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Malaria Diagnosis Using Image Processing Techniques

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ABSTRACT: Malaria which is caused by Plasmodium parasite is one of the diseases that can cause death in patients. Detection of plasmodium parasites on the Red Blood Cell (RBC) image can help diagnose malaria quickly and accurately, especially in the areas that lacked medical expertise. This research proposes a detection method of plasmodium parasite at RBC using double thresholding for improving accuracy of detection. Classification obtained by SVM will achieve betteraccuracy than conventional methods.

KEYWORDS: Malaria,thin blood smears, image segmentation,Image Processing Techniques

I. INTRODUCTION

Malaria is an infectious disease that has been reported to be a serious global health problem, causing between 1.5 and 2.7 million of deaths every year in more than 90 countries. It is caused by intracellular single-celled parasite that belongs to genus Plasmodium. Up to thisdate, 5 species are discovered to infect human by entering bloodstream, namely Plasmodium falciparum, Plasmodium vivax, Plasmodium malariae, Plasmodium ovale, and Plasmodium. knowlesi.Beside numerous advantages, the use of light microscope in diagnosing malaria also has some drawbacks. The quality of smears is not homogenous and the condition of the slide is highly influenced by time and storage. It also relies heavily on the expertise of medical practitioner in the field. In addition, confirming negative status of a malaria slide take considerable time and efforts. As a consequence, these disadvantages bring many difficulties in Mass Blood Screening (MBS) and become a burden in controlling the spread of malaria especially in rural areas.. This condition is mainly observed in eastern part of Indonesia where the numbers of expert microscopists are limited while the prevalence of malaria is considerably high. The aim of this study is to propose a new algorithm for automated malaria status identification based on the standard routine used by medical practitioner performing microscopy diagnosis of malaria. The system is developed to segment the image into parts, i.e. to separate andblood cells from the background, and to detect the parasites infecting them by identifying components of the parasite. The algorithm is expected to provide a positive and negative the diagnosis of malaria with comparable sensitivity and specificity to conventional microscopy.

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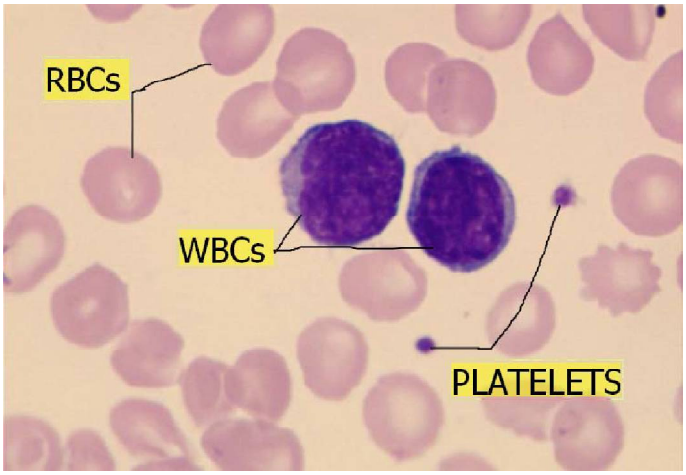

Figure 1. (a)Malaria detected image

II. LITERATURE SURVEY

S.Kareem, R.C.S Morling and I.Kale[1] has described a novel idea to identify the total number of red blood cells (RBCs) as well as their location in a Giemsa stained thin blood film image. This work is being undertaken as a part of developing an automated malaria parasite detection system by scanning a photograph of thin blood film in order to evaluate the parasitemia of theblood. Not only will this method eliminates the segmentation procedures that are normally used to segment the cells in the microscopic image, but also avoids any image pre-processing to deal with non uniform illumination prior to cell detection. The method utilizes basic knowledge on cell structure and brightness of the components due to Giemsa staining of the sample and detects and locates the RBCs in the image. A robust and novel method for estimating the RBC count in a thin blood film has been proposed. Different experimentalanalysis using different images with different contrast andresolution showed that the method is insensitive to thevariation to illumination issues and contrast of the cell images.Hence it will reduce the time and complexity required forsetting up different acquisition and enhancement facilities forthe pre-processing of the images. Not only does it improve thecount but it also provides the location of the cells. In additionto that, the method does not require any binarisation as themethod works directly on the grayscaleimage.Furthermore, it achieves 93% sensitivity and 100% specificity in terms of classification.

S.Kareem, R.C.S Morling and I.Kale [2] has illustrated the automated diagnosis of malaria parasite (Plasmodium species) in microscopic images of Giemsa stained thin blood films. The procedure adapts a morphological approach for blood cell identification and uses the image features such as intensity, histogram, relative size and geometry for further analysis. Two methods of object classification have been described for parasite detection; one based on relative size and morphology and the other based on intensity variation. This method is tested on 543 malaria patients and achieves sensitivityand specificity of 90%in the detection of protozoa parasites.

