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NO-REFERENCE PERCEPTUAL QUALITY ASSESSMENT OF RINGING AND MOTION BLUR IMAGE BASED ON IMAGE COMPRESSION

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Abstract- Objective quality metrics provides a quality based on the squared error between the original and the processed images, although PSNR has been known to be unreliable especially for enhancement function it has been widely used to assess image quality resulting from compression. The estimate PSNR for image coded using DCT and block coding. In this paper we computed subjective quality of different type degraded images based on no reference.

I. INTRODUCTION

Image compression is minimizing the size in bytes of a graphics file without degrading the quality of the image to an unacceptable level. The reduction in file size allows more images to be stored in a given amount of disk or memory space. It also reduces the time required for images to be sent over the internet or downloaded from web pages. There are several different ways in which image files can be compressed. For internet use the two most common compressed graphic image formats are the joint photographic experts group (JPEG) format and the graphics interchange format (GIF) format. The JPEG method is more often used for photographs, while the GIF method is commonly used for line art and other images in which geometric shapes are relatively simple [1]. Digital images are often distorted by impulse noise during data acquisition transmission and storage. Noise can enter through image acquisition by a camera, scanner, and recording and/or when the image is transmitted over a noisy channel. Also the may by compressed in order to be stored or transferred [2].

The quality of an image that is mean for human consumption can be evaluated by showing it a human observer and asking the object to judge its quality on open-defined scale. This is known as subjective assessment and is currently the most common way to assess image and video quality clearly this is also the most reliable method as are interested in evaluating quality as seen by the human eye [3]. Image quality metrics are essential to evaluating the performance of coding and processing algorithms. Often subjective testing with a group of individuals is used determine the perceived quality of pictures. Such subjective testing is the most accurate in terms of human perception of quality [4].

Most of the proposed HVS-based metrics are following the full-reference (FR) approach, meaning, that they rely on the reference image being available for the quality assessment. Clearly this limits their applicability to wireless imaging as a reference image would generally not available at the receiver where quality assessment takes place. Thus a no-reference (NR) metric may be more appropriate since it measures the quality solely based on the received image. Although it is easy for humans to judge the quality of an image without any reference it is extremely difficult for an automated algorithm to execute. For monitoring propose a measurement system that does not required reference signals is preferred. This type of system is called a no-reference (NR) method [5].Original data is visually not available at the receiver it is thus desirable to have a quality measurement system at the receivers that is able to provide quality feedback without requiring the reference signal .This has led to an increased research effect on no-reference (NR) quality metrics and reduced reference (RR) [6][7].

II. PROPOSED MODEL OF IMAGE QUALITY ASSESSMENT

Sharpness described the clarity of detail in an image and can be a valuable creative tool for emphasizing texture sharpness is defined by the boundaries between zones of different tones or colors. It is considered the most important photographic image quality factor. Two fundamental factors contribute to the perceived sharpness of an image: resolution and acutance. Sharpness also depends on viewing distance. Images which are designed to be viewed from further away such as posters or bill boards way have much lower resolution than fine art prints in gallery, but yet both may be perceived as sharp because of viewing distance [8].

In our proposed model statistical features are used as an input. Two of these features are computed depending on the spatial domain. These features are mean of distorted image (μ) and signal-to-noise ratio (SNR). The mathematical style for mean is as following:

$$\mu = \frac{1}{N \times M} \sum_{i=0}^{N-1} \sum_{j=0}^{1-M} P(i,j) \ldots \ldots \ldots \ldots \ldots \ldots . (1)$$

The mathematical style for SNR as follow:-

$$SNR(db) = 20 \log_{10} \left[\frac{I_{max-I_{min}}}{\sigma}\right], \ldots \ldots \ldots \ldots \ldots .. (2)$$

Where$I_{max} and\ I_{min}$ represent the max and min values in image, respectively. The $\boldsymbol{\sigma}$ is standard deviation [9].

Blurring an image usually makes the image unfocused. Blurry images are the result of movement of the camera during shooting (not holding it still) or the camera not being capable of choosing a fast enough shutter speed to freeze the action under the light condition [10]. Fourier transform and the efficient algorithm for computing it the fast Fourier transform (FFT) external in a straight for word manner to two (or more) dimensions. The two-dimensional version of the Fourier transform can be applied to images providing a spectral analysis of the image content of course the resulting spectrum will be a complex variable in two dimensions and usually even the magnitude plot is more difficult to interpret than a one dimensional spectrum. When applied to images the spatial directions are equivalent to the time variable in the one-dimensional Fourier transform and this analogues spatial frequency is given in terms of cycles per unit length or normalized to cycles per sample many of the concerns raised with sampled time data apply to sampled spatial data[11]. The ideal filter is called ideal because the transition from the pass band to the stop banned in the filter is perfect it goes from 0 to 1 instantly. However the ideal filter leaves undesirable artifacts in images. This artifact appears in the low pass filtered image. This problem can be avoided by using a non-ideal filter that does not have perfect transition with Butterworth filter can specify the order of the filter which determines how steep the slope is in the transition of the filter function. The filter function of a Butterworth low pass filter of order n is given by following equation:-

$$H(u,v) = \frac{1}{1+\left[\sqrt{u^2 + v^2}/f_0\right]^{2n}} \ldots \ldots \ldots \ldots \ldots \ldots (3)[12].$$

