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Comparison of Segmentation-Based Image Compression Using Threshold, Region Growing, and Edge Detection

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ABSTRACT

In the presenting paper we are dealing with to develop a lossless image compression (IC) method to utilize spatial redundancies inbuilt in image data which employs a best possible amount of segmentation information. To obtaining Multiscale segmentation we are using a earlier proposed transform which gives a tree-structured segmentation of the picture into regions which are identified by grayscale homogeneity. In the given proposed algor we have to shorten the tree to controlling the size and no of regions so that we can get a rate balance between the derived the coding gain and the operating cost inherent in coding the segmented data. Another uniqueness of the given proposed approach is that we are using an image model contain individual descriptions of the pixels lying close to the edges of a section and others lying in the center.

In our results we can see that this proposed algorithm is providing better performance comparable to all the best available methods and it provides 15-20% better compression if we compare it with the JPEG lossless image compression standard for a enormous variety of images.

Keywords : Digital Image Compression Technique, Digital Image Segmentation, JPEG Edge Detection Technique , Threshold Algorithms etc.

I. INTRODUCTION

In digital Image compression, by word 'compression' we mean the matter of to lessen the total sum of data we need for representing a digital image (DI). it's a technique which actually implied that how to create a minimal outline of a photograph, in this way reducing capacity the picture transmission necessities transmission prerequisites. Each picture can have extra information. Repetition denotes that the duplicity of accessible data inside the picture. Either it will revise segment in that picture or a specific example that is revised all the time in the picture. By fascinating advantage of redundant info of available image, compression occurs. Lessening of redundancy give helps to accomplish a reduction of space for storage of a picture. Compression is completed when at least one from those present redundancies are dispensed with. In idea of pressure, essentially three data redundancies are known and distorted. Pressure

is finished by the disposal of 1 or a considerable measure of the each of 3 crucial information or data redundancies [1]

II. IMAGE SEGMENTATION

Image segmentation is an extremely interesting exploration sector for picture management (IP). We think about pictures as a critical medium to pass on data in the region of PC vision. Picture division is a manner; in this technique we segment the picture into acute disjoint areas. The essential reason for picture division is to accumulate pixels in a collection into important picture locales, i.e., proportionate regions to singular sides, things, or regular piece of pieces. we segregate picture into a few segments. for case set of several pixels, pixels display in a specific area are acknowledged with each other in a few criteria like surface or shading force, and to spot and recognize boundaries and questions in a picture. Picture division strategy is the base of the idea protest acknowledgment. Image partition system is the activity in picture examination. In this a division esteem is transfer to all pixels in a picture in a way to such an extent that every pixel with having a similar esteem share assured qualities, for example, color, texture or power in an unusual area. Picture division system is generally unmistakable as the essential photo preparing which splits a given picture f (x, y) into subset f_1, f_2, f_3,…f_n which are continuous in nature, disconnect and nonempty, which provide accessibility to drawing out of attribute [3].

III. IMAGE SEGMENTATION TECHNIQUES

a. Segmentation technique based on edge detection

In this technique we try to conclude image segmentation by spotting the pixels or edges between unrelated region that have firm change in concentration are extracted and connected to each other to form borders with closed object. The result we get is a binary image. Founded on concept there are primarily two methodology are in for each segmentation is centered on edge in which first is gray histogram and second is gradient based method [4]. Edge detection practice is a very strong field in the field of image processing. Edges and Region boundaries have a close link, since there's commonly, at the region boundaries there is a quick adjustment in concentration. so, procedures for particularly edge detection, been used as the provision for an additional segmentation method for shaped segmentation. All the edges which are derived by applying edge detection procedures are commonly discontinuous. We require secure connected region boundaries for section an entity from a picture even if with great complexness. Boundaries of such type of objects are the identified edges.Even we can apply Segmentation approach to already found edges by using edge detectors for detecting extra sharp edges. Lindeberg gave an joined methodology that can fragments edges for object recognition based on fragments, into linear and curvilineal edge segments, based on a minimum description length (MDL) measure which was optimized with a methodology like split and merge with applicant breakpoints which are obtained from corresponding joint cues to get additional possible points at that for considering partitions into totally different segments [5]

b. Thresholding method

Thresholding procedures are often chosen in a manual way according to various priori information or inevitably by image data. These algorithms more splinted into 3 main algo 'Edge ‘based algorithms, 'region'-based segmentation, and 'hybrid' methods. Algorithms which are based on edge relate to the data at the edge of a picture. The Structures of given object are often render by points on edges. famous edge detection procedures for sample canny edge detector and Laplacian edge detector are often classified as the trending area.

These algorithms we use for discover the edge pixels by removing the noise influence. For an example, in

canny edge detector for pointing out the probable edge pixels we use the threshold of gradient magnitude and then suppressed those pixels following procedures of hysterics Thresholding and non-maximal suppression.

