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EMPIRICAL STUDY ON MALARIA DETECTION USING MACHINE LEARNING

A. M. Chougule
Miraj Mahavidyalaya, Miraj, Dist- Sangli, Maharashtra, India

annasahebchougule999@gmail.com
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ABSTRACT

Malaria is the third-deadliest infection on the world. Malaria is cause 14 million more cases and 69,000 more deaths in 2020 than it did in 2019. Between 2019 and 2020, India was the only high-burden country to show progress by sustaining a reduction in malaria burden. In 2020, 29 of the 85 malaria-endemic countries accounted for 96 percent of malaria cases. India was responsible for 1.7 percent of malaria cases and 1.2 percent of deaths worldwide. The gold standard for malaria diagnosis is currently microscopic examination of blood films. It is, however, subjective, error-prone, and time-consuming. To address such issues, computational microscopic imaging methods have recently received a lot of attention in the field of digital pathology. As a result, over the last decade, researchers have focused on digital image analysis and computer vision methods for malaria diagnosis. Various contrast enhancement and segmentation methods for microscopic imaging have been discussed in this study for accurate malaria diagnosis.
Keywords — malaria detection, malaria finding using machine learning, malaria analysis using python

I. INTRODUCTION

The primary goal of this research is to develop contrast enhancement and segmentation methods for accurate malaria diagnosis using microscopic blood imaging, which will relieve technicians of the tedious and time-consuming work required in the manual for malaria diagnosis.

To develop a novel method for automatic contrast enhancement of poor contrast malaria microscopic blood images, which could improve the contrast of poor contrast malaria microscopic images so that the obscured details could be discovered and an image looking subjectively better than the original image could be obtained for diagnosis. In Python programming, we can create applications for detecting malaria viruses and generate results from them. Using this method, we can increase the productivity of malaria detection. [1]

Malaria is a dangerous disease that kills millions of people each year, with India bearing the heaviest burden. [1] This study will demonstrate that a large number of deaths occur each year as a result of a variety of factors such as a lack of medical personnel, laboratory equipment, hospitals, and incorrect interpretation of laboratory results. It also established that remote areas are severely impacted. As a result of the aforementioned challenges, the fusion of Medical Science and Computer Science (Information Technology) in the management of deadly diseases was also established. As a result of this collaboration, computer-based predictive models for medical diagnosis and treatment have been developed. These models are based on existing symptoms or images of malaria parasites. The models are expected to be extremely useful in both urban and rural areas of the affected regions. However, caution must be exercised when developing these computer-based systems. Such systems' accuracy and dependability must be thoroughly evaluated. According to the reviewed works, the majority of these Computer Based Systems for Malaria Diagnosis are based on a single predictive model, the majority provide diagnosis without therapy, and the majority provide diagnosis with therapy. Furthermore, most researchers did not assess the detection rate (accuracy) of the systems. Future researchers must consider the accessibility and simplicity of these systems.

Researchers can work to make these systems mobile application-based, particularly those working in symptomatic environments, so that a large number of people can access them.

II.BACKGROUND

Malaria is a deadly blood disease caused by parasites that are transmitted to humans via the bite of the Anopheles mosquito. It has been infecting humans for over 50,000 years. According to the World Malaria Report 2016, published by WHO, malaria affected approximately 212 million people in 91 countries in 2015, resulting in 4, 29,000 deaths. In 2017, approximately 435 000 people died as a result of malaria.

Plasmodium falciparum, P.knowlesi, P.vivax, P.ovale, and P.malariae are the parasites that cause malaria. The majority of deaths (99 percent) are caused by P.falciparum, and approximately 46 percent of estimated cases worldwide are caused by P.vivax. According to estimates, approximately 3.3 billion people are at risk of malaria, with 1.2 billion at high risk. The WHO, the Center for Disease Control and Prevention (CDC), and the malaria journal are among the major sources of malaria information on the Internet.

Because of the negative impact of malaria on people and the economy, researchers conducted a series of studies to develop computer-based systems that could diagnose and treat malaria cases.

