

Survey on Malarial Parasite Detection in RBC using Image Processing

Sangamesh Gama¹, Praveen J², Surabhi KP³, Yamuna KV⁴

Assistant Professor, Department of Information Science & Engineering,
Atria Institute of Technology, Bangalore, India¹

Student, Department of Information Science & Engineering, Atria Institute of Technology, Bangalore, India^{2,3,4}

Abstract: Malaria is a mosquito-borne infectious disease of humans and other animals caused by parasites (a type of microorganism) of the genus *Plasmodium*. Infection is initiated by a bite from an infected female mosquito, which introduces the parasites via its saliva into the circulatory system, and ultimately to the liver where they mature and reproduce. The disease causes symptoms that typically include fever and headache, which in severe cases can progress to coma or death. The diagnosis of malaria is microscopy in which the blood slide is examined under a microscope, but the reliability, accuracy and timely diagnosis of the results are highly based on the proficiency of the technician examining the slide. False Detection can occur in the case of poorly skilled technician. In this research work we have proposed a system for automating the manual work done by a technician in order to cut down the human error and increasing the accuracy of the malaria diagnosis. This approach will be beneficial for the rural areas, with a scarcity of experts.

Keywords: Image Processing, RGB color, KNN, Naïve Bayes, HSV segmentation, RDT, Otsu method.

I. INTRODUCTION

Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image. Nowadays, image processing is among rapidly growing technologies. It forms core research area within engineering and computer science disciplines too. Image processing basically includes the following three steps: Importing the image via image acquisition tools Analysing and manipulating the image. Output in which result can be altered image or report that is based on image analysis. There are two types of methods used for image processing namely, analogue and digital image processing. Analogue image processing can be used for the hard copies like printouts and photographs. Image analysts use various fundamentals of interpretation while using these visual techniques. Digital image processing techniques help in manipulation of the digital images by using computers. The three general phases that all types of data have to undergo while using digital technique are pre-processing, enhancement, and display, information extraction.

II. RELATED SURVEY

Visual quantification of the parasite in thin blood films is a very tedious, subjective and time-consuming task. This study presents a resourceful methodology for quantification and classification of erythrocytes in stained skinny blood films infected with *Plasmodium*. The proposed approach is composed of three main phases: a pre-processing step, which corrects luminance differences. A segmentation step that uses the normalized RGB color area for classifying pixels either as red blood cell or background followed by associate degree Inclusion-Tree illustration that structures the pixel info into objects, from which erythrocytes are found. Finally, a two-step classification method identifies infected erythrocytes and differentiates the stage of infection, employing a trained bank of classifiers. Additionally, users intervention is allowed when the approach cannot make a proper decision. Four hundred fifty malaria images were used for training and evaluating the strategy. Automatic identification of infected erythrocytes showed a specificity of 99.7% and a sensitivity of 94. The infection stage was determined with an average sensitivity of 78.8% and an average specificity of 91.2%. This paper introduces a new paradigm for the problem of malaria quantification and life stage classification. Instead of attempting to separately detect and quantify parasite and cell, we dedicate our efforts to develop a semantic strategy which classifies

erythrocytes as either healthy or infected in a specific life stage, based on their internal structure but with no explicit parasite detection. Besides, the present investigation also explores side quantification problems such as the clumping of cells and proposes an original approach which separates many of the frequently superimposed shapes.^[1]

Evaluation of blood smear is a common clinical test these days. Most of the time, the hematologists are interested in white blood cells (WBCs) only. Digital image process techniques will facilitate them in their analysis and diagnosing. For example, a disease like acute leukemia is detected based on the amount and condition of the WBC. The main objective is to phase the WBC to its 2 dominant elements: nucleus and living substance. The segmentation is conducted employing a projected segmentation framework that consists of associate degree integration of many digital image process algorithms. Twenty microscopic blood pictures were tested, and the proposed framework managed to obtain 92% accuracy for nucleus segmentation and 78% for cytoplasm segmentation. The results indicate that the projected framework is {in a position|is ready} to extract the nucleus and living substance region in a WBC image sample. The main objective is to phase the WBC to its 2 dominant components nucleus and living substance. Digital image processing techniques can help them in their analysis and diagnosis. For example, a disease like acute leukemia is detected based on the amount and condition of the WBC and it consists of the integration of several digit image processing algorithms. WBC or leukocytes play a major role within the diagnosing of various diseases and so extracting info this valuable for hematologists. And here our goal is to segment the WBC nuclei and cytoplasm using a framework that has been developed using digital image processing and there are a few complications in extracting the data from WBC.^[2]

