2018-08

Image visualization and face detection technique into extreme dark environment

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Image Visualization and Face Detection Technique into Extreme Dark Environment

By

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This Project report has been submitted in fulfillment of the requirements for the Degree of Bachelor of Science in Software Engineering.

Department of Software Engineering
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Spring 2018

APPROVAL

This bachelor thesis titled “Image Visualization and Face Detection Technique into Extreme Dark Environment”, submitted by Md.Fakrul Abedin Bhuiyan , ID: 141-35-582 and Rubaiya Reza Rothi, ID :141-35-601 to the Department of Software Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Software Engineering (SWE) and approved as to its style and contents.

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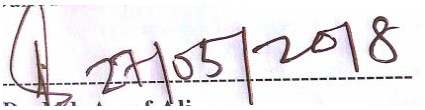

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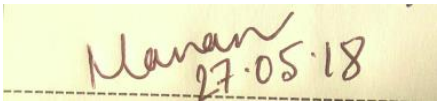

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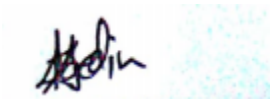
It hereby announces that, this bachelor thesis under the supervision of Dr. Shaikh Muhammad Allayear, Associate Professor, Department of Software Engineering, Daffodil International University. It is also declared that neither this thesis nor any part of this has been submitted elsewhere for award of any degree.



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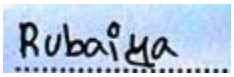

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ACKNOWLEDGEMENT

Firstly, I might want to thank my supervisor, Associate Professor Dr. Shaikh Muhammad Allayear. I owe such a great amount to his motivating direction over the span of this venture, for his recommendations on papers to peruse, and for his endless hours of accommodating exchanges and assessment. He gives me an opportunity to work in Smart Data Science Center (SDSC) for complete my research. SDSC is a computer research laboratory of Daffodil International University. I might likewise want to demonstrate appreciation to my committee, including Associate Professor Dr. Md. Asraf Ali, Chairman, Project/Thesis Committee, Department of Software Engineering and my noteworthy our department head Professor Dr.Touhid Bhuiyan for their profitable instructions.

All the more by and large, I can't exaggerate the amount Daffodil International University's software engineering offices have helped me develop as an understudy. Uncommon much gratitude goes lecturer Mirza Mohtashim Alam for putting me on the way to seeking after hypothetical software engineering research and for being a uniquely rousing coach and to lecturer Ms. Manan Binth Taj Noor for filling in as my scholarly consultant. I would also like to thank lecturer Mr. Sheikh Shah Mohammad Motiur Rahman and Md. Habibur Rahman for his incredibly extensive and important input on the evidence of my principle result. I'm particularly appreciative for Research Associate MD. Tahsir Ahmed Munna for being regular teammates on issue sets. I also want to give special thanks researcher Delwar Alam and S. Rayhan Kabir. I'm particularly thankful for my paper observers' lecturer Mr. Sheikh Shah Mohammad Motiur Rahman and lecturer Ms. Manan Binth Taj Noor for being continuous collaborators on issue sets and their suggestions on research report to peruse or read.

Lastly, I might want to thank my parents for bringing me into this world and making everything conceivable. They were the reason I initially began to look all starry eyed at learning, and I am appreciative consistently for what they have done to raise me up to be simply the best form.

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ABSTRACT

In this study, Enhancement techniques in the spatial domain have been proposed for the enhancement of dark and extreme dark images. Image processing is most important part of computer vision. Face detection and recognition is another important research subject in machine learning. We worked three image processing techniques which we used to visualize the extreme Dark image. We were using contrast stretching, Histogram equalization, Adaptive Histogram equalization. Here it is exhibited the comparison of enhancement techniques. In this research, another part is face detection. After processing image, it can be detected in the face. Here is presented a face detection system from proceeding output image. It creates a green circle on the face and crops the face. The strategy models the circulation of human face designs by methods for a couple of view-based "face" and "non-face" demonstrates groups. In the process, another thing is it can be detected the face in the last processing stage in the dark image (original image). We also illustrate our proposed model, algorithm, comparison with other research. We are analyzing our dataset. Mainly we do our research an application perspective.

Keywords: - Image enhancement, contrast enhancement, Histogram Equalization, Adaptive Equalization, Face detection, Image processing, Computer vision.

