Review: Salt And Pepper Noise and Denoising Methods

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Abstract: In modern era where data transmission is done within fraction of seconds with accuracy and clarity, resulting in image enhancement Process if needed. In image processing image enhancement plays an important role in computer vision and according to research topic.
 Image processing mainly concern with image pre-processing or post-processing ,to make the processed image clear for subsequent image analysis and understanding. Here some main methods of image denoising are presented.

Index Terms - **image processing, noise, denoising image** .

I. INTRODUCTION

Definition of Image:

An image is defined as a function of x,y (F(x,y)), in two dimensional ,where x and y are spatial coordinates, and F is the amplitude at any pair of coordinates (x,y) is known as the intensity of the image at that point. For digital image the value of x,y, and amplitude F are finite. We can define an image as a two-dimensional array arranged in rows and columns.
Digital Image is formed by a finite number of elements, where each elements have a particular value at a specific location. These elements of digital image are referred as picture elements, image elements, and pixels. A Pixel is most widely used to represent the elements of a Digital Image.

II. TYPES OF AN IMAGE

BINARY IMAGE–As its name suggests, this image contains only two pixel elements i.e 0 & 1.0 stands for black and 1 stands for white. This type of image is also known as Monochrome.

8 bit COLOR FORMAT– This image format is the most famous ,image format. It is having 28 i.e. 256, different shades of colours .Generally known as Grayscale Image. In this colour format, 0 is for Black, and 255 is for white, and 127 is for gray.

16 bit COLOR FORMAT– This is a colour image format. It has 216 i.e. 65,536 different colours in it, also known as High Colour Format. The distribution of colour is not as same as Grayscale image in this format .
A 16 bit format is actually divided into three further formats which are Red, Green and Blue, which is RGB format.

III.PHASES OF IMAGE PROCESSING[1]:

1.**ACQUISITION**– It is simple image which is in digital form. This work involves:
  a) Scaling
  b) Colour conversion(RGB to Gray or vice-versa)

2.**IMAGE ENHANCEMENT**– It is the process of manipulating a stored image digitally using software. Its main purpose is to increase the interpretability or perception of the information in images for human viewers, or to give good input for other image processing techniques.

3.**IMAGE RESTORATION**– It deals with appealing of an image but restoration is based on mathematical or probabilistic model or image degradation.

4.**COLOR IMAGE PROCESSING**– It deals with pseudo-colour and full colour image processing colour models are applicable to digital image processing.

5. **MULTI-RESOLUTION PROCESSING**– Multi resolution analysis is a new concept that provides information in time as well as frequency simultaneously.

6.**IMAGE COMPRESSION-** Image compression is a type of data compression .In this digital images are compressed , to reduce the cost for storage and transmission.

7.**MORPHOLOGICAL PROCESSING**-Morphology is process in image processing , for the analysis and processing of image and its geometrical structures which is based on set theory, lattice theory, topology, and random functions.

8.**SEGMENTATION PROCEDURE**- It is the process of partitioning a digital image into multiple segments i.e. sets of pixels, also known as image objects. It is mainly used to locate objects and its boundaries.

9.**REPRESENTATION AND DESCRIPTION**- After the process of segmentation an image is segmented into regions , resulting in aggregate of segmented pixels and described for further computer processing.

• Representing region involves two choices:
Its external characteristics (boundary)
Its internal characteristics (pixels comprising the region)

10.**OBJECT DETECTION AND RECOGNITION**-It is image processing technology that deals with detecting of semantic objects of a certain class (such as humans, buildings, or cars) in digital images and videos.

IV. Noise model

The main source of image distortion is noise. There are different sources which introduces the noise in the image, and these noises come from various ways such as image acquisition, transmission, and compression. It is very difficult to remove noise from the digital images without using of filtering techniques. As there are different sources of noise so there are different types of noise are also there, such as salt and pepper noise, Gaussian noise, etc. Different processing algorithms are there for different noises. The filters can be selected by analysis of the noise behaviour so that a complete and quantitative analysis of noise can be done.

4.1Noise in images:

Image noise is random variation of brightness or colour information in the images captured. It is degradation of an image signal , by external sources. Digital images which contains, multiplicative noise shows the characteristic, that the brighter the area the noisier it. But mostly it is additive.