III. LITERATURE REVIEW

This one was created a Web-Based Medical Assistant System for Malaria Diagnosis and Therapy. The motivations for this work are as follows: most existing malaria diagnosis systems fail to provide therapy while some provide therapy without diagnosis, half of the world's population is at risk of malaria, malaria deaths are increasing, and there is a need for a web-based system that can diagnose malaria and provide therapy.[2]

Research Methods: A machine learning method Rough Set was used on the training set to generate a classification model for malaria diagnosis for various malaria cases, and treatment was given accordingly. [3]

The Application of Machine Learning Techniques for Malaria Diagnosis, the motivations for this study are: a lack of medical specialists, which has increased the mortality of malaria patients, and the need to use computer technology to reduce the number of deaths and the waiting time to see a malaria specialist.

Prabhu et al developed Decision Support Systems to identify different species of malaria parasites. [4]

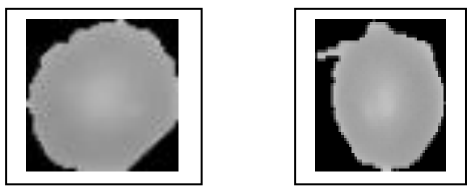
Motivations for the work: A child is estimated to be killed every 30 seconds, and 500 million cases of malaria are reported in Africa each year. Malaria rapid diagnosis is hampered by the fact that current diagnostic tools are harmed by harsh tropical weather, a lack of qualified medical laboratory technicians to read test results, and a lack of regular or no electricity supply to preserve available diagnostic tools. A total of four million additional health workers are required around the world. Medical experts from Nigeria's Ahmadu Bello University Teaching Hospital were interviewed, and data describing the evolution cycle of malaria and treatment methods were collected. The collected data were used to construct the knowledge-based rule-based system. PHP was used as the scripting language, MySQL as the database, and Apache as the server hosting the inference engine. [2]

IV. DIAGNOSTIC TECHNIQUES

Malaria is clinically diagnosed based on the symptoms and signs of the disease. Clinicians usually make the preliminary diagnosis based on fever, chills, body pain, and headache without performing any medical testing. Because these symptoms are not unique to malaria, the clinical diagnosis has a low level of accuracy. Malaria Rapid Diagnosis Tests (RDTs) are blood tests that take approximately 15-20 minutes to diagnose. RDTs have a number of disadvantages. Currently, the cost of an examination is significantly higher than the cost of a microscopic examination, and it does not provide quantitative results. [3]

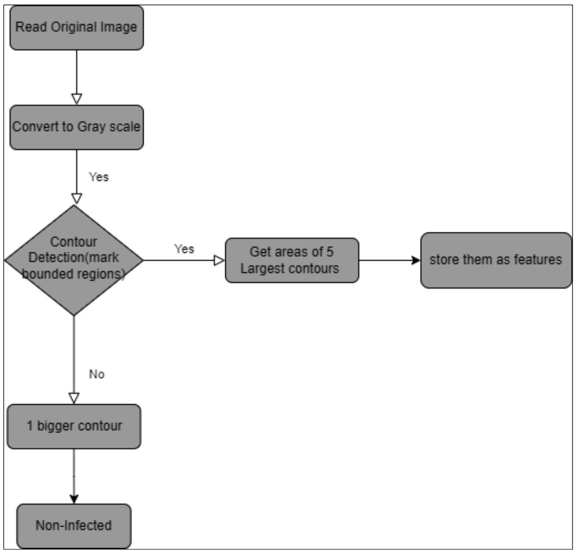
Data set as an example:

Infected



Uninfected

Procedure:



