"An Approach for Reconstructing the Image with combine Structure and Texture Image Inpainting with Edge detection and Exemplar selection based Method "

Onshi Verma[1] & Pravesh Pal[2]

1 M.Tech Scholar, Dept. of Electronics & Telecommunication Engg., Chhattisgarh Swami Vivekanand Technical University, Bhilai, Chhattisgarh-India

2 Asst. Prof, Dept. of Electronics & Telecommunication Engg., Chhattisgarh Swami Vivekanand Technical University, Bhilai, Chhattisgarh-India

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ABSTRACT *In the digital world, Inpainting (also known as image interpolation) refers to the application of sophisticated algorithms to replace lost or corrupted parts of the image (mainly small regions or to remove small defects).Inpainting is the technique of modifying an image in an undetectable way, is as ancient as art itself. The goals and applications of inpainting are numerous, from the restoration of damaged painting and photographs to the removal/replacement of selected objects. In this paper, we introduce an algorithm for digital inpainting of still images that attempts to replicate the basic techniques used by professional rest orators. After the user selects the regions to be restored, the algorithm automatically fills-in these regions with information surrounding them. The fill-in is done in such a way that lines arriving at the regions, boundaries are completed in-side. In contrast with previous approaches, the edge detection algorithm and texture synthesis algorithm is introduced. We are using here edge detection and Exemplar selection based method for combine structure and texture image inpainting. all these algorithm is applied step by step and give the accurate and improved output.Image encoding and image decoding algorithm is used by which we get improved PSNR,SNR,MSE.*

Keywords: *Image inpainting, Structure layer, Texture, Reference image.*

I INTRODUCTION

The object of Inpainting is to reconstitute the missing or damaged portions of the work, in order to make it more legible and to restore its unity .The need to retouch the image in an unobtrusive way extended naturally from paintings to photography and film. The purposes remain the same: to revert deterioration (e.g., cracks in photographs or scratches and dust spots in film), or to add or remove elements e.g., removal of stamped date and red-eye from photographs,a number of techniques exist for the semi-automatic detection of image defects mainly in film, the regions to be inpainted must be marked by the user, since they depend on his/her subjective selection. Here we are concerned on how to "fill-in" the regions to be inpainted, once they have been selected.

Structure inpainting: Structure Inpainting uses geometric approaches for filling the missing information in region which will be inpainted. A Structure space of an image contains elements, which allow the basic outline of the important components in the image, In many cases structure space is intended to be the edge map of the image.

Textural inpainting: Textures are in general divided into two categories, stochastic and deterministic. Stochastic textures do not have easily identifiable primitives (e.g. sand).Often textures in the real world have a mixture of the two (e.g., plowed fields). Texture synthesis involves synthesizing an image that matches the appearance of a given texture. The new image may be of arbitrary size and the main goal is to achieve a tile able image (i.e., no seams or borders are visible if the image is periodically extended).

Combined structure and texture inpainting:Combine structure and texture Inpainting perform simultaneously filling the structure and texture in the region of missing information.

We are using here Exemplar based method for reconstructing the image.The exemplar based approach is an important class of inpainting algorithms. And they have proved to be very effective.

II PROBLEM IDENTIFICATION

In this context, the inpainting problems are stated in two different perspectives of the digital inpainting paradigm and they will be introduced.

Pure Inpainting– Signal processing solutions which the main goal is restoring damaged or removed areas using information from undamaged areas, e.g. restoring,occlusion recovery, in the most transparent way, i.e. an observer would not be able to notice that an inpainting procedure had taken place; therefore, the user would not be able to distinguish the original undamaged image from its restored image.

Inpainting-based Coding– Signal processing solutions which main goal is exploiting digital Inpainting tools to significantly increase the compression efficiency in comparison with standard-based coding solutions. From the pure inpainting perspective, the inpainting problem

Figure 2.1 – Illustration of the inpainting problem

from the pure inpainting perspective and from the coding perspective at the decoder side. From the pure inpainting perspective, digital inpainting consists mainly in repairing objects in images or video sequences by filling-in target areas, eventually according to some previously chosen assistant information, extracted from the source image areas which may also include the area to be inpainted if repairing is the problem, or neighbor source areas if filling a hole is the problem; this task has to be performed in the most transparent way as defined.