4.2 Types of Image noise:

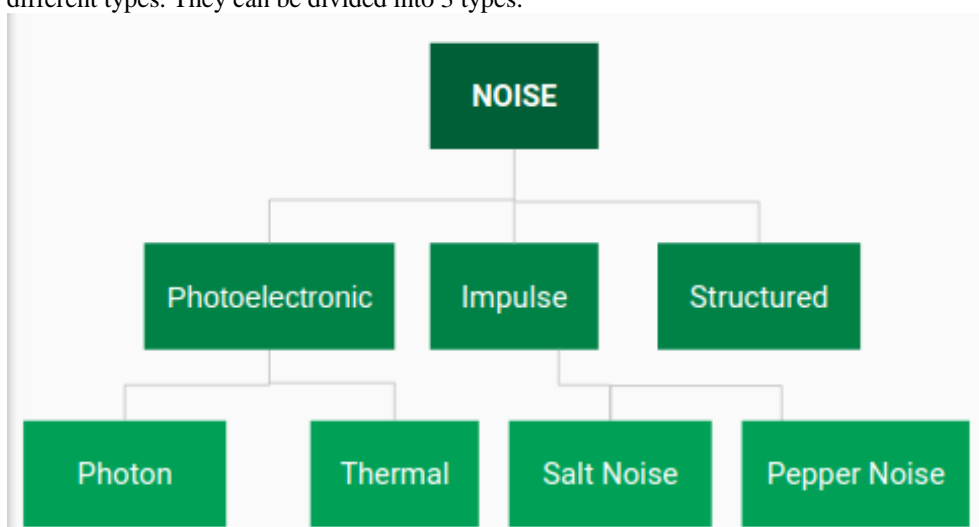Image noise are of different types. They can be divided into 3 types.

Fig.1 classification of noise

Further Impulse noise can be classified as Photoelectronic, Impulse and Structured.
Our main concern is with Impulse noise.

4.3 Impulse noise[2]

It shows the random occurrences of energy spikes or irregular pulses of short duration. Impulse noise can be caused by voltage spikes in equipment, voltage changes in adjacent pairs in a copper cable and tones generated for electrical signalling.

4.3.1 Types of Impulse Noise:

There are three types of impulse noises. Salt Noise, Pepper Noise, Salt and Pepper Noise.

(a)Salt Noise: It is a addition of random bright (with 255 pixel value) all over the image.

(b)Pepper Noise: It is a addition of random dark (with 0 pixel value) all over the image.

(c) Salt and Pepper Noise: Salt and Pepper noise is result of addition of both random bright (with 255 pixel value) and random dark (with 0 pixel value) all over the image. This is also known as data drop noise as statistically it drop the original data values [5].

V Salt and Pepper Noise

Salt and pepper noise is also known as data drop noise because its drop the original data values. In this the image is not fully corrupted by salt and pepper noise instead of some pixel values are changed in the image. Although in noisy image, there is a possibilities of some neighbours does not changed. This noise is seen in data transmission. In salt and pepper noise image pixel values are replaced by corrupted pixel values . These values may be either maximum 'or' minimum pixel value i.e., 255 'or' 0 respectively, if number of bits are 8 for transmission.

Let us consider 3x3 image matrices which are shown in the Fig. 2.
Let assume the central value of matrices is corrupted by Pepper noise. Therefore, this central value i.e., 219 is given in Fig. 3 is replaced by value zero. Here we can say that, this noise is inserted dead pixels either dark or bright. So in a salt and pepper noise, progressively dark pixel values are present in bright region and vice versa .

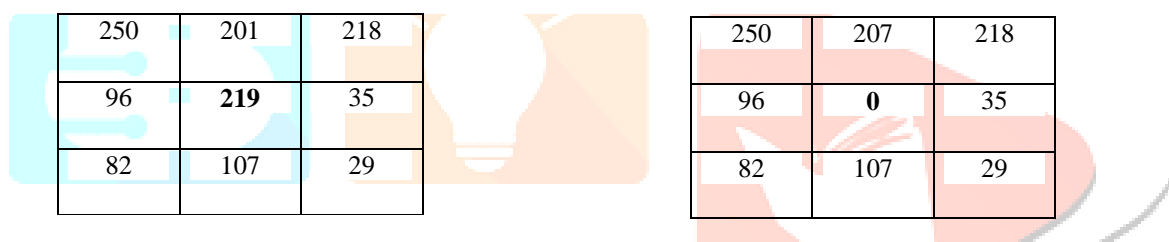| 250	201	218		250	207	218
96	**219**	35		96	**0**	35
82	107	29		82	107	29

Fig. 2 The central pixel value is corrupted by Pepper noise

Inserted dead pixel in the image is due to error in analogy to digital conversion and errors in bit transmission. The percentagewise estimation of noisy pixels, directly determine from pixel metrics.