V.METHODOLOGY

At the present time, identifying Malaria parasites in single cell slides is entirely manual. This procedure could be improved by taking an image of the blood smear and then using the proposed model to determine whether or not the cells are contaminated. The proposed model makes use of image processing systems to improve existing techniques and shorten the time required to detect malaria parasites in blood tests. The data was gathered by hand from the CDC's Division of Parasitic Infection and Malaria. Our primary goal here is to create a mechanised capacity to distinguish the proximity of Malaria parasite in minor blood spread and measure the segment of RBC in the example that are contaminated. The primary task is to fragment the contaminations, for which segmentation of the cells is the previous undertaking. [5] Techniques for segmentation include edge detection, watershed segmentation, and morphological segmentation. [6] Once the cells have been segmented, the infections can be segmented as well. This is achieved by utilising a threshold intensity pixel value for the infection, i.e. if the pixel value is within the range of the threshold, the infection is identified. A. Cell segmentation When we "segment" an image, we separate the regions of interest (ROIs) from the non-ROI portion, resulting in a binary mask of what we want to qualify, quantify, track, and so on. Segmentation is an important part of many image processing problems and should be studied thoroughly. We will also segment our cell images here. [7,8] One of the most difficult issues in segmenting human blood cells is cell contiguity; there may be a lot of cell overlapping. One of the most difficult tasks in image processing is segmenting touching objects. We employ various approaches such as Edge Detection, Watershed Segmentation, and Morphological Segmentation [2,9].

1) Edge Detection (Gradient Based Techniques): Edge detection algorithms based on gradients look for the first derivative of an image where maxima and minima occur. For finding the edges, these techniques used the sobel, prewitt, and robert's cross operators. [10]

2) Edge Detection(Gaussian Based Techniques): The main goal of this technique is to detect zero crossings in an image's second order derivative in order to find edges. Laplacian of Gaussian (LOG) and Canny edge detection are Gaussian-based techniques. The LOG operator outperforms all other edge detection techniques.

3) Watershed Segmentation: The Watershed segmentation algorithm is applied to the dataset's images, and it segments or divides the various cells present in the image. These divisions aid in the detection and classification of the malaria parasite in blood samples. [9,10]

4) Morphological Segmentation: The shape and size of the objects within the image are referred to as morphology. We used cell shapes in our study because the majority of the cells were circular and had a specific radius r range. As a result, a circle detection algorithm was created that could detect cells based on their shape. Highlight all lines containing the author's and affiliations. [10,11]

Image processing Steps:

The paper employs an auto-generated segmented that goes through the following five steps:
(1) Make the conversion to grayscale.
(2) Start segmentation using Otsu's threshold.
(3) Select components based on their size.
(4) Form created by masking the input and segmented images.

2. Detecting Edges-We used a variety of edge detection techniques such as Canny, Laplacian of Gaussian, Prewitt, Roberts, Sobel, and the Zerocross operator. LOG produces the best results.
3. Logically combining the edges with the segmented regions.
4. Improve the edge mask by using morphological operations such as imclose, skeleton, and so on.
5. Cleaning and refining of the mask
6. Apply various segmentation techniques such as watershed, thresholding, and k-means clustering-based segmentation. Watershed segmentation was

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chosen because the other techniques have tiny pores and do not produce good results for further segmentation.
7. We use the imhmin function to improve the result and flatten the pools from the watershed results.
8. To compensate for the shortcomings in watershed segmentation, we employ another segmentation technique, morphological segmentation. This technique detects circles by specifying a radius range.
9. Histogram matching is performed because all of the images have different intensities and we need all of the images to be standard with the same intensity for classification.
10. At last, if the intensity values are within the threshold, we show the percentage of infected cells.

VI.CONCLUSTION

Malaria is clearly a deadly disease, killing millions of people each year, with Africa bearing the heaviest burden. According to this study, a large number of deaths occur each year as a result of a variety of factors such as a lack of medical personnel, laboratory equipment, hospitals, and incorrect interpretation of laboratory results. It also established that remote areas are severely impacted. As a result of the aforementioned challenges, the fusion of Medical Science and Computer Science (Information Technology) in the management of deadly diseases was also established. As a result of this collaboration, computer-based predictive models for medical diagnosis and treatment have been developed. These models are based on existing symptoms or images of malaria parasites. The models are expected to be extremely useful in both urban and rural areas of the affected regions. However, caution must be exercised when developing these computer-based systems. Such systems' accuracy and dependability must be thoroughly evaluated. According to the reviewed works, the majority of these Computer Based Systems for Malaria Diagnosis are based on a single predictive model, the majority provide diagnosis without therapy, and the majority provide diagnosis with therapy. Furthermore, most researchers did not assess the detection rate (accuracy) of the systems. Future researchers must consider the accessibility and simplicity of these systems. Researchers can work to make these systems mobile application-based, particularly those working in symptomatic environments, so that a large number of people can access them.

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