Entity Elimination by Image Inpainting using Coherency Sensitive Hashing Method

Ravi Choyal[1], Prof. Aashish Patidar[2]
[1]PG Student, M. Tech.-Digital Communication, VITM, Indore (M.P.)
[2]Assistant Professor, EC Department, VITM, Indore (M.P.)

Abstract- *Image processing involve different techniques are mathematical computations to enhance the image quality of images. In these techniques the images are manipulated for reducing the sensor errors, noises and other unwanted effects. One of the image processing technique known as the image inpainting is used for improving the image quality by reconstruction of the defected image or noisy image. In this proposed work the image inpainting techniques are evaluated and investigated in detail. The proposed CSH based image inpainting technique includes the four main phases for image enhancement. First identification of target regions of image, secondly computations of hash table, third the computation of best patches and mapping and finally the updates on the target image. The proposed technique is implemented using the MATLAB technology and the performance of the algorithms are compared and measured in terms of MSE, PNSR and time consumption.*

Keywords- image inpainting, CSH, MATLAB, PSNR

I. INTRODUCTION

The term inpainting is derived from the ancient art of restoring image by professional image restorers in museums. Image Inpainting is the technique of restoring vanished parts of an image and reconstructing them based on the background information. This has to be done in an undetectable way. Inpainting techniques range from the automatic methods to those labor intensive retouching methods. Digital Image Inpainting tries to imitate this process and perform the inpainting automatically. This movement consists of filling in the mislaid areas or modifying the smashed ones in a visually plausible way by an observer not familiar with the original images. This is reminiscent of interpolation approaches used in film restoration and the global optimization method. Applications of image inpainting choice from restitution of photographs, films and paintings, to elimination of occlusions, such as text, subtitles, stamps and publicity from images. In addition, inpainting can also be used to produce special effects [1].

Ancient images are restore by professional artist as shown in figure 1.1 where a professional artist restoring the image manually. Figure 1.2 (a) shows original damaged image while figure 1.2 (b) shows image after restoration perform by professional artist who completes the image in undetectable way. After that this work is extended so as to remove scratches, gaps like that, it is further extended so that it can remove small objects from image like stamp, alphabets, missing portions, dates etc [2].

Figure 1.1 Ancient Art - Image Restoration

Figure 1.2 (a) Original image (b) Restored Image

In this presented work the image inpainting and restoration techniques are investigated and a new technique for enhancing the performance of image inpainting is proposed. The proposed technique utilized for Coherency Sensitive Hashing (CSH) technique for removal of objects in target image. The object removal from images is nothing but an image manipulation technique. The purpose of region completion varies from remove-undesired object to improve the quality of image.

II. NEED OF INPAINTING

Image is a kind of digital data which is stored in a matrix; this matrix contains the numerical values for information. This information represents the real-world objects and information. In long time preservation the image can be corrupted or damaged by the noise or sensors effects. Thus the corrupted or noisy areas of images are repaired or restoration is required. Thus image inpainting is a technique where the mathematical models are used for improving the quality of corrupted image or targeted region in an image.

Thus image inpainting is a technique by which the image improvement is performed by the re-generation of the corrupted images. There are a number of image restoration techniques and image inpainting techniques are available for image inpainting. The next section provides the different techniques and algorithms which are frequently used for image inpainting or image restoration.

Nowadays, there are different approaches to image inpainting are available. And we can categorize them into several categories as follows:-

Texture synthesis based algorithms are one of the earliest methods of image Inpainting. And these algorithms are used to complete the missing regions using similar neighborhood of the damaged pixels. The texture synthesis algorithms synthesize the new image pixels from an initial seed. And then strive to defend the local formation of the image. All the earlier Inpainting techniques utilized these methods to fill the absent region by sampling and copying pixels from the neighboring area. For e. g, Markov Random Field (MRF) is used to model the local distribution of the pixel. And new texture is synthesized by querying existing texture and finding all similar neighborhoods. Their differences exist mainly in how continuity is maintained between existing pixels and Inpainting hole [3].

Partial Differential Equation (PDE) based algorithm is proposed by Bertalmio et.al [4]. This algorithm is the iterative algorithm. The main idea behind this algorithm is to continue geometric and photometric information that arrives at the border of the occluded area into area itself. This is done by propagating the information in the direction of minimal change using "isophote lines". This algorithm will produce good results if missed regions are small one. But when the missed regions are large this algorithm will take so long time and it will not produce good results.

The Exemplar based approach is an important class of inpainting algorithms. And they have proved to be very effective. Basically it consists of two basic steps: in the first step priority assignment is done and the second step consists of the selection of the best matching patch [2]. The exemplar based approach samples the best matching patches from the known region, whose similarity is measured by certain metrics, and pastes into the target patches in the missing region. Exemplar- based Inpainting iteratively synthesizes the unknown region i. e. target region, by the most similar patch in the source region. According to the filling order, the method fills structures in the missing regions using spatial information of neighboring regions. This method is an efficient approach for reconstructing large target regions.

Hybrid inpainting technique is also called as Image Completion. It is used for filling large target (missing) regions. And also preserves both structure and texture in a visually plausible manner. The hybrid approaches combine both texture synthesis and PDE based Inpainting for completing the holes. The main idea behind these approaches is that it decomposed the image into two separate parts, Structure region and texture regions. The corresponding decomposed regions are filled by edge propagating algorithms and texture synthesis techniques. These algorithms are computationally intensive unless the fill region is small [5].