VI. Image Denoising

It is a process to reserve the details of an image while removing the random noise from the image as far as possible.
We classify the image denoising filters into 2 broad categories –

1) **Traditional Filters** - Filters which are traditionally used to remove noise from images.
   These filters are further divided into Spatial domain filters and Transform domain filters.

2) **Fuzzy based Filters** - Filters which include the concept of fuzzy logic in their filtering procedure.
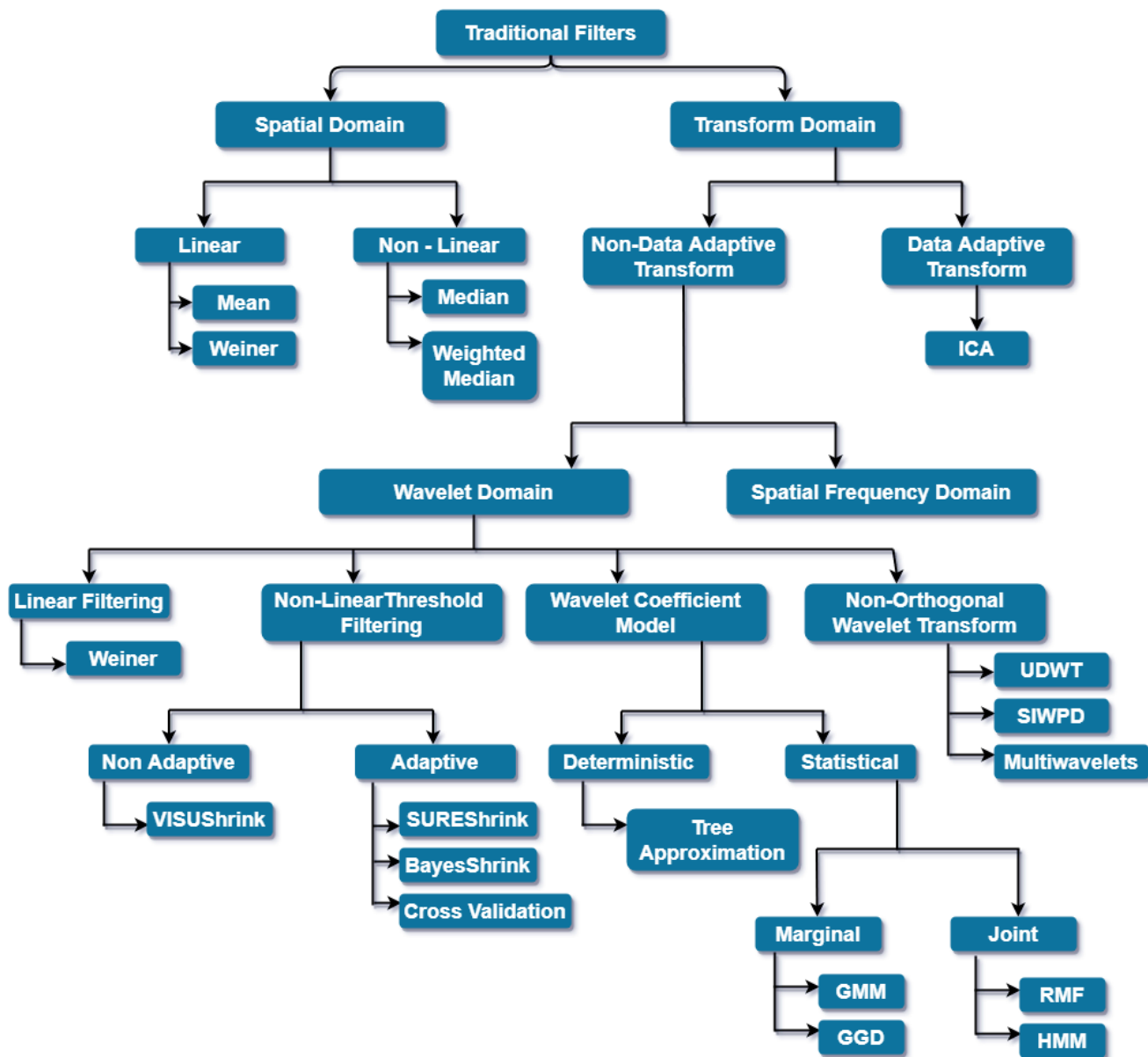
VII. CONCLUSIONS

In image acquisition and transmission, noise is seen in the images and can be characterised by noise model. Hence the study of noise model is very important in image processing. To receive the correct image or we can say noise free image , Image denoising is necessary process in image processing operation. Without knowing of noise present in the image we cannot perform denoising actions. Hence, here we have reviewed and presented various noise available in digital images.

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