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IMAGE ENHANCEMENT USING DIFFERENT ORDER STATISTIC METHODS

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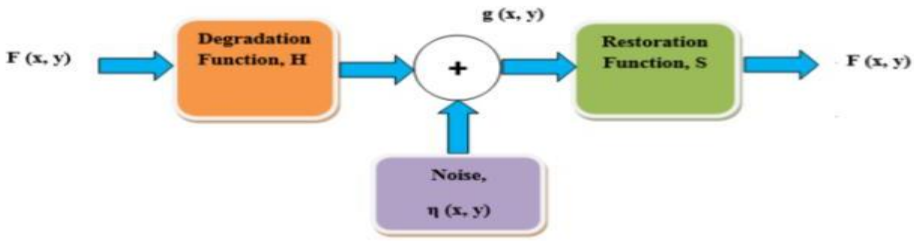
ABSTRACT

Image restoration is the act of restoring an image to its original state by removing noise and blur. Images are frequently ruined by random noise. During the image capture, coding, transmission, and processing phases, noise is always present in digital images. Without previous understanding of filtering techniques, it is extremely difficult to eliminate noise from digital photographs. The noise behavior may be used to choose these filters. The type of data and the filter's behavior influence the filter's selection. Image filters can be used to minimize image noise and improve image edges. The focus of this research study is on several order statistic approaches for recovering the image from noise. Order static filters are nonlinear spatial processes that respond to the order of pixels in the image region covered by the filter. Several order statistic approaches are used in this work, and the results are examined**.**

Keywords: Noise, Restoration, Image, Order statistic filter

1. INTRODUCTION

The amplitude of F at any pair of coordinates (x, y) is termed the intensity or grey level of the picture at that position. Imaging equipment that span nearly the whole spectrum of the electromagnetic spectrum creates digital images. Ultrasound, electron microscopy, and computer-generated pictures all fall within the category of digital images. Processes that distinguish individual objects based on extracted attributes from pictures are included in digital image processing. This processing approach was primarily focused on two goals. They improve pictorial information for human interpretation and picture data processing for storage, transmission, and representation for autonomous machine perception. Random noises frequently damage images. It can happen during picture acquisition, transmission, or processing, and it may or may not be related to image content.



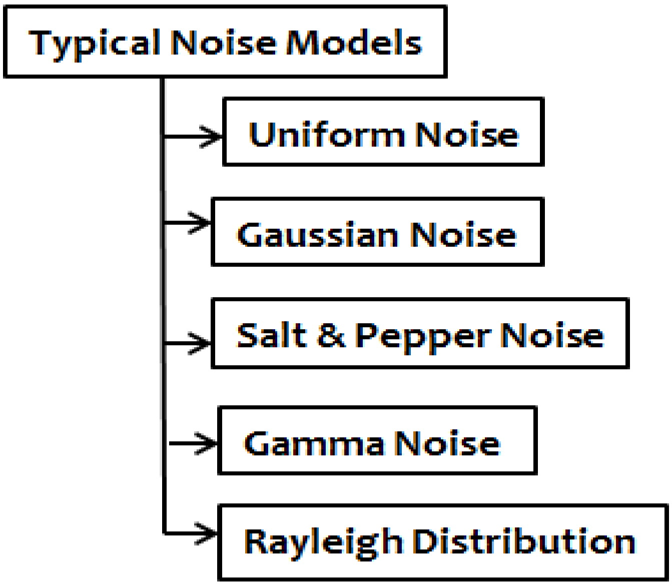
The removal of noise from a picture is one of the most important tasks in image processing. This research article focuses on investigating picture noises and analysing existing filtering approaches, which lays the groundwork for developing new algorithms for eliminating image noise..

2. METHODOLOGY

2.1 Noise in the Image

The probabilistic features of noise are commonly used to characterize it. White noise, for example, has a constant process spectrum (its intensity does not decrease with increasing frequency). In most applications, it's used to provide a rough approximation of picture noise. It has the advantage of making computations easier. During the picture capture, coding, transmission, and processing phases, noise is always present in digital images. Without prior understanding of filtering techniques, removing noise from digital photos is extremely difficult. A basic introduction of several noise filtering techniques is provided in this article. These filters can be chosen based on noise behavior study. Image data filtering is a common procedure in practically all image processing systems. This is accomplished through the use of filters. They reduce picture noise by keeping the image's features. The filter to use is determined by the filter's behavior and the kind of data.

Picture filters can be used to minimize image noise and improve the image's edges. Picture filtering is the process of adjusting the colors of pixels in an image to change its look. Applying filters to photographs can result in increased contrast and a range of interesting effects. Noise is defined as a sudden shift in the pixel values of a picture.



2.2 Analyzing Noises

We examined here the noises are Gaussian noise or normal noise and Salt and Pepper noise or Impulse noise by order statistic filtering for which filtering methods are absolutely best for these two noises.

The PDF of a Gaussian random variable, z, is defined by the following familiar expression

$$p(z) = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{(z-\bar{z})^2}{2\sigma^2}} \qquad -\infty < z < \infty$$

The PDF of salt-and-pepper noise is given by

$$p(z) = \begin{cases} P_s & \text{for } z = 2^k - 1 \\ P_p & \text{for } z = 0 \\ 1-(P_s+P_p) & \text{for } z = V \end{cases}$$

2.3 Order Statistics Filtering

Order statistic filters are non-linear spatial filters that respond by ordering (ranking) the pixels in the picture region covered by the filter and then substituting the value in the centre pixel with the value determined by the ranking result.

