

Habitual Untimely Exposure of Malarial Parasites Using Intellectual Algorithm

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ABSTRACT: This project “Habitual untimely exposure of Malarial Parasites using Intellectual Algorithm ” is a system which could be used to detect the presence of parasites at any stage. The system will be develop a fully automated image classification system to positively identify ,malaria parasites present in thin blood smears, and differentiate the species. The algorithm generated will be helpful in the area where the expert in microscopic analysis may not be available. The effort of the algorithm is to detect presence of parasite at any stage. One of the parasites grows in body for 7 to 8 days without any symptoms. So if this algorithm is incorporated in routine tests, the presence of malarial parasite can be detected.

I.INTRODUCTION

Malaria is a serious global health problem, and rapid, accurate diagnosis is required to control the disease. An image processing algorithm to automate the diagnosis of malaria in blood images is developed in this project. The image classification system is designed to positively identify malaria parasites present in thin blood smears, and differentiate the species of malaria Images are acquired using a charge-coupled device camera connected to a light microscope. Morphological and novel threshold selection techniques are used to identify erythrocytes (red blood cells) and possible parasites present on microscopic slides.

Image features based on colour, texture and the geometry of the cells and parasites are generated, as well as features that make use of a priori knowledge of the classification problem and mimic features used by human technicians. The first order features provides the basic mathematical ranges for different types of parasites.

A two-stage tree classifier distinguishes between true and false positives, and then diagnoses the species (*Plasmodium falciparum*, *P. vivax*, *P. ovale* or *P. malariae* or *P.knowlesi*) of the infection. Malaria samples obtained from the various biomedical research facilities are used for training and testing of the system.

II.PROPOSED SYSTEM

The proposed system is developed by using five modules:

1. Channel Identification
2. Histogram Generalization
3. Image Segmentation
4. Feature Extraction
5. Classification of Parasite and result verification.

1. CHANNEL IDENTIFICATION:

One normal color image has a combination of red, green, blue values. We can extract the individual values of an normal image. In this paper we could extract the green values. Because when capturing image from the camera some illuminating bias will occur. To avoid this only we can compute green channel for the original image.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 3, March 2015

Another reason is that the affected cells are very clear in only green values so for this purpose also we can compute the green channel. For example identifying some problems in eye they taken only the red channel value because affected areas in eye are very clear in red color. This process is to be done in the channel identification.

2. HISTOGRAM GENERALIZATION:

Histogram equalization is a method in image processing of contrast adjustment using the image's histogram. This method usually increases the global contrast of many images, especially when the usable data of the image is represented by close contrast values. Through this adjustment, the intensities can be better distributed on the histogram. This allows for areas of lower local contrast to gain a higher contrast. Histogram equalization accomplishes this by effectively spreading out the most frequent intensity values. The method is useful in images with backgrounds and foregrounds that are both bright or both dark. In particular, the method can lead to better views of bone structure in x-ray images, and to better detail in photographs that are over or under-exposed.

A key advantage of the method is that it is a fairly straightforward technique and an invertible operator. So in theory, if the histogram equalization function is known, then the original histogram can be recovered. The calculation is not computationally intensive. In scientific imaging where spatial correlation is more important than intensity of signal (such as separating DNA fragments of quantized length), the small signal to noise ratio usually hampers visual detection.

Histogram equalization often produces unrealistic effects in photographs; however it is very useful for scientific images like thermal, satellite or x-ray images, often the same class of images that user would apply false color to. Also histogram equalization can produce undesirable effects (like visible image gradient) when applied to images with low color depth. For example, if applied to 8-bit image displayed with 8-bit gray-scale palette it will further reduce color depth (number of unique shades of gray) of the image.

Histogram equalization will work the best when applied to images with much higher color depth than palette size, like continuous data or 16-bit gray-scale images. There are two ways to think about and implement histogram equalization, either as image change or as palette change. The operation can be expressed as $P(M(I))$ where I is the original image, M is histogram equalization mapping operation and P is a palette. If we define a new palette as $P'=P(M)$ and leave image I unchanged then histogram equalization is implemented as palette change. On the other hand if palette P remains unchanged and image is modified to $I'=M(I)$ then the implementation is by image change. In most cases palette change is better as it preserves the original data. Generalizations of this method use multiple histograms to emphasize local contrast, rather than overall contrast. Examples of such methods include adaptive histogram equalization and *contrast limiting adaptive histogram equalization* or CLAHE Histogram equalization also seems to be used in biological neural networks so as to maximize the output firing rate of the neuron as a function of the input statistics. This has been proved in particular in the fly retina. Histogram equalization is a specific case of the more general class of histogram remapping methods. These methods seek to adjust the image to make it easier to analyze or improve visual quality (e.g., retinex)

