MALARIAL PARASITE CLASSIFICATION USING CNN TECHNIQUES

Hassan S[1*], Indiran P[2], Kaandhakumar M[3], Kamalesh U[4]

[1,2,3,4]*UG Students, Department of Information Technology, SRM Valliammai Engineering College Tamilnadu, India*

Abstract -Anopheles mosquito vector is the most deadliest and common human infected parasites which is known as Plasmodium Falciparum. To cure a malaria infected patient and stop further spreading, malaria diagnosis using microscopy to ascertain Giemsa-stained parasites is typically done. The microscopy diagnosis are somewhat not time friendly and requires well-trained malaria experts to interpret what they seen under the microscope. To deal with this limitation, an automatic malaria infected diagnosis is required. This work introduced a computer-aided automated diagnosis system which may perform remote field diagnosis with high accuracy while requiring low computational demands. The introduced framework consists of two main parts which are red blood corpuscle counting and parasite life-cycle stage division. The counting process were performed by computer vision techniques, called Hough transform. Various machine learning techniques, i.e., Multilayer Perceptron, Linear Discriminant Analysis, Support Vector Machine, and Weighted Similarity Extreme Learning Machine, are implemented in classification of task. The experimental results shows that the proposed methods could correctly count and divide at 97.94% and 98.12% accuracy, accordingly. The general proposal system are ready to do at 96.18% accuracy.

Key Words: **S Combining features, Giemsa-stained thinfilm, malaria**

1.INTRODUCTION

Global management of malaria is extremely difficult since early detection of malaria infection relies totally on diagnosis using manual microscopy of Giemsa-stained infected cells. The disease is tough to detect, even developed are lacking in technology. It's a explanation for several deaths once a year [1]. genus Plasmodium is that the explanation for disease [2]. There are four species of Plasmodium P. vivax, P. oval, and P. malaria. The disease are often transmitted by female Anopheles mosquito

1.1 OBJECTIVE

The proposed solution to the given problem is to develop a CNN based deep learning model and train it using the provided dataset so on achieve the very best accuracy possible. The input to the model are going to be a picture of the blood .The model will then use various different image processing techniques for basic filtering and segmentation and suite of pattern are recognized using machine learning (ML) algorithms and directed toward robustly recognizing infected cells during a light or whole slide microscopic image. The output in the final layer would be a number indicating the probability percentage of malaria parasite in the image.

1.2 BENEFITS

Early detection of malaria helps in reducing the death rates across the globe. Deep Learning can emerge as a highly beneficial solution in diagnosing the disease. This model gives very much faster and cheaper rate of method for detecting Plasmodium parasites

1.3 CHALLENGES

Main challenge of the IQ test is repetition of questions which affects the exact values of the result. In most of the IQ tests, the user cannot view their previous IQ test result and the other details. Other IQ scales also will not provide any variation in age groups.

2. LITERATURE SURVEY

Deepali A. Ghate, Prof. Chaya Jadhav, Automatic Detection of Malaria Parasite Fromm blood images International Journal of Computer Science and security, vol.5, issue.3, pp.310-315, May-2017

The primary concept here is, initially conversion of the input color blood image to greyscale, and then calculating the range of yth order of a greyscale. Here in this paper an Effective Algorithm, with the gamma equilization(GE) method is implemented whose main motive is to protect the fundamental structures of the acquired blood images which is infected by malaria

Mahdieh Poostchi, Kamolrat Silamut, Richard Maude, Stefan Jaegar George Thoma, Image analysis and machine learnin for detecting malaria, Translational Research(2018), TRSL 1210 S1931-5244(17)30333-X.

Poostchi wrote a survey paper on image analysis and machine learning methods used for detection and covered the basics, they mention that there is a high prospect for further development, especially using deep learning

Malaria parasite Detection using Different Machine Learning Classifier -Adedeji Oluboja, Zenghui Wang – Machine College of Science, Engineering and Technology, University of South Africa

Adedeji Oluboja, Zenghui Wang concluded that Machine Learning algorithms are a very powerful tool used in detection and classification of malaria parasites. Among the 6 algorithms used, they found out the Fine Gaussian SVM performed better in the classification tasks and the Subspace KNN had the best overall performance.