III METHODOLOGY

In the majority of signal processing problems, the various ways to study the in painting problem can be classified depending on the technical concepts and tools used.

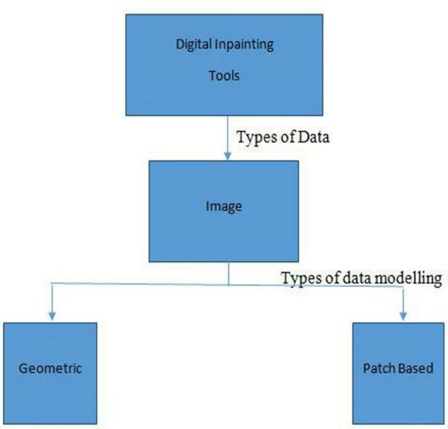

Figure 3.1 – Proposed Synthesis for digital inpainting tools.

Based on the literature review made for the purpose of understanding and structure based in painting problem, this means image in painting, some texture synthesis emerged as more relevant for in painting solutions helps in understanding their relationships, notably similarities and differences between available and emerging solutions. In this context, the main edge texture synthesis proposed to problem and classify the technologies and solutions for image and in painting, as shown in Figure 3.1.

Image Inpainting Tools :Digital inpainting tools are divided into two main categories, in geometric and patch based depending on the type of data being considered, notably images. The main differences between these two types of data are the world they live in and the amount of information to be processed. Images live in a 2D world which is spatially constrained by two coordinates. Recently, there is emerging a new direction to exploit perceptual redundancy and to improve visual quality. This approach is inspired by the remarkable progresses in image inpainting and texture synthesis. The basic idea is to remove some image regions at encoder, and to restore them at decoder by inpainting or synthesis methods.Moreover since source images are available at encoder, various distinctive features can be extracted from removed regions and transmitted as assistant information, which may greatly empower the inpainting or synthesis methods.The assistant information can be regarded as a compact description of some image regions. From the inpainting point of view, assistant information makes inpainting a guided optimization for visual quality instead of a blind optimization. In this paper, we try to investigate the capabilities of inpainting as well as synthesis in image compression, given edges as assistant information. We propose an image coding scheme, in which some blocks are removed at encoder side but the edges relating to them are transmitted. At decoder side, we design edge-based inpainting and employ texture synthesis for our scheme, in order to fully utilize edges to restore the removed blocks. Experimental results demonstrate the efficiency of our scheme in terms of great reduction in bit-rate.

Edge-Based Inpainting Algorithm: Our proposed EBI method is performed based on individual edges. For each edge, EBI is completed in two steps as shown in Figure 3.2,First, a linear interpolation is adopted to generate the unknown pixels on the edge from the known ones on the same edge. Second, the neighbourhood of an edge, known as influencing region, is progressively filled-in by pixel generation.

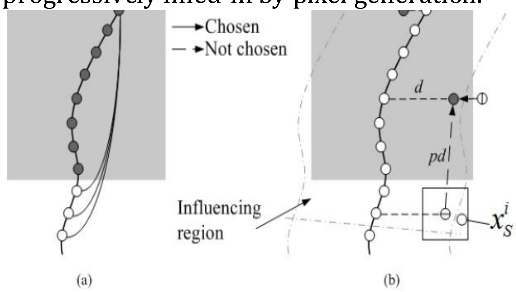

Figure 3.2 Edge-based inpainting. (a) Unknown edge pixels are restored by interpolation; (b) the other unknown pixels are generated one by one, each of which is filled-in by one of two Candidate pixels.

