A SURVEY OF DETECTION OF MALARIA PARASITE IN BLOOD USING IMAGE PROCESSING

Avani Patel, Zalak Dobariya, Chandresh Paramar
Electronics and Communication Department
Silver Oak College of Engineering and Technology, Ahmedbad

Abstract- **Malaria is a female Anopheles mosquito-borne infection disease, and it's translated into human and other animals caused by the protozoan parasites of the genus plasmodium. This infection is invited by a bit from an infected Anopheles female mosquito. Which is also to be introducing life threatening parasite via it is pressure into a circular system, and liver where they mature and reproduce ultimately. And its symptoms are like fever and headache, which in some of cases its life cycle can progress to coma or death.**

Index Terms- Gray scale image, Binary image and thresholding, Blobs detection, Parasite color intensity selection, RBCs and parasite count

I. INTRODUCTION

Malaria is a most popular life-threatening parasitic disease, and it's transmitted inside human body through female Anopheles mosquito. It's caused by the genus Plasmodium the protozoan parasites. This parasite grows and reproduces to the complex life cycle. During whole process, host is the red blood cells (RBCs) and after it's destroyed. Hence, the ratio of total number of red blood cells to infected parasite cells [1]. Malaria is one of those diseases are caused due to the blood. Malaria is a common but serious disease the detection of the malaria, generally the blood samples are analyzed with the help of microscope. Approximately 781,000 people of the 225 million people infected by malaria in the word annual [2]. In sub-Saharan Africa Majority of deaths are children [3]. Several methods exist for malaria diagnosis. These methods can be classified into two parts, first based on their cost and second based on performance. So malaria is the high cost methods and low cost methods. The of high cost methods is Polymerase Chain Reaction (PCR)- based techniques that detect specific nucleic acid sequences [4] and Third Harmonic Generation (THG) imaging of emission from the *Hemozoin* using infrared ultrafast pulsed laser excitation [5]. This technique provides high sensitivity and specificity to malaria diagnosis. However, they are rarely used in developing countries because of the high cost, specialized infrastructure needs and handling very difficulties. Low cost methods are Rapid diagnostic test. Rapid Diagnostic Test (RDTs) detects specific antigens derived from malaria parasites in blood [6] and conventional microscopy [7, 8]. In malaria diagnosis RTD are relatively fast and can be administered by unskilled personnel. The gold standard method of malaria diagnosis is Conventional microscopy. The technique can be most communally used to detect and differentiate between different life stages and species of plasmodium parasites. But In this technique is time consuming is the most serious limitation. From the above discussion of malaria diagnosis methods, it can be decided that if technique are more sophisticated, so that result are more reliable of diagnosis. Sophisticated techniques are expensive and unaffordable in places where malaria is a serious problem. On the other handless sophisticated techniques are used but their results are not always reliable, it's major problem. Some of the low cost malarial technique improves to detecting. From **Table 1** below, class A would be the ideal diagnosis technique. Class D it would call for expensive detection and processing schemes. Class D translates high cost installation. Operating, high skilled personnel requirement besides being time consuming. Class C would be most conventional diagnosis techniques. Class B is simple detection scheme and complex processing algorithms. So made has semiconductor industry and tremendous improvements in fabrication of low cost and high speed computer processors. In this work, a class B define that malaria diagnosis was explored.

Classes	Detection complexity	Processing complexity
Class A	Simple	Simple
Class B	Simple	Complex
Class C	Complex	Simple
Class D	Complex	Complex

Table 1. Malaria diagnosis classification schemes.

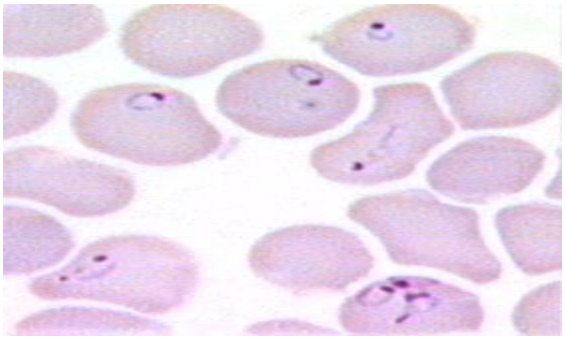
II. FACTS AND FIGURES

Approximately, 45% of the world's population is increase; most of the people is living in the poorest countries in the words, so increase the risk of malaria. Every 30 seconds child was dies of malaria. Severely ill more than 535 million people, become every year, through malaria. Between 300 million and 500 million people in all over the word have the disease? US were estimated at $ 500 million in 2005 for the treatment of the malaria.

