

SURVEY PAPER OF DIFFERENT METHODS FOR IMAGE INPAINTING

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Abstract: Image inpainting is the art of remove object from image or filling in missing data in image using the information from surrounding known region. The main objective of inpainting is Image inpainting is the art of remove object from image or filling in missing data in image using the information from surrounding known region. The main objective of inpainting is to reinstatement of damaged pixel value and elimination of selected object from image. To perform image inpainting task number of techniques is available and all technique has its own advantages and disadvantages. In this dissertation we discuss about criminisi based exemplar inpainting technique. Optimize time required to perform inpainting and quality improvement in final image is main requirements for any technique. This technique can be used in to improve old image quality, to remove undesirable object, remove pedestrian from image captured for survey purpose etc.

Keywords: image processing, image inpainting, data term, confidence term, priority function, patch.

I. INTRODUCTION

Image inpainting is the subfield of image processing. Image processing is task to apply different mathematical operation on image for to fulfill our requirement efficiently. Image inpainting is process to perform operation on image for improvement of image quality or to eliminate object from image. To perform image inpainting many techniques is available now a day, but all the method are not appropriate for all kind of image inpainting task, each method take care about some specific key point according to application. Some technique take care about structural inpainting and some technique take care about texture inpainting.

So selection of proper technique according to our requirement is important. Now a day technique also available which take care about both structural as well as texture inpainting. Different method has its own advantages and disadvantages. Image inpainting used in number of way for fulfilment of different requirement today. Time required to perform inpainting and quality of output is main constrains in image inpainting. Some basic used of image inpainting is to improve quality of old image, to getting information from partial destroyed image after perform image inpainting on that image, to remove pedestrian from different survey images.



(a) : original image



(b) Image after inpainting
Fig : Inpainting task [1]

II. CATEGORY OF IMAGE INPAINTING

A. Structural inpainting

Structural inpainting used geometric approaches for filling in the missing information in the region which should be inpainted. These algorithm focus on consistency of the geometric structure.[5]

B. Textural inpainting

Structural inpainting methods have both, advantages and disadvantages. The main problem is that all the structural inpainting methods are not able to restore texture. Texture has a repetitive pattern which means that a missing portion cannot be restored by continuing the level lines into gap.

C. Combined structural and textural inpainting

Combined structural and textural inpainting approaches simultaneously try to perform texture and structure filling in regions of missing image information. Most part of image consist of texture and structure. That is why, the state of the

art inpainting method attempts to combine structural and textural inpainting.

III. DIFFERENT METHODS FOR IMAGE INPAINTING

1. Partial Differential Equation (PDE) based algorithm
2. Wavelet transform based algorithm
3. Texture synthesis based image inpainting
4. Semi-automatic and Fast In painting.
5. Criminisi algorithm based exemplar method

A. Partial Differential Equation (PDE) based algorithm

Partial Differential Equation (PDE) based algorithm is proposed by Marcelo Bertalmio et al. This algorithm is the iterative algorithm. The 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. Mainly two methods are in PDE based CDD model and QCDD model. QCDD (quick CDD) is modified CDD (curvature-driven diffusion), and both support connectivity and holistic principal. 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. This algorithm is good due to Isophote driven Approach we find the line of equal gray scale values which contains the more promising information and this used to complete the image with less time. This algorithm also provide some problem, The main difficulty with this algorithm is limitation of large texture regions. This algorithm also unable to recover partially degraded Image. [2]