This work describes a region of a malarial image process system for sleuthing and classifying malaria parasites in images of Giemsa stained blood slides so as to judge the blood disease of the blood. A major requirement of the system is an efficient methodology to phase cell images. Morphological approach to cell image segmentation is more accurate than the classical watershed-based algorithm. We have applied grey scale granulometries based on opening with disk-shaped elements, flat and non-flat. We have used a non-f/at disk-shaped structuring element to enhance the roundness and the compactness of the red cells improving the accuracy of the classical watershed algorithm, while we have used a flat disk-shaped structuring part to separate overlapping cells. These ways create use of information of the red blood corpuscle structure that's not utilized in existing watershed-based algorithms. A morphological approach to cell image segmentation is more accurate than the classical watershed-based algorithm. We have used a non-flat disc shaped structuring element to enhance the roundness and the compactness of the red cells. We have applied grey scale granulometries based on opening with disc-shaped elements flat and nonflat. While we used a flat disk-shaped structuring element that is not used in watershed-based algorithms to separate overlapping cells.^[3]

Malaria is an infectious disease that's mainly diagnosed by visual microscopical analysis of Giemsa-stained thin blood films using a differential analysis of color options. The analysis of a color segmentation technique, is based on standard supervised classification algorithms. The whole approach uses a general purpose classifier, which is parameterized and adapted to the problem of separating image pixels into three different classes: parasite, blood red cells, and background. Assessment enclosed not solely four totally different supervised classification techniques KNN, Naive Bayes, SVM, and MLP – however totally different color areas -RGB, normalized RGB, HSV, and YCbCr-. Results show higher performance for the KNN classifiers beside a rising feature characterization within the normalized RGB color space. This paper presents the evaluation of a color segmentation technique, based on standard supervised classification algorithms. The whole approach uses a general purpose classifier, which is parameterized and adapted to the problem of separating image pixels into three different classes: parasite, BRC and background result shows better performance for the KNN classifier along with the improving future characterization in the normalized RGB color space. We present a very simple approach for automatic identification of infected and no infected erythrocytes in thin blood images by means of a supervised pixel classification method. The performance result at the object identification level was superior to the performance at the pixel classification level. ^[4]

The global burden of malaria is enormous and also the development of better laboratory diagnostic tools is a key step in malaria management counseled by the UN agency. Our objective was to develop an automatic tool for the popularity of living thing protozoal infection parasites in stained blood films. we have a tendency to used digital pictures of oil immersion views from microscopic slides captured through a capture card. They were preprocessed by segmentation and grayscale conversion to cut back their spatiality and later fed into a feedforward backpropagation neural network (NN) for coaching it. Then a program was developed incorporating this trained NN. within the final product, the tool permits a user to look at the slide in a very graphical program. once the user offers a command to research, a still image is captured and

sent to the NN for recognition when preprocessing. Preliminary results show that the NN will establish fastidiously selected check information. The coaching information set for the ANN had fifty image segments with the protozoal infection parasites and fifty pictures segments while not. At the top of coaching, the network achieved its performance operate however the time is taken to realize it had been considerably high. once tested with a specific set of various pictures apart from that used for coaching the ANN was ready to reason it consequently. Since the coaching of the ANN continues to be in its early stages post-training analysis has not been administered. once incorporated into the software package tool the performance of the ANN wasn't satisfactory as there have been a considerable range of errors in categorizing. This was expected and also the speculated reasons square measure careful within the discussion [5]

