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EFFICIENT RESTORATION TECHNIQUE OF IMAGE USING KNN ALGORITHM

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Abstract

This paper analyzes coding algorithm of JPEG image and proposes a K-Nearest Neighbor (KNN) approach to perform inpainting in the DCT Coefficients to get a more optimized compression ratio. The proposed methodology is expected to outperform the compression ratio of the Baseline JPEG Algorithm dealing with images having cracks and distortions. The reason behind this is plain and simple. Images having distortions zwill have anomalies in the distorted parts which will contribute to the size of the image. If those distortions are removed before compression, the output will be more optimized.

Keywords: DCT, JPEG, KNN, PSNR

I. Introduction

When using a digital camera to capture images, the relative movement between the camera and objects or defocusing of the camera will blur the image, which reduces the contrast, clarity and edge sharpness of image. Also, it is difficult to detect, track and recognize the target from a blurring image. Generally image restoration system can improve the image quality to some extent, recover the edges and details of images. However, in many cases, due to the lack of a priori information, and the defects of image restoration algorithm, the restoring process may produce more degradation such as ringing artifacts, resulting in a restored image even worse than the original blurred image. Thus, before using the restoration algorithm, there is a crucial step for a practical digital image restoration system called blur identification, which will evaluate the sharpness of image and decide whether to adopt the deblurring process. Also, a image quality assessment algorithm has to be used after restoration to ensure a reliable output. Image restoration is based on the attempt to improve the quality of an image through knowledge of the physical process which led to its formation. The purpose of image restoration is to "compensate for" or "undo" defects which degrade an image. Degradation comes in many forms such as motion blur, noise, and camera misfocus. In cases like motion blur, it is possible to come up with a very good estimate of the actual blurring function and "undo"

the blur to restore the original image. In cases where the image is corrupted by noise, the best we may hope to do is to compensate for the degradation it caused.

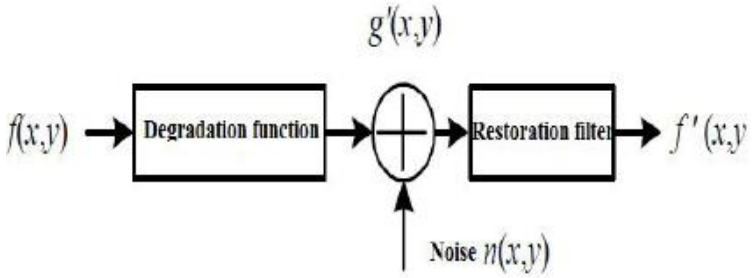

Fig 1. Image degradation and Restoration

Image restoration differs from image enhancement in that the latter is concerned more with accentuation or extraction of image features rather than restoration of degradations. Image restoration problems can be quantified precisely, whereas enhancement criteria are difficult to represent mathematically. Image restoration uses a priori knowledge of the degradation. It models the degradation and applies inverse process. It formulates and evaluates the objective criteria of goodness. The distortion can be modelled as noise or a degradation function. To restore an image from a noise model, different filters like median filter, homo-morphic filters are used.

II. Problem Formulation

Scope of the Study

Existing strategies can be ordered into the accompanying classifications:

i) The principal class concerns diffusion-based methodologies which proliferate level lines (called isophotes) utilizing partial differential equations (PDE) or variational systems.

ii) The second classification concerns examplar-based inpainting methods which have been motivated from texture synthesis procedures. These methods exploit image statistical and equivalence toward oneself priors.

iii) An alternate class of methodologies concerns techniques utilizing sparsity priors.

iv) Most existing algorithms are pixel based, which develop a statistical model from image characteristics. One of the primary burdens of these methodologies is that, their viability is constrained by the surrounding pixels of the destroyed part.

Images in the frequency domain contain sufficient data for image inpainting and can be utilized as a part of data recreation. High frequency indicates image edges or textures, which motivates conducting image inpainting in the frequency domain.

Objective of the Study

The two main objective of this paper is inpainting and compressing images with noise(after denoising/inpainting). As discussed in the introduction section, its preferable that the image is first removed

from any distortions before applying compression to get a more optimised output.

1) To improve the compression ratio of the distorted images, as compared to the baseline JPEG Algorithm with images having minor distortions and cracks.

2) To remove the distortions/redundancy from an image before applying compression (improvement in compression ratio).

3) To apply KNN algorithm on the frequency domain and use the DCT Coefficients to remove the redundancy.

4) To implement the proposed system in MATLAB and obtain the results.

III. Methodology

The methodology adopted for this paper consists of the following steps:

1) **Exploration**: This approach is used to collect information about the techniques mentioned in the papers from the journals.

2) **Reading**: This step is for gaining a thorough knowledge about the techniques by continuous reading.

3) **Deduction**: Summing up the main steps/concepts, according to the field of study.

4) **Conclusion**: Getting into a particular conclusion from the ideas gained from the above steps. The steps are repeated untill the conclusion of the proposed approach is finalized.

IV. Proposed Approach

1) Obtain image (having cracks and minor distortions).

2) Divide it into 8x8 matrix components.

3) Converts to Grayscale.

4) Convert to Black and White (logical class) and save the positions of 1(luminance) from the matrix.

5) Apply DCT to the matrix obtained from step 3.

6) Apply KNN Algorithm to the positions obtained from step 4, in the DCT Coefficients.

7) Apply Quantization to compress the data.

8) Apply Variable Length Coding which includes Zigzag filtering and Run-Length Encoding or Huffman Encoding.