Feature extraction algorithms deployed here to measure and quantify the presence of the different artifacts are listed in Table (1):

Table (1): Feature extraction and related artifact

Feature	Artifact
Edge-based image activity	Ringing
Gradient-based image activity	Ringing

Through different coding methods bring in different artifacts, the ringing artifacts have been observed in both the DCT and wavelet based image compression at low bit rates. The design of pas-processing technique for ringing artifact reduction should be tailored for a specific compression method. For DCT based image coding the ringing effect is considered the major artifact around edges. Thus some methods based on edge-preserving maximum posterior (MAP) estimation or adoptive filtering was proposed the cope with this problem. However besides the ringing effect edges have also been blurred by the law pass filters effect introduced by the allocation of zero bits to high-frequency the ringing effect cannot eliminate the blurring effects and are unable to reproduce the edge sharpness [13]. Now we explain each effect of applying the various type of filters:

A. The Artifact Effect

The artifact of ringing appears to the human observer as periodic pseudo edges around the original edges of the objects in an image. Ringing is caused by improper truncation of high-frequency components, which in turn can be noticed as high-frequency irregularities in the reconstruction. Image activity (IA) provides an indirect means of measuring ringing.

The proposed system is design by using in spatial and frequency domain first we preformed enhancement in these domains and then we will fused in these domains. The Algorithm (1) describes the procedure for carrying out the system work. Figure (1) shows the effect of Butterworth low-pass filter used in frequency domain.

Algorithm (1): Image enhancement domain and in image fusion.

Input: Image in spatial and frequency domains Output: Fusion Image 1. Take input image. 2. Perform image enhancement with spatial domain & frequency domain. 3. Perform image fusion with spatial domain & frequency domain. 4. Objective assessment of image fusion techniques with different metrics. 5. Comparisons of step 2 and step 3 based on error analysis techniques.

Figure (1): Butterworth low-pass filter used in frequency domain.

B. Motion Blur Image

Regarding the measure of clearness-sharpness degradation, we assumed that clearness loss is related with blurring caused by source coding and the pre/post filtering process. This assumption was done for simplification purposes. The conception of the clearness-sharpness metric is shown in Figures (2) and (3).

(a)

(b)

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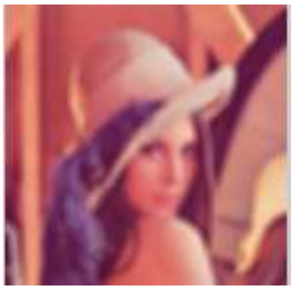
(c)


(d)

Figure (2): Motion blur camera man image: a) original image, b) motion blurred image, c) blurred image, and d) sharpened image.


(a)


(b)


(c)


(d)

Figure (3): Motion blur Lenna image: a) original image, b) motion blurred image, c) blurred image, and d) sharpened image.

C. Filtering in Frequency Domain

We use of the Fourier transform in image processing is due to the convolution theorem: a spatial convolution can be performed by element wise multiplication of the Fourier transform by a suitable filter matrix. Figure (4) show the resulted image after applying FFT with its spectrum.


(a)


(b)

Figure (4): Filtering in frequency domain.

Also, we can apply Butterworth filter in Fourier space (i.e. in frequency domain see figure (5)). The Butterworth filter does cause an attenuation of values away from the center, even if they don't become suddenly zero.

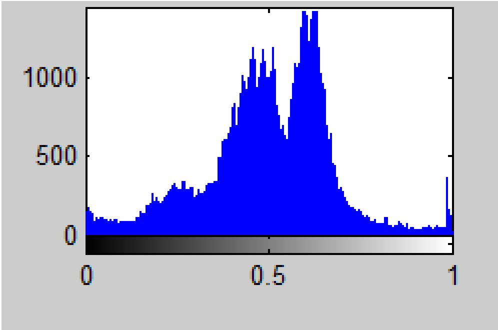


Figure (5): Butterworth low pass filter in Fourier space and its Histogram

III. CONCLUSIONS

In this paper we present the result of computed features such as mean ,SNR, contrast, SSIM, NMSE, PMSE, NCC, SC. These results are computed based on distortion image without using reference image (NR). See Table (2)

Table (2): the subjective quality assessment of distortion image without using reference image (NR)

Lenna Image								
Distortion Types	Mean	PSNR	Contrast	SSIM	NMSE	PMSE	NCC	SC
Ringing	81.27	32.21	115.05	8.83	0.067	0.621	0.718	2.712
Sharpen	111.03	44.91	212.72	15.91	0.012	0.097	0.581	5.381
Camera man image								
Distortion Types	Mean	PSNR	Contrast	SSIM	NMSE	PMSE	NCC	SC
Ringing	60.33	30.81	140.01	10.07	0.081	0.701	0.771	3.305
Sharpen	112.01	42.96	231.04	16.51	0.089	0.093	0.585	4.079

Table (3) shows the effect of quality assessment of motion-based video integrity evaluation.

Table (3): Motion-based video integrity evaluation

Image	Motion Blur Image
Lenna	0.880
Camera Man	0.881

The proposed system outperforms statistical features with respect to quantifying user perceived quality. The introduced system may be used for NO-Reference in service image quality monitoring.

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