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IDENTIFICATION OF MALARIAL PARASITES USING DEEP LEARNING

Dr.S. Saravanan[1], N Abinesh Kumar[2], V A Ajith Kumar[3] , R Joseph Patrick Soloman[4]

Department of Computer Science and Engineering, Agni College of Technology, Chennai-130

Abstract - *The traditional system for detecting the infection of Malaria has been the manual process of diagnosing the stained slides under a microscope. This manual process might consume more time for producing the results and the availability of medical experts is not always assured. Considering this fact in mind we proposed a method which curbs the human error while detecting the presence of malarial parasite in the blood sample by using Image Processing. Hence by automating the diagnosis process, results can be acquired relatively quicker and more accuracy can be expected. The technologies and techniques to patently extract the required features and efficiently classify the infected samples are surveyed.*

Key Words: **Malarial Parasite, Image Processing, Segmentation, Machine Learning, Detection.**

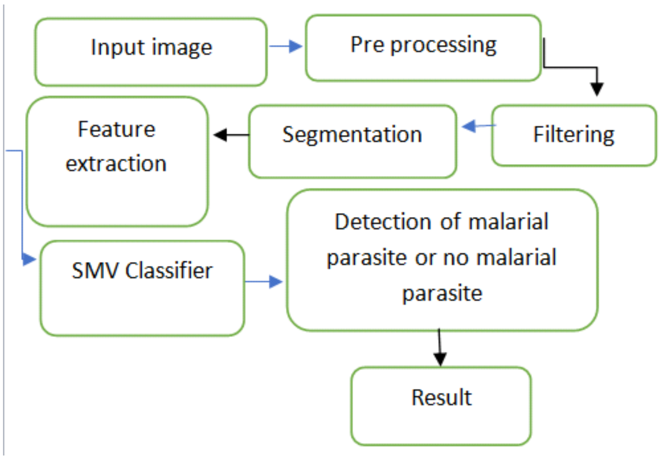
1. INTRODUCTION

The mosquito-borne parasitic infection is spread by a female Anopheles mosquito by the Plasmodium parasite. It is a single-celled parasite that multiplies amongst the red blood cells of humans as well as the mosquito's intestine. When the female feeds on an infected person, the parasites are ingested along with the human blood. The parasites multiply in the mosquito's gut and these infectious worms are passed onto another human when the mosquito feeds on them. Humans can also get Malaria by blood transfusion and an offspring from it's mother during childbirth from the placenta. To detect Malaria, the affected red blood cells are diagnosed first. Blood smear in analyzed under a microscope, which is the traditional process done by a medical expert. To automate the process, various Image Processing and Machine Learning methods were used. Various segmentation methods have been used to detect the presence of the parasite. The typical ring structure of the parasite that has held host in the red blood cells can be identified from the microscopic image. So, this image is segmented and classified to detect both infected and non-infected cells. The objective of this new system is to possibly increase the sensitivity, accuracy and the F-score of the previously existing systems to provide a more right diagnosis of the infectious disease.

1.1 Malaria Parasite Detection From Peripheral Blood Smear Images Using Deep Belief Networks

This paper has introduced a trained model based on a DBN to classify 4100 peripheral blood smear images into the parasite or non-parasite class. The proposed DBN is pre-trained by stacking restricted Boltzmann machines using the contrastive divergence method for pre-training. To train the DBN, they have extracted features from the images and initialized the visible variables of the DBN. A concatenated feature of color better than the other state-of-the-art methods with an F-score of 89.66%,a sensitivity of 97.60%, and specificity of 95.92%.]. In this study, a concatenated feature of color (histogram-based features and color coherence vector) and texture (Haralick features, LBP features and gray level run length matrix feature) has been used to train the DBN. In this method, there are 4 hidden layers, and every hidden layer is independently trained as an RBM. To initialize the weights, the RBM uses contrastive divergence (CD) pre-training. The states of the hidden nodes derived from the trained RBM are used as inputs to the next layer of the RBM. A series of RBMs are trained in a similar way. Finally, a DBN is constructed by stacking the prepared RBMs. The newly formed DBN adds a final layer of variables that represent the desired output values and performs the discriminative tune up using back propagation. Finally, the DBN with 484 visible layers and the output layer with two nodes with four hidden layers containing 600 hidden nodes in every layer.

1.2 BLOCK DIAGRAM



PROPOSED SYSTEM

A system does not require a large dataset. It accurately identifies the parasite. Detect and classify the parasitemia under supervised learning. To design a system advantageous of the precise requirement of the problem statement. Our proposed system utilizes microscopic images of blood smears to detect the occurrence of malarial parasites. A median filter will be applied to remove the noises. After preprocessing stage image will be segmented to identify malaria. Then by extracting the features of segmented image using morphology presence or absence of malaria will be classified using SVM.

2. PREPROCESSING

Digital image processing is the use of computer algorithms to create, process, communicate, and display digital images. Digital image processing algorithms can be used to:

Convert signals from an image sensor into digital images. Improve and other artifacts.Extract the size, scale, or number of objects in a scene. Prepare images for display or printing. Compress images for communication across a network.

2.1 INPUT IMAGE TO SYSTEM:

The digital image is converted to matrix format or RGB format.

2.2 PLANE SEPERATION:

Creates a simple TrueColor image and then separates the color. Channels (planes). The example displays each color channel and the original image. Create an RGB image with uninterrupted areas of red, green, and blue. The dimensions of this image are 200-by-200 pixels. Display the image. Display each color channel separately, along with the original RGB image.

