iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 4 **Issue:** V **Month of publication:** May 2016

DOI:

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

Volume 4 Issue V, May 2016
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

Proper Diagnosis and Automation System for Detection of Malaria Infected Blood Cells in a Microscopic Images of a Blood

Dayananda R
[#]*Electronics & Instrumentation Department, Bangalore Institute of Technology*

Abstract — Malaria is a mosquito-borne disease mainly caused by the plasmodium parasites carried by a mosquito of Anopheles genus. Mainly there are five kinds of Plasmodium parasites namely plasmodium falciparum, plasmodium vivax, plasmodium malariae, plasmodium ovale and plasmodium knowlesi. Malaria infection will be identified mainly by patient's symptoms and by testing the blood samples. Whereas symptoms will gives intimation about the disease but it will be confirmed only after proper testing. But the limitations is that if the malaria infected patient belongs to rural areas then for testing the blood expertized person is required to diagnose the blood and also if he is available, he may take two or three days to give the reports depending on the patients he need to handle. Since because of microscopic images contains very minute things, technician must be free from eye site. Also every processes involved will be manual and hence chances of getting error report will be more. Even the person in the urban areas will also have to face many problems such as they have to pay more money to diagnostic centres and also some amount of time required to get the report.

By considering all this conditions the problem will be solved by proper diagnosis and by implementing an automation system for processing the microscopic images of blood. All this will be set and done by employing a MATLAB software and Image processing (segmentation) to process the image and to count the number of cells infected.

To achieve this, automation process will involve the multi-thresholding of Otsu's method for proper diagnosis and for counting the total number of infected cells will be carried out using watershed algorithm and connected component extraction.

Keywords— Connected component extraction, Mosquito, multi-thresholding, Otsu's method, Plasmodium.

I. INTRODUCTION

THE disease Malaria is a highly infectious, it will transferred from person to person by the bites of infected female mosquitos. WTO (world health organisation) has taken lot of precautionary measures to control its spreading every year. In 2010 it will be flooded like a natural disaster because of lack of medical aid many people lost their life [1]. About 80% of infected cases will be reported in Asia it's self. Parasites of Plasmodium have five different stages of life which will be morphologically distinguishable among the four species. Life stages common to all Plasmodium species are ring stage, trophozoite, segmenter, schizont and gametocytes.

A. Present Diagnostic Problems

Malaria infection will be identified mainly by the patient's symptoms and by testing blood sample. Whereas symptoms will gives intimation about the disease but it will be confirmed only after proper blood testing. The limitations is that if the malaria infected patient belongs to rural areas then for testing the blood sample expertized person is required to diagnose the blood i.e. in other words the rural hospitals must hire or possess expertized persons and also if he is present, he may take two or three days to give the reports depending on the patients he need to handle. Since because of microscopic images contains very minute things, technician must be free from eye site.

Also every processes involved will be manual and hence chances of getting error report will be more [2].

Even the person in the urban areas will also have to face many problems such as they have to pay more money to diagnostic centres and also some amount of time required to get an analysis report. Even though if we compromise with these things final available report will not contain Diagnosed image to support the analysis of technician so that technicians review will be final, it will not give any chance to the physician to analyse the exact status based on his experience.

B. Literature Survey

This project is mainly depends on segmentation, but segmentation will mainly depends on the pixel values they have been assigned

Volume 4 Issue V, May 2016
ISSN: 2321-9653

while taking an image if the camera we have used will be a poor quality lenses then the chances of getting an error report will be high even a small variations of pixel values will change the results by giving a false report. Not only will a camera

Be responsible while taking an images the amount light illuminating on the blood sample and lenses will also gives a large differences.

Previously four persons have tried to segment the malaria images by different techniques and as well they have achieved it for some extent let's see all the details in below discussions.Pixel's Intensity based thresholding is employed for segmentation. Image binarization is decided on the Hue value. Maxima (localized maxima) will be responsible for identification of cells which are infected by parasites. Because of its complexity it require more time to complete the process and hence this method was not encouraged up to the extent [3].

