

CHAPTER 1 - INTRODUCTION

1.1 Background

Malaria is a global disease that infects human blood. The malaria parasite will infect human's erythrocyte by Anopheles mosquito bites. Five malaria species that have been discovered, namely *Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium malariae*, *Plasmodium ovale*, and *Plasmodium knowlesi*. According to the WHO (2013), in 2012 there were 207 million cases which mostly occurred in Africa and South East Asia and caused 627,000 deaths. In 2000, International funding spent 100 million USD for malaria controls and rocketing to 2 billion USD in 2012. They spent a large amount the money for drugs, identification malaria parasite and malaria prevention.

To solve the malaria problem, a lot studies have been conducted to help identify malaria parasites in victims' blood. The previous studies need binary image or even RGB image to do so. The result from the studies is for differentiate between healthy erythrocyte and infected erythrocyte but if there are other blood components, the result still bad. The other problem is if there are overlapping cells, there is a study to solve overlapping cell but the result is not satisfied enough.

1.2 Research Objectives and Scope

The primary purpose of this research paper is to develop Computer Aided Diagnostic based on Free Open Source Software (FOSS) that will automatically identify erythrocyte in thin blood smears microphotograph. The research is conducted due to the needs of an intelligent system that can assist medical practitioners to distinguish erythrocyte from the other blood components.

Throughout the development of algorithm to distinguish erythrocyte, the research focused on analysing thin blood smears images of Plasmodium from the species Falciparum during the early to late trophozoite stage.

The expected output of this research is high accuracy in identifying the blood components (healthy erythrocytes, infected erythrocytes, leucocytes, thrombocytes and artefacts).

1.3 Hypothesis

In research on identification of malaria parasites, most researches used thin blood smears image and differentiated between infected erythrocyte with malaria parasite and the healthy erythrocyte but there is possibility other components exist in a blood image like leucocyte and dirt. These components lower the accuracy level. The other issue is there are overlapping cells in the image. The healthy erythrocyte may be linked together with another component like dirt or thrombocyte, which may cause error. The healthy erythrocyte may be named as the infected one.

1.4 Benefits of Research

1.4.1 Public

This study contributes to the improvement of public health by providing a system that can improve malaria diagnosis based on Free Open Source Software (FOSS), which is one way to overcome health problems caused by malaria, especially in remote places.

1.4.2 Academic Community

This study can be used as literature for further development of CAD system based on Free Open Source System for malaria cases in Indonesia.

1.5 Research Questions and Hypotheses

1.5.1 Questions

Question #1: What are the distinctive characteristics of erythrocyte to the other blood cell components?

Question #2: How to deal with overlapping erythrocyte cells?

Question #3: How to formulate the characteristic of red blood cell mathematically?

1.5.2 Hypotheses

Hypothesis #1: Area of cell is the distinctive characteristic of erythrocyte to the other blood components.

Hypothesis #2: Watershed can handle overlapping cells.

1.6 Methodology

1.6.1 Literature Study and Problem Identification

Searched and studied materials related with malaria identifications using thin blood smears image is done in this step. The materials are in English and Indonesia. The previous studies were discussing about various image segmentation and identification methods, using grayscale image or even using RGB colour image. The methods can be used to solve problems in this research that may be appeared at the future work.

1.6.2 Analysis Construction

After identifying problems, questions should be reformed and solutions for answers for each question will be constructed. Designing solution will require analysis about this topic as its basis.

1.6.3 Design Phase

The analysis conducted in the previous step will be used as reference for designing general architecture for identifying malaria parasites from the blood smears image. Proper planning and design should be conducted based on previous study. The output of this phase should be an illustration of how the application should behave and required steps from data set input into generating result.

1.6.4 Implementation Phase

This is the step when the implementation phase takes place. All information that already collected will be used in this phase. The image (data sets) will be used and all algorithms will be tested to get best results. The accuracy in identification becomes the most important things here.

1.6.5 Evaluation Phase

The result of implementation should be to answer all of the research questions and solve the problems. The result also has to be evaluated such as the accuracy and the sensitivity of algorithms that used. This phase also can used for strengthen the algorithm so it can generate the best result.

1.6.6 Publication

The result of this study will be published in the form of Bachelor Thesis in Swiss German University.