CHAPTER 1: INTRODUCTION

Last few decennia lots of work are being done in based on image processing and face detection. It's necessary for all people. Now time for data, images are one kind of data. Images illustrate a momentous subset of all measurements made. An example such in a place someone takes an image. But somehow it is a dark image nothing is showed here. If you can explore these images, we can find out new information. Human eyes have around 10 8:1 outright ranges from completely adjusted dull vision to completely adjusted lighting conditions at twelve on the equator. But some image can't visual for low contrast. It depends on our visual perception. It looks like a dark image. Dark image is such a kind of image which can't receive, reflecting, transmitting, or radiating light when it's taken. There subsists a common imbalance between the direct observation of scenes and image captured through cameras. For example, a human can see subtle elements both in profound shadows and in close-by very lit up zones. Then again, a photo of a similar scene will either demonstrate the shadow as excessively dim or the brilliant zone as overexposed. The color of an image changes from different illumination. When color appearance is a key parameter in detecting an object then it should be constant in the different context.

Last few decades lots of works are being done in face detection. It is one of the best techniques for person identification. It does not need human cooperation so that it is popular day by day. There are two classifiers which are learning based approach. In this research along with the Histogram equalization, adaptive equalization, contrast stretching using filtering, the edges are also smoothed to get an explicit look of the shaded image and developed a face detection technique based on filtering image.

1.1 Background

If look back in this research, some terms are focused like dark image, extreme dark environment, image processing, face detection. Image is processed three techniques. In previous researchers are used one or two techniques for improve image quality. Here try to visualize image of extreme dark environment and used Haar-Cascade algorithm for face detection.

1.2 Motivation of the Research

Before starting research, need advanced level programming skill. This research manuscript faced some difficulties about new technology. In current situation, mobile camera didn’t detect face in extreme dark environment, that's why in this research, try to solve that’s problem.

1.3 Problem Statement

Normally camera can't capture clear picture in extreme dark environment. It looks like dark image. Face Detection algorithm can't work that situation. To detect face that image must be visualized any way.

1.4 Research Questions

- How to improved image intensity for increase image quality?
- Which are the best techniques to visualize image of extreme dark environment?
- How can detect face in the dark image?

1.5 Research Objectives

Normally previous researcher uses any one type of equalization. In this research, using three types equalization and detect face from proceed image.

1.6 Research Scope

From existing research and gathering knowledge we fixed our scopes range. Existing research most of them proceeds one equalization process and they only process image. In this research we can compare three processed images which processed by three different equalization techniques for visualizing dark image. After procedure, it is detected face in the dark environment, in before which cannot.

1.7 Thesis Organization

In chapter one introduced the thesis title. Here decision about Background of research, Motivation of research, problem statement, research question, objectives and scope. In chapter two is Literature review, where discussed previous work. The summary of related works is discussed previous research activity and confabulation of the common problem. In the last part of this chapter is a summary. Chapter three is research methodology. This chapter has discussed plan, goal, scope, processes. In here give a proposed processing model. In this part also add algorithm with sample dataset. Give a short summary in last of the chapter. The most important part is result and discussion part which is chapter 4. Here give result and comparison. At the last section, chapter 5 described the conclusion and recommendations. This part has described finding and contributions and recommendations for future work.

CHAPTER 2: LITERATURE REVIEW

2.1 Previous related work

Human Detection in Hours Of Darkness Using Gaussian Mixture Model Algorithm (Komagal, Seenivasan, Anand and Raj, 2014):
They proposed a method of Human detection in night time(darkness) using Gaussian Mixture Model (GMM) in real night environment employing an infrared radiation camera. Video surveillance systems are extremely important in our daily life. Night imagination could be the strength to see in low sunshine conditions. Surveillance video may not be seen clearly. Especially, under the weak illumination conditions, most of the earlier work has concentrated on sunlight hours Surveillance. The infrared video is taken as Input to perform Human detection at night. Then the video was prepared using Gaussian mixture model algorithm, it was proved that by using this technique accurate detection of the human at night is possible [1].

Detection of Partial Invisible Objects in Images using Histogram Equalization (Satbir Singh, Abhishek Godara, Gaurav, 2014):
In here they are recognition of partially invisible objects in images using image enhancement techniques. The issue mainly arises in night vision images which involve impaired contradict standards. Also for the duration of sunlight hours, the item that's captured below sunrise may be survives and the rest of information isn't captured by camera properly. Histogram Equalization (HE) is a flexible figure development skill which might be coordinated for converting the colored detectable objects/undetectable objects right into a correct vision. Histogram Equalization (CLAHE) is fused and eventually, for smoothing duty, the picture then obtained is undergone a Gaussian filter. Results on more than a few sets of imagery exhibit which raised two techniques H and CLAHE as well as a Gaussian filter out moderately get well the standard of drawing and as a deduction lend a hand to find out the in part visible/invisible objects [2].