D. Anggraini employed adaptive thresholding extracted from V-value histogram of HSV image to discriminate image Object and Background. Foreign parasites will be identified by considering the magenta and red pixels of Hue and all these will identified and bifurcated based on parasites chromatin size but the results based only on the chromatin will not that much acceptable and hence future enhancement has to be performed[4].

Ningbo Zhu has carried out the process by employing multiple thresholding where image is first is converted to grayscale image and then it was transformed to binary image that represents 0's and 1's by using intensity classes to extract the foreground and the background by using Otsu's thresholding method and it also employs hole filling and CCL. It was successful for some extent.

Finally, Kumar was also employed Otsu's thresholding but the thresholding point was found by the 2D histogram with this thresholding point background and foreground will be separated. This method was somewhat faster when compared to previous techniques.

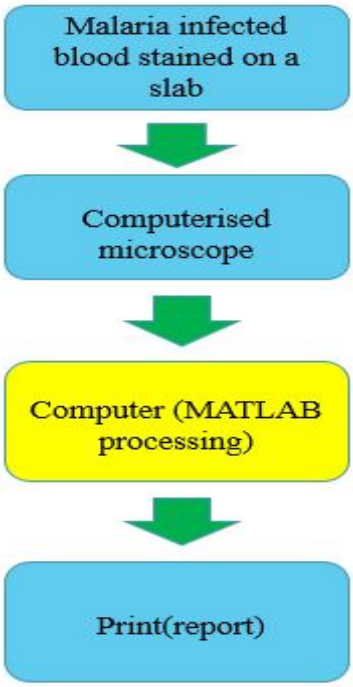


Fig. 1. Block diagram showing a complete process involved in a diagnosis and discrimination of Malaria infected RBC's from a healthy RBC's

We can observe that none of the method tried to automate the processing and also all the methods needs an accurate image to process, so that image pixels values will be accurate that helps us for proper segmentation but this paper will support compromisation over quality of image for some extent since we are using multiple threshold levels and this papers also employed in finding count of infected cell and segment this for proper diagnosis. With this we can easily predict the severity of infection as well. The complete details will be given in upcoming sections pictorially [4].

II. SAMPLES AND METHODS

Samples are the main raw material to perform an image processing. The samples are collected from biological research lab with proper permission. The processing of image will be carried out by employing multi thresholding and jet colour map of scale 10 since here many threshold level are considered small variations in pixels values will not affect the processing

A. Image Acquisition

It this paper we are using 700ppi image we can also employ more ppi images to get back at an accurate result even though images contains more ppi but the camera lens is not proper then it's not a good approach. As the number of pixels are more its helps a proper segmentation but the time taken to process the images will be more than the image of moderate pixels normally the images formats must be JPEG or JPG.

B. Processing and Segmentation

Complete process involved in diagnosis is of taking a blood sample, processing and finally generating a report will be shown with a block diagram in Fig 1. In this figure only the block which was colored yellow will be performed in this paper how and all will be explained in detail in coming discussions[5]. This paper is mainly concentrating on a processing of Microscopic images of blood remaining other blocks will be incorporated later during implementation. Image processing here it will involve two stages, in first stage proper processing will be involved where as in second stage identification of number of infected cells and severity will be decided based on the cells infected.

In first stage, Image processing will be carried out by employing multiple thresholding with a jet color map of scale 10.i.e image pixels will categorized using 10 threshold levels and all the levels will be chosen automatically no manual intervention is involved in choosing a threshold levels but it will depends mainly on the image quality[6].

In second stage, images will be processed using watershed algorithm and connected component extraction where here image will not take under multi-level thresholding since we are going to segment and to identify the number of infected cells this stages transform the input image into binary image and carry out the process by applying above mentioned techniques.

Finally, by the identification of infected cells severity will be decided. In my code for time being we have choosen the status as "beginning stage" for single cell infected, "growing stage" for two cells infected and "critical stage" for cells greater than three. Detailed explanation will be seen in next section with proper figures and GUI.