3. IMAGE SEGMENTATION:

For the actual recognition stage, *segmentation* should be done before it to extract out only the part that has useful information. The goal of the segmentation process is to define areas within the image that have some properties that make them homogeneous. The definition of those properties should satisfy the general condition that the union of neighbouring regions should not be homogeneous if we consider the same set of properties. After segmentation, the discontinuities in the image correspond to boundaries between regions can be easily established. Threshold can be applied locally, i.e. within a neighbourhoods of each pixel, or globally. Due to highly varying defect sizes, it will be impossible to find one neighbourhood size that works for all. Adaptive histogram threshold Technique to be followed.

3.1 METHODS:

- Adaptive histogram threshold.
- Background and foreground separation.
- Recognition of different objects that compose the background.

In Image segmentation process use the algorithm Adaptive Threshold. First of all get the original image in array and get the green channel value for the original image. Next step is to develop the histogram for the green channel image.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 3, March 2015

Separate the foreground and the background in the original image. Select the round cells in the image. H is the threshold that will define all the heavily stained objects included in the Foreground.

4. FEATURE EXTRACTION:

Feature selection is one of the most important tasks in data mining area, with methods which allows determining the most relevant features for pattern recognition. A suitable subset of features is found when it permits synthesizing the similarity of the pattern within its class and dissimilarity amongst other different classes. The goal of feature selection is to reduce the dimensionality of vectors associated to patterns selecting a subset of attributes smaller than the original. The classifier performance is often improved eliminating redundant features. Hence the purpose of feature generation is to compute new variables from the image array that concentrate information to separate classes. The classifier has two functions: it must determine whether or not a detected cell is truly positive for malaria, and what the species of the infection is. Features are created with these functions in mind. They provided information with which the classifier distinguished between parasites and other artifacts in the blood, and allowed the classifier to differentiate between parasites of different species. The final performance of the classifier directly depended on the success of the feature generation stage. Two sets of features had been chosen for development. The first set is based on image characteristics that have been used previously in biological cell classifiers, which include geometric features (shape and size), colour attributes and grey-level textures.

4.1 TEST ALGORITHM USING FIRST ORDER FEATURES:

Texture is generated from the grayscale image matrices of the red, green and blue components, as well as the intensity component from the hue-saturation-intensity image space. First order features, based on the image histograms are used.

1. Average Gray level or mean
2. Average contrast or standard deviation
3. Third moment or skewness
4. Kurtosis
5. Energy
6. Entropy or Randomness

Mean:
$$S_M \equiv \bar{b} = \sum_{b=0}^{L-1} bP(b)$$

Standard Deviation:
$$S_D = \left[\sum_{b=0}^{L-1} (b - \bar{b})^2 P(b) \right]^{1/2}$$

Skewness:
$$S_S = \frac{1}{\sigma_b^3} \sum_{b=0}^{L-1} (b - \bar{b})^3 P(b)$$

Kurtosis:
$$S_K = \frac{1}{\sigma_b^4} \sum_{b=0}^{L-1} (b - \bar{b})^4 P(b)$$

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 3, March 2015

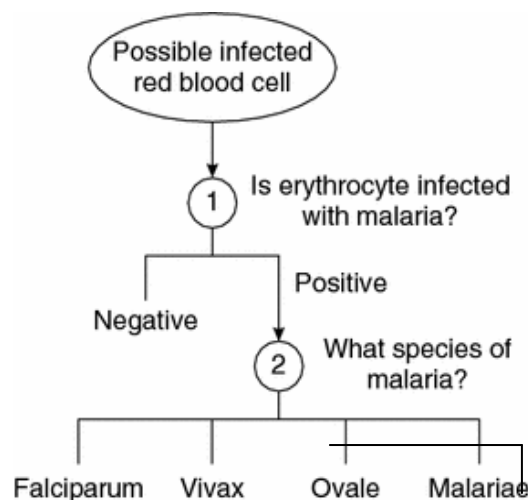
Energy:
$$S_N = \sum_{b=0}^{L-1} [P(b)]^2$$

Entropy:
$$S_E = -\sum_{b=0}^{L-1} P(b) \log_2[P(b)]$$

Where, P (b) is the first-order histogram estimate, Parameter b is the pixel amplitude value. L is the upper limit of the quantized amplitude level. Finally, σ is the standard deviation.