As mostly operations we used in above algorithms are grounded on pixels, the found edges which are consisted of distinct pixels and that's why considered to be incomplete or broken.

c. Region based segmentation methods

In contrast edge detection methodology, segmentation algorithms fall within the category of region are comparatively easy and highly resistant to noise. Edge based methods a picture is partition based on fast intensity changes close to edges while region-based methods, deploy a picture into dissimilar regions which are same following to a predefined criterion. Mostly Segmentation procedures grounded on region include following given methods:

1. Region Growing

It's a procedure which group's pixels in complete image into many associate regions or other larger regions which are centered on predefined criterion. Region growing may be performed in following four steps:

- Selecting a pack of seed pixels in form of original image.
- Select a set of similarity like greyish level intensity criteria or color and setting up a stopping rule.
- Growing regions by adding to each individual seed with the adjoining pixels that have already defined properties like the original seed pixels.
- Stop growing the region once no new pixels are meeting the criteria for similarity in that specific region like the size, likeliness between a candidate pixel & neighbor pixel grown so faraway and appearance of the region being grown.

2. Region splitting and Merging

On the behalf of selecting seed points, we can divide the image in a group of impulsive regions which are unconnected and then combine the regions for fulfilling the terms of affordable image segmentation technique. splitting and merging of these regions sometimes implemented with the theory of quad tree. Let R defined the whole region of an image (as a super set) and pick a predicate Q.

- We begin with the entire image, if Q(R) = FALSE, the image is partitioned we into quadrants, if value of Q is false for any of the quadrant that's, if $Q(R_i)$ = FALSE, we sub partitioned these quadrants in more sub quadrants then on until no additional splitting is feasible.
- If splitting is employed only, partition we finally get might contain neighboring regions with the matching properties. This disadvantage may be penalized by permitting each merge and split at a similar time i.e., unite any adjacent regions R_j & R_k for which, $Q(R_j \cup R_k)$ = TRUE.
- Stop once no merging is feasible [6].

IV. JPEG/DCT COMPRESSION

The JPEG/DCT compression is now become a standard and extremely common compression scheme. For taking the benefit of this technique, firstly, image is basically divided into non overlayed 8×8 blocks. A function which is called called Discrete Cosine Transform (DCT) is functional to every block to transform them to different gray levels of pixels within the spatial region into factors in the frequency region.

The all coefficients are normalized by completely different scales according to quantization table provided by the standard of JPEG conducted by some psycho visual proof. The quantized coefficients are rearranged in a exceedingly in a very} zigzag scan order to be additional compressed by an economical lossless coding strategy like run length coding, arithmetic coding, or Huffman coding. The decoding is just the inverse method of the encoding. So, in

JPEG compression technique it takes equivalent time for encoding and for decoding. The encoding and the decoding algorithms provided through a free JPEG cluster are accessible to trial on the real-world pictures. the data may be loss that happened in the coefficient quantization.

The JPEG standard explains the standard 8×8 quantization table for images which cannot be suitable or proficient. to attain best decoding quality of various pictures with constant compression by using the DCT approach, an adaptive quantization table [7].

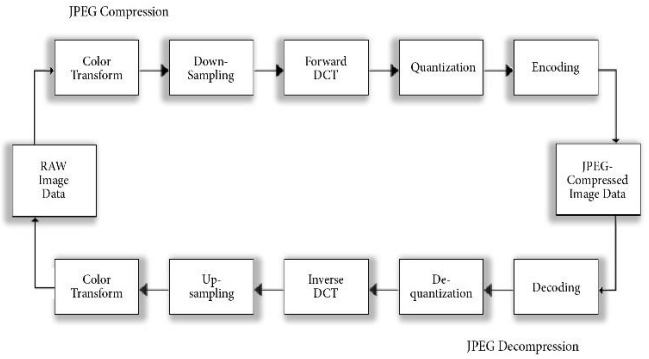


Fig. 2 JPEG/DCT compression

V. LITERATURE SURVEY

Lei Chen et. Al. [2016] In this paper, our propose a nearly lossless compression algorithmic program with background segmentation for sixteen bits X-ray image. Background of the image and foreground of image are separated with a threshold calculated through detecting background peak of image gray histogram. Background pixels connected to image border are segmented as background by two pass run-length labeling. Then image background is compressed with Run-Length-encoding (RLE) and the foreground is encoded via Lempel-Ziv-77 (LZ77). To validate the proposed algorithmic program, we compare it with state-of-art compression algorithms LZ77, JPGE_LS, and arithmetic secret writing. Experimental outcome shows that our algorithmic program obtains smart performance each on compress magnitude relation and speed with neglectable info loss [8].