Internal Noise-Induced Contrast Enhancement OF Dark Images (Rajib Kumar Jha, Rajlaxmi Chouhan, P. K. Biswas, Kiyoharu Aizawa, 2012):
In this paper, they proposed a contrast enhancement technique using scaling of an internal noise of a dark image in discrete cosine transform (DCT) domain. This progress is effected respectively intramural turbulence suggest because of loss of sufficient enlightenment and may be formed by a universal process exhibiting progressive imaginary resonance. The planned mode adopts a native flexible processing and significantly enhances the picture diverge and paint instruction although ascertaining excellent intuitive quality. [4]

Enhancement of dark and low-contrast images using dynamic stochastic resonance (Rajlaxmi Chouhan, Rajib Kumar Jha, Prabir Kumar Biswas, 2013):
They proposed a dynamic stochastic resonance (DSR)-based technique in spatial domain has been proposed for the enhancement of dark- and low-contrast images. Stochastic fullness (SR) can be an episode wherein the opera of a technique (low-contrast icon) may be progressed by enhancement of noise. However, within the planned implement, the interior turbulence of a picture archaic utilized to present a cry-induced progress of a darkened figure starting with a voice of low weight to that fact of high distinguish. DSR is applied in an iterative fashion by correlating the system parameters of a double-well potential with the intensity values of a low-contrast image. The optimum product is ensured by modifying counting of dance poetry – uncle varies enrichment consideration (F), no cognitive high-quality measures and color improvement consideration. Comparison having a geographical sphere SR-based performance has further been illustrated. [5]

Robust Focus Measure for Low-Contrast Images (Shen andH. Chen, 2016):
The paper, they proposed a robust focus measure based on the energy of the image. The complication of auto-focusing has been designed for long, but such a lot techniques present in biography don't at all times implement properly for low-contrast images. In this paper, It performs impartially thoroughly on plain and low-contrast images. In enhancement, it's miles computationally efficient. [6]

Adaptive Object Detection and Visibility Improvement in Foggy Image (Nan Dong, Zhen Jia, Jie Shao, Zhipeng Li, Fuqiang Liu, Jianwei Zhao, Pei-Yuan Peng, 2017):

An algorithm which provides foreground objects detection concept from video sequences with fog and then enhances their visibilities. First, they suggest a unique metrical to assess the picture fog goods to make a decision if the picturesque scenery is concealed by fog or not. Second, if there's hard puzzle the scenery, a different procedure for opposing disclosure according to a climatic irregular form is proposed. This innovative procedure can be utilized to discover not just freshly entering objects but in addition, sojourned objects. Once the leading edge oppose is detected, we improve its visually best to keep away from processing the complete perception. Their suggested algorithm is approved including a few inspection videos below the various fog conditions. Experimental results reach which the suggested method is efficient and efficient for façade oppose disclosure and clarity increase below fog overcomes conditions. [7]

Human Skin Colour Clustering for Face Detection (Jure KovaE,Peter Peer,Franc Solina,2003):
Computer imagination is one of the numerous areas that desire to remember the method of individual functionality and duplicate a well-known process including purpose to implement character living upon rational machines. For correct human-computer communication, it's necessary for the mechanical device to see people. Its algorithm is based on a skin color detection. One of one's issue this can be and similar algorithm need to manage is awareness of the brightness setting less than whatever the knowledge figure is captured. One of one's aspects of where they will examine brightness shape may be the style of your correct wash space. Since a number color times are designed to get rid of the shape of enlightenment (illumination) just as describing the color of a protest, a concept of the use of this sort of darken field for shave darken uncovering out-of-date reserved into account and approximately of one's methods have already been researched and certified. [10]

A Survey of Feature Base Methods for Human Face Detection (Hiyam Hatem,Zou Beiji,Raed Majeed, 2015):
They try to focused on the featured base approach. They try to represent that face feature techniques can be mainly divided into two approaches one is Feature base and another image base. They provided an idea about challenging problems in the field of human face analysis and as such. They work on facial expression, pose and so on. [11]

2.2 Common problem from review

Some paper shows how to visualize image from little dark environment. But they didn't work in extreme Dark environment. They didn't compare various type enhancements. No knowledge found about face detection in extreme Dark Environment. That's why in this thesis we try to work in this chapter.

