

**NEW PROPOSED FILTER WITH BOUNDARY FUNCTION FOR IMAGE  
RESTORATION PROCESS**

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JUDUL: NEW PROPOSED FILTER WITH BOUNDARY FUNCTION FOR IMAGE RESTORATION PROCESS

SESI PENGAJIAN: 2011

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NEW PROPOSED FILTER WITH BOUNDARY FUNCTION FOR IMAGE  
RESTORATION PROCESS

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This report is submitted in partial fulfillment of the requirements for the  
Bachelor of Computer Science (Artificial Intelligence)

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY  
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DECLARATION**

I hereby declare that this project report entitled  
**NEW PROPOSED FILTER WITH BOUNDARY FUNCTION FOR IMAGE  
RESTORATION PROCESS**


is written by me and is my own effort and that no part has been plagiarized without  
citations.

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## DEDICATION

To my beloved family, thank you for all of your supports. Especially for mom and dad, thanks to become very supportive and idealistic in giving me hope, courage and love.

To my dedicated supervisor Dr. I. Gede Pramudya Ananta, thank you for being such a good teacher for me. Thanks for your efficient guidance, incredible knowledge and a good person of you in helping me to complete my thesis.

To all my friends, thanks for being such healthy competitors and for all your supports that really help me to complete this thesis. Hopefully, we were success afterwards.

Good luck to all my lovely friends.

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## ABSTRACT

New proposed filter for image restoration process system is to find the best filter for image restoration. There are a lot of filters out there that has been applied to do image restoration, but each of them has their own drawbacks and need to be improvised. For this project, I choose Averaging filter algorithm to be modified. Averaging filter is the filter that can restore an image but gives the result with blurry edge. It's also makes noise become spread too larger than before. Thus, I have an idea to overcome this matter. The Proposed filter is used the same algorithm like Averaging filter but had been modified with boundary function to make the resulted image become more sharpen and excellent in removing noise. It is also perhaps can give the best performing in time consumed to process image compared to others.

The first chapter is describing the idea of this project. It is the introduction of the whole system. The second chapter is literature review. This chapter describes all the revision from all kinds of possible sources. In this chapter, all the literature must be put with citation to be documented. The third chapter is analysis phase. The analysis describes the information details about the system. Analysis phase is a very crucial part of gaining and gather information. After analysis, it is the design phase. At here, all the modification needs to do is identified. Drafting of the system and modification of the coding is done here. Next part is implementation phase. At this phase, all the modification and drafting done in design phase will be implemented into the system. The purpose is to make sure that there is no error while running them.

While there is no error at implementation phase, the testing phase needs to be done. At this phase, the system needs to be testing with all possible data. It must be done by ourselves and somebody else at least two persons. For this system, the testing is conducted by testing the system with all formats of image, try and error with degraded image and fine image. Then, the results of the testing are analyzed and will be concluded at project conclusion part. As a conclusion, the system will be scaled whether it is good, moderate or poor based on the testing phase results.

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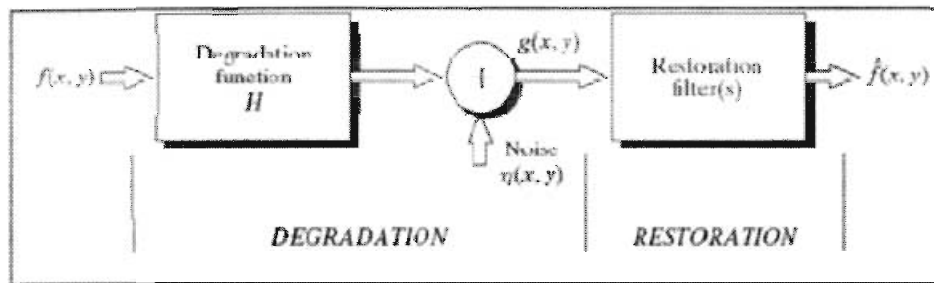
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## **CHAPTER I**

### **INTRODUCTION**

#### **1.1 Project background**

Image restoration is a process of restoring an image to get better quality of an image. Much application in camera used the application of image processing. Image restoration involves several stages before it can get the better image. Nowadays, the camera still produce imprecisely image. It also can be named as degraded image. The degraded image is an image that would harm by the high light intensity, blur and other noise. Thus, to eliminate this kind of noise the image restoration process need to be done. Image restoration is to improve the appearance of an image by using application of a restoration process that uses a mathematical model for image degradation.



**Figure 1.0: The overview of image restoration process**

### 1.1 Problems statement(s)

Image restoration is important to restore the better image. The image could be the evidence of the criminal. Just imagine if we have just one exhibit to solve the case. And the image is the degraded one. The image restoration process needs to be done to help to get the clear one. To do image restoration, a suitable filter is needed to identify noise. Thus, the system is about to find the best filtering for image restoration.

Averaging filter is a built in function in MATLAB software. This filter is already built in MATLAB. Thus, the Averaging filter has its drawbacks to do image restoration. This filter makes noise becomes larger rather than removing. It makes the restored image became blur and gave poor quality of image representation.

Thus, Proposed filter perhaps can overcome this matter. By working on the Averaging filter algorithm, some functions are added and the algorithm is modified to make sure the Proposed filter can do image restoration process successfully. The function added perhaps could remove the noise efficiently.



## 1.2 Objective

The main objective is to fulfill the requirement of degree workshop, is to apply any artificial intelligence techniques to solve problems. To do image restoration, the best filter needs to be recognized.

- To find the best filtering for image restoration
- To propose new filter that can overcome the drawbacks of Averaging filter

## 1.3 Scope

The scopes of the project are:

- Community education  
Student, photographer or others can use this application to do their work on image processing. Blurred image could be easily normal when using this application. There can be easy for student as a learning tool. This application can benefit in museum too where as any precious old painting can look better new.
- Industrial safety and security body  
When there is only one exhibit and it is a blurred image, this application can help them to get the clear one. Proposed filter can be used to identify the clear one.

## **1.4 Project significance**

This project is important to fulfill the requirement of degree workshop. The application is important to help people to get the image with better quality. Community can use this application to get the clear image on their purpose. For example the student can apply it as a learning process while the security body can use it to get clear on the only one exhibit and others.

## **1.5 Expected output**

The system can display the best restored image by using the Proposed filter. The Proposed filter should be the best filter in image restoration.

## **1.6 Conclusion**

As a conclusion, this chapter is about the introduction of the system. The next chapter is the literature review where all the information needed to do the system is identified.

## **CHAPTER II**

### **LITERATURE REVIEW AND PROJECT METHODOLOGY**

#### **2.1 Introduction**

A literature review is an information research as a guide to complete the system. A literature review also known as a body of text that aims to review the critical points of current knowledge including substantive findings as well as theoretical and methodological contributions to a particular topic. A literature review is important guidance in completing the system.

## 2.2 Facts and findings (based on topic)

Image restoration is functioning to get improvement over image. It is to improve the appearance of an image by application of a restoration process that uses a mathematical model for image restoration. It will recover an image that has been degraded using a priory model of the degradation. Restoration models the degradation and applies an inverse process to recover the original image. It is an objective process. [1]

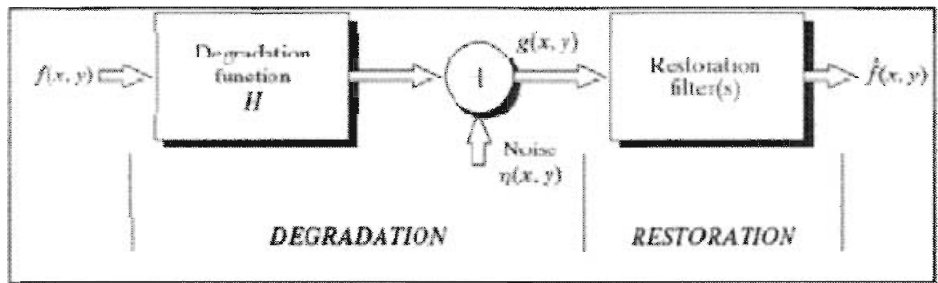
An objective process is assuming a priori knowledge of the degradation process. The inverse process is applied in order to recover the original image. In this system, a priori knowledge used is sharpening technique.

Types of degradation are blurring and other additive noise that caused by motion or atmospheric disturbance, geometric distortion caused by imperfect lenses, superimposed inference pattern caused by mechanical systems and noise from other electronic sources. [1]

From MATLAB tutorial, the restoration process model consists of two parts which are degradation function and noise function. Degradation process is modeled through a degradation function  $H$  and additive noise  $n(x,y)$ .

$$\underline{g(x, y) = H[f(x, y)] + n(x, y)}$$

**Figure 2.0: Given some knowledge of  $H$  and noise  $n(x,y)$**



**Figure 3.0: The image restoration process**

Noise is any undesired information that contaminates an image. Noise can be formed by digital image acquisition process. Types of noise that will be choosing in this system are Gaussian noise and Salt & Pepper noise. Gaussian noise is a noise with blur while the Salt & Pepper noise represents itself with dotted sign. The Salt noise is declared when the noise is on the white background while Pepper noise is when it is on a black background. The parameter of both noises can be set to do image restoration.

### Gaussian noise

- **Gaussian Noise**

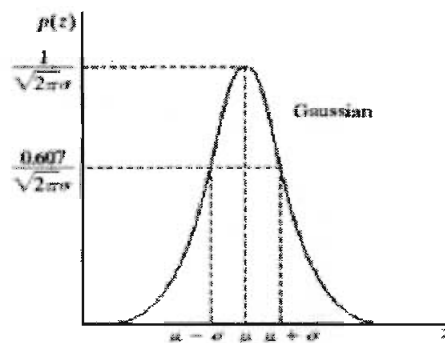
$$p(z) = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{(z-\mu)^2}{2\sigma^2}}$$

where

$z$ : gray scale

$\mu$  = mean (average)