5. CLASSIFICATION OF PARASITE AND RESULT VERIFICATION:

The final classification of an erythrocyte as infected with malaria or not, and if so, the species of the parasite, falls to the classifier. The classifier is a two-stage tree classifier, with an infection classified as positive or negative at the first node, and the species assigned at the second node. The design of a tree classifier has the following steps: the design of a tree structure (which has already been assigned), the selection of features to be used at every node, and the choice of decision rule at each node. The same type of classifier is used at both nodes. For classification we use the artificial neural networks. In these we will use the concept as Back phase propagation network. By using this classifier we can identify what species of malaria that affect the blood sample images.



Knowlesi

The features selected for the first classifier are those that describe the colour and texture of the possible parasites. The features used by microscopes to differentiate malaria species are selected for the second classifier. The training goal is to minimize squared errors, and training is stopped when the error of a validation set increased. This is done to avoid overtraining.

5.1 CLASSIFICATION USING SVM CLASSIFIER

The SVM is a powerful solution to the classification problems. In this project, it has been used for the recognition and classification of cells. The main advantage of the SVM network used as a classifier is its very good generalization ability and extremely powerful learning procedure, leading to the global minimum of the defined error function. Linear SVM is a linear discriminant classifier working on the principle of maximum margin between two

International Journal of Innovative Research in Science, Engineering and Technology

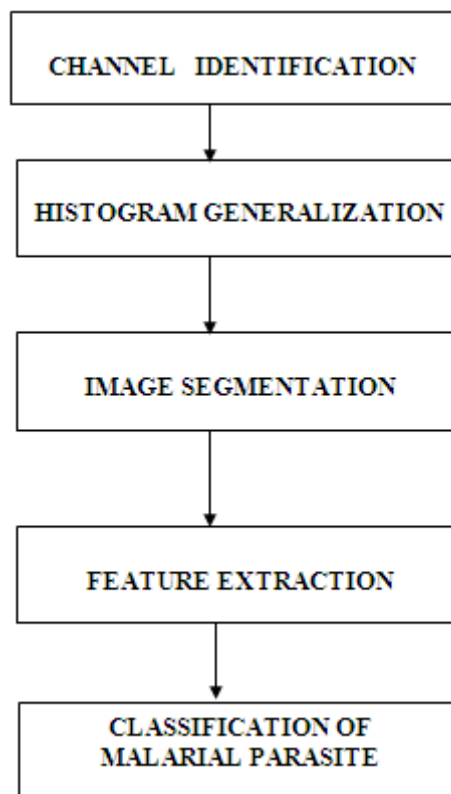
(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 3, March 2015

classes. The decision function of the n -dimensional input vector x for K -dimensional feature space ($K > N$). All values of weights have been arranged in decreasing order and only the most important have been selected for each pair of classes and then used in the final classification system.

The learning of the SVM network working in the classification mode is aimed at the maximization of the separation margin between two classes. Simple classification algorithm is proposed that classifies points by assigning them to the closer of two parallel planes (in input or feature space). Standard support vector machines (SVMs), which assign points to one of two half spaces. SVM classifier is used for classification of normal and infected cells. Results adaptive histogram threshold to get binary image of cells, feature extraction and finally detection of infected cells.

SYSTEM DESIGN:



Gradient of a continuous two-dimensional scalar function $f(x, y)$ is defined as the vector field whose components are the partial derivatives of f . Derivatives are larger at locations of the image where the image function undergoes rapid changes. The gradient vector in the particular point in the image points in the direction of the greatest rate. Since a digital image is discrete in nature, derivatives must be approximated by differences.

Gradient magnitude image is, however, not computed directly from the extinction image IE . The image IE is first filtered by a Gaussian filter to remove local variations in intensity due to noise. The filter is approximated by a 3×3 convolution mask H and the filtered image is computed. The features calculated from the gradient image can be considered as a quantification of the velocity of changes of gray values in the original extinction image. Images containing many objects with well defined edges also contain many pixels with higher values of gradient magnitude. This is valid, for example, for images of infected cell containing several ring-shaped trophozoites. In contrast, a non-infected red blood cell with relatively uniform intensity within its area will typically produce only low values in the gradient magnitude image.