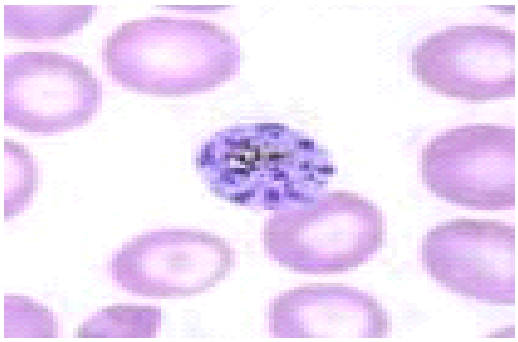
III. DIAGNOSIS OF MALARIA

Through a microscope malaria parasite was detected in blood slides (films). The detection and recognition of Plasmodium into blood sample and its possible and efficient by a chemical process is known as (Giemsa) staining. The Giemsa highlights the life-treating Plasmodium parasites, white blood cells (WBC), platelets and slightly colored the red blood cells (RBCs).

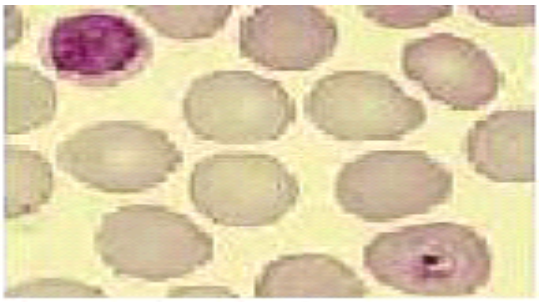
In the figure there are four types of human detected malaria – P. Plasmodium falciparum, P. vivax, P. malarial, and P. ovale. Most common type was P. falciparum and P. Vivax. Most deadly type of malaria infection is far by P. falciparum.



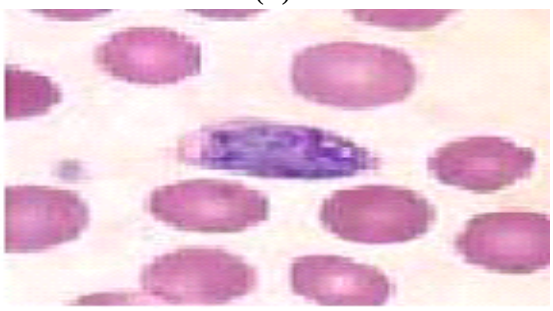
(a)



(**b**)



(C)



(d)

Fig.1 Human Detected Malaria (a) Plasmodium Falciparum (b) P. Vivax (c) P. Malarial (d) P. Ovale [1]

IV. OBJECTIVE

Objective is to develop a image processing system which identifies the malaria parasites or infected malaria cell in blood smears blood sample.

REVIEW OF METHODS

Makkapati and Rao [9] funded the segmentation for HSV color space. The process in [9] is based on HSV color space that segments Red Blood Cells, white blood cells and parasites, and also calculating optimal saturation thresholds. In this processes using the image, and its images taken from Leishman-stained

blood smears. This process was found to be 83% sensitivity. The process operates in HSV space. This processes is cannot determine local and global thresholding, but it's only determine optimum thresholding. This Scheme is segment Red Blood Cells and chromatin dots. The work in [9] defines the use of color image processing techniques.

Ravi raja and et al. [10] informed to us a blood image processing. It's detecting and classifying malarial parasites in images of Giemsa stained blood slides. It's detecting the red blood cells which are infected by malarial parasites. And after it's used statistical based approach. Its rest the infected blood image then separate automatically the parasites like trophozoites, schizonts and gametocytes. In this case different information is use like infected blood image, color, shape and size. After image is compare with the infected images and last image transformation by shaping and scaling to reconstruct the image.

Ruberto et al. [11] introduces morphological approach technique. It's defined that cell image segmentation technique is more accurate than the normal watershed based algorithm. Here used non-flat disk-shape structuring element that's improving the accuracy of normal watershed based algorithm. Separate overlapping cells are use through the flat disk-shape structuring element. These methods make use of knowledge of the RBC structure that is not used in existing watershed based algorithm.

Sadeghian et al. [12] is introduce demonstrated a framework. And it's segmenting white blood cells using digital image processing. This grey level image processing divided into two parts. 1) Nucleus segmentation based on morphological analysis 2) then cytoplasm segmentation is based on pixel-intensity thresholding.

In [13] processes based on RGB color space that is segments Red Blood Cells and malaria parasites. It's detecting by dominant hue range. And it's calculating by optimal saturation thresholds. In this processes taken the image from Leishman-stained blood smears. This processes founded 83% of Sensitivity.

