Available online at: http://www.ijmtst.com/vol6issue06.html
International Journal for Modern Trends in Science and Technology
ISSN: 2455-3778 :: Volume: 06, Issue No: 06, June 2020

Image Enhancement Techniques for Acute Leukemia Images

K Jyothi[1] | G Sai Pavitra[1] | K V N M Sri Pragjna[1] | M Yaswanth[1] | A Narayana Murthy[1]

[1]Department of ECE, VSM College of Engineering, Ramachandrapuram, AP, India.

To Cite this Article
K Jyothi, G Sai Pavitra, K V N M Sri Pragjna, M Yaswanth and A Narayana Murthy, “Image Enhancement Techniques for Acute Leukemia Images”, *International Journal for Modern Trends in Science and Technology*, Vol. 06, Issue 06, June 2020, pp.:99-103; https://doi.org/10.46501/IJMTST060621

Article Info
Received on 03-May-2020, Revised on 02-June-2020, Accepted on 07-June-2020, Published on 12-June-2020.

ABSTRACT

Leukemia is a malignant disease (cancer) that affects people in any age either they are children or adults over 50 years old. Nowadays, there are screening system guidelines for leukemia patients. The screening result from looking at a sample of patient blood, can determine the abnormal levels of white blood cells, which may suggest leukemia for further diagnostic stage. Therefore, medical professional using medical images to diagnose leukemia. However, there are blurness and effects of unwanted noise on blood leukemia images that sometimes result in false diagnosis. Thus image pre-processing such as image enhancement techniques are needed to improve this situation. This study proposes several contrast enhancement techniques which are local contrast stretching, global contrast stretching, partial contrast stretching, bright and dark contrast stretching. All techniques are applied on the leukemia images.

KEYWORDS: *leukemia, image enhancement*

DOI: https://doi.org/10.46501/IJMTST060621

I. INTRODUCTION

Leukemia is a malignant disease (cancer) that affects people in any age either they are children or adults over 50 years old. Nowadays, there are screening system guidelines for leukemia patients. The screening result from looking at a sample of patient blood, can determine the abnormal levels of white blood cells, which may suggest leukemia for further diagnostic stage. Therefore, medical professional using medical images to diagnose leukemia. However, there are blurriness and effects of unwanted noise on blood leukemia images that sometimes result in false diagnosis. Thus image pre-processing such as image enhancement techniques are needed to improve this situation. This study proposes several contrast enhancement techniques which are local contrast stretching, global contrast stretching, partial contrast stretching, bright and dark contrast stretching. All techniques are applied on the leukemia images.

In common usage, an image or picture is an artifact that produces the likeness of some subject–usually a physical object or a person. Images may be two dimensional (e.g. a photograph) or three dimensional (e.g. a statue). They are typically produced by optical devices–such as cameras, mirrors, lenses, telescopes, microscopes, etc. and natural objects and phenomena, such as the human eye or water surfaces. The word image is also used in the broader sense of any two dimensional figures or illustration, e.g. a map, a graph, a pie chart, an abstract painting, etc. In this wider sense, images can also be produced manually (by drawing painting, carving, etc.), by computer graphics technology, or a combination of the two. A volatile image is one that exists only for a short period of time, e.g. the reflection of an object by a mirror, a projection of the sun on a wall by a pinhole camera, or a scene displayed on a cathode ray tube. A fixed image, also called hardcopy, is one that has been recorded on a material object, such as paper or textile.

TYPES OF LEUKEMIA

Clinically and pathologically, leukemia is subdivided into a variety of 2 large groups. They are

- Acute Leukemia &
- Chronic Leukemia.

A. ACUTE LEUKEMIA:

Acute leukemia is a disease of the leukocytes and their precursors. It is characterized by a rapid increase in the numbers of immature blood cells. Crowding due to such cells makes the bone marrow unable to produce healthy blood cells. Immediate treatment is required in acute leukemia due to the rapid progression and accumulation of the malignant cells, which then spill over into the bloodstream and spread to other organs of the body. Acute forms of leukemia are the most common forms of leukemia.

B. CHRONIC LEUKEMIA:

It is characterized by the excessive build up of relatively mature, but still abnormal, white blood cells. Typically taking months or years to progress, the cells are produced at a much higher rate than normal, resulting in many abnormal white blood cells. Whereas acute leukemia must be treated immediately, chronic forms are sometimes monitored for some time before treatment to ensure maximum effectiveness of therapy. Chronic leukemia mostly occurs in older people, but can theoretically occur in any age group. The chronic leukemia's are a group of malignancies involving the hematopoietic system. Chronic myelogenous leukemia (CML) is a myeloproliferative disease that arises from a clonal process involving an early progenitor hematopoietic stem cell. In chronic leukemia's, there is an accumulation of malignant hematopoietic cells in the bone marrow that ultimately may lead to bone marrow failure states.

II. IMAGE ENHANCEMENT MODELS

There are 4 steps involved in applying image enhancement process.

