ISSN: 2277-9655
(I2OR), Publication Impact Factor: 3.785

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

AN ENHANCED APPROACH FOR BLIND MEASUREMENTS OF BLOCKING ARTIFACTS IN IMAGES

Mankirat Singh*, Khushpreet Kaur
* M.Tech Student CSE Department BMSCE , Mukatsar.
Assistant Professor CSE Department BMSCE , Mukatsar.

ABSTRACT

Rapid improvement in available technologies for communication has made digital media content more visible. For the communication of visual information, large size images with higher resolution are needed. Although these images are responsible for high picture quality and various other pros but there are lots of problem with declare their presence with these bandwidth consuming images. Thus image compression is really very important to set a strict upper limit on the volume of data. Majority of applications need high compression ratios with low bit rate. However, this need in general is in conjunction with desire for top quality of the final content because of artifacts. Therefore, it is vital to take actions against this problem and finding a resolution for detecting and reducing of artifacts by preserving the edges is exactly what that is needed. In the proposed work, an enhanced approach for Blind Measurements of Blocking Artifacts in images has been developed. Proposed system is tested on various images using MATLAB and results of the proposed systems are very accurate as compared to existing methods.

KEYWORDS: Image Processing, Artifacts in Images, DCT Compression, Genetic Algorithm, Fuzzy edge detection and filtering.

INTRODUCTION

There are lots of multimedia as well as remote sensing applications that need image compression to cut down the data in images. This is really very important for compact storage. Basically block based Discrete Cosine Transformation (DCT) is one of the fundamental components of any image compression standards. There are many standards such as JPEG or MPEG which are very famous even with the presence of quantization noise. Need to improve the resolution of an image is an issue that often declare its presence in visual communication as the same is affected by artifacts.
In compressed images, artifacts are one of the most common problems which degrade the quality of image up to a great extent. Artifacts are visible at block boundaries in block boundary approaches and ringing patterns around the edges depending on the bit rate of compression scheme. When compressed at similar bit rate, images with more data get affected more than those which have lesser data. To remove or to reduce the artifacts, an accurate description of the quantization noise is very important. Actually the statistical explanation of quantization noise offers very essential insight into the origins of artifacts after compression. In spatial domain, the compression artifacts are correlated and spatially varying. To know the overall efficiency of a compression approach, it's good to numerically assess the degree of artifacts in a visual signal.

Blocking artifacts

One of the very common types of compression artifacts is the blocking one. They are present in both JPEG as well as in MPEG. The JPEG works only with N×N blocks where n can be 8 or 16. It is important that block size is either 8 or 16 at a time. Due to loss that occurs during quantization, vertical and horizontal borders are created between the blocks which can also be considered as small squared blocks. Their presence basically represents the inability of discrete Cosine Transformation blocks to consider correlations among the blocks. This phenomenon can be explained in a better way by adopting the compression of one or two adjacent blocks. For several applications, single block is determined and outcomes are sufficient to justify blocking artifacts. These artifacts affect the texture and change the compression noise. Basically these artifacts can be represented as 2-D step functions and is a perceptual measure of block structure. Transmission errors can also cause them and in such case whole slices of blocks of image get affected.

Genetic Algorithm

Genetic Algorithm (GA) was invented in the year 1970 by John Holland. This search algorithm can be applied to a wide range of subjects starting from some simple mathematical problems to highly complex engineering problems such as image processing, flow control, robotics. It is better recognized as an optimization scheme or a problem solving strategy. Input is usually a set of potential solutions to a specific issue and a metric with fitness function allow each solution to be quantitatively evaluated. Basically solutions are represented as chromosomes in binary as strings of 1's and 0's. However, distinct encodings can also be considered. Fitness function, objective function, implementation of genetic representation in solution domain as well as implementation of genetic operators are the important aspects to be defined with Genetic algorithm.

LITERATURE SURVEY

XINFENG ZHANG, RUIGIN XIONG AND SIWEI MA, 2012 proposed an effective method for reducing blocking artifacts by estimating the transform coefficients from quantization process. Researchers estimated the transform coefficients based on an image statistic model and non-local similarity between blocks in transform domain. Window size and smoothness factor are the two parameters considered.