In [14] scheme Automated image analysis-based software. "Malaria Count" for determination parasitemia, i.e. in these processes describes the level of quantitative evaluation in the blood. The process is based on the parasite boundaries and detection of edges representing cell. In this processes include the pre-processing step, edge detection step, edge linking and clump splitting.

S.P.Premaratnea at el. [15] views digital images through microscopic slides. Here used digital image of oil immersion. And it's microscopic slides captured by a capture card. Pre-processed is reduce their dimensionality. For training it fed into a feed forward back propagation neural network (NN). 64 pixels X 64 pixels images to be used as a training data set and its segment into a digital image.

In [15] Automated malaria detection by flow cytometry. in the combination with fluorescence staining. But 2000 par/mL of blood detect "background noise". However, THG images have higher detection in compassion. Using image THG emission malaria parasite infection can be detected in infected red blood cells.

A method by Chen Pan et al. [16] is based on image retrieval. It's classifying cell of the image from high image databases. There are two type of histogram are use like RGB color histogram of cell and two intensity histograms. It's corresponding to those local regions. Here represented the Kernel principal component analysis (KPCA) and it's used to extract effective features from the feature vector.

Lee and et al. [17] is introduced automatic detection and classification of MCCs. A block region growing and k-means clustering is used and it's employed to extract the breast region. Then, a blanket method is finds to a MMCs clusters. The MCCs detection module is extract the MCCs from the ROIs. The system [16] is achieves 95% high classification rate and detection rate 93%.

Amit and P. U. in [18] Introduce segmentation of infected cells in blood smear images with adoptive thresholding. In this case adoptive thresholding can be performing with the help of Otsu algorithm which can give better result as compare to averaging

technique. In this case the Lab sample images and for the available image database, it is parasites count is near about matching with the manual count while in the RBCs count, some more other difference is observed.

In [19] Rapid diagnostic tests (RDTs) immune chromatographic methods use. It does detect the antigens derived from malaria parasites in lysed blood. This test are currently available on the detection of the substance like a Histidinerich protein II, Parasite lactate dehydrogenises (pLDH). In [20] Histidinerich protein II (HRP-II) a water-soluble Protein is produced by trophozoites and young gametocytes of P.

Parasite lactate dehydrogenises (pLDH) is a produced by asexual and sexual stages (gametocytes) of parasites of P. RDTs have reported to achieve sensitivities of greater than 90% in the detection of P. falciparum or above 100 parasites/µl of blood. Below this level, sensitivity was decreases.

In [20] **Quantitative Buffy coat (QBC) speed in detecting malarial** parasites is a definite advantage in laboratories. And which screen large number of samples. Other feature is low levels of Parasitaemia (2 parasites/µl) can easily be detected as more blood is being used per sample (55-65µl). There is no loss of parasites during the procedure. In [22] another advantage of QBC is its ease to interpretation and it technically easy to perform. A technician can be carry out the QBC test and accurately detect the malaria parasite, in less than a Day. Other Disadvantages of the QBC are that it is expensive, and there are chances of leaking and breaking of blood filled QBC tubes. In [23] describe one more disadvantage of QBC technique is that a permanent record of test cannot be kept.

QBC technique showed a higher sensitivity and specificity in a laboratory setting (97.77% sensitivity and 99.73% specificity) than in the field (sensitivity 70.97% and specificity 97.40%) when compared with Blood smears.

V. CONCLUSION

We reviewed different type of malaria parasite technique. This was done previously. With help of these methods malaria parasite can be easily detected. We conclude that among all provider methods Otsu algorithm is more batter to compare other. Main advantages of this algorithm it takes less time in compression with many evaluations.

REFERENCE

[1] Pallavi T. Suradkar Detection of Malaria Parasite in Blood Using Image Processing International Journal of Engineering and Innovative Technology (IJEIT) Volume 2, Issue 10, April 2013.

[2] World Health Organization (2010) World - Malaria Report.

[3] Snow, R.W., Guerra, C.A., Noor, A.M., Myint, H.Y. and Hay, S.I. (2005) The global distribution of clinical episodes of plasmodium falciparum malaria. *Nature*, **434**, 214-217. http://dx.doi.org/10.1038/nature03342.

[4] Warhurst, D.C. and Williams, J.E. (1996) Laboratory diagnosis of malaria: ACO broadsheet no. 148. *Journal of Clinical Pathology*, **49**, 533-538. http://dx.doi.org/10.1136/jcp.49.7.533.