At present, malaria rapid diagnostic tests (RDTs) are widely available and used in parts of Asia and Latin America. In Africa, their use has been restricted chiefly to private health facilities. With the adoption of artemisinin combination therapies (ACTs) by most African countries as initial line treatment for malaria, an effective, but expensive treatment is available, and the case for an expanded role for fast medicine within the fight against malaria is obvious. Despite this perceived potential role for RDTs, some challenges hinder their introduction and scale-up in the public health sector. Among the requirements are important investments in policy development, training, infrastructure, and supply chain and quality assurance systems. While RDTs are often effective in clinical settings when utilized by trained personnel, they also have great potential in rural areas with limited access to health facilities and health professionals. If RDTs can be used with a high level of sensitivity and specificity by CHWs at the village level, it will be possible to make a positive diagnosis in a much greater proportion of malaria cases. Results can include a shorter lag time between the onset of symptoms and also the starting of treatment, less suffering on the part of the infected individual, and reduced transmission potential. It may also lead to a significant cost savings by avoiding unnecessary use of anti malarials, and will therefore contribute to reduce resistance development. Finally, it would be important to establish the role and cost-effectiveness of RDTs in special situations such as those caused by conflicts or environmental catastrophes, including the displacement of non-immune populations into malaria-endemic areas among alternative complicated emergencies.[6]

Image analysis studies aiming at automated diagnosis or screening of malaria infection in microscope images of thin blood film smears. Malaria is the mosquito-borne infectious disease of humans and . animals caused by parasites (a form of microorganism) of the genus Plasmodium. Infection is initiated by a bite from associate degree infected feminine genus Anopheles dipteran, which introduces the parasites via its saliva into the circulatory system and ultimately to the liver where they mature and reproduce. The illness causes symptoms that typically include fever and headache, which in severe cases can progress to coma or death. Malaria is widespread in tropical and subtropical regions in a broad band around the equator, including much of Sub-Saharan Africa, Asia, and the Americas. The detection of malaria parasites is completed by pathologists manually using Microscopes. So, the chances of false detection due to human error are high, which in turn can result in a fatal condition. This seminar curbs human error while detecting the presence of malaria parasites in the blood sample by using image processing and automation. We achieved this goal mistreatment Image Segmentation smoothing technique techniques, gradient edge noticeion technique to detect infection parasites in pictures noninheritable from Giemsa stained peripheral blood samples. The system during a sturdy manner so it's unaffected by the exceptional conditions and achieved high percentages of sensitivity, specificity, positive prediction, and negative prediction values. And the extraction of red blood cells achieves a reliable performance and therefore the actual classification of infected cells.[7]

Manually examine the blood smear for the detection of Plasmodium vivax consumes lot of time for trend pathologists. As the process power will increase, the role of automatic visual review becomes additional important. An automated system is thus required to complete the maximum amount work as possible for the identification of malaria parasites. The given theme based on used of RGB color area, G layer processing, and segmentation of Red Blood Cells (RBC) as well as cell parasites by auto-thresholding with offset value and use of morphological processing. The work compare with the manual results obtained from the pathology laboratory, based on total RBC count and cells parasite count. The designed system successfully detects malaria parasites and red blood cell cells in thin smear image. We area unit experimenting with the semiautomated approach for detection of Plasmodium vivax. The selection of G layer from the RGB color space gives better result by performing the segmentation based on Otsu and some offset values. The proposed scheme reduced the time taken for malaria detection and the chances for human errors. The image (DSC09250) might not provide better result for RBC count because of improper illumination throughout capturing. However, the variability and artifacts in microscopic images of blood samples create vital challenges for correct detection. In future we try and use the opposite color areas and totally different thresholding techniques. It is more extended for the detection of various maturity level of malaria parasites.

[8]

III. CONCLUSION

From the above we conclude that the detection of Malaria parasites is done by pathologists manually using Microscopes. So, the chances of false detection due to human error are high, which in turn can result into fatal condition. Hence the images can be selected from the image acquisition step and then the image is pre-processed into the desired format which is required for processing the image. The morphological operations are applied on pre-processed image for a structured comparison which is later segmented using HSV techniques. Image Segmentation smoothing processing techniques, gradient edge detection technique to detect malaria parasites in images acquired from Giemsa stained peripheral blood samples, and the extraction of red blood cells achieves a reliable performance and the actual classification of infected cells.

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