Bias, S.D., Reni S.K., Kale, I.: A Novel fuzzy logic inspired edge detection technique for analysis of malaria infected microscopic thin blood images. In: 2017 IEEE Life SciencesConference (LSC), Sydney, NSW, 2017, pp.262-265.

This paper proposes a novel, efficient, low complexity algorithm for edge detection, specifically focusing on the analysis of malaria infected microscopic thin blood smears. The algorithm proposes a simple, dynamic thresholding technique that is computed via histogram analysis, designed to capture as much information about the blood cells with minimal computational effort, which is followed by a morphological filtering process to remove noise and artifacts. A binary edge tracking system inspired by the works in fuzzy logic is introduced, defined by a semi ambiguous rule system that can be efficiently implemented in hardware

Mehanian, C., et al.: Computer-automated malaria diagnosis and quantitation using convolutional neural networks. In: 2017 IEEE International Conference on Computer Vision Workshops (ICCVW), Venice, 2017, pp. 116–125.

The optical microscope remains a widely-used tool for diagnosis and quantitation of malaria. An automated system that can match the performance of well-trained technicians is motivated by a shortage of trained microscopists. We have developed a computer vision system that leverages deep learning to identify malaria parasites in micrographs of standard, field-prepared thick blood films. The prototype application diagnoses P. falciparum with sufficient accuracy to achieve competency level 1 in the World Health Organization external competency assessment, and quantitates with sufficient accuracy for use in drug resistance studies. A suite of new computer vision techniques-global white balance, adaptive nonlinear grayscale, and a novel augmentation scheme-underpin the system's state-of-the-art performance. We outline a rich, global training set; describe the algorithm in detail; argue for patient-level performance metrics for the evaluation of automated diagnosis methods; and provide results for P. falciparum.

Malarial Parasite Detection and Recognition using Microscopic Images, Arslan Khalid;Zulqarnain Haider;Ikramullah Khosa, 2019 16th International Bhurban Conference on Applied Sciences and Technology (IBCAST)

Malaria has been a serious infectious disease since 18th century. Manual diagnosis of malaria is most widely used method but it is a time consuming process, and it involves the risk of error due to the subjective assessment of the sample. In this paper, an automatic method involving image processing techniques is presented which is capable of detecting and recognizing the infection in the microscopic images. The images are generated by using a microscope with 800× zooming capacity. Giemsa staining is used before acquiring the images. Five different categories of malarial parasites are defined and used for classification. Image processing techniques are employed to initially detect a parasite and later to classify it as one of the target categories. Images belonging to three categories were classified perfectly, while one of the category received lower recognition rate. As a result, the proposed method produced 100% classification accuracy for four classes, and 60% for the remaining class. The algorithm developed for classification in hierarchical manner showed good results overall, considering the fact that no such research is available for local data.

Malarial parasites detection in RBC using image processing, Shipra Saraswat;Utkarsh Awasthi;Neetu Faujdar, 2017 6th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO)

The gold standard for 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. The System is tested for a dataset of 80 images of a thin blood smear. The infected cells are extracted using HSV segmentation. This approach will be beneficial for the rural areas, with a

scarcity of experts.

A Novel Stacked CNN for Malarial Parasite Detection in Thin Blood Smear Images, Muhammad Umer;Saima Sadiq;Muhammad Ahmad;Saleem Ullah;Gyu Sang Choi;Arif Mehmood, IEEE Access

Malaria refers to a contagious mosquito-borne disease caused by parasite genus plasmodium transmitted by mosquito female Anopheles. As infected mosquito bites a person, the parasite multiplies in the host's liver and start destroying the red-cells. The disease is examined visually under the microscope for infected red-cells. This diagnosis depends upon the expertise and experience of pathologists and reports may vary in different laboratories doing a manual examination. Another way around, many machine learning techniques have been applied for spontaneous detection of blood smears. However, feature engineering is a challenging task that requires expertise to adjust positional and morphological features. Therefore, this study proposes a novel Stacked Convolutional Neural Network architecture that improves the automatic detection of malaria without considering the hand-crafted features. The 5-fold cross- validation process on 27, 558 cell images with equal instances of parasitized and uninfected cells on a publicly available dataset from the National Institute of health, the accuracy of our proposed model is 99.98%. Furthermore, the statistical results revealed that the proposed model is superior to the state-of-the-art models with 100% precision, 99.9% recall,and 99% f1-measure.