[5] Balisle, J.M., Costantino, S., Leimanis, M.L., Bellemare, M.J., Bohle, D.S., Georges, E. and Wiseman, P.W. (2007) Sensitive detection of malaria infection by third harmonic generation imaging. *Biophysical Journal's BioFAST*, **94**, L26-L28.

[6] Beadle, C., Long, G.W., Weiss, W.R., P.D. McElroy, Maret, S.M., Oloo, A.J. and Hoffman, S.L. (1994) Diagnosis of malaria by detection of p. falciparum HRP-2 an- tigen with a rapid dipstick antigen—Capture assay. *Lancet*, **343**, 564-568. http://dx.doi.org/10.1016/S0140-6736(94)91520-2.

[7] Report of Joint WHO/USAID (2005) new perspectives of malaria diagnostics, informal consultations. 25-27 October 1999.

[8] WHO (2004) the role of laboratory diagnosis to support malaria disease management: Focus on the use of rapid diagnostic tests in the areas of high transmission.

[9] V. V. Makkapati and R. M. Rao, .Segmentation of malaria parasites in peripheral blood smear images., Proceedings of IEEE International

Conference on Acoustics, Speech and Signal Processing, ICASSP 2009, pp. 1361-1364, Apr. 2009.

[10] S. Raviraja, G. Bajpai and S. Sharma, .Analysis of Detecting the Malaria Parasite Infected Blood Images Using Statistical Based Approach., IFMBE Proceedings, 3rd Kuala Lumpur International Conference on Biomedical Engineering 2006, vol. 15, part 12, pp. 502-505, 2007.

[11] C. Di Ruberto, A. Dempster, S. Khan and B. Jarra, .Segmentation of blood images using morphological operators., Proceedings of 15th International Conference on Pattern Recognition Barcelona, Spain, vol. 3, pp. 3401, 2000.

[12] F. Sadeghian, Z. Seman and A. R. Ramli, .A Framework for White Blood Cell Segmentation in Microscopic Blood Images Using Digital Image Processing., Biological Procedures Online, vol. 11, no. 1, pp. 196-206, Dec. 2009.

[13] Vishnu V. Makkapati and Raghuveer M. Rao .Segmentation of malaria parasites in peripheral blood smear images. IEEE 2009.

[14] S. Raviraja1, Gaurav Bajpai1 and Sharma S .Analysis of Detecting the Malarial Parasite Infected Blood Images Using Statistical Based Approach., Proceedings 15, pp. 502-505, 2007.

[15] S.P.Premaratnea, N. D. Karunaweerab, and S. Fernandoc, .A Neural Network Architecture for Automated Recognition of Intracellular Malaria Parasites in Stained Blood Films., 2003.

[16] C. Pan, X. Yan and C. Zheng, .Recognition of Blood and Bone Marrow Cells using Kernel-based Image Retrieval., IJCSNS International Journal of Computer Science and Network Security, vol.6 no.10, October 2006.

[17] [S. K. Lee, C-S. Lo, C-M. Wang and P-C. Chung, .A Computer- Aided Design Mammography Screening System for Detection and Classification of Micro calcifications., International Journal of Medical Informatics, vol. 60, pp. 29-57, 2000.

[18] Amit Kumar, Prof. Arun Choudhary, Prof. P. U. Tembhare, Prof. C. R. Pote Enhanced Identification of Malarial Infected Objects using Otsu Algorithm from Thin Smear Digital Images International Journal of Latest Research in Science and Technology Vol.1,Issue 2 :Page No159-163 ,July-August(2012) http://www.mnkjournals.com/ijlrst.htm.

[19] Howard RJ et al. (1986). Secretion of a malaria histidinerich protein (Pf HRP II) from Plasmodium falciparum-infected erythrocytes. J Cell Biol, 103:1269–77.

[20] WHO/United States Agency for International Development (2000). New perspectives: malaria diagnosis. Report of a joint WHO/USAID informal consultation, 25–27 October 1999. Geneva, World Health Organization.

[21] Howard RJ et al. (1986). Secretion of a malaria histidinerich protein (Pf HRP II) from Plasmodium falciparum-infected erythrocytes. J Cell Biol, 103:1269–77.

[22] WHO/United States Agency for International Development (2000). New perspectives: malaria diagnosis. Report of a joint WHO/USAID informal consultation, 25–27 October 1999. Geneva, World Health Organization.

[23] Salmani MP, Mindolli PB, Peerapur BV. Comparative Study of Peripheral Blood Smear, QBC and Antigen Detection in Malaria Diagnosis. Journal of Clinical and Diagnostic Research. 2011; 5(5): 967-9.