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STUDY OF EXEMPLAR BASED IMAGE INPAINTING TECHNIQUES

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Abstract: - Image Inpainting refers to filling up the missing area of an image by using the information from surrounding's known area such that the resultant image is logically accepted. OR it is a technique of altering the given image in such a way that the resultant image is undetectable by the ordinary observer. It is the technique of repairing the disrupted /missing part of an image plus elimination of unwanted objects. It has wide range of applications-used in restoring the ancient paintings, removal of superimposed text like dates, subtitles, logos or publicity, repairing the damaged parts of photographs and films. In this paper we have discussed various inpainting techniques such as Texture synthesis, PDE based image inpainting, Exemplar based image inpainting, Semi-automatic image inpainting, Hybrid inpainting

Keywords: Image inpainting: exemplar-based, Texture synthesis, Object removal

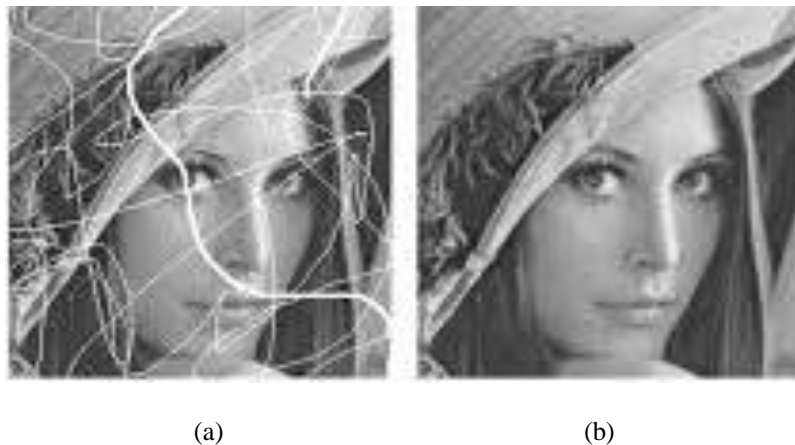
Introduction

In present image inpainting techniques has gained very high popularity in the field of image processing and computer graphics. It has important value in a heritage preservation, film and television special effects production, removing redundant objects etc. In the fine art museums, this Inpainting concept is used for degraded paintings. It's only purpose is to is to reconstruct the deteriorated/damaged part of the image by utilizing the spatial information of the neighbouring region. Image inpainting is widespread in several applications like reformation of old images/films removal of objects in digital images. The idea of image inpainting is to repair the damaged portions, remove the unwanted objects of an image or fill in the holes. This uses the known image information to fill up the missing region such that the texture as well as structure of the image is preserved.

Image Inpainting: Image inpainting has been used to fill in small holes in the image, by propagating structure information from image to the region to be filled. So the aim of the inpainting algorithm is not only reconstruct what used to be in that hole, But instead to create a visually pleasing continuation of the data around the hole in such a way that it is not detectable by ordinary observer.

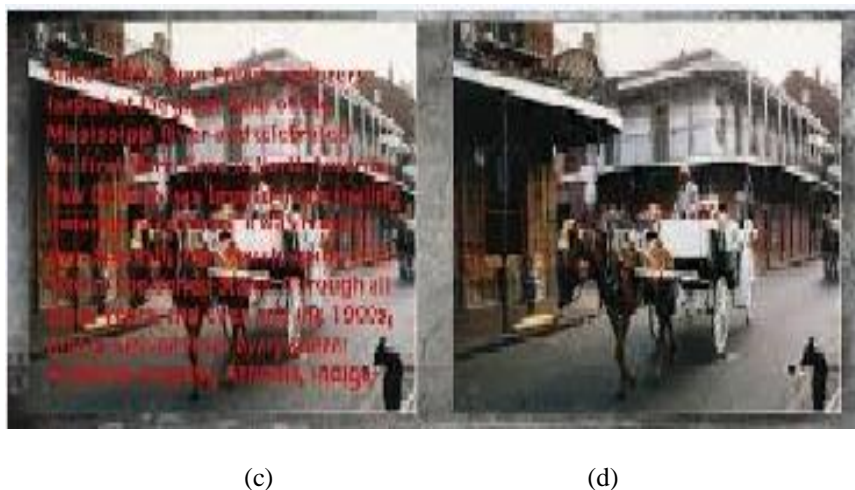
The mixture of texture synthesis technique and inpainting technique produces a new inpainting technique known as **exemplar based image inpainting technique**. That's why exemplar based image inpainting can rebuild texture part as well as structural part of an image

Fig.1 filling of missing/damaged areas



In Figure (a) some missing /disrupted areas are filled up and restored version Fig.(b) is the result of image inpainting.

