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Image Compression using Gaussian Smoothing Filter and Median Filter

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***Abstract*—** Now a day's we are facing a lots of problem regarding data storage. We have very large amount of data with high resolution quality and it is increasing day by day. Data compression is playing a vital role in modern world, because data compression is a technique by which we can store large amount of data in a limited storage device. Data compression can be used in mass communication, online data storing and real time data storing. This paper is based on data compression using efficient data compression algorithm. In this paper we use Gaussian filter as sharping tool and median filter as compression tool.

Keywords- *Gaussian smoothing filter , median filter, mean filter, JPGE compression, images compression.*

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I. INTRODUCTION

Today we are living in digital world. Digital world's means modern and technical world. Everyone is trying to connect in digital world. By which we are facing the busy server problem, because the incoming data is more than the capacity of storage data. And today we are moving from hard copy to soft copy storage technique because is easy to manage and store for long time purpose. But some time if hard disk get breakdown or corrupt due to storage capacity problem then all data gets abolish. So it is very big problem to solve and manage the data.

The main purpose of this paper is to manage the problem of data storage. It can be only solve by data compression technique. There are two techniques to data compression, one is lossless technique and second is lossy technique. In lossless technique no information is lost but in another hand in lossy compression technique, we search marginally important information and delete it. We used Gaussian filter and median filter in cascade form. As we know that Gaussian smoothing filter is a very classical and linear filter. Gaussian filter can be used as blurring the image and sharping the image both. Median filter is based on lossy compression technique and it's perform better in all field like edges preserving, spiky noise etc.

II. THEORY

A. Role of Filters

Filter is a technique for modifying or improve the image quality just like sharpness and brightness. For example we can filter an image to emphasize desire features or remove undesired features. Image processing operation implement with filtering include smoothing, sharpening,, compression and edge enhancement. The same idea is applied in image processing area to remove the unwanted feature. Digital filter plays a major role in image processing. It mainly used to suppress either the high frequencies in the image smoothing the image or the low frequencies enhancing or detecting edges in the image. The first involves transforming the image in to the frequency domain multiplying with filter function and retransform the result in to the new domain. The filter function is shaped so as to loss some frequencies and enhance other. In this we have used the concept of convolution or correlation. This technique is applying the filter mask to the image. Hence the new image filtered matrix coefficients.

B. Image Smoothing

Smoothing method has a tuning parameter which is used to control the extent of smoothing. The aim of smoothing is leaving out noise or other rapid phenomena. In smoothing the data point of image are modifying. So individual points because of noise are reduced and points that are lower than the adjacent points are increased leading to a smooth image. Smoothing would be used in two important causes that can aid in data analysis. First one by being able to extracts more information from the signal. And second one by being able to provide analyses that are both flexible and robust be used different algorithm.

C. Sharpening Filters

Image sharpening is a powerful tool emphasis shape and drawing viewer focus. The visual quality of an image can be extremely poor if the high frequencies are attenuated or completed removed. In contrast increasing the high frequency components of an image leads to an improvement in the visual quality. Image sharpening refers to any enhancing technique that highlights edges and fine details in an image. The mandatory requirement of effective

sharpening process lies in the choice of the high –pass filtering operation .basically, linear filter have been used to implement the high pass filter.

III. IMAGE COMPRESSION USING MEDIAN FILTER

The median filter is used to decrease noise in image. It is able to reduce some kind of noise on an image or signal. The median filter is a non linear filter. Here we used digital filter technique to remove noise signal. Such noise reduction is a pre processing step to enhance the result of later signal. It preserves edge while removing noise.

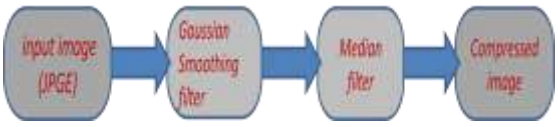


fig.1. block diagram of image filtering

In this fig .1 we have discussed about two filter, Gaussian and median filter. Both filters are connected in cascade form, that mean output of one filter work as the input of other filter as shown in figure.

Step.1

In step 1, we take a JPGE image and pass through the efficient Gaussian filter Which is design in MATLAB.

When we have pass input image through the Gaussian filter , after that Gaussian filter gives three output images, first output image is motion blurred image, second output image is blurred image and third output image is sharpened image. The main objective of use Gaussian filter is to obtain highlight the edge of image and fine details in an image.

Step.2

In step 2, we take the sharpened image and pass through the median filter, because as all we know that median filter gives excellent suitability for edge preserved, spiky noise and random noise. When we pass sharpened image through the median filter we find that the compression ratio of image has been decreased. Therefore, it would be a good image compression tool.

Dotted image	Filtered image

fig .2,

1. Advantages

The median filter has some advantages over the mean filter.

- The median filter is more robust average than the mean filter and so a single very unrepresentative pixel in a neighborhood will not affect the median value significantly.

- The median filter value must actually be the value of one of the pixels in the neighborhood, the median filter does not create new unrealistic pixel values when the filter straddles an edge.