SEYDI KACMAZ, SEMA KOC KAYHAN AND ERGUN ERCELEBI, 2012 This paper represents a novel adaptive post-filtering approach to neglect blocking artifacts which are observed after DCT image compression at low bit rates. As blocking artifacts are identified, fuzzy filter is considered by adjusting filtering range and the parameters. This algorithm has lower computational cost than other approaches and it can simple be used for real time image as well as video applications.

PARAMJEET KAUR, POONAM SETH, 2012 Image compression is very important for obvious reasons and blocking artifacts often comes out after image is compressed. Original image is recovered with decompression through various filtering methods and a few of them are discussed by in this work. These methods include DCT filtering, spatial filtering as well as Hybrid filtering. Parameters compared are MSE, BER and PSNR.

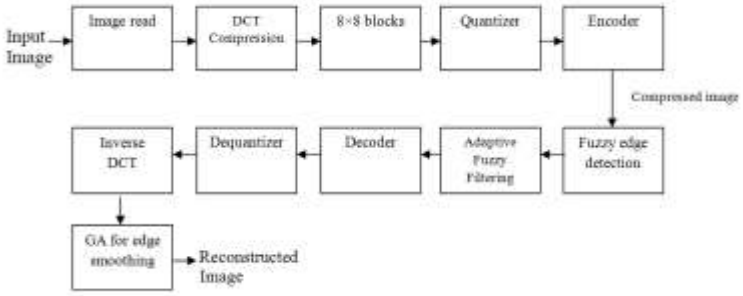
HUIBIN CHANG, MICHAEL K. NG AND TIEYONG ZENG, 2014 provides a new artifact reduction scheme for JPEG decompression via redundant and sparse over a learned dictionary. A two-step approach is applied. Firstly learning dictionaries is considered and then total variation regularization for decompressed images. This method outperforms the total variation and weighted total variation decompression methods in measuring peak of signal to noise ratio.

ROBERTO CASTANGO, GIOVANNI RAMPONI, 2014 presents a simple operator for reducing of blocking artifacts. The approach is based on rational filter and the operator is simply expressed as a ratio among a polynomial and a liner function of the input data. Filter is good enough of biasing its behavior to provide good performance in uniform areas where liner smoothing is needed. This method is a post-processing approach for frames or blocks coded at low bit rate.

PROPOSED METHODOLOGY

In this research work, firstly image is compressed with DCT approach which converts the image in different blocks that have size 8×8. The primary objective is to cut down the overall number of bits needed to represent an image and at the same time boosting the storing capacity. As some information is lost during compression because of blocking artifacts, an adaptive fuzzy filter is considered to reduce the blocking artifacts so that the relevant information and quality can be maintained. The fuzzy filter considers 3×3 and 3×2 mask scanning technique with a mean filter. The fuzzy filter considered in this research work is used with Genetic algorithm. As an optimization algorithm, GA is opted for smoothing the edges of the image.

The following is the block diagram representing the working of the proposed system



The proposed system works in the following steps :

DCT compression

DCT coverts signal into elementary frequency components. Less important frequencies are neglected simply at quantization where compression actually occurs. Thus only the important frequencies which are left are considered to retrieve the image during decompression and this is the reason that why reconstructed image have some distortion in it in the form of blocking artifacts at low bit rate.

Fuzzy edge detection and filtering

Edge detection is a process that refers algorithms in identifying points or pixels in an image where the brightness has discontinuities or it get changes rapidly. Primary goal of edge detection is to locate pixels which correspond to the edges of objects present in the image.

Genetic algorithm for edge smoothing

A genetic algorithm (GA) is a search algorithm followed by the mechanics of natural selection and genetics to emulate the evolutionary behavior in biological systems. In general, a GA contains a "fixed-size population of potential solutions over the search space or from random numbers. These solutions are performed as binary or real-number strings and called individuals or chromosomes. The initial population can be created by random numbers or based on the problem-specific knowledge. In each loop, called a generation, a new population is created based on a preceding one through the following three steps: (i) evaluation: each chromosome of the old population is evaluated using a fitness function and given a value to denote its merit, (ii) selection: chromosomes with better fitness are selected to generate next population, and (iii) mating: genetic operators such as crossover and mutation are applied to the selected chromosomes to produce new chromosomes for the next generation.

