Review On Image Portion Mixing With Background Using In-painting Technique

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Abstract—**Inpainting is the technique of modifying an image in an imperceptible form, is a very old fine art itself. The goals and applications of inpainting are frequent from the restoration of damaged paintings and image photographs to the removal or replacement of selected objects. Image Inpainting is the ability of filling in misplaced data in an image. The principle of inpainting is to restructure missing regions in a visually feasible manner so that it seems realistic to the human eye. There have been numerous approaches proposed for the equivalent. In this paper, we present an algorithm that improves and extends a previously proposed algorithm and provides faster inpainting. Using our approach, one can inpaint huge regions i.e. remove an object as well as recover minute portions.**

Keywords—**Image-restoration, Image-inpainting, Object removal, Super resolution.**

I. INTRODUCTION

Inpainting is the process of reconstructing lost or deteriorated parts of an images and videos. In the museum world, in the case of a painting, this task would be carried out by a trained art conservator or art restorer. In the digital world, inpainting also called as Image Interpolation or Video Interpolation refers to the application of sophisticated algorithms to replace lost or corrupted parts of the image, generally to remove small regions or small defects.

Image inpainting refers to the technique of reconstructing the original image which has been scratched due to factors such as ageing, wear and tear and occlusion. The challenge lies in the fact that the viewer seeing the inpainted image should not be able to estimate that the image had been tampered among. Around lots of inpainting techniques available in literature. Some performance are based on Partial Differential Equations (PDE), some are Statistical-based techniques and some are Exemplar-based techniques. Due to the better correctness of inpainting, the modern period has seen an increasing focus on exemplar-based method for image inpainting by researchers.

The term inpainting is also called retouching. The need to retouch the image in an unremarkable way extended logically from paintings to photography and film. The purposes remained the same, to lapse deterioration (e.g. scratches and dust spots), or to add or remove objects. In the digital domain, the in-painting problem primary appeared under the name 'Error concealment' in Tele-communication, where the need was to fill-in image blocks that had been lost during data transmission. Popular requirements used to denote inpainting algorithms are also 'Picture Completion' and 'Image Fill-in'.
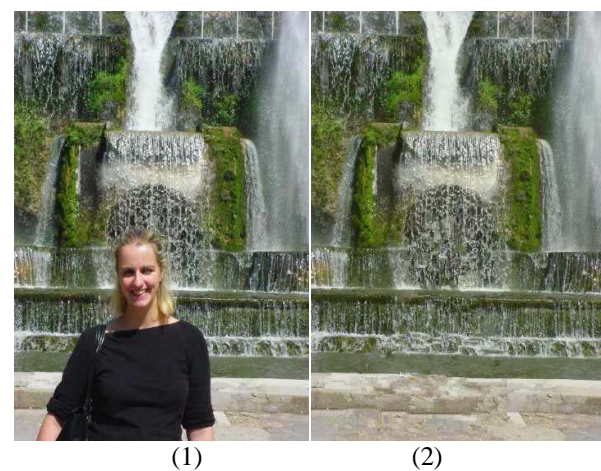

Figure: (1) Input original image, (2) Output inpainted image

Inpainting refers to methods which consist in filling missing regions or holes in an image [1]. Existing methods can be classified into two most important categories. The first category concerns diffusion-based approaches which propagate linear structures or level lines so called Isophotes, using diffusion based on PDE [2][4] and variation methods [4]. The diffusion-based method tends to initiate some blur when the hole to be filled in is large. The consequent relations of approache concerns examplar-based methods which sample and copy finest matching texture patches from the recognized image region [4]. These methods have been stimulated from texture synthesis techniques [8] and are known to work well in the case of expected or repeatable textures. A modern approach [10] combines an examplar-based approach with super-resolution. It is a two-steps algorithm. First a coarse version of the input picture is inpainted and the second step consists creating an improved resolution picture from the coarse inpainted image. Even though remarkable improvement has been made in the past years on examplar-based inpainting, there still exists a number of problems. We believe that the most significant one is associated to the parameter settings such as the filling order and the patch size.

II. RELATED WORK

This section describes the various existing schemes which are compared in this paper:

A. Image Inpainting

M. Bertalmio and Guillermo Sapiro [2] introduced image inpainting for digital image handing out. Their representation is based on nonlinear partial differential equation, and imitates
the techniques of museum artist who specialize in restoration. They focused on the principle that better inpainting algorithms should propagate sharp edges into the scratched parts that need to be filled in. This can be done, by involving contours of constant gray scale image strength, called isophotes to each one across the inpainting region so that gray levels at the edge of the damaged region extend continuously into the interior. They also impose the direction of the isophotes as a boundary condition at the edge of the inpainting domain.

B. Region filling Object removal by exemplar-based inpainting

A. Criminisi, P. P´erez and K. Toyama [7] decomposes the original image into two components; one of which is processed by inpainting and the other by quality synthesis. The output image is the sum of the two processed mechanism. This approach still remains inadequate to the removal of small image gaps, however, as the dispersion process continues to blur the filled region. One of the first attempts to use exemplar-based synthesis specifically for object removal. There, the order in which a pixel in the target region is filled was dictated by the level of 'texturedness'of the pixel's neighborhood. Although the insight is sound, strong linear structures are often overruled by close to noise, minimizing the value of the additional computation. A associated technique group the fill order by the local shape of the target region, but did not search for to explicitly propagate linear formation.

C. Mathematical Models for Local Deterministic Inpaintings

T. Chan, J. Shen [4] proposed fill in the missing data by the property of isophotes (lines of equal gray value). Inspired by the work of Bertalmio, T. Chan and J. Shen proposed the Total Variation (TV) inpainting model which includes denoising, inpainting, and deblurring[3], then extend it to Curvature-Driven Diffusion model by defining the strength of diffusion process.In this process consist of two steps. In the first step the noisy pixels are detected and they are piped to next step. In that step, these noisy pixels are inpainted using the information from their neighbourhood.Above methods needed to solve Partial Differential Equations (PDE). It is a very complex and time- consuming process that takes minutes.