Image inpainting encoding and decoding Algorithm:- The objective of this inpainting-based image coding solution is to design a fully automatic frame work towards image compression, which aims at significantly reducing visual redundancy inherent to natural images while achieving good restored image perceived visual quality. In this context, some distinctive features are extracted from the originals at the encoder side, which help selecting the regions to be and not to be in painted; therefore, allowing the system to choose, for each region, the most suitable coding approach from those available. In the proposed solution, edges have been chosen as the features to be extracted since the human visual system relies on them to identify and interpret the objects' attributes and their mutual associations; thus, it is expected that their inclusion in this in painting-based image coding solution will positively impact the restored image perceived visual quality.

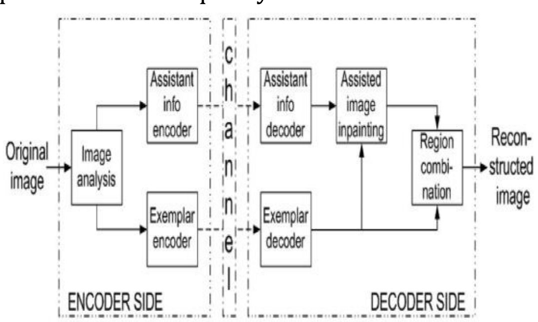

Figure 3.3 Image encoding and decoding algorithm

In our proposed scheme as shown in Fig 3.3 , the normal image encoder/decoder can be any of the existing compression systems. Block-based coding methods are more suitable because our exemplar selection is also block-based. In this paper, we test our scheme on image intra coding. The edges related to the removed blocks are collected and coded. One binary map, which indicates whether a block is removed or not, is also coded into the bit stream .In the comparison with standard JPEG, we use the image and set the quality parameter from 50 to 95. Since PSNR is not quite suitable here, the method proposed is adopted to evaluate the quality of decoded images.

Fig 3.3 depicts our proposed image compression scheme, in which inpainting and synthesis methods are integrated with normal image encoder/decoder such as JPEG codec. In our scheme, edge extraction is first performed on the original image. Then, according to exemplar selection, some blocks will be removed and the others will be encoded. Here, the coded blocks are called exemplars because they will be used as exemplas in inpainting and synthesis. For the removed blocks, corresponding edges will be encoded and transmitted. At decoder side, edge performed successively, both of which utilize edges and exemplars to restore the removed blocks. Simple edges, which only record the locations of edge pixels, are regarded as the assistant information for inpainting or synthesis for the following reasons. First, edges are crucial to the restoration of salient structures in images, as have been analyzed with some mathematical models. Second, edges are concise and easy to be described in the compressed fashion. Last but not least, edge information is a low-level image feature which can be easily extracted compared with some semantic image features, the adoption of edges enables a fully-automatic system.

EDGE EXTRACTION AND EXEMPLAR SELECTION

Edge Extraction: At encoder side, edges are first detected from the original image . Then, for the purpose of efficient compression, we propose a thinning process which condenses edges into one-pixel-width curves. In this process, we consider the following factors: the second derivative of each edge pixel calculated by the Laplacian operator; the difference in values between neighboring edge pixels; and the curvature of the edge at each pixel. These three terms are minimized to yield a smooth edge whose intensity is also continuous.

Exemplar Selection:

After edges are extracted, exemplar selection is performed to remove some blocks from an original image, and the remaining ones are regarded as exemplars which will be coded by normal image encoder. The exemplar selection is conducted at non-overlapped 8×8 block level. Each 8×8 block is classified into structural or textural. In specific, if a block contains more than one-quarter pixels which are located within a short distance (e.g. 5-pixel) from the edges, it will be regarded as structural, otherwise textural. Two kinds of blocks are processed independently.