2.3 Summary

After literature review we understand that existing papers shows the different types of enhancement of their image. Some of them survey on face detection, Detect face in image. Few researchers visualize image using Histogram Enhancement.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Plan

First of all, in this research was tried to collect some dark image and answered a question, is it possible to detect face in that image? But that image wasn't as clearer to detect face. Then try to visualize sample image and collect darker image of experiment. Researchers try to experiment many techniques which can be given best output. Then among them, put up three techniques. Decide to use some techniques for this research .which is listed below

- Contrast stretching
- Histogram Equalization
- Adaptive Equalization
- Face Detection

3.1.1 Goal

From tested sample goal was visualized that as much as possible, improve intensity and detected face in image. Compare which output is best among them.

3.1.2 Scope

From existing research and gathering knowledge can find out scope range. This research tried to avoid handling one technique. Multiple techniques can give a better result. That's why in this work used three enhancement techniques to visualize image which increased percentage of face detection.

3.1.3 Process Description

3.1.3.1 Contrast stretching:

Contrast stretching is another known term is normalization. It's simple enhancement technique which tries to improve the contrast using stretching range of intensity values. It differs from other equalization because of only it can be applied a linear scaling function to the image pixel value [23]. It is being used to increase the contrast of the image by making dark portions darker and the bright portion brighter [24].

3.1.3.2 Histogram Equalization:

Histogram equalization increases the contrast of images by metamorphosis the values in an intensity image in order that output image matches closed to a specified histogram. Histogram method improves the contrast and so that extend the intensity range. Here equalization means mapping given image to another image with increase total intensity values spreader over the entire range [23].

3.1.3.3 Histogram Equalization:

Histogram Equalization is a common tool for improving contrast. In this paper it is used for recovering lost contrast in input image by remapping the brightness value. After enhancement some details part appear to be wasted. Try to use this method which can increases areas of lower local contrast to higher contrast in input image.

3.1.3.4 Adaptive Equalization:

Adaptive histogram equalization is a computer image processing technique which is used to improve contrast in an image. It differs from ordinary histogram equalization in the respect that the adaptive method computes several histograms, each corresponding to a distinct section of the image, and uses them to redistribute the lightness values of the image. It has an aptitude to over amplify noise in relatively homogeneous regions of an image.

In this research it is used because of prevent limiting the amplification any noise that might be present.

3.1.3.5 Face Detection:

Face Detection has an extensive variety of utilizations, for example, programmed confront automatic face recognition, human-machine interaction, and surveillance. It has some problem due to variation in facial appearance, lighting problem, facial expression and so many factors. It divided two class problem-faces, non-face [18]. It also refers to the psychological process by which humans locate and attend to faces in a visual scene.t is applicator Face motion capture, Facial recognition, photography, can find out gender, age range which is advertisement. Now we can see Face ID. Which is a best advantage of Face detection? Skin tone detection cannot perform equally on various skin colors and impressionable to change in illumination. [22]

3.2 Proposed Processing Model

Image processing has various kinds of steps. Every step is related next steps. In the very beginning the program takes an input from following location. Then that is processed by three image processing techniques.

After loading image, it is converted as a float. Float image is taken for contrast stretching, histogram equalization, Adaptive equalization process. In every process we fixed some range for better output. Contrast stretching techniques. We fixed range in 2 ,98. Where the image is rescaled to include all

Intensities fall in the $2^{nd}$and 98^{th} percentiles. Where the image is rescaled to include all intensities and fall within the 2nd and 98th percentiles. In histogram equalization, the number of possible intensity values, often 256. Adaptive Equalization, we use Clip limit. Common values limit the resulting amplification as similarity 0.5 percent.

After getting three output images, then time to detect face. From our output image we take input for Detection part. We used Haar Face Detection algorithm where used “Haar Cascade Classifier”. It is Filtering by human skin color. Then it is detected face. Make a rectangular shape in the face. Face rectangular makes a map. This can help to detect face in Dark image. In before that cannot detect.

