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A Review on Image Restoration Using Median Filter, Wiener Filter with Edge Detector

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Abstract--- Digital image processing techniques now are used to solve a variety of problems. One such important problem in image processing is restoration. The goal of the restoration approach is to improve the given image so that it is suitable for further processing. Image restoration is an inverse problem stated as the recovery of an image from its probably degraded version. Digital image recovery entails a process which is meant to recover the original image data considering the degradation (noise in the acquisition, transmission problems, etc.) that this image has undergone. Numbers of filters have been used for de-noising digital images corrupted by mixed noise. Till now wiener filter and median filter have been used to reduce white Gaussian noise and impulse noise respectively. In the proposed work apply a Hybrid filter technology in image Restoration. Hybrid filter combines the advantages of median filter, wiener filter, edge detector and neuron fuzzy logic (neural network fuzzy logic). This filter is designed to remove both impulse noise (salt and pepper noise) and Gaussian noise. Thus, hybrid filter is able to reduce the mixed noise. Hybrid filter is also able to reduce the blurring effects in the image by using the edge detector.

Keyword-- Median Filter, Wiener Filter, Edge Detector, Image Restoration

INTRODUCTION

Images are the way of recording and presenting information visually. Pictures are important to us because they can be an extraordinarily effective medium for the storage and communication of information. A digital image is a two-dimensional array of these pixels. Each sample corresponds to a small, square area of the image, known as a pixel. In digital imaging, a pixel (or picture element) is the smallest item of information in an image. Pixels are normally arranged in a 2-dimensional grid, and are often represented using dots or squares. Each pixel is a sample of an original image, where more samples typically provide more-accurate representations of the original. The intensity of each pixel is variable; in color systems, each pixel has typically three or four components such as red, green, and blue, or cyan, magenta, yellow, and black.

Image processing is a general term for the wide range of techniques that exist for manipulating and modifying images in various ways. Image processing can be defined as technique which takes image (such as photographs of frames of video) as input; the output of image processing can be set of characteristics of parameters related to the image or image itself.

The main importance of digital image processing stems from two principal application areas:

- Improvement of pictorial information for human interpretation and
- Processing of scene data for autonomous machine perception. In Image processing, data from an image are digitized and various mathematical operations are applied to the data, in order to create an image that is more useful or pleasing to a human observer, or to perform some of the interpretation and recognition tasks.

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LITERATURE REVIEW

This gives a brief survey of previous work that is related to image restoration in general and Prevalent techniques which are used for cleaning of images(removing noise from the images)

Such as use of filters named Weiner filter, median filter etc. Also the related basic concepts have been discussed in brief. L. Alparone [1] said that **a** modification has been introduced into the sigma filter, aimed at improving the capability of both suppressing noise pulses, and locally preserving step edges, contours and thin lines, by fitting the basic local structures of the scene. Median operation is combined into sigma filter to enhance the polluted image. L. Khriji [2] developed a new filter which is edge preserving and is called as the MMH (Mean and Median Hybrid Filter. He says that this filter achieves all kind of noise removal and edge preservation.