Review of Surface Enhanced Raman Spectroscopy for Malaria Diagnosis and a New Approach for the Detection of Single Parasites in the Ring Stage, Keren Chen;Clint Perlaki;Aoli Xiong;Peter Preiser;Quan Liu, IEEE Journal of Selected Topics in Quantum Electronics

Malaria is a global disease that desires early diagnosis in the field, for which one way is to detect hemozoin (a unique biomarker of malaria infection) at low concentrations. Moreover, many anti-malarial drugs inhibit the formation of hemozoin and facilitate toxic free heme stacking to kill malaria parasites. Therefore, monitoring hemozoin within malaria parasites is important to malaria diagnosis and drug development. Here, we first review various surface enhanced Raman spectroscopy-based techniques for malaria diagnosis. Then, to enable hemozoin detection in single parasites in the ring stage for the first time, we report a method based on surface enhanced Raman spectroscopy for hemozoin detection in Plasmodium falciparum in the ring stage. In this method, silver nanoparticles are directly synthesized within parasites after the lysis of red blood cells and parasites are confirmed to be in the ring stage by Giemsa staining after a special procedure of sample postprocessing. The Raman spectra of hemozoin acquired from parasites with silver nanoparticles synthesized inside are compared with those from parasites mixed with nanoparticles synthesized separately. The results confirm the feasibility of detecting hemozoin crystals within single parasites in the ring stage. This method offers a promising strategy to investigate the mechanism of heme metabolism in malaria infection and a tool to evaluate theeffectiveness of anti-malaria drugs

3. EXISTING SYSTEM

The two main phases of the system architecture that's the training and therefore the testing phases is shown Training phase starts with taking the pictures from the dataset. Multiple images are given to the training phase in order that the pictures are well processed and enhanced in order that the quantity of knowledge to be handled gets reduced. Because the number of trained images increases the performance of the system also increases. The segmentation technique removes the noise and other disturbances present within the pictures. The segmented image is enhanced by extracting only the required features and are classified by employing a classifier. In the testing phase, a test image is subjected to all or any the above mentioned stages then identifies the test image as an infected or a healthy sample.

3.1 PRPOSED SYTSTEMMODULES :

3.2 PRE-PROCESSING

There are variety of re-processing techniques utilized in image processing for the enhancement of the pictures. Grey scale conversion, resizing of the image, increase the brightness of the pictures and other pre-processing techniques are applied to vary the image into desired format for subsequent segment. Pre- defined and in-built filtering techniques are applied for the higher contrast on a picture and also other techniques for multiple dimension for images are applied. The main objectiveof pre-processing are Resizing the image, Reduce or eliminate noise, Enhancing.

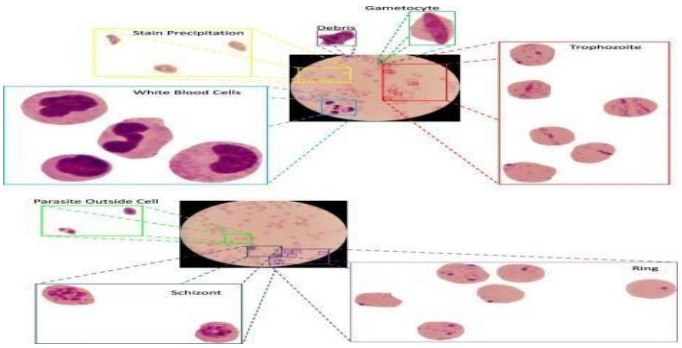


Fig 3.2.1 Separation Process of Overlapping RBCs

3.3 SEGMENTATION.

The process is employed to divide image into objects and region. Representing a picture into a way simpler and more understandable, which may be easy to analyse within the next process segmentation is employed. This helps to analyse the code simpler. It segments the image pixels supported region of homogeneity by extracting certain features which are in common. It also removes the noise present within the images. Differentiating blood cells and background is the ultimate goal. The image obtained by segmentation as shown in figure 3.3.1 are passed on to subsequent process. The cells that are identified as possibly infected are then extracted from the image and passed to subsequent stage of the algorithm for feature extraction