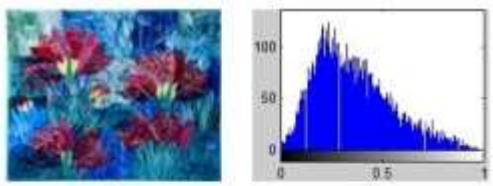
During the work, it has been observed that the size of the population highly influences the overall performance of the Genetic Algorithm. Evaluation cost is reduced with a small size population however results in convergence that is not as mature as it needs to be. This is mainly because the population offers the samples in search space which are insufficient. GA can gain more or useful information with a large size population to provide better solutions and this is mainly because the populations contain more solutions over search space. However, there is always a need of more computations in population which is large in size and this situation often results in an unacceptably slow rate of convergence. This is one major reason that why GA consumes more time.

RESULTS AND DISCUSSION

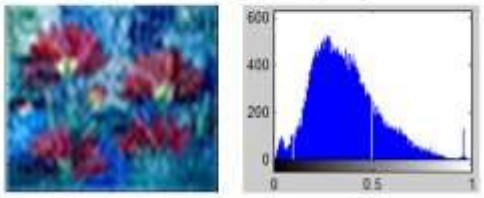
Proposed work is evaluated on various Images using the following parameters:
Peak signal to Noise Ratio (PSNR) : Quality of reconstructed image after compression is measured with PSNR i.e. Peak signal to Noise Ratio. Here signal is the original data and noise is the error that declares its presence after compression.

Mean square error (MSE) : Cumulative squared error among compressed and original image is called as Mean square error while measure of peak error is PSNR. MSE is basically a criterion for an estimator.

Result snapshot of the proposed system



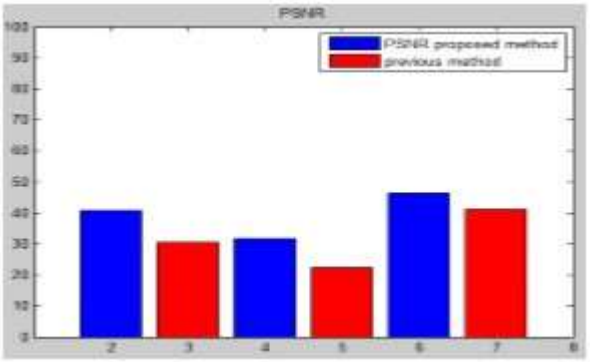
(a) Original 'flowers' image. (b) Image histogram



(a) Compressed image. (b) Image histogram

PSNR value of proposed algorithm compared with previous algorithms

Test Image	Bit per pixel (bpp)	**PSNR Value**					
		H.263	MPEG4	POCS	Wavelet Representation	Previous	**Proposed**
Lena		30.20	30.02	30.23	31.18	30.57	**40.87**
Mandrill		22.35	22.15	22.44	22.55	22.49	**31.63**
Airplane		29.34	29.32	29.34	30.98	31.08	**46.28**



Graph for various images PSNR of proposed & previous work

Choosing population size or the number of individuals in the population is the first step in application of GA. Here the value of population size varies is 40 and it can go up to 60. Population individuals are selected or generated randomly using Matlab's random number generator. This is the reason that the value generated by the GA for each image may not be same for other image or for the same image in the next attempt.

CONCLUSION AND FUTURE SCOPE

The aim of this research work is to reduce the blocking artifacts from an image compressed using DCT which is block based approach. Here an adaptive fuzzy filter for reducing blocking artifacts is considered. It acts as a mean filter and process mean value of pixels to bring desired results. The Genetic Algorithm (GA) is applied for smoothing the edges of the image. Although the results of the algorithm proposed in this research work are able to be considered but it has been observed that GA is very time consuming. It needs to have a better population of individuals so that more effective solutions can be availed. Because it is purely based on selection procedure and there is no mathematical guidance presence to solve problems with GA, sometimes results cannot declare their presence in the accurate way or doesn't appear at all. It has also been observed that blocking artifacts are different in different images and images with more blocking artifacts needs more smoothing of edges as compare to those with less blocking artifacts at the block boundaries. Fuzzy filter is found to be a trusted filter because it provides results that are quite accurate.

FUTURE SCOPE

This research work deals with blocking artifacts which are present at block boundaries and at some points with ringing artifacts which are present at the edges or corners of the image. There are other two important types of artifacts and they are mosquito and flickering which can be reduced from an image.

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