The best-known example is the median filter. It is particularly effective in the presence of impulse or salt and pepper noise, with considerably less blurring than linear smoothing filters.

3. MODELING AND ANALYSIS

3.1 Types of Order Statistics Filtering Methods

Median filtering, Max and Min filtering, Midpoint filtering, and Alpha-trimmed mean filtering are examples of order statistics filters.

Median filter : The median of the pixel values in the pixel's surroundings is used to replace the pixel's values.

f (x, y) = median{g (s t) }

Max & Min Filtering: The following equation is used to obtain maximum filtering.

f (x, y) = max g(s, t)

The following equation is used to accomplish min filtering.

f (x, y) = min g(s, t)

Mid-point filtering: The midpoint between the highest and least pixels in a neighbourhood is used to replace the value of a pixel.

f (x, y) = ½ [max{g(s, t)} + min{g(s, t)}]

Alpha-trimmed mean filtering: The remaining mn-d pixels are represented by gr(s, t). The leftover pixels are averaged to create a filter.

f (x, y) = 1/mn-d £ gr(s, t)

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Advantages of Order Statistic Methods :

i. The advantages of median filtering are

• It works well for diverse noise types, with less blurring than linear filters of similar size

• Odd sized neighbourhoods and efficient sorts give a computationally cheap implementation

• It is the most often used order-statistic filter

ii. The advantages of Max and Min filtering are

• Max filters are useful for locating the brightest points in an image and for reducing pepper noise (i.e. dark pixel values)

iii. The advantage of Mid-point filtering is

• Mid-Point filters are excellent for reducing noise that is randomly distributed, such as Gaussian noise.

4. RESULTS AND DISCUSSION

Figure 1: Processing of reducing Gaussian noise using Midpoint Filter

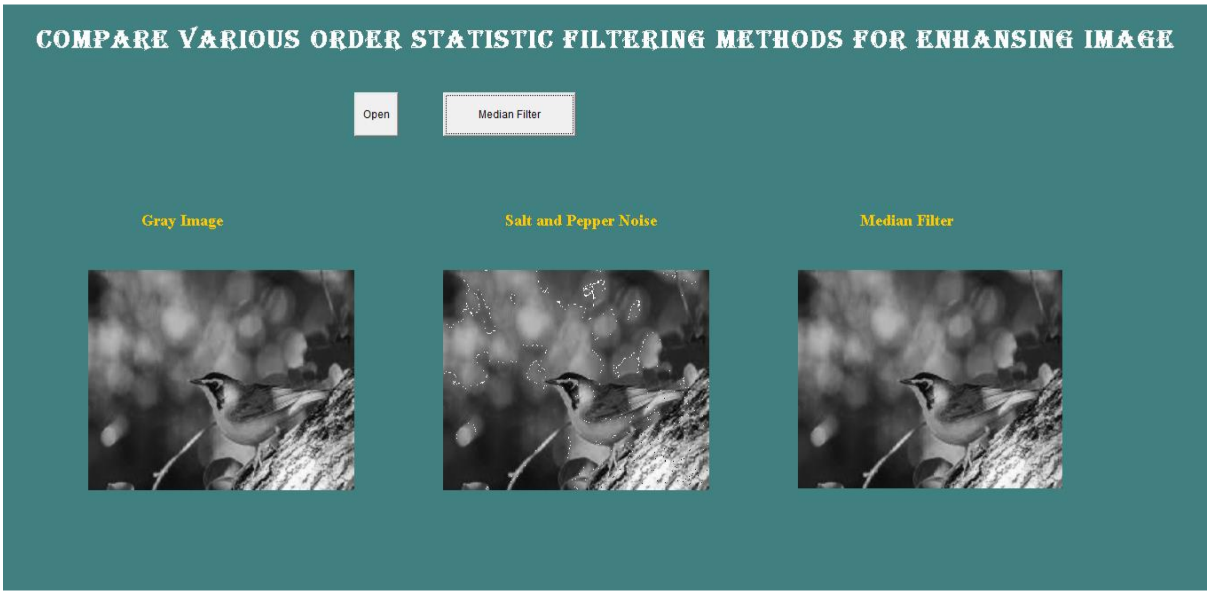

Figure 2: Processing of reducing salt and pepper noise using Median Filter

Figure.1 represents Gaussian noise(also called normal). Gaussian noise arises in an image due to factors such as electronic circuit noise and sensor noise caused by poor illumination and/or high temperature. Midpoint Filter most probably used to reduce Gaussian noise.

Figure.2 represents Salt and Pepper noise(also called impulse noise). Salt and Pepper noise is found in situations where quick transients, such as faulty switching, take place during imaging. Median Filter most probably used to reduce Salt and Pepper noise.

5. CONCLUSION

We covered order statistic filtering approaches for reducing noise from images in the article. We also reported and arranged the outcomes of various filtering procedures. The image is supplied as the input, and if it is a colour image, it is converted to grey scale to save time. The comparison of filtering approaches can bring this study to a close.

• For reducing Gaussian and impulsive noise, the median filter is the optimum restoration approach.

• The best Restoration approach for eliminating salt and pepper noise is to use the Max and Min filters. Only salt noise is removed by Max, while only pepper noise is removed by Min.

• Gaussian and uniform noise can be removed using a midpoint filter.

6. REFERENCES

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