III. IMPLEMENTATION OF PROPOSED WORK AND APPLYING OF PROPOSED ALGORITHMS IN DETAIL

A. Pre-Processing

This paper will mainly deals with the image processing and image segmentation. This two processes will be carried out in two separate stages in first stage proper diagnosis will be carried out with multilevel thresholding where as in second stage identification of RBC's which are infected by the parasites will be identified and counted by proper logic, based on the number of cells infected severity of infection will be identified and displayed in GUI[6].

Volume 4 Issue V, May 2016
ISSN: 2321-9653

The initial stage will employed in image processing by multilevel thresholding in detail it will be explained in segmentation part. Briefly the acquired image will be transformed in to grayscale image where it involves only three shades white, gray and black after that it will be subjected to segmentation stage.The second stage will be involved in transformation of acquired image into binary image of 1's and 0's. This will be undergone watershed algorithm and connected component extraction with series of stages to identify the infected cells. Fig 2 will shows an input image we have used that for both image processing and segmentation process. Fig 3 will shows a grayscale converted image that helps to preserve all the information i.e. if we employ color image for processing then we must manage more number of color scale there is a chances of losing some vital information so that by converting it to an gray scale number of color component is reduced and it was easy to manage because less number of color differences will cover all the details. So that grayscale conversion will be beneficial to manage the images with less memory by not losing even a bit of information that will be seen clearly in Fig 3. It's a grayscale conversion of Fig 1.

B. Cells Segmentation

As we seen in pre-processing this support two section where as in first section we employ multi thresholding and in second watershed and connected component will be used.

In initial stage, so obtained gray scale image will be sliced into ten level by different thresholds. This uses Otsu's method but of different technique because of Otsu method the thresholds will be chosen automatically no manual intervention will be involved. Depending on the quality of image and details to be segmented we can change the number of levels and also the color map of image. In this current processing we are using jet color map and ten scales these are enough to get the details in this situation.