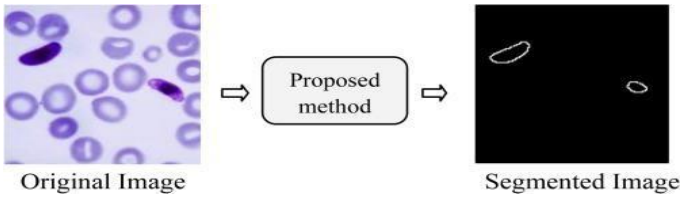


Fig 3.3.1 Transforming Region into Segmented Image

3.4 FEATURE EXTRACTION

Feature extraction is that the next step within the process where the segmented image from the previous step is provided as an input. This technique reduces the quantity of knowledge to be loaded by extracting only the features those are required. The features include contrast, correlation, homogeneity, energy, entropy, color histogram, color moments and so on. As the number of features increase the extent of accuracy also increases

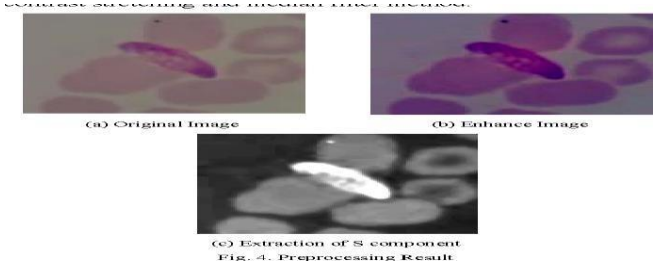


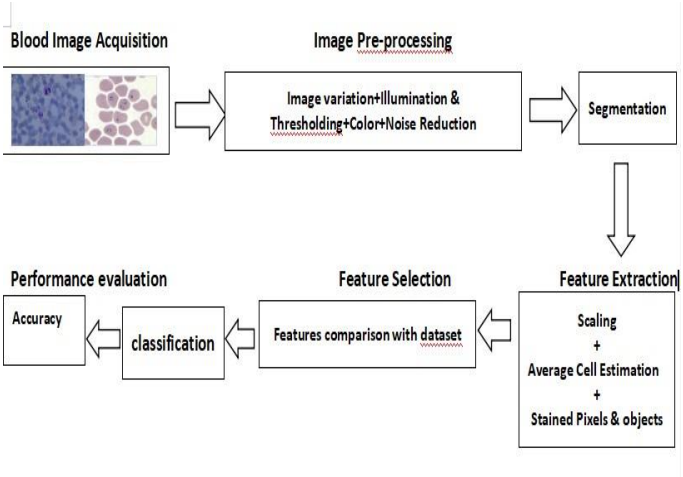
Fig 3.4.1 Processed Image of Malaria RBCs

4. SYSTEM DESIGN

The front end is designed with HTML, CSS, and Flask while the backend is built using Python (Apache server). The questions and choices of every question is stored within the database and accessed using apache server

4.1 ARCHITECTURAL DESIGN

In order to conduct a series of experiments, the available malaria dataset was used. Data collection and data preprocessing techniques are discussed in the following Diagram. In the series of experiments, we choose our best model in terms of performances and effectiveness, which is discussed in proposed model architecture. Experimental details and settings are discussed in training details ,where training of the models is discussed under three training procedure which are general Image Pre-processing, Feature Extraction, Feature Selection and Performance Evaluation, details are provided in the designated subsections.