- The first step is image capturing of acute leukemia
- Then, save the images under .jpg extension.
- The third step is to select picture with 3 different types which is normal image, bright image and dark image. Three images are selected for each different type.
- The last step is applying the 5 proposed techniques to the selected images.

A. CONTRAST STRETCHING TECHNIQUES FOR ACUTE LEUKEMIA IMAGES

Image enhancement processes consist of a collection of techniques that seek to improve the visual appearance of an image or to convert the image to a form better suited for analysis by a human or machine. Contrast stretching is the image enhancement technique that commonly used for medical images. They are 5 contrast stretching techniques. They are local, global, bright,dark and partial techniques.

B. LOCAL CONTRAST STRETCHING TECHNIQUE:

In a low contrast image, the entire range of the gray-scale is not exhaustively occupied by its pixels. A poor ambience of light illuminating the object or scene to be imaged may be a possible reason for such low contrast. However, even if an image exhaustively utilizes its entire range of gray scale, the contrast over different smaller regions of the image may suffer from low contrast and may require contrast enhancement. Usual methods of contrast enhancement treat the image globally and does not pay special attention to smaller regions of low contrast. A relatively smaller number of pixels from such areas are insufficient to have any significant influence on the computation of global transformation. So the conventional histogram stretching or histogram equalization technique fails to serve the purpose. Such images need local enhancement and the technique by which this can be achieved is termed as local contrast stretching.

Local contrast stretching (LCS) is an enhancement method performed on an image for locally adjusting each picture element value to improve the visualization of structures in both darkest and lightest portions of the image at the same time. LCS is performed by sliding windows (called the KERNEL) across the image and adjusting the center element using the formula

Ip (x, y) = 255 • [Io (x, y) - min] /(max - min)

Where,

Ip(x, y) is the color level for the output pixel(x, y) after the contrast stretching process. Io(x, y) is the color level input for data the pixel(x, y).

max - is the maximum value for color level in the input image. min - is the minimum value for color level in the input image.

C. GLOBAL CONTRAST STRETCHING TECHNIQUE

Global contrast stretching will consider all color palate range at once to determine the maximum and minimum for all RGB color image. The combination of RGB color will give only one value for maximum and minimum for RGB color. This maximum and minimum value will be used for contrast stretching process.

Where, Ip (x, y) = 255 • [Io (x, y) - min] /(max - min)

Ip(x, y) is the color level for the output pixel(x, y) after the contrast stretching process. Io(x, y) is the color level input for data the pixel(x, y).

max - is the maximum value for color level in the input image. min - is the minimum value for color level in the input image.

From the formula (x, y) are the coordinates of the center picture element in the KERNEL and min and max are the minimum and maximum values of the image data in the selected KERNEL. This technique will consider the one value which is the maximum of RGB components and the minimum value of RGB components. It will not consider the individual values.

D. BRIGHT CONTRAST STRETCHING TECHNIQUE

Bright stretching is a process that also used auto scaling method which is a common linear mapping function to enhance the brightness and contrast level of an image. This method is based on mapping equation .The bright stretching process is implemented based on Equation,

Out(x,y)=(in(x,y)/TH)*NewTH forin(x,y)<TH

=(((in(x,y)-TH)/(255-TH))*(255-NewTH))+min forin(x,y)>TH

Where,

TH: threshold value

NewTH: bright stretching factor

E. DARK CONTRAST STRETCHING TECHNIQUE

Dark stretching is known as part of partial contrast stretching. This process is also based on equation as describe in previous section which involves auto scaling method. Dark stretching is a reverse process of bright stretching process. The color level produces is based on equation.

Out(x,y) =((in(x,y)-TH)/(255-TH))*NewTH forin(x,y)<TH

= (((in(x ,y)-TH)/(255-TH))*(255-NewTH))+min for in(x,y)>TH Where,

In (x ,y) : value of pixel color level located at (x,y) input image TH : threshold value.

NewTH : dark stretching factor

F. PARTIAL CONTRAST STRETCHING TECHNIQUE

Partial contrast is an auto scaling method. It is a linear mapping function that is usually used to increase the contrast level and brightness level of the image. This technique will be based on the original brightness and contrast level of the images to do the adjustment. The mapping function is as follows

pk = ((max − min)/(fmax − fmin)) * (qk − fmin) + min

Where,

Pk: Color level of the output pixel qk: Color level of the input pixel

fmax: Maximum color level values in the input image fmin: Minimum color level values in the input image

max &min: Desired maximum and minimum color levels that determines color range of the output image, respectively.

maxTH = (max red+maxgreen+maxblue)/3

minTH = (min red+mingreen+minblue)/3

maxRed, maxBlue and maxGreen are the maximum color level for each red, blue and green color palettes, respectively. minRed, minBlue and minGreen are the minimum value for each color palette, respectively. maxTH and minTH are the average number of these maximum and minimum color levels for each color space.