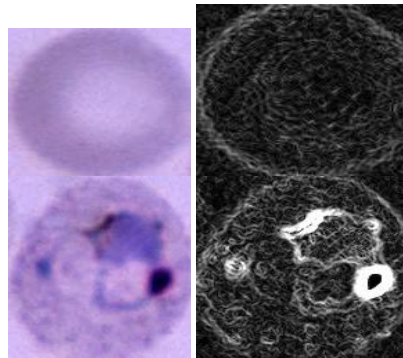
International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 3, March 2015

The algorithm for computing features from the gradient magnitude image is implemented in function fGradientTransform.m and can be summarized as follows:

1. Rescale both the input extinction image IE with the cell sample and its corresponding mask image IM with factor $60 / RA$
 2. Filter the rescaled image IE by Gaussian filter using convolution with Gaussian convolution kernel HG : $IE2 = \text{convolution}(IE, HG)$
 3. Calculate discrete gradients in the vertical and horizontal direction IG_i and IG_j using gradient magnitude image IG :
$$IG = \sqrt{IG_i^2 + IG_j^2}$$
 4. Erode binary mask image IM using disk-shaped structuring element S of size $RA / 10$: $IME = \text{erode}(IM, S)$
 5. Calculate histogram measurements from the gradient values distribution within the region specified by IME :
 $fG\text{-}\langle \text{histogram_measurement} \rangle = \langle \text{histogram_measurement} \rangle(IG(p \in IME))$
- RA is the estimated average cell radius



Gradient images for a non-infected and an infected red blood cells. Original images are shown on the left. Gradient images on the right were calculated from the green channel of the corresponding extinction image. Contrast had to be enhanced and therefore the intensity in the gradient image of the infected cell is saturated.

III.OBJECTIVE OF THE PROPOSED PROJECT

The objective of this work is to identify malaria parasites in early stage to save the mankind.

A.Objectives of the proposed project

The objective of this work is to segment the peripheral blood smears. This project is also to develop a fully automated image classification system to positively identify malaria parasites present in thin blood smears, and differentiate the species. The algorithm generated Will be helpful in the area where the expert in microscopic analysis may not be available. The effort of the algorithm is to detect presence of parasite at any stage. One of the parasites grows in body for 7 to 8 days without any symptoms. So if this algorithm is incorporated in routine tests, the presence of malarial parasite can be detected.

B.Review of R&D in the proposed area (National & International Status, Importance, patents etc.)

International:

Africa between 300-500 million people in Africa, india, southeastasia, the middle east asia,southbacific and central and south America have been decises.

National:

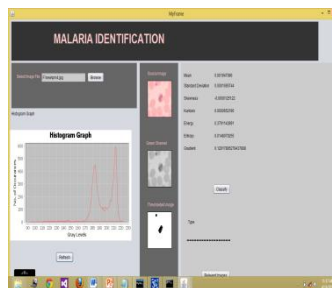
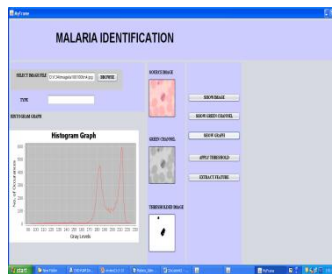
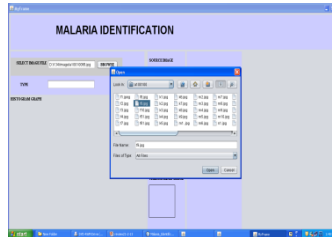
Malaria decises can be occurred most frequently in agastheesaaram, kalkulam, anjuvillage, palapallam, safthanuvai, thuthur, villayankodu in kanyakumari district, vempar in thoothukudi district.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 3, March 2015

IV.EXPECTED RESULTS



V.CONCLUSION

In this paper we propose a new technique to identify malaria present in the blood cells or not and also find what species of malaria present in the blood cells within some amount of time. The project is to develop a fully automated image classification system to positively identify malaria parasites present in thin blood smears, and differentiate the species. The algorithm generated will be helpful in the area where the expert in microscopic analysis may not be available. The effort of the algorithm is to detect presence of parasite at any stage.

International Journal of Innovative Research in Science, Engineering and Technology

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Vol. 4, Issue 3, March 2015

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