III. PROPOSED SOLUTION

Patch-based methods have been very successful in a wide variety of computer vision and graphic applications. Patch-Match takes image consistency to the risky and uses it for various image editing applications. It was recently generalized and applied to other applications as well, such as image de-noising. Patch-Match works in rounds [6]. Given a pair of images it randomly assigns each patch in image A to a patch in image B. Most assignments yield poor matches, but some are quite good. Patch-Match then propagates the good matches to nearby patches, in the image plane. To avoid being trapped in local minima, it also performs a number of random patch assignments for each patch, keeping the best match after each stage. The algorithm usually converges after a small number of iterations. In addition of that it consumes more cycles for improving the image quality. Thus required to reduce the number of cycles and also required to improve the resource consumption

In order to improve the traditional technique of the image object removal the following suggestions are proposed to implement.

1. Evaluation of exemplar based technique: In this phase the exemplar based technique is analyzed and implemented using MATLAB to understand the working of the inpainting.

2. Obtaining the enhanced technique of patch based technique: In this phase the enhanced techniques of the patch based method is obtained where two improved methods are found first is known as LSH (f locality sensitive hashing) and second is known as CSH (Coherency Sensitive Hashing) [7].
3. Implementing the obtained technique for object removal for inpainting: Among them the CSH is more efficient and promising for image restoration. Thus the CSH based inpainting technique is required to developed.

To understand the process of the inpainting the figure 1.3 provides the different components and their descriptions.

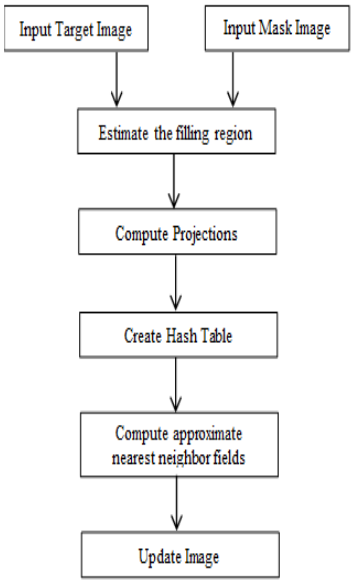

Figure 1.3 Proposed Inpainting

IV. RESULTS

In order to implement desired compression algorithm and their analysis the following development environment is required to setup.

- Tool: User Interface Design (UI Design)- MATLAB
- Hardware Specifications: 40GB Storage Disk (Minimum), 512MB RAM (Minimum), Intel P4 Processor or higher.
- Software Specification: Windows XP or higher.

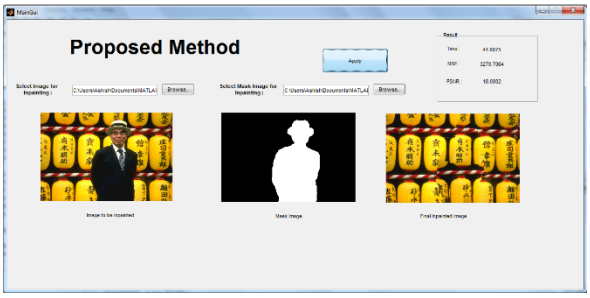

Figure 1.4: Inpainted result for image 1

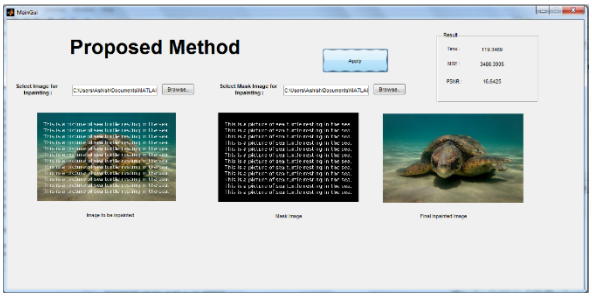

Figure 1.5: Inpainted result for image 2

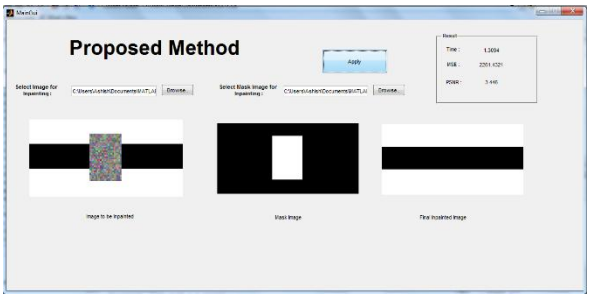

Figure 1.6: Inpainted result for image 3

During execution of the algorithms the system required time and memory resources. The given table 1.1 gives the experimental values of all performance parameters.

Table 1.1: Performance parameters

S.No	Test	Time Taken	MSE	PSNR
1	Man	41.68	3270.7	18.08
2	Tortoise	119.34	3486.3	16.64
3	Square	1.30	2261.4	3.44

The implementation of the proposed technique is performed using MATLAB simulation tool and the C++. Additionally the results are evaluated in terms of different parameters, the evaluated performance of both the implemented technique is given using the below given table 1.2.

Table 1.2 Performance summary

S.No	Parameters	CSH	Exemplar
1	Time	Less	High
2	MSE	High	Less
3	PSNR	Less	High

According to the evaluated results the performance of the proposed inpainting technique is found optimum and efficient as compared to traditionally available exemplar based technique.

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