III. RESULTS

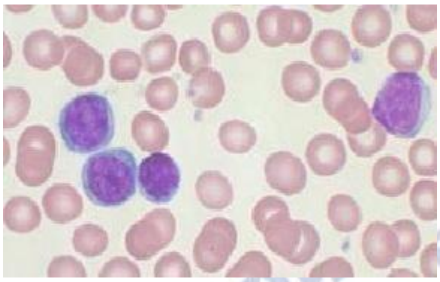

Fig: Normal input image

Fig: Result for local contrast stretching

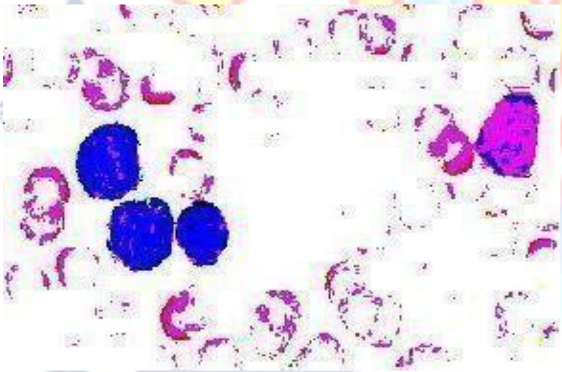

Fig: Result for global contrast stretching

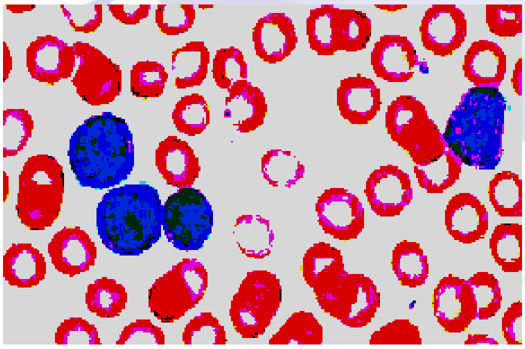

Fig: Result for bright contrast stretching

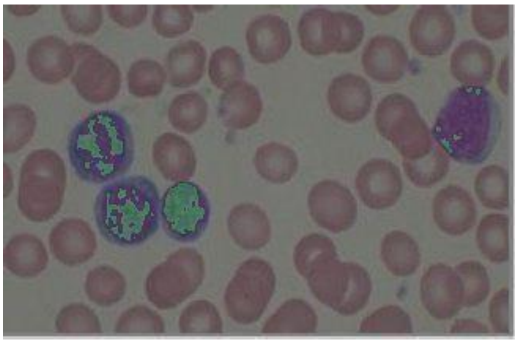

Fig: Result for partial contrast stretching

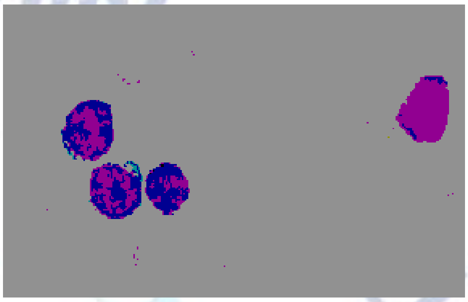

Fig: Result for dark contrast stretchin

IV. APPLICATIONS

Various applications are

- Bio-medical applications
- Detection cancer affected blood cells
- Diagnosis of cancer affected blood cells
- It is used for the developments in analysis methods and computer-aided diagnosis, has propelled medical imaging into one of the most important sub-fields in scientific imaging.

V. CONCLUSION

Contrast stretching algorithm was studied in much detail and the various steps of the different contrast stretching techniques were implemented on the MATLAB successfully. This project gave us the thorough knowledge and understanding of Contrast stretching process.

In order to compare the image enhancement techniques, the comparison of image before and after enhancement is needed. The proposed contrast enhancement techniques were applied to three leukemia images labeled as normal, dark and bright images. Those images were categorized based on the human visual interpretation. Partial stretching shows original

FUTURE ENHANCEMENT:

While several features of this project were lacking (most notably the exact image enhancement algorithms for comparison), the overall outcome appears to be positive. The algorithm appears to have worked with some degree of success, yielding what is believed to be reasonable quality images in a relatively short amount of time. With further work devoted to verifying the algorithm's validity when compared to exact image enhancement algorithms, and further work optimizing the algorithm, it could indeed become very versatile where fast image enhancement is preferred over slow, yet exact image enhancement algorithms.

REFERENCES

[1] Jaspreet Kaur, Amita Choudhary "Comparison of Several Contrast Stretching Techniques on Acute Leukemia Images," International Journal of Engineering and Innovative Technology (IJEIT) Volume 2, Issue 1, July2012

[2] R.Ravindraiah, Dr. M.N.Giri Prasad, M.Venkata Srinu "Qualitative Evaluation Of Enhancement Methods For Analysis Of Acute Leukemia Images," ISSN: 0975-5462 Vol. 3 No. 8 August 20116447

[3] Aimi Salihah, A.N., M.Y.Mashor, Nor Hazlyna Harun, AzianAzamimi Abdullah, H.Rosline "Improving Colour Image Segmentation on Acute Myelogenous Leukaemia Images Using Contrast Enhancement Techniques", 2010 IEEE EMBS Conference on Biomedical Engineering & Sciences (IECBES 2010), Kuala Lumpur, Malaysia, 30th November - 2nd December2010