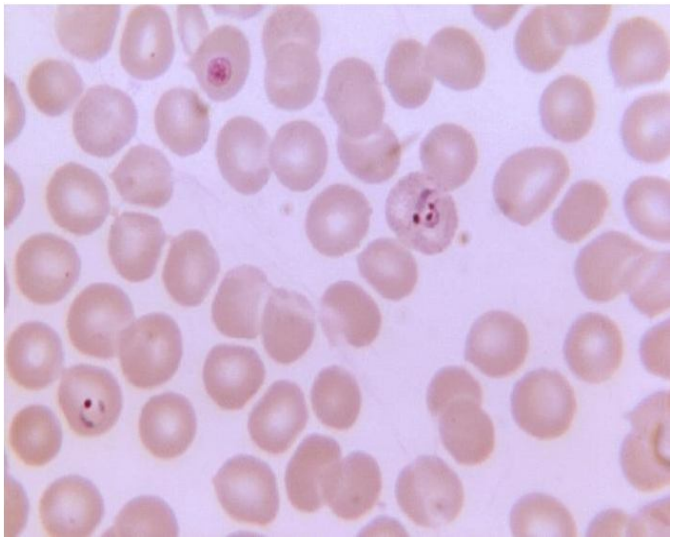


Fig. 2. Microscopic image of malaria infected blood sample

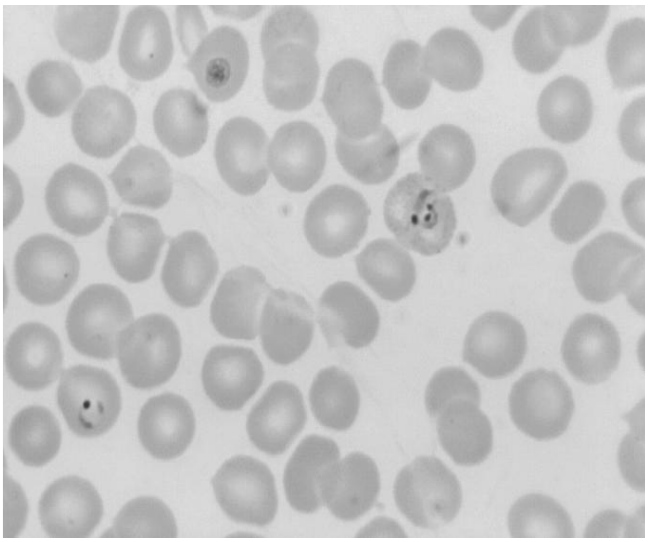


Fig. 3. Gray scale image of malaria infected microscopic

Volume 4 Issue V, May 2016
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

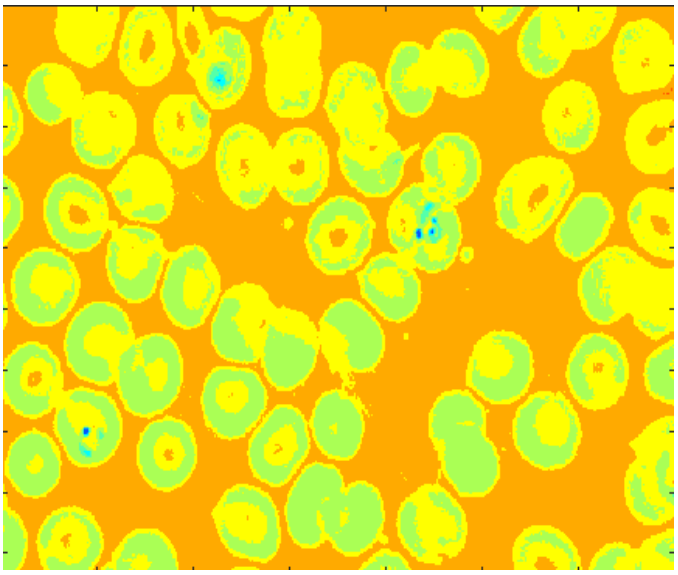


Fig. 4. Proper diagnosed image using jet color map and multiple thresholding

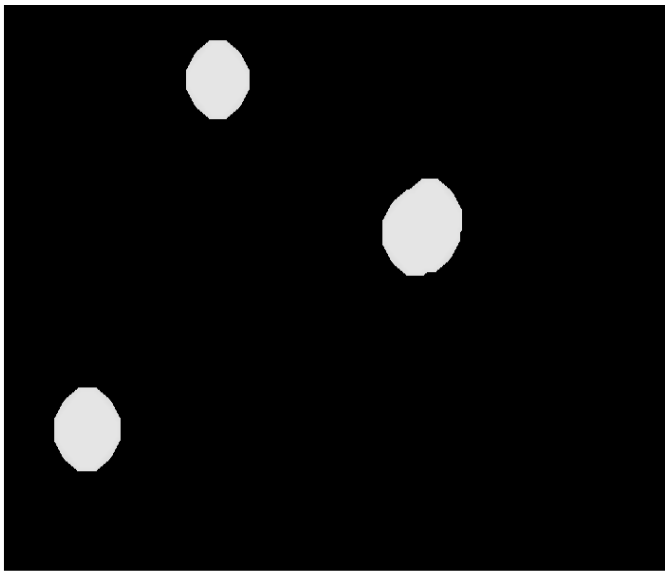


Fig. 5. Infected cell segmentation for a healthy cell (RBC's)

Second stage will mainly relay on segmentation of number of infected cells from a healthy cell and also the count of infected cells, based on the count we will going to decide the severity of infection. Whereas here we are using watershed algorithm to make the image perfectly ready for developing and connected component extraction. As I told previously this paper will withstand, even though captured image quality is poor on the basis of following reason. Normally in all previous papers the infected cells will be segmented by considering the infected cells gray scale value this may lead to false prediction if the image was not captured at an isolated environment this method works well by considering the nucleus as target to identify the infected cells and as well for the segmentation as well.

