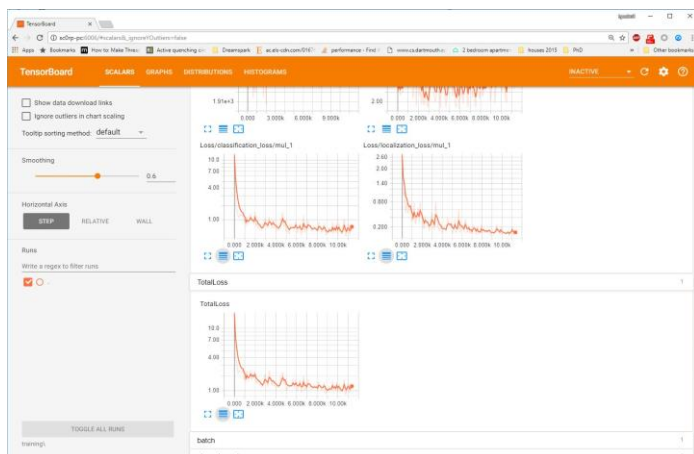


Fig -2: Tensorboard trained model graph

3.1 CONVOLUTION NEURAL NETWORK

Convolution neural network use the pre-processing techniques very little when compared to other algorithms that are used for image classification. This makes the network to learn the filters that in traditional algorithms were hand-engineered. This independence from prior knowledge and human effort in feature design is a major advantage. They have various applications in recognition of images and videos, image classification, medical image analysis, industrial applications and natural language processing.

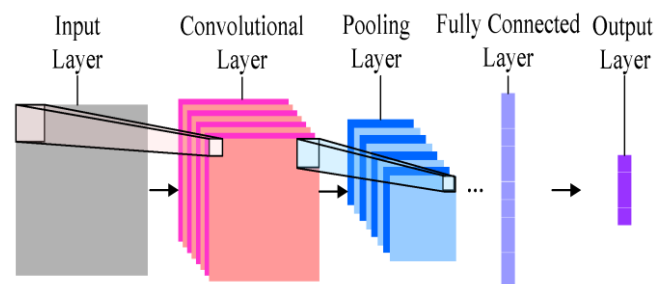


Fig -3: Convolution neural network

3.2 FASTER R-CNN

The Faster R-CNN has two networks that are used widely: region proposal network for generating region proposals and a network using these proposals to detect objects. The cost to generate region proposals is very smaller when compared to selective search. It Computes the region proposals on the image and maps them to the feature maps. Then these extracted features are computed and it is used to classify the regions. The faster R-CNN plays a vital role in classifying the parasites and it is found effective when it comes to object detection.

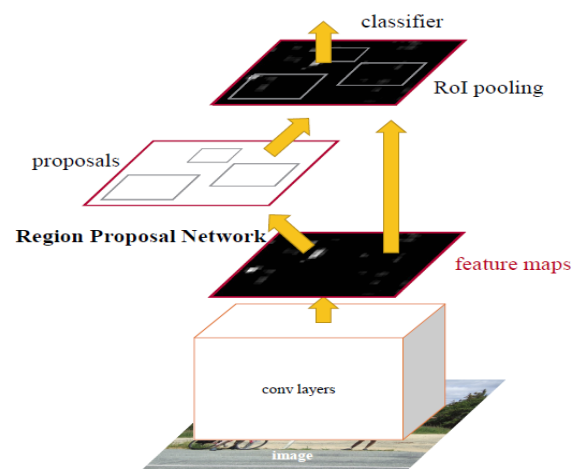


Fig -4: Faster R-CNN

4. OUTPUT

The system implemented using faster R-CNN model is capable of detecting the parasites with a highest accuracy level of 98% denoting their stages and type.

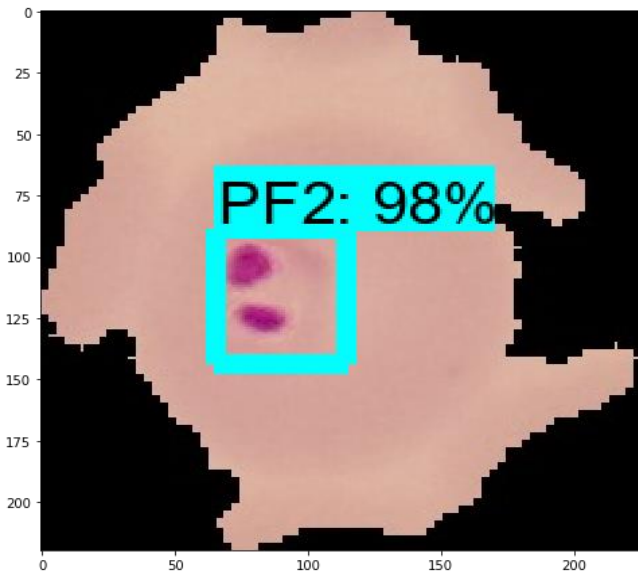


Fig -4: Parasite detection

The various parasites and their stages are denoted using the following alphanumeric characters.

Table -2: Alphanumeric characters representation for parasites

Types	Stage1	Stage2	Stage3
P.falciparum	PF1	PF2	PF3
P.vivax	PV1	PV2	PV3
P.malariae	PM1	PM2	PM3
P.ovale	PO1	PO2	PO3

5. CONCLUSION

Object detection has brought a change to our world and it is employed in many areas to reduce the task and the mistakes made by humans. Thus the object detection plays a major role by creating a system which enables the practitioner to find the infected malarial cells in the microscopic images of patient's blood sample and produces the output with the classification of their stages of the parasites and their type present in the image. The faster R-CNN is used to process the images and uses them as training images in order to identify and classify the parasites.

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