B. Wavelet transform based algorithm

The algorithm presented the technique with the help of the wavelet transform. Here we expect the best global structure estimation of damaged regions in addition to shape and texture properties. If we consider the fact of multi-resolution analysis, data separation, compaction along with the statistical properties then we have to consider the wavelet transform due to its good image representation quality. Wavelet transform try to satisfy the human visual system (HVS). The algorithm decomposition of incomplete image is done with the help of wavelet and after that wavelet and scaling coefficients is found. The image inpainting process is applied in the wavelet domain by considering both scaling and wavelet coefficient from coarse to fine scales in the target region. Firstly the damaged area is roughly resorted by the fast marching inpainting method in spatial domain. Then the image is projected on to the wavelet domain, the wavelet coefficient corresponding to the damaged block is revalued based upon the known of its neighborhood in detail sub band, while the wavelet approximation is restored by fast marching inpainting method. An inverse wavelet transform is carried out to get an image in spatial domain. This procedure is repeated in several times and the image is projected onto wavelet domain and spatial domain alternately with being applied suitable constraints in each domain. The method iteratively converges

to an image with the damaged area being. Using this algorithm one benefit is This utilizes inter and intra scale dependency to maintain image structure and texture quality using Wavelet Transform. But difficulties In this algorithm is mask for regions are defined manually. [3]

C. Texture synthesis based image inpainting

The Texture synthesis is a field of study independent from, but related to inpainting. In the general definition of this problem, an input sample of a texture is given, and the goal is to produce more of that texture. The simplest solution is to tile the texture sample on a rectangular grid of desired size. However, even if the sample can be tiled seamlessly, the resulting larger grid structure is easily noticeable and it distorts the perception of the actual texture. More sophisticated techniques are required for reproducing the actual texture with all its features and nothing more. A regular (also called deterministic, structured, periodic) texture is characterized by a primitive element (text on or texel) that is regularly placed on a grid or a lattice. For example, floor tiles, brick walls are regular textures, sand and smoke are non regular. Contrarily, in non-regular (stochastic, random) textures, there is no apparent repeating pattern or local structure, but global statistical properties. The texture synthesis based Inpainting perform well in approximating textures. These algorithms have difficulty in handling natural images as they are composed of structures in form of edges. Hence while appreciating the use of texture synthesis techniques in Inpainting. It is important to understand that these methods address only a small subset of Inpainting issues and these methods are not suitable for a large objects. [4]

D. Semi-automatic and Fast Inpainting.

sketching object boundaries from the known to the unknown region and then a patch based texture synthesis is used to generate the texture. The missing image patches are synthesized along the user specified curves by formulating the problem as a global optimization problem under various structural and consistency constraints. Simple dynamic programming can be used to derive the optimal answer if only a single curve is present. For multiple objects, the optimization is great deal more difficult and the proposes approximated the answer by using belief propagation. All the methods discussed above take minutes to hours to complete depending on the size of the Inpainting area and hence making it unacceptable for interactive user applications. [4]

E. Criminisi algorithm based exemplar method

The exemplar based consists of two basic steps 1.priority assignment is done and the 2.the selection of the best matching patch. 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. The method fills structures in the missing regions using spatial information of neighboring regions. This method is an efficient approach for reconstructing big target regions. [6] The Exemplar-based algorithms adopt the greedy strategy, so these algorithms suffer from the common problems of the greedy algorithm, being the filling order is very critical. [7] Exemplar based inpainting will produce good results only if the missing region consists of simple structure and texture. And if there are not sufficient samples in image then it is impossible to synthesize the desired image. [4]

F. Summary

For performing image inpainting number of methods is available and each method have its own advantages and disadvantages .PDE based method is good if filling area is small but if filling area is large then this method take so long time and it will not produce good result. Texture synthesis based algorithm have difficulties in handling natural images as they are composed of structure in form of edges. So these methods address only small area of inpainting issues and these methods are not suitable for a large object. Wavelet transform based method has one advantage that this utilize inter and intra scale dependency to maintain image structure and texture quality using wavelet. But difficulties in these algorithms are mask for regions are defined manually. Semi-automatic and fast inpainting method is give result fast but not suitable when filling area is in form of large hole as they lack explicit methods to in paint edge regions. This technique give blur effect in result image. Finally criminisi based exemplar inpainting method iteratively synthesize the target region by most similar patch in the source region. This method is an efficient approach for filling big target region. Criminisi based inpainting give good result for both texture and structure parts of image.

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