S.Kareem , I .Kale, R.C.S Morling ,"A Novel Fully Automated Malaria Diagnostic Tool Using Thin Blood Films" Pan American Health Care Exchanges (PAHCE2013), Medellin, Columbia, May 2013 [3]This paper illustrates the automated diagnosis ofmalaria parasite (Plasmodium species) in microscopic images ofGiemsa stained thin blood films. The procedure adapts amorphological approach for blood cell identification and usesthe image features such as intensity, histogram, relative size andgeometry for further analysis. Two methods of objectclassification have been described for parasite detection; onebased on relative size and morphology and the other based onintensity variation. Furthermore, an analytical

S.Kareem, I.Kale, R.C.S Morling[4] The gametocytes of the malaria parasite Plasmodium falciparum are highly resistant to antimalarial drugs. Its presence in the blood can be detected even after a successful malaria treatment. This paper explains a modified Annular Ring Ratio method which successfully locates and differentiates gametocytes of P.falciparum species in thin blood film images. The method can be used as an efficient tool for gametocyte detection for post-treatment malaria diagnosis.This method achieves sensitivity of 97.25% and specificity of 96.85%.

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BorayTek, Andrew G. Dempster, IzzetKale."Computer Vision for microscopy diagnosis of malaria". Malaria Journal 2009 [5] reviews computer vision and image analysis studies aiming at automated diagnosis or screening of malaria infection in microscope images of thin blood film smears. Existing works interpret the diagnosis problem differently or propose partial solutions to the problem. A critique of these works is furnished. In addition, a general pattern recognition framework to perform diagnosis, which includes image acquisition, pre-processing, segmentation, and pattern classification components, is described. This paper provides a good basis for researchers who are starting to investigate the automated blood film analysisfor diagnosis or screening of malaria or similar bloodborne infectious diseases. In this paper, a review and critiqueof computer vision and image analysis studieswhich address the automated diagnosis of malaria on thinblood film smears and its necessary auxiliary functions isprovided. The results are compared with hand-drawn ground truth which achieves sensitivity of 75.43%and specificity of 99.99%.

WHO: Global report on antimalarial efficacy and drug resistance: 2000-2010 [6]: This report provides a comprehensive, global overview of antimalarial drug efficacy and the resistance of malaria parasites to the antimalarial medicines used between 2000 and June 2010. Policy-makers in national ministries of health will benefit from this document, as it provides both a global and a regional picture of the efficacy of the antimalarial medicines currently used in national treatment programmes. In addition, the report will be a reference for scientists, enhancing their understanding of the complexity of antimalarial drug resistance.

Anna Rosanas-Urgell, Dania Mueller , InoniBetuela, Céline Barnadas, Jonah Iga, Peter A Zimmerman, Hernando A del Portillo , Peter Siba, Ivo Mueller and Ingrid Felger[7] have studied an ," Accurate diagnosis ofPlasmodiuminfections is essential for malaria morbidity and mortality reduction in tropical areas. Despite great advantages of light microscopy (LM) for malaria diagnosis, its limited sensitivity is a critical shortfall for epidemiological studies. Robust molecular diagnostics tools are thus needed.The present study describes the development of a duplex quantitative real time PCR (qPCR) assay, which specifically detects and quantifies the four human Plasmodium species. Performance of this method was compared to PCR-ligase detection reaction-fluorescent microsphere assay (PCR_LDR_FMA), nested PCR (nPCR) and LM, using field samples collected from 452 children one to five years of age from the Sepik area in Papua New Guinea. Agreement between diagnostic methods was calcualted using kappa statistics.

C.DiRuberto, Andrew G. Dempster, S.Khan, and B.Jarra,"Analysis of infected blood cell images using morphological operators,"Image and vision computing,vol 20,no.2,pp.133-146,February 2002 [8] :This paper reviews computer vision and image analysis studies aiming at automated diagnosis orscreening of malaria infection in microscope imagesof thin blood film smears. Existing works interpret the diagnosis problem differently or propose partial solutions to the problem. A critique of these works is furnished. In addition, a general pattern recognition framework to perform diagnosis, which includes image acquisition, pre-processing, segmentation, and pattern classification components, is described. The open problems are addressed and a perspective of the future work for realization of automated microscopy diagnosis of malaria is provided.

III. CONCLUSION

This study provides a good basis for those who are aiming to investigate the automated blood film analysis for screening of malaria or other infectious disease. Unlike prior algorithm, the method proposed in this project was developed based on the routine manual microscopy and each step of the development has been confirmed by expert microscopists from Eijkman Institute of Molecular Biology Indonesia. As a result, the malaria blood image processing can significantly reduce the main detractions of microscopy, which are its dependence on the skill and experience of human technicians and the time and labor intensive work of conventional blood smear analysis.

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