Structural exemplar selection:

The selection of exemplars from structural blocks is accomplished in two steps. First, some blocks are regarded as necessary because inpainting can hardly restore them. Second, some additional blocks are selected in order to improve the visual quality of reconstructed images. block located at the end points or conjunctions of edges are regarded as necessary blocks, because they contain the transition between different image partitions and thus are hard to be restored by inpainting. For a circle edge, two necessary blocks are identified in its inner and outer regions, re-e-based inpainting and texture synthesis are respectively. These two are selected to provide exemplas for inpainting. Moreover, additional structural blocks are selected to represent local variations. If a block contains obvious variation, it has the priority to be preserved. In practice, each black , Denoted as Bi, is assigned a variation parameter Vi defined as:

$Vi = w1 V ar(Bi) + w2$

Bj?$\mu4(Bi)$

$|E(Bi) - E(Bj)|$

where $w1$ and $w2$ are weighting factors, and $\mu4()$ indicates four neighbors of a certain block. The functions $V ar()$ and $E()$ are the variance and the mean of pixel values, respectively. Note that in one block, the different partitions separated by edges are independent in calculating the variance and the mean; then the resulting parameters of different partitions are summed up to get the total variation parameter of the block . Given an input threshold, the blocks with higher variation parameters will be selected as exemplars.

Textural exemplar selection:

Textural exemplars are also selected in two steps. Denoted by the white blocks necessary textural blocks are selected at the border of textural regions. In specific, if a textural block is next to a structural one, it is considered as necessary. Such blocks are preserved because they can clearly separate textural blocks from structural ones and thus facilitate texture synthesis at the decoder. Additional blocks are also selected according to their variation parameters .The textural blocks with higher variation parameters will be preserved as exemplars.

Image Restoration:

At the decoder side, we propose a compression-oriented image restoration method to reconstruct the removed blocks. Different from the previous work on inpainting or synthesis, our image restoration method tries to fully utilize the transmitted edges. In specific, edge-based inpainting (EBI) is performed to restore the pixel values on the edges and neighboring the edges, and texture synthesis is utilized for the restoration of textural regions.

Edge-Based Inpainting:

Our proposed EBI method is performed based on individual edges. For each edge, EBI is completed in two steps: First, a linear interpolation is adopted to generate the unknown pixels on the edge from the known ones on the same edge. Second, the neighborhood of an edge, known as influencing region, is progressively filled-in by pixel generation. In the following we will concentrate on the second step. In general, edges represent the structural information that consists of the discontinuities in images. But the textural information, referred to as kinds of regularities in statistics, geometric shapes, etc., also exists in the neighborhoods of edges. How to simultaneously restore the two kinds of information is an important issue .We approach the problem by the pixel generation method. For each unknown pixel in the influencing region, known as the target pixel, we modify the pair matching method to find out two candidate pixels. One is denoted as structural candidate (S-candidate), which lies within the influencing region; the other, textural candidate (T-candidate), locates within the neighborhood of the target pixel. S-candidate is chosen to minimize the following weighted sum of squared difference (SSD).

Texture Synthesis: After EBI, a patch-wise texture synthesis algorithm is adopted to restore the remaining regions, where patches are blocks with fixed size (e.g. 7 × 7). The patch furthest from the edges will be generated first, so as to prevent the interference of edges in texture synthesis. For a target patch which is partially unknown, a known patch is searched out from its neighborhood in terms of the least SSD between two patches .Graph-cut and Poisson editing are utilized to merge the known patch into the position of the target patch. This process is repeated until no unknown pixel exists.

IV EXPERIMENTAL RESULTS

Block-based coding methods are more suitable because our exemplar selection is also block-based. In this paper, we test our scheme on JPEG. The edges related to the removed blocks are collected and coded by JBIG method. One binary map, which indicates whether a block is removed or not, is also coded into the bit stream. In the comparison with standard JPEG, we use the different image and set the quality parameter from 50 to 95.The quality score is independently calculated for R/G/B color components. our scheme outperforms JPEG in terms of the quality score. We would like to remark that the method is specially designed to capture ringing and block artifacts. How to evaluate the artifacts introduced by inpainting or synthesis is still an open problem. Figures show some results of the different jpeg image,The decoded exemplars as well as edges (white curves) are depicted. EBI is first performed to give out , then texture synthesis fills-in other unknown regions and presents the final result .fig. 4.4 is the decoded image .