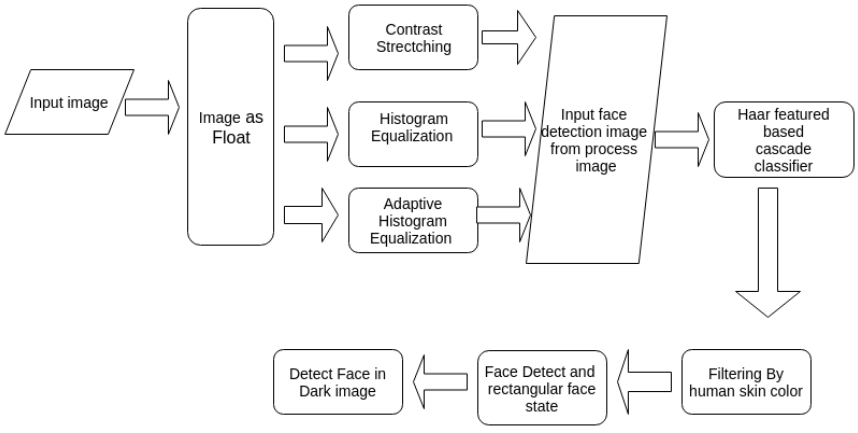


Figure 3.1: Proposed Process Model

3.3 Algorithm 1

Algorithm 1: Face Detection in Dark Image Algorithm

```
import OpenCV library cv2;
darkImg ← read raw dark image;
testImg[ testImg1,  testImg2, testImg3 ];
testImg1 ← ContrastStraching(darkImg);
testImg2 ← HistogramEqualization(darkImg);
testImg3 ← AdaptiveEqualization(darkImg);
detectFace[ detectFace1, detectFace2, detectFace3 ];
detectImg[ detectImg1, detectImg2, detectImg3 ];
face_cascade ← Identify human front face by Haar
Cascade Classifier XML file;
Rectangular Area Pont: x; y; w; h;
i = 0;
while ( testImg[ ].length( ) not complete )
    readImg ← testImg[ i ];
    gray ← cv2.cvtColor( readImg, RGB↔GRAY flag ) ;
    face ← face_cascade.detectMultiScale(gray,1.1, 5) ;
    for ( complete x, y ,w, h in face )
        cv2.rectangle(readImg,(x,y),(x+w, y+h),(255,0,0),2) ;
        cv2.rectangle(darkImg,(x,y),(x+w,y+h),(255,0,0),2);
        ROI_gray ← gray[ y : y + h, x : x + w];
        ROI_color ← readImg[ y : y + h, x : x + w];
        cv2.imwrite(detectFace[ i ], ROI_color);
        cv2.imwrite(detectImg[ i ], darkImg);
        showResult(detectImg[ i ]);
    end for
    i++;
end while
```

3.4 Data Set

In this study, using images are almost 60 but from them used 30 images in dataset because they are darker. Dataset is eight columns. In Table 1, there are given 6 sample data in this dataset. These Data have a different number of pixels.

Table 3.1: Sample Dataset

Image number	Total number of pixels	Original image mean intensity
1	2073600	2.76753
2	518400	2.454
3	38937600	17.25
4	15116544	2.6423
5	6220800	1.351999
6	1555200	7.6694

Table 1 is represented total number of pixel and mean intensity of input image (Dark image). It represents total number of data.

3.5 Summary

For experiment, was taken more than 60 samples image. From them picked up 30 images. To get perfect result must be followed these techniques properly .First of all, used the plan, defined scope. Researcher classified Image based on pixel. Run the program on sample image, collected output. Note down final result.

CHAPTER 4: RESULTS AND DISCUSSION

Using Enhancement is easily visualizing image, can reduce darkness. It is more than productive from any other technique. The processing output, we see that our image mean intensity is increasing. To Detect face, we try to input a good quality proceed image for detection. We are use 30 sample dark image. Analyzing that we found out a good percentage for visualize and detect image.

4.1 Percentage of Visualized image

Collected image samples are from various types, which categories in lighting effects, camera pixel and so on. Based On that's, most of the image can visualize to following techniques. But full Dark image cannot visualize because that image can't reflect light.