Anshu Mittal et al. [2016] In this paper, our have projected an algorithmic program to reduce the whole energy consumption per data bit for a particular bit error rate demand. This algorithmic program segments a picture and compress a no of them based on their data entropy. We discover that best segmentation is helpful as against uncompressed or absolutely compressed image. We have compared wavelet and JPEG compression techniques. We observed that very same variety of segments to be compressed at comparatively smaller distance once needed BER improves. Our have seen that because the space between transmitter and receiver will increase a lot of variety of segments need to be compressed to induce the minimum energy consumption. With the optimized algorithmic program, we are capable to save energy up to 28.26% compared to fully compressed or fully uncompressed image for the fixed series block size 16x16 attain higher CR [9].

Gholamreza Akbarizadeh et al. [2015] This paper represents a technique referred as ordered unsupervised segmentation using lossy data compression for SAR pictures, wherever super pixels are in use rather than pixels. within the represented paper, merging of the super pixels is addressed by combining options like edges, surfaces, and brightness. This procedure is finished in 2 stages. the primary stage is merging all super pixels till there's no distinct boundary between them. In 2nd stage, merging of super pixels is executed if piece of data codes is decreased under specific distortion. [10].

Veenadevi.S.V et al. [2014] in this paper, the outcome show that for the permanent range block size 4x4 reach higher Peak Signal to Noise ratio (PSNR) ~ 28dB and Compression ratio (CR) of ~ 3.7 for the satellite and lena images. This results of ~69 and PSNR of ~20dB for the river and Satellite images. This

technique is found to point higher PSNR, good Cr and reduced encryption - decryption time. The results are given and mentioned within the paper [11].

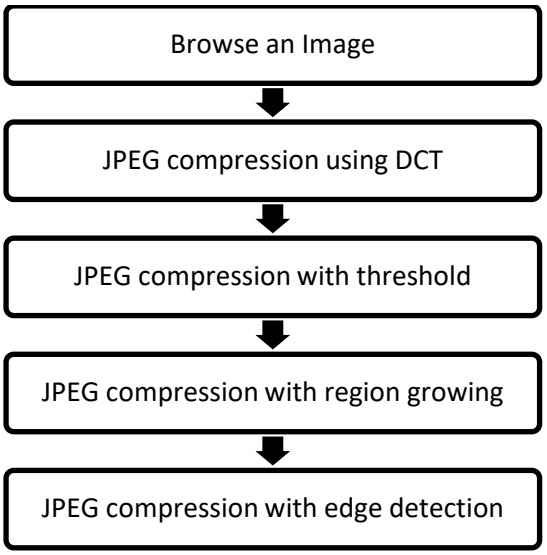
S.Sathiya Lakshmi et al. [2014]in this paper techniques which are propose Region growing technique and changed set Panel In hierarchical Tree (MSPIHT) can improve the result of loss less image compression and in addition improve the peak Signal to Noise ratio (PSNR) and Compression ratio (CR) than the SPIHT coding technique [12]

Ratan Kumar Basak et al. [2016] In this given paper, a system for segmentation-based compression is recommended. 2 varieties of segmentation techniques which are used, specifically threshold and region growing algorithms, and JPEG, they are applied to get the ultimate compressed result, that provides higher ratios compared to standalone compression algorithms [13].

VI. PROPOSED WORK

In this paper, a formula for segmentation based mostly compression is usually recommended. 3 types of image segmentation techniques are used, namely, threshold, region growing, and edge detection segmentation based mostly compression and the application of lossy image compression to every segmented image. The obtained result is additional efficient in conditions of the bit rate decrement than most alternative lossy technique.

Segmentation based compression can always be optimum for situations during which we don't need top quality versions of the picture because it ensures faster transmissions and lesser memory usage.



Steps followed as below:

1. First browse an image.
2. Apply JPEG compression using DCT.
3. Apply threshold-based JPEG IC with size 256x256
4. Apply threshold-based JPEG IC with size 512x512.
5. Apply region growing based JPEG IC with size 256x256.
6. Apply region growing based JPEG IC with size 512x512.
7. Apply edge detection-based JPEG IC with size 256x256.
8. Apply edge detection-based JPEG IC with size 512x512.

VII. RESULT ANALYSIS

Original Image

1. JPEG Compression using DCT

[256 x 256] [512 x 512]

2. Segmentation using Threshold then JPEG

[256 x 256] [512 x 512]

3. Segmentation Using Region Growing then JPEG

[256 x 256] [512 x 512]

4. Segmentation Using edge detection then JPEG

[256 x 256] [512 x 512]

Image size	JPEG only	Threshold	Region Growing	Edge Detection
(256x256)	4.0553	3.9245	3.6904	3.3336
(512x512)	3.9937	3.8649	3.6325	3.3886

VIII. CONCLUSION

This paper discussed about the efficient image segmentation and image compression by using edge detection algorithm. It gives higher range Compression Ratio (CR) when comparing to Region growing segmentation and threshold algorithm.

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