The image is converted into Black and White to retrieve the positions of cracks/distortions. In this, only luminance is shown with 1(the cracks and distortions) in the matrix. Rest every chroma component is 0. This is known as logical class.

V. Results and discussion

Running the file inpainting. which is used to implement the standard jpeg algorithm, we have achieved these outputs.

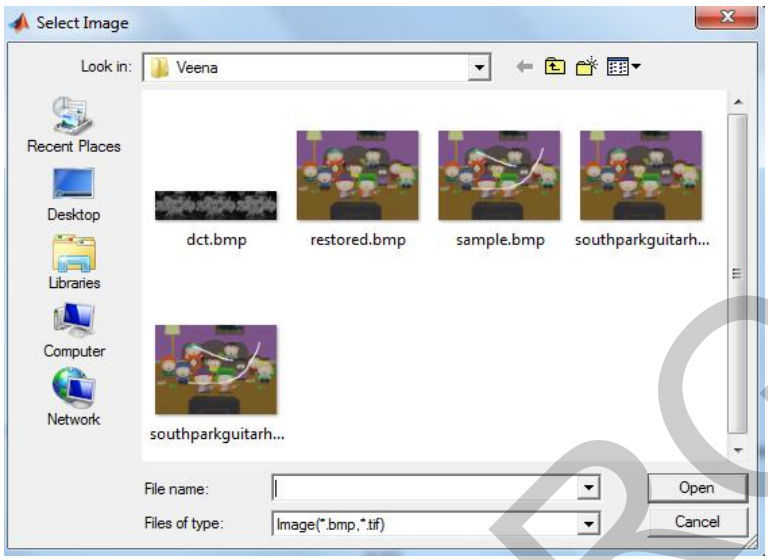

Fig 2. Importing the Image

The message box shows that the jpeg file is created and stored in the hard drive. Check the size of the newly created jpeg image.

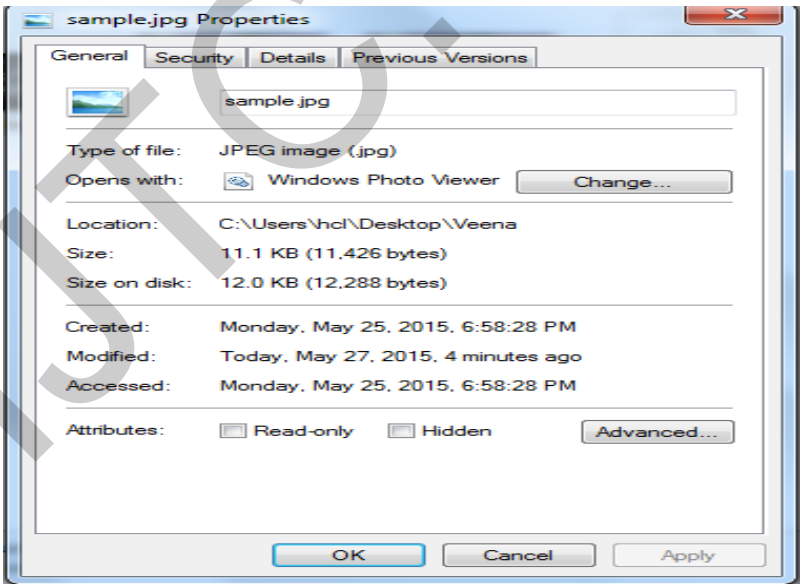

Fig 3. Property of Image

Now import the same distorted uncompressed image for our inpainting algorithm.

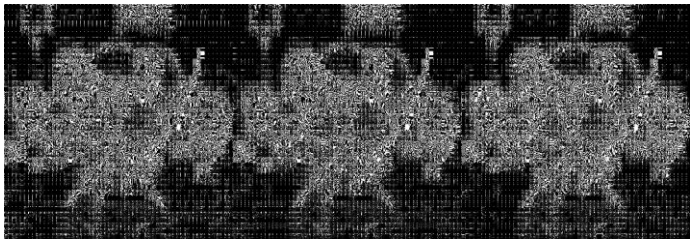

Fig 4. DCT of Image

Fig 5. After DTC

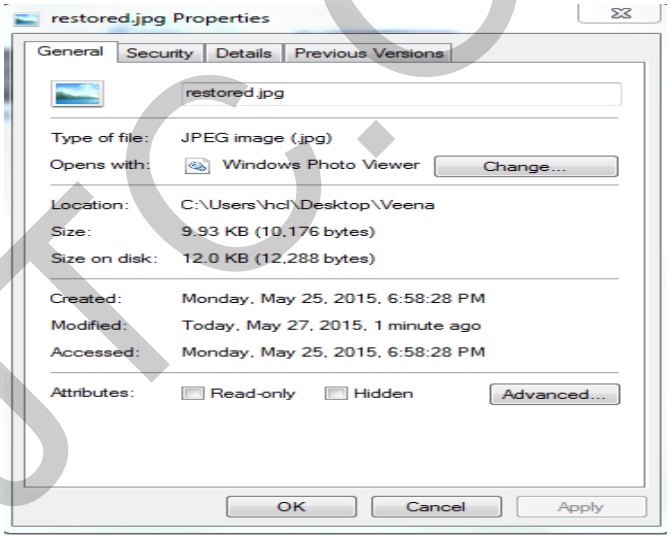

Fig 6. After Impainting property of image

V. Conclusion

The proposed methodology is expected to give a good PSNR value compared to the output of JPEG Baseline Algorithm. The output image from the system is expected to be visually more attractive to the Human eyes because of the removal of noise that were present before compressing the image.

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VII. Bibliography

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