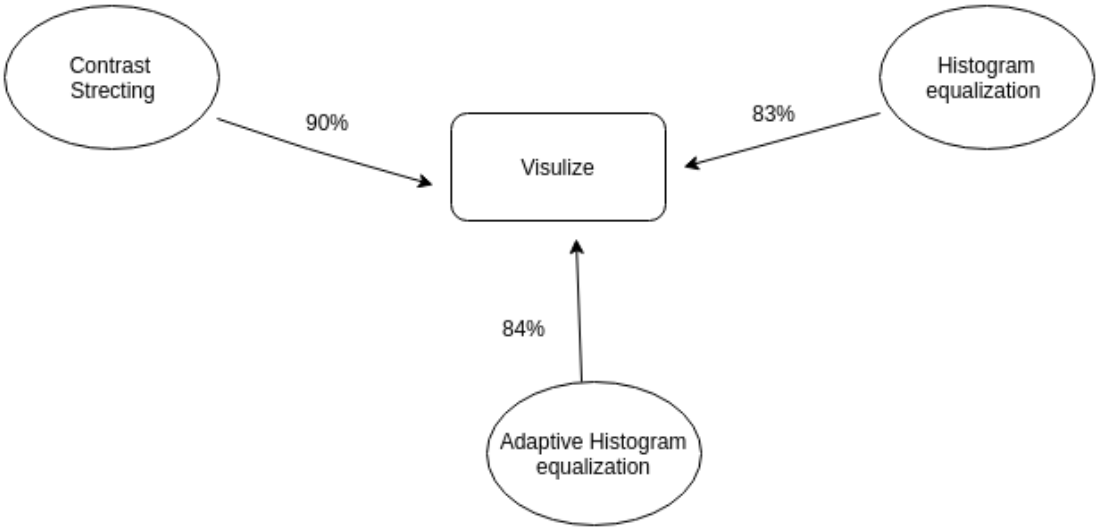


Figure 4.1: Percentage of visualized image

Among them, Total percentage of visualization rate is 94 percent. From there Contrast Stretching 90 percent, Histogram Equalization 83 percent, Adaptive Histogram equalization 84 percent can be visualized image. Some image is visualized only one or two processes. But most of these images are visualized in following processes.

4.2 Face Detection Rate

In previous result section, we can see that total visualization Rate is 94 percent. Now here shows Total rate of face Detection. From the pie chart, seeing that the number of face Detection rates is 70 percent. Some of the image cannot detect because of after processing the image has so much noisy. The non-detection percent is 30 percent.

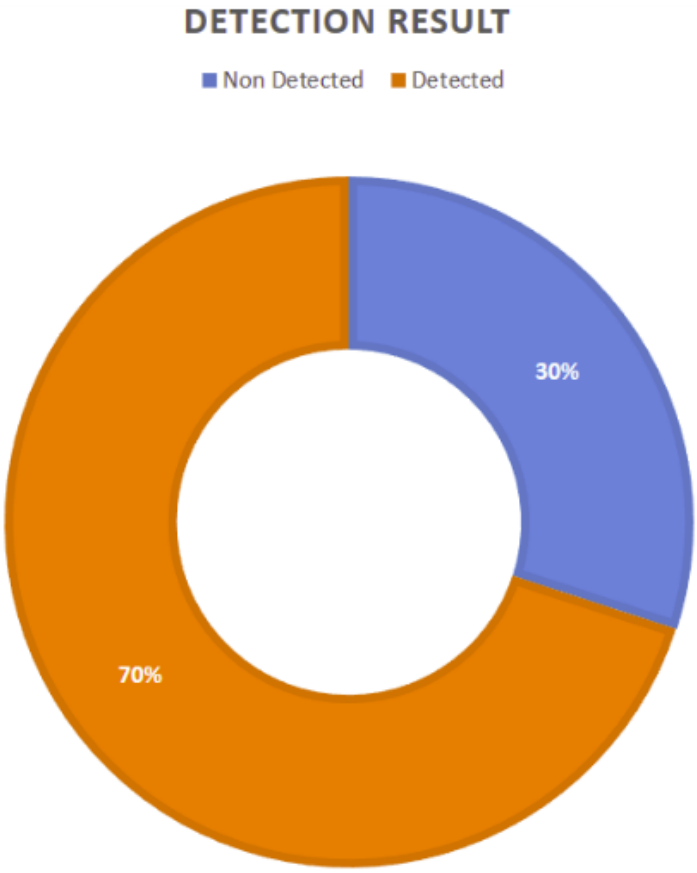


Figure 4.2: Percentage of detected face

From the pie chart, seeing that the number of face Detection rates is 70 percent. Some of the image cannot detect because of after processing the image has so much noisy. The non-detection percent is 30 percent.

4.3 Processed and output image result

This research have processed image by three techniques. They are Contrast stretching (C.S), Histogram Equalization (H.E), and Adaptive Histogram Equalization (A.H.E). After processing the image of every step, the processed image show by the histogram. And Last picture is Detection point where the face found.