Shaomin Peng and Lori Lucke [3] developed a hybrid filter that consists of a non linear filter and a fuzzy weighted linear filter to reduce the fixed noise. This hybrid filter can efficiently remove large amounts of mixed Gaussian and impulsive noise while preserving the image details. The performance and robust stability of the proposed filter are compared to linear filters and nonlinear filters theoretically and experimentally. A. Taguchi [4] proposed fuzzy filters in order to remove additive non-impulsive noise (e.g., **Gus**sian noise) while preserving signal details. He proposed a novel fuzzy filter for removing mixed noise (i.e., Gaussian noise and impulse noise are mixed). In order to remove mixed noise efficiently, he set fuzzy rules by using multiple difference values between arbitrary two pixels in window. J.H.Wang, W.J.Liu and L.D.lin [5] proposed histogram method, which is used as the input to fuzzy filter to remove the heavy tailed noise. A novel histogram-based fuzzy filter (HFF), which is capable of suppressing impulsive noise while preserving image details, has been presented. HFF performs noise suppression by exploiting the input image statistics.) Image. The initial parameters of a set of membership functions are derived from the estimated histogram, which is followed by applying a conservation principle to adjust the initial parameters to obtain a set of well-conditioned membership functions. Rui Li, Yu-Jin Zhang [6] designed a hybrid filter for mixed noise cancellation. The proposed approach combines the advantages of the improved adaptive Wiener filter and bilinear interpolation filter, which can efficiently reduce both the white Gaussian noise and impulse noise. To select the corresponding filters with respect to the noise types, a novel method for impulse noise detection is also designed. Experimental and comparison results show that the proposed approach is particularly effective in removing the mixed Gaussian and impulse noises even with the severe contamination.

IMAGE RESTORATION

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

Applications of Image Restoration

- The initial application of digital image restoration within the engineering community was within the space of astronomical imaging. The astronomical imaging degradation downside is usually characterized by Poisson noise, mathematician noise etc.
- Restoration has been used for mammograms, filtering of Poisson distributed film-grain noise in chest X-rays and digital angiographic pictures, and for the removal of additive noise in resonance Imaging. Another necessary application of restoration technique is to revive aging and deteriorated films. The film restoration is usually linked to digital techniques area unit wont to eliminate scratches and dirt from previous movies and conjointly to color black and white films.
- The increasing space of application for digital image restoration is that within the field of image and video writing. As techniques area unit developed to enhance writing potency, and cut back the bit rates of coded pictures abundant has been accomplished to develop ways in which of restoring coded pictures as a post-processing step to be performed once decompression.
- Digital image recovery has conjointly been wont to restore blurred X-ray pictures of craft wings to enhance aeronautic federal management procedures. It's for the recovery of the motion evoked within the gift frame or composite effects, and is mostly used, restoring TV pictures blurred uniformly.

NOISE

Noise is any undesired information that contaminates an image.The term noise in digital images refers to any pixel value

of an image which does not match the reality quite exactly. The noise present in the images may significantly decrease the accuracy of the operations such as feature extraction and object recognition.

Image noise is the random variation of brightness or color information in images produced by the sensor and circuitry of a scanner or digital camera. Digital noise in images with digital cameras is random pixels scattered all over the photo. It is a similar effect as “grain" in film photography and it degrades the photo quality. The noise term is important because in practical imaging situations, additive noise is not negligible.

TYPES OF NOISES

Impulse noise

Impulse noise is also known as salt and pepper noise. Impulse noise is typically caused by malfunctioning of the pixel elements in the camera sensors, faulty memory locations, or timing errors in the digitization process. For the images corrupted by impulse noise, the noisy pixels can take only the maximum and the minimum values in the dynamic range.An image containing salt-and-pepper noise will have dark pixels in bright regions and bright pixels in dark regions.

Gaussian noise

The dominant noise in the lighter parts of an image from an image sensor is typically that caused by statistical quantum fluctuations, that is, variation in the number of photons sensed at a given exposure level; this noise is known as photon shot noise. Gaussian noise has a root-mean-square value proportional to the square root of the image intensity, and the noises at different pixels are independent of one another.

Electronic noise

It results from thermal motion of electrons in the electronic components of the imaging system.

Photoelectric noise

It is due to statistical nature of light and photoelectric conversion process in the imaging sensor.