Fig 4 will shows a proper diagnosed image with multi thresholding whereas Fig 5 will shows the infected cells segmented image. Both the figure will have their own importance of identification of infected cell, the resulting diagnosed image is such that even a person having basic knowledge color will be easily identify the infected cell but this in not case in previous paper only a expertized person can only diagnose that perfectly since, because of perceptual view is poor and well as the resulting diagnosed image will be gray scale image. but this paper support a color mapped image and also ten threshold levels for each threshold, one color is assigned and hence the infected cells will easily identified because of color difference.

Thus perceptual view will also improved and also because of colored segmentation this image can be printed on the final diagnostic report so that it allows the physician to further analyse the diagnosed image based on his experience so that this will give a one push forward to treat the patient in more better way.

C. Classification of Cells

Initial stage will be mainly employed in proper diagnosis of malaria images. Diagnosis will be mainly based on a small principle that, blood cell will not contains any nucleus and cytoplasm and hence after multi thresholding if the cells contains any nucleus surrounded by a cytoplasm then that nucleus and cytoplasm belongs to a foreign parasites and cell will be treated as infected cell. Where as in previous paper results final processed image will be a gray scale image and hence discrimination between healthy cell and infected cell will be difficult even by knowing the principle because blood will contains mainly of three things RBC's, WBC,s and a platelets.

While imaging the blood sample if the platelets are present above the healthy cells then that will be imaged as a nucleus thus in gray scale processed image will gives false result this disadvantage will be overcome by using colour map and multiple thresholding. Thus based on the threshold different colours will be assigned to the nucleus and platelets and hence even though platelets present above the healthy cell that can be discriminated easily from a nucleus. And similarly cytoplasm will also be discriminated from other cell structure by a different colour map and hence we can say this is well accepted in manner of perceptual view as well.

Second stage will mainly deals with the identification of the infected cells from the healthy cells for this initially image will be

Volume 4 Issue V, May 2016
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

converted into binary image of 1's and 0's while converting, here we will not targeted the infected cells instead we targeted the nucleus in other words the cells that possess nucleus will be infected. Thus initially we will going to segment the nucleus from that nucleus we develop the cell by considering the suitable structural element and neighbours will considered to decide the pixel values. In the current circumstances we have considered 'ball' structural element.

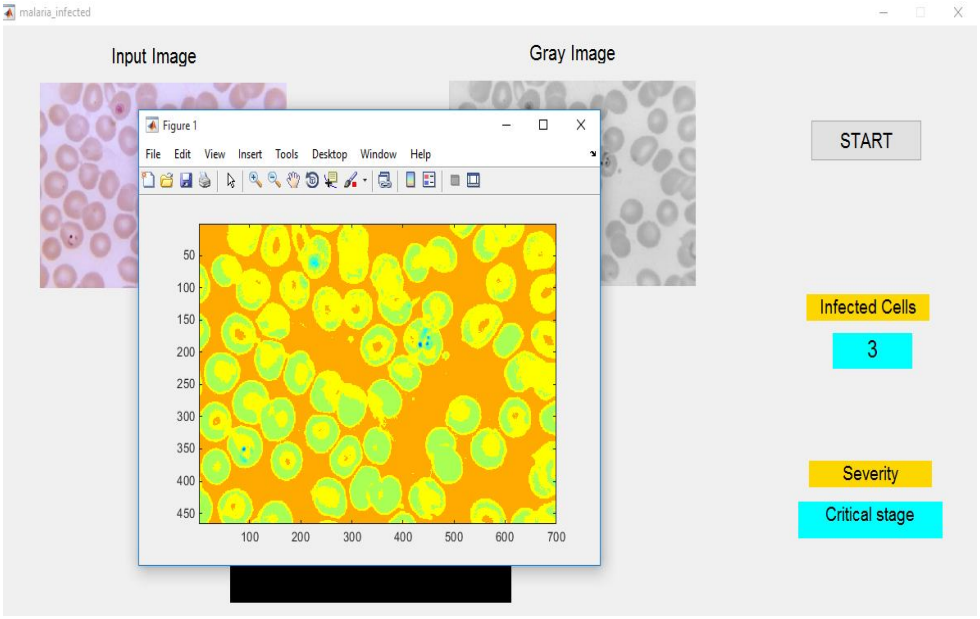


Fig. 6. Final GUI representing complete process.