In the face detection Image we see that a rectangular is shown in the image. This rectangular circle is Detected face in the dark image. After processing the program make a point in precede image. Then the rectangular shape coordinates in the dark image.

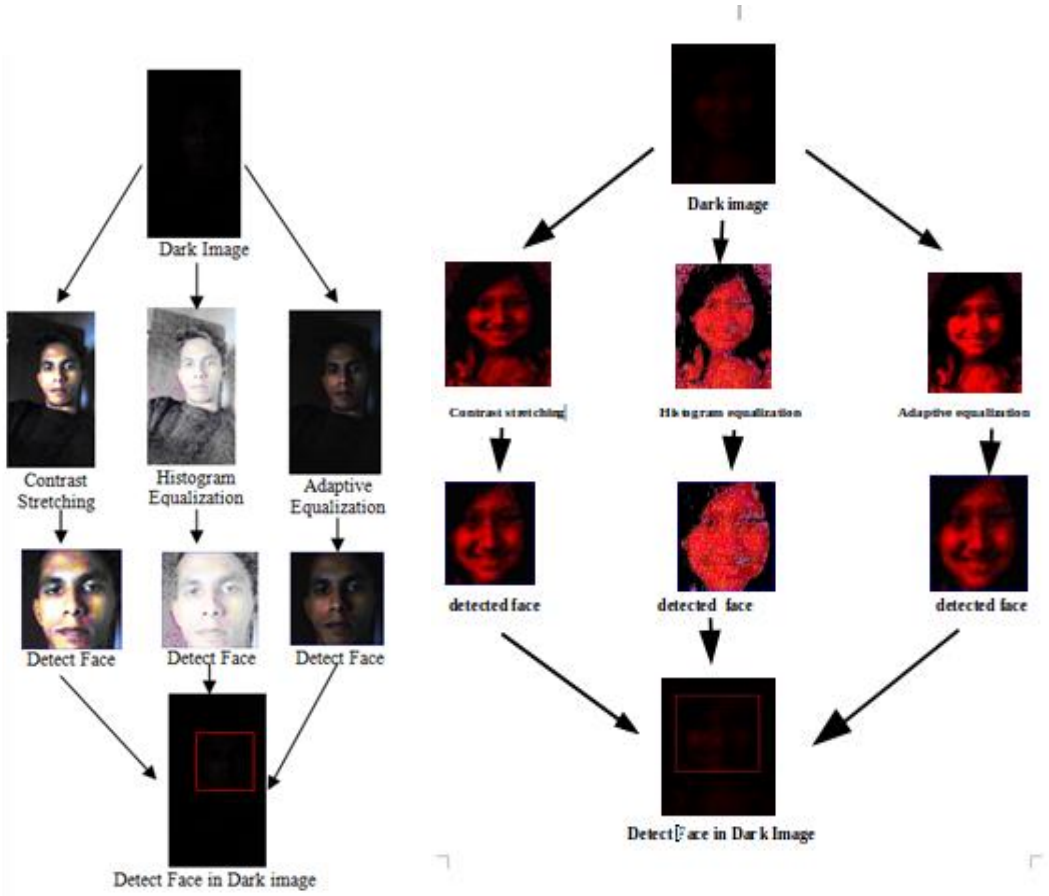


Figure 2.3: Image Output

4.4. Dataset analysis

Table 1 is represented original dark image number of pixel and their mean intensity. Table 2 represents the result of output images, visualize and detection rate.

From Dataset, easily recognize that Histogram equalization increases intensity more than another two techniques. It makes a big problem. The original image intensity is very low. When the image processed and increased intensity so much that time its making noise in image, then image is not visible. Another two techniques contrast stretching and adaptive histogram equalization are increasing intensity maintain a range and making less noise. Contrast Stretching and Adaptive Histogram Equalization increase intensity nearly. That's why their visualization rate in dark environment is little high than histogram equalization.

In visualize part, seeing that some image is visualized by one or two processes but can't detected for noise. Simply which images aren't visible, they can't be detected face.