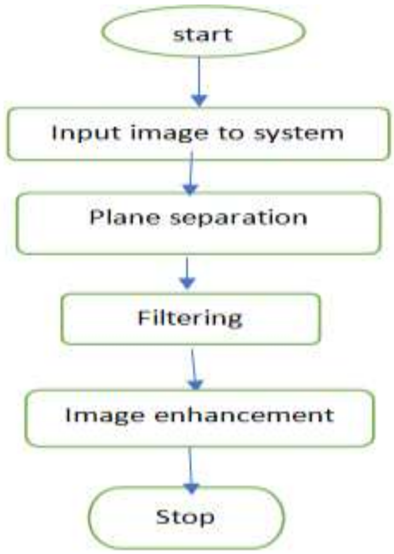
2.3 FILTERING:

Digital filters are used to blur and sharpen digital images. Filtering can be performed by:

- convolution with specifically designed kernels (filter array) in the spatial domain
- masking specific frequency regions in the frequency (Fourier) domain

2.4 IMAGE ENHANCEMENT

Image enhancement features that correct color hue and brightness imbalances as well as other image editing features, such as red eye removal, sharpness adjustments, zoom features and automatic cropping.



3. PDI calculation and classification:

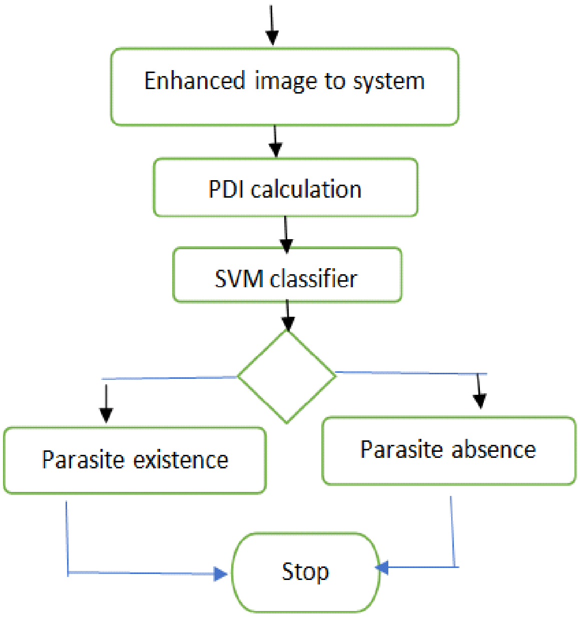
3.1 POLYDISPERSITY INDEX:

Dispersity is the measure of the heterogeneity of sizes of molecules or particles in mixture. Monodisperse is composed of molecules of same mass. Polydisperse is composed of non-uniform molecular mass if its chain length vary over a wide range of molecular mass.

PDI = Mw/M_n

3.2 SVM CLASSIFIER

Support-vector machine constructs a hyperplane or set of hyperplanes in a high- or infinite-dimensional space, which can be used for classification, regression, or other tasks like outliers detection.[3] Intuitively, a good separation is achieved by the hyperplane that has the largest distance to the nearest training-data point of any class (so-called functional margin), since in general the larger the margin, the lower the generalization error of the classifier.



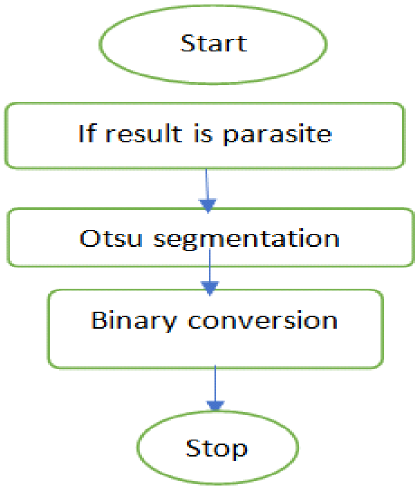
4. SEGMENTATION:

4.1 OTSU SEGMENTATION

In computer vision and image processing, **Otsu's method**, is used to perform automatic image thresholding. In the simplest form, the algorithm returns a single intensity threshold that separate pixels into two classes, foreground and background. This threshold is determined by minimizing intra-class intensity variance, or equivalently, by maximizing inter-class variance. Otsu's method is a one-dimensional discrete analog of Fisher's Discriminant Analysis, is related to Jenks optimization method, and is equivalent to a globally optimal k-means performed on the intensity histogram.

4.2 BINARY CONVERSION:

Converts the grayscale image to binary image BW, by replacing all pixels in the input image with luminance greater than level with the value 1 (white) and replacing all other pixels with the value 0 (black).This range is relative to the signal levels possible for the image's class. Therefore, a level value of 0.5 corresponds to an intensity value. Halfway between the min and max values.



RESULT:

Presence or Absence of the Malarial infection. Therefore, this analysis directly depends on the experience of the pathologists. At the same time, this is a time-consuming process and results are difficult to reproduce. hence we have proposed our system to detect it early

CONCLUSION:

An overview of the various technologies and techniques used for detecting and classifying the infected specimens are presented in this paper. The predominantly used methods for feature extraction are Convolutional Neural Networks, Deep Belief Networks and k-means clustering. Classification is mostly done using Support Vector Machines. We can apply image processing in any other detection of a blood sample as this study will help a lot as a pioneer.

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