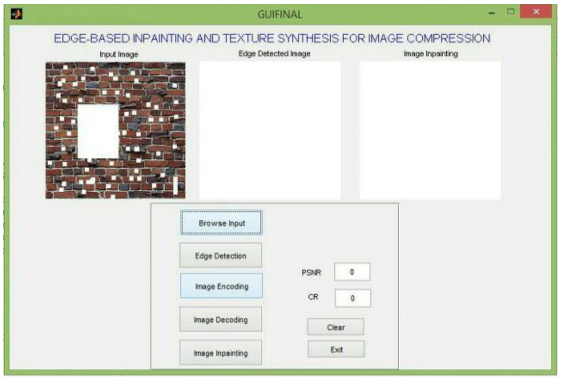

Fig: 4.1 Browse input in GUI.

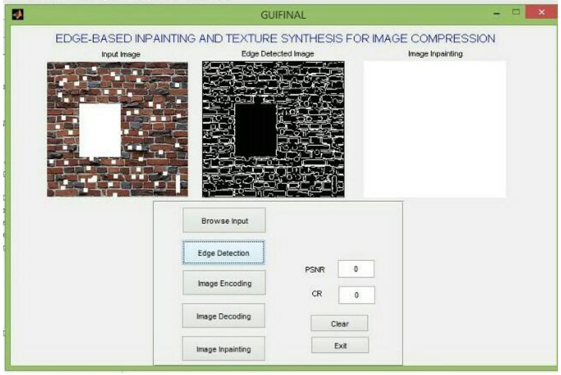

Fig 4.2 : Edge Detection of Image

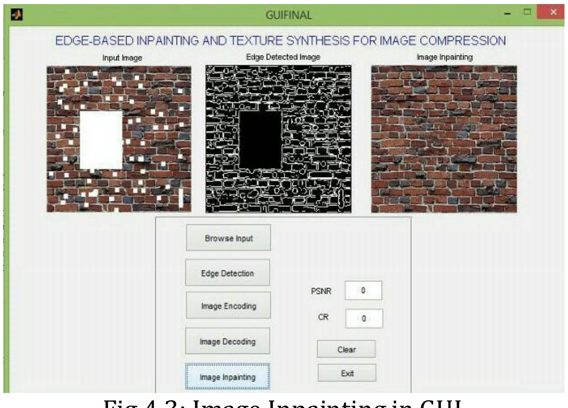

Fig 4.3: Image Inpainting in GUI

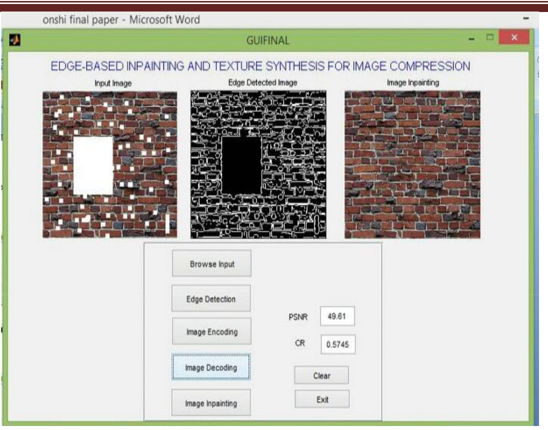

Fig 4.4 : Final Image after inpainting with PSNR and CR

V CONCLUSION AND FUTUREWORK

In this paper, we have investigated a compression approach towards visual quality rather than pixel-wise fidelity. An image compression scheme is proposed to take advantage of inpainting as well as synthesis techniques and combination of edge exemplar and selection. In our method, firstly edge detection is performed after that exemplar selection are selected to get original image,while simple edges are transmitted as assistant information. To fully utilize these edges, we design edge-based inpainting and adopt texture synthesis to restore original image. Experimental results show that our scheme can achieve bit-rate saving as high as 32% at similar visual quality levels. The peak signal to noise ratio in encoding and decoding process is calculated. Currently we have not implemented any optimization at either algorithm or realization level, the decoding will cost a few minutes for a 512×512 image. It requires our future work on the acceleration of inpainting and synthesis algorithms.

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