From this above discussion we can conclude that even though the image quality is worse we get back at a proper result since nucleus is the only thing that possess dark pixels in these type of images. Finally, so segmented image will be complemented and connected components will be extracted this will gives a count of number of cells infected cells.

Based on the number of cells infected, severity will be decided in present case, for time being we have chosen the status as "beginning stage" for single cell infected, "growing stage" for two cells infected and "critical stage" for cells greater than three. Depending on the requirement it can be altered to suit our requirements. Fig 6 will gives a detailed study of how the entire process will be carried out, what are all processed and resulting processed image. All this will be shown in a GUI for better experience and made convenient for normal people to handle it in an efficient way. The GUI creation will reduce the time required for processing. with a single click we will get back at the output and also GUI has made the user easier to handle so that even a simple person who knows the how to handle the computer can easily carryout the diagnosis no expertized persons are required. And hence the amount conserved by not hiring an expertized person will make the centers to offer the diagnosis process at a lesser rate. So that both will get benefitted.

IV. RESULT

From this technique we can achieve an accuracy of 100% provided all the cells at the corner have to be captured completely. Thus we can say this technique will be accepted in all the situation but it fails to identify the cells which are half captured i.e. half captured cells at the corners of the image, apart from that it will well accepted whatever the situation will be even though captured image will be of a poor quality for some extent. Because of half captured cells at the edges accuracy will be reduced.

I have tried using 4 images having 8 infected cell, after diagnosis it will be successful in segmenting the 7 infected cells and fails to identify the corner infected cell mainly because of half capturing. Thus accuracy will be reduced to 87.5%. This accuracy will be improved by capturing all the cells completely.

V. CONCLUSION

This paper will provide the good accuracy when compared to previously proposed techniques. This paper is mainly intended to automatize the entire process of malaria diagnosis and finally diagnosed report generated will contains a diagnosed image and hence it allows the physician to further analyse the processed image to treat the patient in more better way but in present circumstances

that's not the case, physician has to treat, based on technician review and may develop some discrepancies. All these will be overcome in this paper.

Also the final report will contain total number of infected cells and severity made the analysis easier. Since here we were mainly supporting automation in this paper both time and manual intervention will come down and also the chances of getting an error report will also minimized.

This paper will fails mainly in some situations due to improper imaging i.e. if the infected cells are imaged half at the corners then this method will fails during that situation. Future enhancement can be made to overcome from this problem and thus by increasing an accuracy.

REFERENCES

[1] G. Diaz, F. Gonzales, and E. Romero, "Infected cell identification in thin blood images based on color pixel classification: comparison and analysis", Springer Berlin, pp. 812-821, 2007.

