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An Approach of various Techniques used in Image Filtering

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ABSTRACT:

The present paper introduces a novel approach for denoising the images corrupted by impulsive noise (IN) by using a new nonlinear IN suppression filter, entitled k-nearest neighbourhood pixels-based Adaptive-Fuzzy Filter (k-AFF). The proposed filter is based on statistical impulse detection and nonlinear filtering which uses Adaptive-Network-Based Fuzzy Inference System (ANFIS) as a missed data interpolant over the k-nearest neighbour pixels of the corrupted pixels. The impulse de- tection is realized by using the well-known Kolmogorov–Smirnov-based goodness-of-fit test, which yields a decision about the impulsivity of each pixel. To demonstrate the capability of k-AFF, extensive simulations were realized revealing that the proposed filter achieves a better performance than the other filters mentioned in this paper in the cases of being effective in noise suppression and detail preservation, even when the images are highly corrupted by impulsive noise (IN)

Keywords— Adaptive fuzzy filter (K-AFF) Denoising, impulsive noise (IN), impulse detection, nonlinear.

I. INTRODUCTION:

Images are often degraded by impulsive noise (IN) because of the errors caused by noisy sensors or transmission channels, thus suppression of IN is one of the most impor- tant issues in image and video restoration systems. In image denoising, a compromise has to be achieved between noise reduction and preserving significant image details. [1]. There are two types of impulse noise salt and pepper noise and random valued noise. Salt and pepper noise can corrupt the images where the corrupted pixels take either maximum or minimum gray level. Salt and pepper noise can corrupt the images where the corrupted pixels takes either maximum or minimum gray level .Several nonlinear filters have been proposed for restoration of images contaminated by salt and pepper noise. Md [2]. When an image is acquired by a camera or other imaging system, often the vision system for which it is intended is unable to use it directly [3]. The image may be corrupted by random variations in intensity, variations in illumination, or poor contrast that must be dealt with in the early stages of vision processing [4]. A class of widely used nonlinear digital filter are median filters. The main drawback of a standard median filter (SMF) is that it is effective only for low noise [5]. In Decision Based Algorithm (DBA) or switching median filter the decision is based on a threshold value. The major drawback of this method is that defining threshold is difficult [6].The main drawback can be removed by Decision Based Unsymmetrical Trimmed Median Filter is proposed [7]. At high noise densities if the selected window contain all the 0's or 255's or both, then trimmed median value cannot be obtained. Recently a Modified Decision based Unsymmetrical Trimmed Median Filter (MDBUTMF) [8] has been proposed which performs well at low and high noise densities.

The rest of the paper is organized as follows .The proposed algorithm is described in section II. Section III gives the idea of value distribution in image. Section IV illustrates the filtering techniques. V.gives the brief description of image enhancement.VI. Is the conclusion of this paper.

II. PROPOSED ALGORITHM:

The proposed Decision Based Partial Trimmed Global Mean Filter (DBPTGMF) algorithm starts with the detection of impulse noise in an image. The processing pixel is checked whether it is noisy or noise free. That is if the processing pixel lies between maximum and minimum gray level values then it is noise free pixel, it is left unchanged. If the processing pixel is either maximum (i.e. 340) or minimum (i.e. 0) value gray level then the processing pixel is noisy.

Step 1: Select 2-D window of size 3×3. The processed pixel is assumed as P ij.

Step 2: The pixel P ij is a non noisy pixel if $0 < P_{ij} < 340$.

Step 3: If $P_{ij} = 0$ or $P_{ij} = 340$ then P_{ij} is a corrupted pixel then four cases are possible as given case

Case1): If the selected window contains all the elements as only 0.Then replace the processing pixel P_{ij} with the salt noise (i.e. value 340) trimmed global mean value of the image.

Case2): If the selected window contains all the elements as only 340.Then replace the processing pixel P_{ij} with the pepper noise (i.e. value 0) trimmed global mean value of the image.

Case3): If the selected window contains all the elements as 0's and 340's both .Then replace the processing pixel P_{ij} with the salt and pepper noise (i.e. both value 0 and 340) trimmed global mean value of the image.

Case4): If the selected window contains not all the elements as 0's and 340's .Then eliminate 340's and 0's and find the median value of the remaining elements. Now replace the P_{ij} with the median value.

Step 4): Steps 1 to 3 are repeated until the processing is completed for the entire image.

Where the central pixel is processing pixel i.e. noisy. So if one take median value it will be 0 which is again noise and if one take mean value which is also noise at $P_{ij} = 0$.To overcome such a problem the processing pixel is replaced by the salt noise trimmed global mean value.

III. EXTREME VALUE DISTRIBUTION IN IMAGE:

Extreme value distribution (EVD) [8] is often used to model the smallest or largest value among a large set of independent, identically dis- tributed random values representing measurements or ob- servations. EVD, which is also known as the Fisher–Tippett distribution or Log-Weibull distribution, is the distribution of the extreme order statistic X (i.e., the maximum) for a distribution of Xg whose element number is N. The value of N is 64 for a 256×256 pixels sized image because the number of 32×32 pixels sized unoverlapping subimages is only 64 and Xg denotes number of the pixels possessing the gray value g.