Fig.2 Removal of super imposed text

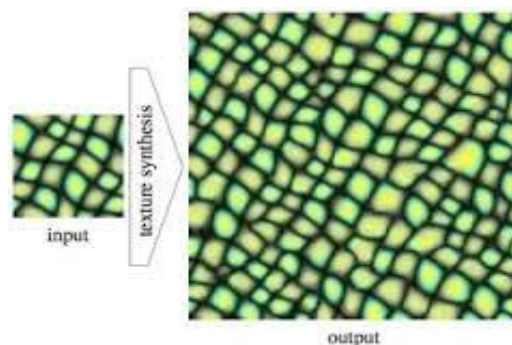


In Fig (c) text has been superimposed on the image .Fig (d) is the required result in which the superimposed text has been removed in order to have greater insight into the image.

Existing Techniques

a) Texture Synthesis: Texture synthesis [4] has been used to fill large image regions with texture pattern similar to given sample. Texture is the most repetitive pattern of the image. So this can be used for generating large image regions from sample texture. Methods used for this purpose range from parametric, which estimate parameterized model for the texture and use it for synthesis, to nonparametric, in which synthesis is based on direct sampling of the supplied texture pattern,. Texture synthesis methods have also been used to fill in small holes in the image which might originate due to deterioration of image or desire to remove some objects.

b) PDE based image inpainting: Partial Differential Equation based method is to continue the geometric and photometric information that appears at the border of disrupted area. The focus of partial differential equation based algorithms is mainly on maintaining the structure of the inpainting area.



The focus of partial differential equation based algorithms is mainly on maintaining the structure of the inpainting area. It is good if missing area is small. But results blurred if missing area is large. Another problem with these algorithms is that the large textured areas are not well regenerated.

c).Exemplar based image inpainting

The exemplar based image inpainting [7] is an important category of inpainting algorithms. The exemplar based image inpainting is an efficient technique of reinstatement of big target regions. The exemplar based image inpainting consists of two stages:

1. First priority assignment

Priority function is utilized to compute the filling order for all unoccupied pixels in the starting of each filling iteration.

2. Choice of the best matching patch.

The exemplar based image inpainting selects the best matching patches from the well-known area, and insert into the target patches in the missing area. According to the filling order, the technique fills structures in the missing regions using spatial information of neighbouring regions

d) Semi-automatic image inpainting

Semi-automatic inpainting method demand user intervention in the form of guidelines to assist in the structure completion in which the user gives the essential missing information in the gap by sketching object boundaries and then a texture synthesis is utilized to produce the texture. but it takes much time for completion.

e) Hybrid Inpainting

It is also known as image completion .Hybrid inpainting is a combination of both texture synthesis and partial differential equation based inpainting for completing the missing area. It produces good results for large missing areas. This technique uses a two-step approach: the first stage is structure completion followed by texture synthesis. In the structure completion stage, segmentation, is performed based on the geometry, colour and texture information on the input . The second step consists of synthesizing texture and colour information in each segment.

Literature Survey

1. Christine Guillemot and Olivier Le Meur, Image Inpainting[1]

This paper introduces methods which are based on the assumption that pixels in the known and unknown parts of the image share the same statistical properties and geometrical structures. This assumption translates into different local or global priors, with the goal of having an inpainted image as physically plausible and as visually pleasing as possible.

2. Swati1 et al [2] he studied and reviewed two algorithms Exemplar Base Inpainting & Progressive Image Inpainting based on Wavelet Transform. These algorithms uses patch based technique for completing missing region of the image with the help of surrounding information that already is present in original image.

3. Bertalmio et al [3] author described an algorithm for the simultaneous filling-in of texture and structure in regions of missing image information is presented in this paper. The basic idea is to first decompose the image into the sum of two functions with different basic characteristics, and then reconstruct each one of these functions separately with structure and texture filling-in algorithms.

4. A.Criminisi, P.perez and K.Toyama, Region Filling and Object removal by Exemplar based Image Inpainting [4]

This paper introduces a new algorithm for removing large objects from digital images. It addresses two classes of algorithms.

- 1) Texture Synthesis algorithms for generating large image regions from sample textures and
- 2) Inpainting techniques for filling in small image gaps

5. Chan and Shen [5] proposed two image inpainting algorithms Total variation (TV) inpainting model uses an Euler Lagrange modelling. Inside the inpainting domain, this model employs anisotropic diffusion based on contrast of the isophote.

6. Nalawade and Ruikar [6] propose to utilize the advantages of wavelet transforms for image inpainting. Unlike other inpainting algorithms, we can expect better global structure estimation of a damaged region in addition to shape and texture properties.

7. Patel and Sarode [7] in this paper, exemplar based image inpainting techniques is used and an algorithm which improves and extends the previously proposed algorithm is presented. This technique is mainly used for removing objects and cracks from the image.

8. Lee et al [8] this paper proposes robust exemplar-based image inpainting algorithm using region segmentation. Exemplar-based inpainting methods iteratively search the source region and fill the missing or damaged region, i.e., target region, with the most similar patch in the source region.

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