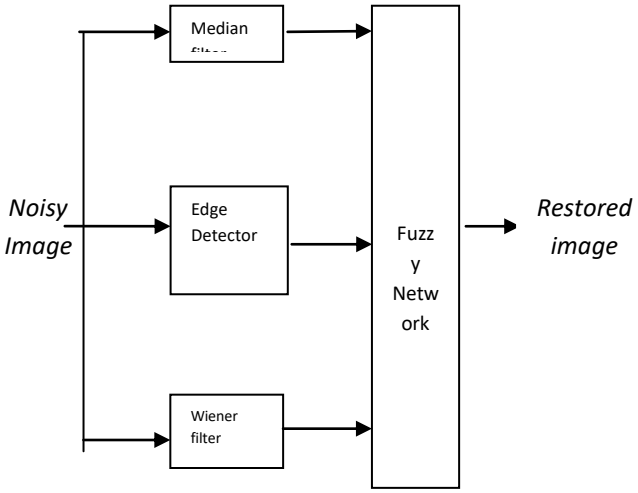
Film grain noise

It is due to randomness of silver halide grains in the film used for recording.

Thermal noise

An additional, stochastic source of electrons in a CCD well is thermal energy. Electrons can be freed from the CCD material itself through thermal vibration and then, trapped in the CCD well, be indistinguishable from "true" photoelectrons. By cooling the CCD chip it is possible to reduce significantly the number of "thermal electrons" that give rise to thermal noise or *dark current*. As the integration time *T* increases, the number of thermal electrons increases. The probability distribution of thermal electrons is also a Poisson process where the rate parameter is an increasing function of temperature. While this does reduce the dark current *average*, it does not reduce the dark current *standard deviation* and it also reduces the possible dynamic range of the signal.

METHODOLOGY



MEDIAN FILTER

Median filter and modifications of it belong to wide class of filters based on classification of chosen samples collection. Let us remember that measurement. 3-step error filtering process includes: 1. Collection of N values of measured variable. 2. Truncation of maximal and minimal values, i.e. anomalous errors filtering. 3. Calculation of arithmetic average of rest N-2 values, i.e. filtering of errors with Gaussian probability density function (noise temperature and other environmental influences and inaccuracies). Intuitive error filtering approach consists of two sequentially connected filters. First one represents median filter, the second linear FIR filter is based on principle of moving average with samples decimation. Median filter is often used in case of rare impulse errors suppression superposed on useful signal. The filter is very often used in applications of video correction [1]. Low-pass filters are not applicable because of picture edges blurring.

WIENER FILTER

It removes the additive noise and inverts the blurring simultaneously. The **Wiener filtering** is optimal in terms of the

mean square error. In other words, it minimizes the overall mean square error in the **process** of inverse **filtering** and noise smoothing. The **Wiener filtering** is a linear estimation of the original **image**.

EDGE DETECTION TECHNIQUES

Edge detection techniques are grouped into two categories: o Gradient o Palladian First-order derivatives in an image are computed using the gradient. Second-order derivatives are obtained using the Laplacian Edge Detection using function edge The basic idea behind edge detection is to find places in an image where the intensity changes rapidly, using one of two general criteria:[7] 1. Find places where the first derivative of the intensity is greater in magnitude than a specified threshold. 2. Find places where the second derivative of the intensity has a zero crossing. The general syntax for edge function is:

[g, t] = edge(f, 'Log' , T, sigma)

Where f is the input image, method is one of edge detection technique and parameters are additional parameters.

CONCLUSIONS

My proposed work is design of Hybrid Filter. Hybrid Filter is shown in above diagram. Hybrid filter combines the advantages of median filter, wiener filter, edge detector and neuron fuzzy logic (neural network fuzzy logic). This filter is designed to remove both impulse noise (salt and pepper noise) and Gaussian noise. Thus, hybrid filter is able to reduce the mixed noise. Hybrid filter is also able to reduce the blurring effects in the image by using the edge detector. Hybrid filter provide better quality of image as compared to the single filter. Because we combine the quality of several filter and edge detector into a single hybrid filter.

Hybrid filter is composed of four modules: wiener filter, median filter, edge detector and fuzzy network. Wiener filter and median filter is selected to remove the respective Gaussian noise and impulse noise. Edge detector is selected to extract the edges of the images so that the blurring effect is reduced.

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