A Review of Literature on Image Inpainting

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Abstract— The main goal of the In painting algorithm is to change the damaged region in an image in such a way that the in painted region is invisible to the ordinary observers who are not known with the original image. Image in painting is an art of missing value or a data in an image. The purpose of image in painting is to reconstruct missing regions which is visible for human eyes. Image in painting is the process of reconstructing missing part of images based on the environment information. This proposed work presents a brief survey of different image in painting techniques and comparative study of these techniques. In this paper we provide a review of different techniques used for image in painting. We discuss Total Variation based image in painting.

Keywords: Image In painting, Exemplar based in painting, Partial difference equation inpainting

I. INTRODUCTION

Inpainting is the process of reconstructing lost or deteriorated part of images based on the surroundings information. I.e. image Inpainting fills the missing or damaged region in an image utilizing spatial information of its near region. Inpainting algorithm have many applications. It is helpfully used for return of old films and object removal in digital photographs.[1] It is also applied to redeye correction, super decision, density etc. In case of digital images, only the available image is taken for the experiment and thus filling in a hole that encompasses a whole object. It is not possible to replace that whole object based on the required current information. The goals and applications of in painting are many, from the return of damaged paintings and photographs to the removal/replacement of selected objects.

II. REVIEW OF LITERATURE

We can classify them into several categories as follows:-

A. Exemplar Based Inpainting:

Exemplar based in painting is also known as surface combination Technique .This Method fill the in painting region with a touch patches from the surrounding area. Exemplar- based in painting iteratively synthesizes the unknown region i.e. target region, by the most similar patch in the source region.[2] According to the filling order, the method fills structures in the missing regions using spatial information of near regions. This method is an efficient approach for reconstructing large target regions. Exemplar based In painting will produce good results only if the missing region consists of simple structure and texture. And if there are not enough samples in image then it is impossible to synthesize the most wanted image.

Generally, an exemplar-based Inpainting algorithm includes the following four main steps:

1) Initializing the Target Region, in which the initial missing areas are extracting and represented with appropriate data structures.
2) Computing Filling Priorities, in this a predefined priority function is used to compute the filling order for all unfilled pixels pєδΩ in the beginning of each filling iteration.
3) Searching Example and Compositing, in which the most similar example is searched from the source region Φ to compose the given patch, Ψ (of size N × N pixels) that centered on the given pixel p.
4) Updating Image Information, in which the boundary δΩ ofthe target region Ω and the required information for computing filling priorities are updated.

Most of the new exemplar-based algorithms adopt the greedy strategy, so these algorithms suffer from the common problems of the greedy algorithm, being the filling order (namely priority) is very critical.

1) Advantage:

This approach is not only helpful to remove the objects from small scale images but this can be applied with the large scale image also. This approach by combining the two techniques provides us the better results.

B. Partial Difference Equation Inpainting:

PDE based in painting models are more suitable for completing small non-textured Target region. This algorithm is the iterative algorithm. The main idea behind this algorithm is to continue algebraic and photometric information that arrives at the border of the Close area into area itself [3]. This is done by propagating the information in the direction of minimal change using isophote lines. In this algorithm the user has to select the area to in painted and after that algorithm restore the image by collecting the information available from the surrounding area of the source image. If mission region are small then this algorithm is work good result but when missed region are large this algorithm will take so long time & it will not produce good result. PDE based technique has been widely used in number of applications such as image segmentation, restoration etc.

C. Total Variation Method:

The use of TV Regularization was originally developed for image denoising & Euler-Lagrange equation and anisotropic diffusion based on the power of the isophotes. The drawback of this method is that this method neither connects broken limits nor greats texture patterns.

In mathematics the total TV identify several slightly different concept related to the global or local structure of the target set of a function. TV-regularized inpainting does not create texture, the method is limited to inpainting the geometric structure. Total variation (TV) regularization is an effective inpainting technique which is capable of improving pointed limits under some conditions [10]. TV minimization can also systematically repress the noise in the images. The time required for the inpainting process depends on the size of the image and the regions to be inpainted, and it ranges form few seconds to several minutes for large images. This noise removal technique has advantages over simple techniques such as linear smoothing or center filtering which reduce noise but at the same time

smooth away edges to a greater or lesser degree. All these researches focused on inpainting in the pixel domain.

D. Texture Combination Based Inpainting

These algorithms are best of the earliest method of the image Inpainting. It is used to complete the missing region using similar near of the damaged pixels. This algorithm synthesizes the new image pixels from an initial start. The main objective of texture synthesis based Inpainting is to generate texture patterns, which is similar to a given sample pattern, in such a way that the reproduced texture retains the statistical properties of its origin texture.

The texture synthesis based Inpainting perform well in similar to textures. These algorithms have difficulty in handling natural images as they are composed of structures in form of edges. Also they have complex interface between structure and texture boundaries. These methods address only a small division of Inpainting issues and these methods are not suitable for a wide variety of applications.

In some cases, they also require the user to specify what texture to replace and the place to be replaced. Hence while appreciate the use of texture synthesis techniques in Inpainting; it is important to understand that these methods address only a small separation of Inpainting issues.

Texture synthesis there are three categories: numerical (parametric), pixel-based and patch-based (non-parametric). Numerical methods are more likely to succeed in reproducing irregular textures, but usually fail to reproduce regular textures [4]. On the other hand, pixel-based methods "build" on the sample texture pixel-by-pixel instead of applying filters on it, and their final outputs are of better quality than those of numerical methods, but they usually fail to grow large structured textures. Finally, patch-based [8] methods "build" on a sample texture patch-by-patch as opposed to pixel-by-pixel, thus they yield faster and more possible regular textures.

E. Hybrid Inpainting:

Hybrid inpainting technique is also called as Image achievement. 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. This technique uses a two-step approach: the first stage is structure completion followed by texture synthesis. In the structure completion stage, segmentation, using the algorithm of, is performed based on the insouciant geometry, color and texture information on the input and then the partition boundaries are extrapolated to generate a complete segmentation for the input using tensor voting. The second step consists of synthesize texture and color information in each segment, again using tensor voting.

We discussed a variety of image Inpainting techniques such as texture synthesis based Inpainting, PDE based Inpainting, Exemplar based Inpainting, Diffusion based Inpainting techniques. For each technique we have provided a detailed explanation of the techniques which are used for filling the missing region making use of image. From this analysis, a number of shortcomings and limitations were highlighted of these techniques. Mostly image inpainting used as remove scratches & cracks, red eye correction, remove object etc.

III. Conclusion

"It is observed that the PDE based Inpainting algorithms cannot fill the large missing region and it cannot restore the texture pattern. The theoretical analysis proved that exemplar based Inpainting will produce good results for Inpainting the large missing region also these algorithms can inpaint both structure and textured image as well."

IV. Acknowledgment

I would like to thank deeply My Husband for their guidelines in making this paper. Inpainting, a set of techniques for making undetectable modifications to images, is as very old as art itself. Applications of image Inpainting are range from the removal of an object from a view to the retouching of a damaged painting or photograph.

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