4.2 SAMPLE OUTPUT:

UN INFECTED :

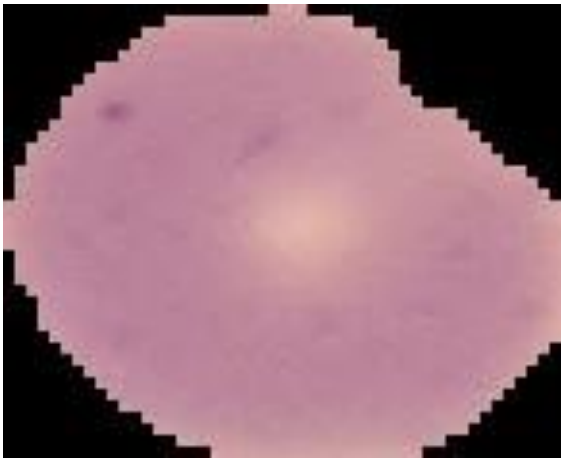


Fig 4.2.1 Images of healthy RBCs

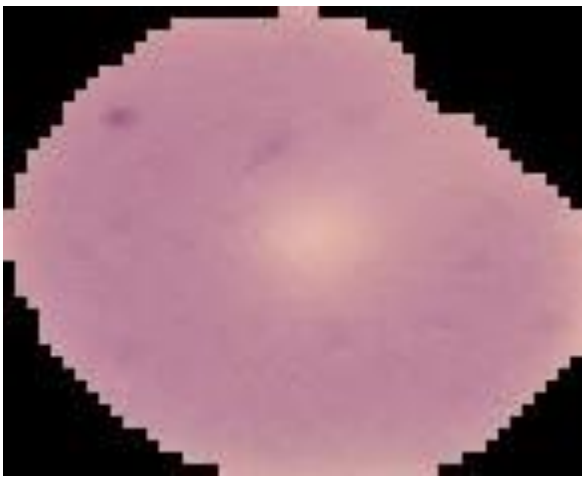


Fig 4.2.2 Images of Healthy RBCs

INFECTED :

Fig 4.2.3 Images of Unhealthy RBCs which wepredicted as parasite of the ring form stage

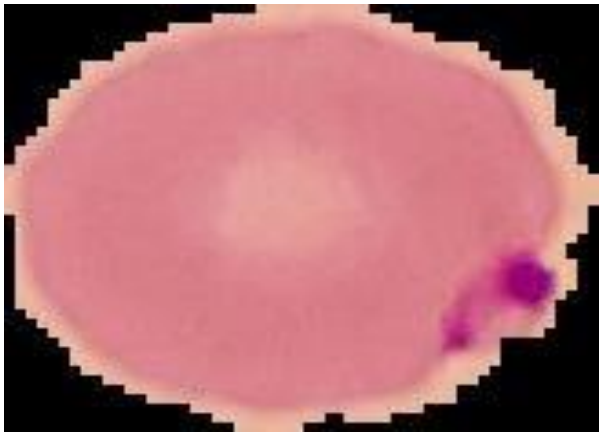


Fig 4.2.4 Images of Unhealthy RBCs which wepredicted as parasite of the ring form stage

FUTURE WORK

In future, the appliance are often widened by using the adaptive method within the test. In an adaptive method if a user gives an incorrect answer then subsequent question are getting to be easier else subsequent question are getting to be harder than the previous one. This method provides more reliable results. Additionally, the generated report are often shared to the examinee's mail for more interactions. The report generated are often during a more detailed version. If the user performs well the system enhance by indicating Green, if wrong then indicates Red. IQ is one a neighborhood of testing the facility of a private. Another one is Emotional Quotient, is that the potential of individuals to acknowledge their own emotions and discern between different feelings and label them appropriately. Individuals can easily mingle with professional environment and colleagues by developing this EQ.

CONCLUSION

The introduced system has the tendency to calculate the intelligence and cognitive skills of an person. The introduced system owns the potential to improve the IQ of the person by taking the tests. It has three various age group divisions so it is feasible to analyze the specific child's IQ. The result are going to be generated immediately after the completion of the test; this reduces the time taken for evaluation. Once the IQ is improved the system will assign the report. By implementing randomization method, the level of test is increased. Because of its simple implementation it lessens the manual work of calculating the IQ position and respective IQ level. The user can view their previous history and that they can compare their growth easily through this technique.

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