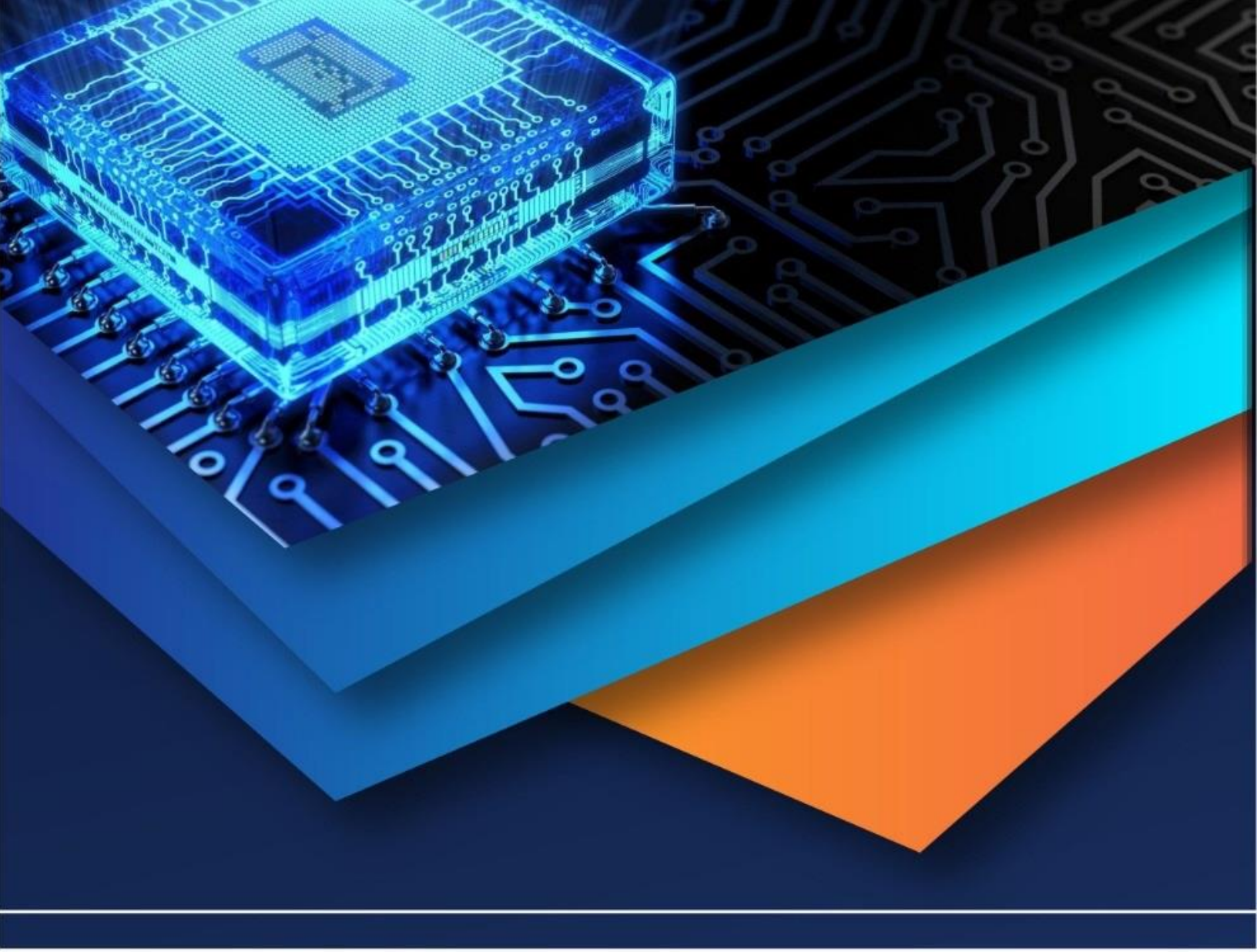
[2] F.Tek, A.Dempster, and I.Kale, "Blood cell segmentation using minimum area watershed and circle radon transformation"Mathematica Morphology: 40 Years On, pp., 441-454, 2005

[3] C. Di Ruberto, et al, "Morphological image processing for evaluating malaria disease", IWVF4, pp. 739-748, 2001.

[4] N. Ritter, and J. Copper, "Segmentation and border identification of cells in image of peripheral blood smearmslides", Proceeding of Thirtieth Autralasian Computer Science Conference, 2007.

[5] N. Otsu, "A threshold selection method from grey level histogram, IEEE Transactions on Man, System, and Cybernetic, vol.9, no.1 pp. 6 66, 1979

[6] N.E. Ross, et al, "Automated image processing method for the diagnosis and classification of malatia on thin blood smeras," Medical and Biological Engineering and Computing 44, pp. 427-436, 2006.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY