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# A Survey on various Edge Detection and Filter Techniques in Image Restoration

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***Abstract: Image restoration is an important branch of image processing, dealing with the reconstruction of images by removing noise and blur from degraded images and making them suitable for human perception. Any image acquired by a device is susceptible of being degraded by the environment of acquisition and transmission. Therefore, a fundamental problem in the image processing is the improvement of their quality through the reduction of the noise that they can contain being often known as "cleaning of images". The goal of the restoration approach is to improve the given image so that it is suitable for further processing. Removal of noises from the images is a critical issue in the field of digital image processing.***

***Keywords—Ant Colony Optimization, Fuzzy Logic, Wiener Filter, Impulse Filter, Low Pass Filter, High Pass Filter***

## I. INTRODUCTION

Digital image processing has numerous applications in different technology and study. Fields that use digital image processing include: biological researches, finger print analysis, medical fields, publishing fields and photography.

The fundamental classes of Digital image processing which are grouped depending on their operations:

a. Image enhancement: image enhancement deals with contrast enhancement, spatial filtering, frequency domain filtering, edge enhancement and noise reduction.
b. Image restoration: in this class the image is corrected using different correction methods like inverse filtering and feature extraction in order to restore an image to its original form.
c. Image analysis: image analysis deals with the statistical details of an image. Here it is possible to examine the information of an image in detail. This information helps in image restoration and enhancement. One of the representations of the information is the histogram representation to show the brightness and darkness in order to arrange and stretch the images to have an enhanced image relative to the original image. During image analysis the main tasks include feature extraction, image segmentation and object classification.
d. Image compression: image compression deals with the compression of the size of the image so that it can easily be stored electronically. The compressed images are then decompressed to their original forms. Here the image compression and decompression can either lose their size by maintaining high quality or preserves the original data size without losing size.
e. Image synthesis: this class of digital image processing is well known nowadays in the game industry and film. Nowadays the game industry and film is very advanced in 3-dimensional and 4-dimensional productions. In both cases the images and videos scenes are constructed using certain techniques. The image synthesis has two forms tomography and visualization.

### 1.2 Image Restoration Process

Distortion is almost always involved in recorded images. Distortion is mainly due to imperfections in the imaging system. This problem can get complicated due to random noise involved in the imaging. Degradation process works on input image f (x, y) to produce a degraded image g(x, y). With g(x, y) some knowledge of the degradation function H and knowledge about the additive noise term , the objective of restoration is to obtain an estimate f'(x, y) of the original image f(x, y) .

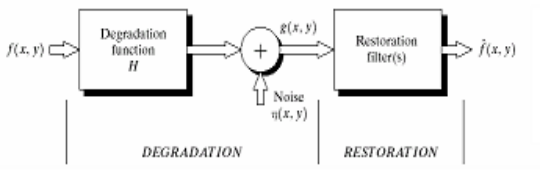


**Figure1: A Model of the degraded/restoration process**

 

Degraded image given in the spatial domain

$$g(x,y) = h(x) * f(x,y) + \eta(x,y)$$

An equivalent Frequency domain representation

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

Where $H(u,v)$ : Degradation functions $\eta(x,y)$ : Additive noise term

**1.3 Applications of Image Restoration**

Applications in the field of image restoration are

1. The first application of digital image restoration in the engineering community was in the area of astronomical imaging. Extraterrestrial observations of the Earth and the planets were degraded by motion blur as a result of slow camera shutter speeds relative to rapid spacecraft motion. The astronomical imaging degradation problem is often characterized by Poisson noise, Gaussian noise etc.
2. In the area of medical imaging, image restoration has played a very important role. Restoration has been used for mammograms, filtering of Poisson distributed film-grain noise in chest X-rays and digital angiographic images, and for the removal of additive noise in Magnetic resonance Imaging.
3. Another important application of restoration technique is to restore aging and deteriorated films. The motion picture restoration is often associated with digital techniques are used to eliminate scratches and dust from old movies and also to colorize black and white films. There has been significant work in the area of restoration of image sequences and well explained in literature.
4. The expanding area of application for digital image restoration is that in the field of image and video coding. As techniques are developed to improve coding efficiency, and reduce the bit rates of coded images. Much has been accomplished to develop ways of restoring coded images as a post-processing step to be performed after decompression.
5. Digital image restoration has also been used to restore blurry X-ray images of aircraft wings to improve federal aviation inspection procedures. It is used for restoring the motion induced effects present in still composite frames, and in general, restoring uniformly blurred television pictures.

## II. RELATED STUDY

[1]The paper provides an overview of some possible usage of the software. It contains some real examples of image quality improvement, objective and subjective quality assessment, distortion simulations and other ways of image processing that can be obtained by the individual applications.

[2]Every digital image processing system can be represented by a block diagram containing three important elements. Image processing started with the input of an image in the processing system. There is a integrated Software within the chip that handles the task. On the basis of need it can be further processed. But the application of algorithm or processing method depends on how the image is inputted and stored. Processed image quality also depends on many criterions. In this paper digital processed image hardware comparison, quality comparison and human perception and visual limitations are analyzed to find out common quality dependencies of processed image. The objective of this is to educate newcomer to basic and fundamental technique of different types of image processing and to find out common image quality dependencies. All basic algorithms of image processing will be discussed and quality of processed image output comparison will be shown to find out dependencies.

[3]Medical image enhancement is the processing of medical images to improve their appearance to human viewers, in terms to enhance their performance in subsequent computer-aided analysis and diagnosis or to have better contrast and visibility of features of interest. In this paper, the various low pass and high pass filters specifically high boost filter are applied on the hand x-ray image to improve their performance. All these techniques are mathematical techniques that are aimed at realizing improvement in the quality of a given image. The result of it is another image that demonstrates certain features in a manner that is better in some sense as compared to their appearance in the original image. Basic aim of this paper is to improve the image quality of the X-ray image. Different image quality measures have been applied to find the performance of the image enhancement.

[4] The main purpose of this paper consists of demonstrating advantages of using implicit filtering schemes (non causal IIR filters, in the signal processing language) for geometric modeling applications and some basic image processing. In particular, applications of implicit filtering for image filtering, estimating image derivatives, curve subdivision and deblurring Gaussian blur are considered.

[5] Edge detection aims to mark sharp intensity changes in an image and is a basis for a large number of machine vision applications and image analysis. Ant colony optimization is an evolutionary optimization algorithm which is inspired by food

 

searching behaviour of ant species. In this paper an edge detection algorithm which combines an ant colony optimization and fuzzy logic is presented. The heuristics information for movement of ants is decided by using fuzzy logic. Experimental results are provided here to demonstrate the superior performance of proposed method.

[6] Ant Colony Optimization (ACO) is a paradigm for

designing Meta heuristic algorithms for combinatorial optimization problems. The essential feature of ACO algorithms is the combination of a priori information about the structure of a promising solution with a posteriori information about the structure of previously

obtained good solutions. Meta heuristic algorithms are those which, in order to escape from local optima, drive some basic heuristic either a local search heuristic starting from a complete solution and iteratively modifying some of its elements in order to achieve a better one, or a constructive heuristic starting from a null solution and adding elements to build a good complete one. ACO is a class of algorithms, whose first member, called Ant System, was initially proposed by Dorigo, Colomi and Maniezzo. The functioning of an ACO algorithm can be summarized as a set of computational concurrent and asynchronous agents (a colony of ants) moves through states of the problem corresponding to partial solutions of the problem to solve. In this paper the implementation of ACO for 2-d images and its results is presented.

[7] In this paper, a novel method of hybrid filter for denoising digital images corrupted by mixed noise has been presented. The proposed design of hybrid filter utilizes the concept of neuro fuzzy network and spatial domain filtering. This method incorporates improved adaptive wiener filter and adaptive median filter to reduce white Gaussian noise and impulse noise respectively. On the basis of performance of the impulse noise detection process filters are selected. The edge detector is capable of extracting edges from filtered images which has been blurred due to different filtering actions. Optimization of neuro fuzzy network training with its internal parameters is collectively accomplished with different synthetic and natural images. Data accomplished from the edge detector, noise filter with the corrupted image together form the training data set. The most distinctive feature of the proposed operator over most other operators is that it offers excellent edge, line, detail, and texture preservation performance while, at the same time, it effectively removing noise from the input image.

## III. CONCLUSION

Edge detection is a very important area in the field of Computer Vision. Edge detection is a fundamental of low-level image processing and good edges are necessary for higher level processing. Image edge detection refers to the extraction of the edges in an image. Filtering is one of the most common applications of image processing. By filtering we mean the processing of the image in order to remove or reduce a particular unwanted component for example noise, or to enhance or extract a particular set of features, such as edges. This study has been devoted to various existing edge detection techniques like edge detection using ant colony optimization (ACO) and A hybrid approach to edge detection using ant colony optimization and fuzzy logic and the study also devoted to various filter techniques like improved adaptive wiener filter used to reduce white gaussian noise, Adaptive median filter used to reduce impulse noise, the, ideal low-pass filter suppresses noise and high-frequency information providing a smoothing effect to the image and High-pass filtering is used for image sharpening and extraction of high-frequency information such as edges.

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