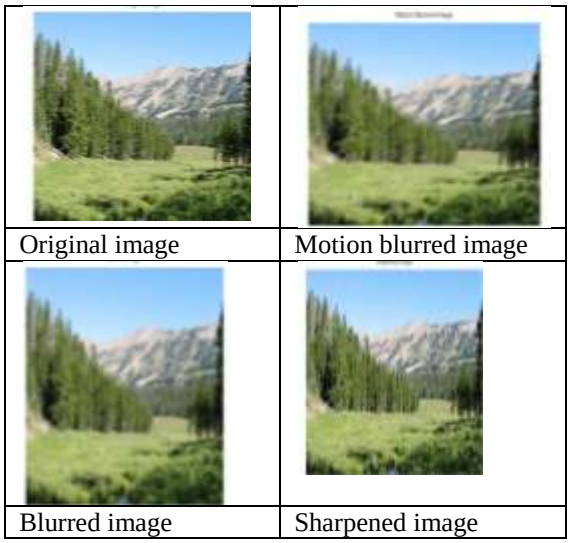
  For this reasons the median filter is much better at preserving sharp edges than the mean filter.

A. Input Image (JPEG Image)

We used input image in JPEG format, because it is easily available from mobile phone, personal computer, laptop, and internet etc.

B. Gaussian Smoothing

The Gaussian smoothing operator is used to blur images and remove unwanted detail and noise. Median filter is similar to the mean filter, but it uses a different kernel that represents the shape of a Gaussian hump. In image processing, a Gaussian smoothing is the result of blurring an image by a Gaussian function. It is a widely used effect in graphics software, especially to reduce image noise and reduce detail. Gaussian filter is a filter whose impulse response is a Gaussian function. Gaussian function depends on mean value and variance. Gaussian filter have the property of no overshoot to a step function input while minimizing the rise and fault time. It is consider the ideal time domain filter and sinc domain filter. Gaussian function require a infinite window length since it decays rapidly



Original image	Motion blurred image
Blurred image	Sharpened image

fig.3,

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C. Median filter

The median filter is a non linear filter. In median filter we consider each pixel of a window, and it arrange in ascending order of pixel value, take middle value and delete all neighboring values . So it is often known as lossy technique. In median filter a window slides along the image and the median intensity value of the pixel within the slides. Suppose the pixel within the image are 1,7,45,11and 17and the pixel being proceed have the value of 45. The output of the median filter and the current pixel location is 11.which is the median of the five values. An example of median filtering of a single 3x3 window of values is shown below.

unfiltered values (original value)		
45	146	225
256	88	49
85	47	0

in order:
0, 45, 47, 49, **85**, 88, 146, 225, 256

median filtered (output value)		
*	*	*
*	85	*
*	*	*

Center value (previously 88) is replaced by the median of all nine values (85).

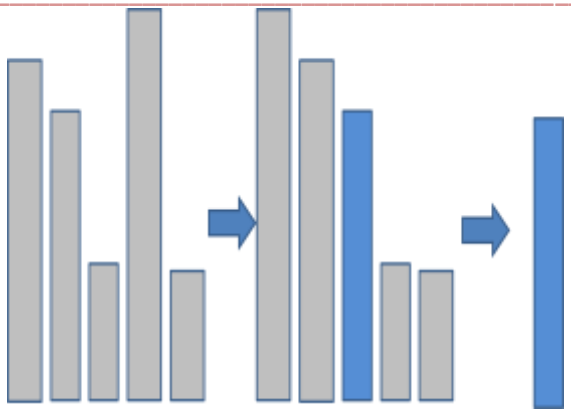

fig .4. *Understanding median filter*

Note that for the first (top) example, the median filter would also return a value of 85, since the ordered values are 0, 45, 47, 49, **85**, 88, 146, 225, 256.

IV. RESULTS

When we pass an image through the Gaussian filter then the size of sharp image get increase but when we pass that sharp image through the median filter then we see the rapidly change in the size of output image. The size of image decreases and the compression ratio get increased. The input image and compressed output image with their size and compression ratio is shown below.

	
Original Image CR: 18.62 Size: 66.1KB	Compressed Image CR: 29.60 Size: 33 KB
	
Original Image CR : 18.7195 Size : 56.6KB	Compressed Image CR : 26.5283 Size : 33.4KB
	
Original Image CR : 22.5258 Size : 2.07MB	Compressed Image CR : 46.8895 Size : 20.9KB

	
Original Image CR:10.6865 Size:115KB	Compressed Image CR: 36.8194 Size: 41.7KB

fig .6.

Choosing a Filter

+ indicates good suitability
++ indicates excellent suitability.

TABLE. 1

Table Head	***Type***	***Random noise***	***Spiky noise***	***Edges preserved***	***comments***
mean	linear	+			Gaussian is a better choice
gaussian	linear	+			Less affected by spikes than mean
conservative	Nonlinear		+	+	Only removes very sparse spikes
Trimmed mean	Nonlinear	++	++		Best if edges not present or not wanted
mode	Nonlinear	+	+		Only use on discrete or class attributes
median	Nonlinear	++	++	+	Good all-rounder
SNN	Nonlinear	++	++	++	Best all-rounder
kuwahara	Nonlinear	+	++	++	Enhances edges, but use median filter first

V. CONCLUSION

In this paper, we have designed a Gaussian sharping filter and median filter for data compression and On the basis of result, we have reached on the conclusion that is if we use the Gaussian filter as the sharping tool and sharp image passes through the median filter, then the compression ratio will be the excellent as and image quality will be the better.

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