Table 4.1: Result Dataset

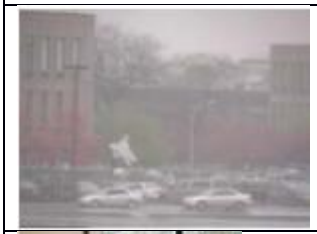
Image number	Total number	Original image	Contrast Stretching	Histogram equalization	Adaptive Histogram	Visualize (yes/No)	Detected (Yes/No)

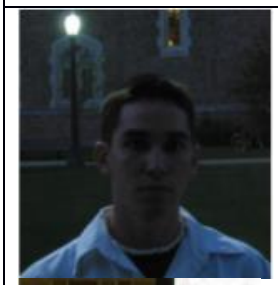
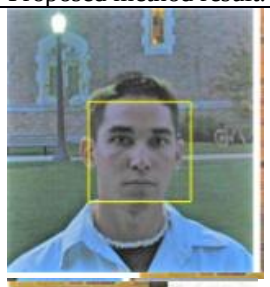
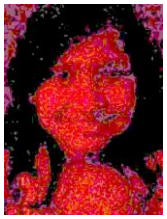
	of pixels	mean intensity	(image) mean Intensity (1)	(image) mean Intensity (2)	Equalization (image) mean Intensity(3)		
1	2073600	2.76753	96.9806	132.6429	60.79818	Y,1	N
2	518400	2.454	24.469	53.814	20.115	Y,1,2,3	Y
3	3893760 0	17.25	134.731	132.771	57.899	No	N
4	1511654 4	2.6423	111.4941	153.6413	61.3342	Yes 1,2,3	Y
5	6220800	1.351999	47.3247	138.0999	18.98071	Yes 1,2,3	Y
6	1555200	7.6694	11.742	54.00757	13.9327	Yes 1,3	Y

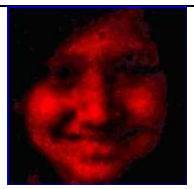
4.5 Comparison

In this research, researcher tries to compare working success rate with another researcher work. In this section, we try to comparison with other works.

Table 4.2 : Comparison with other research

Input image	Output image	Ref number	Description
	 Histogram equalization  CLAHE  Filtered Image	2	In this research they mainly focus on object detect which is in visible. They focus three techniques. They improve visible quality and detect object.
		7	In this paper they proposed an algorithm to detect foreground with fog and enhance object from a video sequences.
	 .H.E. Result, Intensity pair		They worked various enhancement techniques .in their study they proposed a new algorithm. They test their

	result.  LRM result. ORMIT result  Proposed method result.	8	algorithm in various images and compare with other techniques.
 	 	25	They proposed an image enhancement technique which was used as an image preprocessor for face Detection.
	 Contrast Stretching  Histogram equalization  Adaptive histogram equalization	This research	In this research, image is processed by three techniques. Give a better comparison between them. Face is detected in process image and Dark image.

	 Detected face  Detect face in Dark environment		

In table 3, we can see some comparison. If we see all input we easily check out that in this study, researcher worked the darker environment from another. But visible rate and detection rate is good. Some research techniques detect an object in the dark environment. In reference 25, they work with those images which have mean intensity almost 60%. But in this study, image intensity is minimum 2 and maximum 20 out of 256. They detect object after processing. In this study Detect face in the processed image and at the last stage detect the face in dark image which image can't detect in the first stage.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

In this research, we determined the current status of the extremely dark environment, the face detection failed in that environment. Improving the visibility and visual quality of dark images easily can detect face. Three techniques are working well but Contrast sStretching is better in this environment. Another view points, all techniques working well from their technical perspectives. Our face detection results are indicating that the image enhancement technique can increase the percentage rate of face detection.

5.1 Findings and Contributions

Dark image is the almost useless image if it can't give any information. So, we find out the background information from the dark images. We must visible that image. If it can visualize, it will give information. In this research, researcher finds some solution which is more effective.

1. Image visualize in extreme dark environment.
2. Detect face in processed image
3. Detect face in extreme dark environment.
4. Comparing between three techniques.
5. Previous Researchers process image one or two techniques.

This study tries to use almost three techniques. In this research using dataset image are darker than previous researcher dataset image. Before No one can Detect Face in Dark image. In this study Detect face in dark image which cannot be detected without process. After processing our following proposed algorithm can visible dark image, detected face in processing image and also detect face in dark image which we input previous.

5.2 Recommendations for Future Works

Now this study used more than 30 samples. To achieve more perfect result, must be need to consider more samples. Moreover, here considered extreme dark environment, next be tried to detect face in as like full dark environment. Researcher discussed only the current enhancement techniques. Future, in future will be proposed a new enhancement technique which work more effectively.

In future, we can easily plan a specific goal. Form this research next time can be proposed a new enhancement and face detection techniques which will be better than present existing enhancement techniques.

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