D. Fast Digital Image Inpainting

Manuel M. Oliveira [5] uses a diffusion kernel to convolve the inpainting domain try to reduce the complex of PDE. However this method doesn't preserve the isophotes directions very well, some high-gradient image

area must be manually select before inpainting to prevent blur. But, among numerous inpainting techniques, exemplar-based inpainting [9] is most often used to complete damaged area or remove objects in an image. The algorithm proposed in [9] deal with the topology of inpainting by using a priority value for each patch. The priority value P is evaluated by function P = C * D. The confidence value C value is computed according to the percentage of "real" information which is used in the filling process. The data term D is computed by the inner product of an orthogonal-gradient and a unit vector orthogonal to the front damaged area. The work of this inpainting procedure starts with robust algorithm of colour segmentation: mean shift segmentation. After we separate out structure information form image, the missing contour could be repaired by using Bézier90 curve. Finally, the exemplar-based image inpaintng method would be applied to recover all information of damaged area from other source area.

E. Image inpainting by patch propagation using patch sparsity

Le Meur and C. Guillemot [10] combines an examplar-based approach with super-resolution. It is a two steps algorithm. First a coarse version of the input image is inpainted. Another step consists in creating an improved resolution image from the coarse inpainted image. Although tremendous progress has been made in the [past years on examplar-based inpainting, there still exists a number of problems. We believe that the most important one is related to the parameter settings such as the filling order and the patch size. This problem is here addressed by considering multiple inpainted versions of the input image. To generate this set of inpainted pictures, different settings are used. Notice that the inpainting algorithm is preferably applied on a coarse version
of the input image; this is particularly interesting when the hole to be filled in is large. This provides the advantage to be less demanding in terms of computational resources and less sensitive to noise and local singularities. Super Resolution (SR) methods refer to the process of creating one enhanced resolution image from one or multiple input low resolution images. These problems are subsequently referred to as distinct or multiple images SR in that order. In both cases, the problem is of estimating high frequency details which are missing in the input image(s).

F. GPU image inpainting via texture synthesis

Rosner et. al. [9] have presented efficient algorithms for image warping and image inpainting for frame interpolation and their implementation on the GPU. For each pixel on the edge of the fill region, they disseminate its intensity to the fill region and calculate its distance to the boundary of the fill region. Depending on the distance as well as the intensity values, the pixel is inpainted. Kwok et al. [14] have proposed an proficient algorithm for exemplar based inpainting, in which they isolate the exemplars into the frequency coefficients and select only the relevant coefficients. Investigation for best exemplar is prepared by the use of a search array data structure, which

can simply be ported to the GPU. Hamilton Chong [8] has followed a texture-synthesis approach to image inpainting. He assigns weights to every single one pixel in the undamaged portion of the image and based on these weights, he determines the pixel on the way to replaced as the injured pixel that is most constrained by its neighbours. He then replaces the preferred damaged pixel by the pixel with the best district region match. The determination of the replaced pixel and its replacement is carried out on GPU.

G. Hierarchical Super-Resolution-Based Inpainting

Olivier Le Meur, Mounira Ebdelli [1] proposed method builds upon the super-resolution based inpainting method which is base on examplar-based inpainting and single-image examplar-based super-resolution [10]. The main innovation of the algorithm is the combination of multiple inpainted versions of the input picture. The underlying principle behind this approach is to cope with the sensitivity of examplar-based algorithms to parameters such as the patch size and the filling array. Unusual combinations have been experienced and compared. The proposed method improves on the state-of-the-art examplar-based inpainting methods by proposing a new framework involving a combination of multiple inpainting versions of the input picture followed by a single-image examplar based SR method. Note that the SR method is used only when the inpainting method is applied on a low resolution of the input picture.

III. PROPOSED SYSTEM

Image completion of large missing regions is a demanding job. There are a number of solutions to deal with the inpainting problem. In this paper, we propose a latest inpainting framework relying on both the combination of low-resolution inpainting images method and a single-image super-resolution algorithm. In this section, we briefly present the main ideas of this paper and the reasons why the proposed method is latest and innovative. The proposed method is composed of two main and sequential operations.

The first one is a non parametric patch sampling method used to fill in lost regions. The inpainting algorithm is firstly applied on a coarse version of the input image. In fact a low-resolution image is mainly represented by its leading and important structures of the scene. We believe that performing the inpainting of such a low-resolution image is much easier than performing it on the full resolution. A low-resolution image is less contaminated by noise and is composed by the main scene structures. In other words, in this kind of picture, local orientation singularities which could affect the filling order computation are strongly reduced.

Second, as the picture to inpaint is smaller than the original one, the computational time is significantly reduced compared to the one necessary to inpaint the full resolution image. To give more robustness, we inpaint the low-resolution picture with different settings such as patch's size, filling order, etc. By combining these results, a final low-resolution inpainted picture is obtained. Results

will show that the robustness and the visual relevance of inpainting is improved. The second operation is run on the output of the first step. Its goal is to enhance the resolution and the subjective quality of the inpainted areas.

IV. CONCLUSION

In this paper, related work of different schemes is given based on their goals and application briefly describes the different scheme of image inpainting which shows that the proposed scheme overcomes the limitations of other schemes, solve the problem and gives the experimental results on a wide variety of images have demonstrated the effectiveness of the proposed work . The proposed algorithm is intended for filling in locally small areas. For larger inpainting domains, a scale-space approach can be used to preserve the algorithms speed at the expense of reconstruction quality.

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