$\sigma$  = standard deviation



**Figure 4: The description of Gaussian noise**

### Salt & Pepper noise

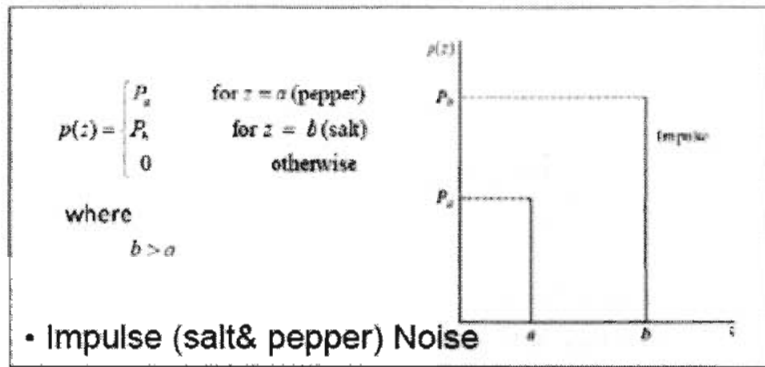


Figure 5.0: The description of salt & pepper noise

Restoration process is involves noise and inverse function. Consider an image degraded with only additive noise. When an image is added by noise, it is a degraded image. The degradation model is further simplified as below in spatial domain:

$$g(x, y) = f(x, y) + n(x, y)$$

While in the frequency domain:

$$G(u, v) = F(u, v) + N(u, v)$$

To do image restoration, a filter is needed and the filters choose for this system is Averaging filter, Median filter, and the Proposed filter. Averaging and Median filter is already built in MATLAB. Thus, these two filters are needed to compare with the Proposed one. The Proposed filter is a filter that has been modified from Averaging filter. The comparison is important to find which filter is the best functioning to do image restoration.

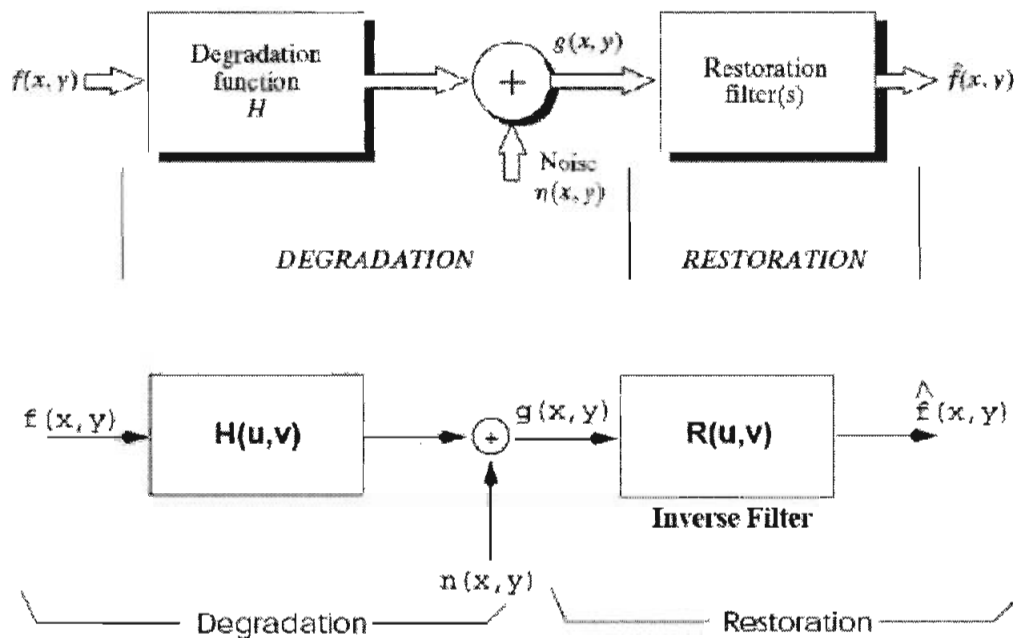
### Median filter

Median filter will select the middle pixel value within an ordered window of pixel values, denoted as:

$$\hat{f}(x, y) = \underset{(s,t) \in S_w}{\text{median}}\{g(s, t)\}$$

It works best with salt-and-pepper noise for both high and low values. It is better noise remover than Averaging filter, which causes blurry edges and details in image and thus not effective against impulse noise. It also preserves line structure. [1]

The overview of full image restoration process is:



**Figure 6: An overview of image restoration process**

### **2.2.1 Domain**

In reality, image processing application is widely use in camera. Many platforms like Adobe Photoshop, Photoscape, and MATLAB was applied image processing as a tool. Thus, in this project, the new Proposed filter for image restoration will be proposed. The research is important before modifying the Averaging filter.

### **2.2.2 Existing System**

There is an existing filter for image restoration. The existing filter like Median filter and Median filter is similar with Averaging filter which having problems when handling with a big size of image. The Averaging filter gave poor results in quality of image. Thus, the Proposed method with boundary function added will overcome this matter.

### **2.2.3 Technique**

Technique used in this system is sharpening. Sharpening technique is widely used in image processing. The Averaging filter gave poor in quality of restored image because of their blurry edge. Thus, this sharpening technique is used to overcome this matter. Sharpening technique will be applied in a coding together with the proposed method. The Proposed filter will be added with boundary function to get the sharpener image.