A. Kolmogorov Smirnov-based goodness-of-fit test

KST works by comparing an empirical distribution func- tion with the distribution of the hypothesized function. This test does not require grouping data, and it is valid for any sample size n when all parameters are known. The KST value, Dn, is defined as

Dn =sup[|Fn(x)− Fx)|]

where sup denotes the supremum function in discrete math- ematics and n= total number of data points. Hence, ˆF() denotes the fitted cumulative distribution function and is defined as

Fn()= Nx n

Nx= the number of Xg's less than x

B. Adaptive-Network-Based Fuzzy Inference System

An Adaptive network based fuzzy interference system(ANFIS), is a fuzzy inference system implemented in the framework of adaptive networks [9]. An adaptive artificial-network is a superset of all kinds of feed-forward neural networks with supervised learning capability. ANFIS serves as a basis for constructing a set of fuzzy if–then–else rules with appropriate membership functions to generate the stipulated input output pairs. ANFIS is the well- known neuro-fuzzy system, which mimics the operation of a Takagi–Sugeno–Kang (TSK) fuzzy system [10]. The AN- FIS network is a 5-layered network, in which the layers are not fully connected. The transfer function of a neuron is determined according to the layer where the neuron is in. Each input of the ANFIS structures has two different tri- angular membership functions and the rule base contains a total of 4(22) rules, which are as follows:

• Rule 1: ifx is A1 and y is B1, then f11=p11x+q11y+r11

• Rule 2: ifx is A1 and y is B2, then f12=p12x+q12y+r12

• Rule 3: ifx is A2 and y is B1, then f21=p21x+q21y+r21

• Rule 4: ifx is A2 and y is B2, then f22=p22x+q22y+r22

IV. FILTERING TECHNIQUES:

A. Inverse and wiener filtering :

It is the process of recovering the output of a system from its output. For example, in the absence of noise the inverse filter would be a system that recovers u (m, n) from the observation v (m, n).that means,

h(m,n;k,l)=h(m,n;k,l)

Inverse filters are useful for precorrecting an input signal in anticipation of the degradation caused by the system, such as correcting the nonlinearity of a display. [9]

B. Pseudo inverse Filter

Ihe pseudo inverse filter is a stabilized version of the inverse filter. For a linear shift invariant system with frequency response the pseudoinversefilter is also known as generalized inverse.

Fig 1 Image Filtering [10]

V. IMAGE ENHANCEMENT:

A. Histogram Modification

Many images contain unevenly distributed gray values. It is common to find images in which all intensity values lie within a small range, such as the image with poor contrast shown in Figure 4.1. Histogram equalization is a method for stretching the contrast of such images by uniformly redistributing the gray values. This step may make threshold selection approaches more effective. In general, histogram modification enhances the subjective quality of an image and is useful when the image is intended for viewing by a human observer. A simple example of histogram modification is image scaling: the pixels in the range [a, b] are expanded to fill the range $[Z_b, Z_K]$.

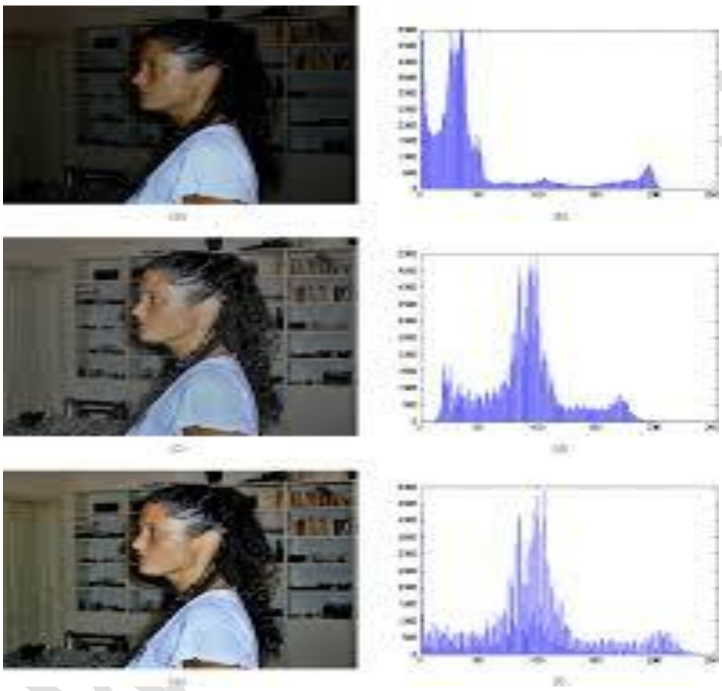

Fig 2 Histogram modification [11]

B. Histogram Modelling

The histogram of an image represents the relative frequency of occurrence of the various gray levels in the image. Histogram modelling techniques modify an image so that its histogram has a desired shape. This is useful in stretching the low-contrast levels of images with narrow histograms. Histogram modelling has been found to be a powerful technique for image enhancement.

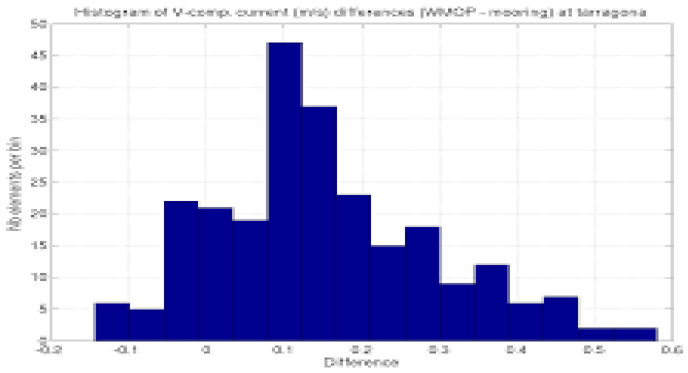

Fig 3 Graph showing histogram modelling [12]

VI. CONCLUSION:

In this paper, various techniques of image filter are discussed. The proposed algorithm can be a good compromise for salt and pepper noise removal in images having high noise densities.

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