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Super Resolution-Based Inpainting

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Abstract: Inpainting is the process of reconstructing lost or deteriorated part of images based on the background information. i. e. image Inpainting fills the missing or damaged region in an image utilizing spatial information of its neighbouring region. Inpainting algorithm have numerous applications. It is helpfully used for restoration of old films and object removal in digital photographs. Super resolution reconstruction produces high resolution image from sequence of low resolution images. The main aim of super resolution is to improve visual quality of available low resolution image. Also existing Low Resolution (LR) imaging can be utilized with help of super resolution reconstruction. Super resolution based inpainting consists in performing first the inpainting on a coarse version of the input image. A hierarchical super-resolution algorithm is then used to recover details on the missing areas. The advantage of this approach is that it is easier to inpaint low-resolution pictures than high-resolution ones. The gain is both in terms of computational complexity and visual quality.

Keywords: Super resolution(SR) images, Exemplar based inpainting, Texture synthesis, Down Sampling, Inplanting.

I. INTRODUCTION

Image inpainting refers to methods which consist in filling-in missing regions (holes) in an image. Old paintings commonly contain damaged parts. However, we may have an image with damaged or unwanted part in its foreground. By removing these parts from the image, some holes appear. These holes are called missing regions. In the digital world, image inpainting is the process of reconstructing missing regions using its own data. These algorithms fill the missing regions of an image in such a way that both structural and textural information of the image remains coherent. Digital image inpainting can be utilized in various applications such as image restoration (e.g., Text removal), special effect (e.g., Object removal), image coding and transmission (e.g., Recovering lost blocks), zooming, and etc.

Related Work of Inpainting Process:

1.1 Diffusion based Inpainting:
Diffusion based Inpainting was the first digital Inpainting approach. In this approach missing region is filled by diffusing the image information from the known region into the missing region at the pixel level. Basically these algorithms are based on theory of variational method and Partial Differential equation (PDE). The diffusion- based Inpainting algorithm produces superb results or filling the non-textured or relatively smaller missing region. The drawback of the diffusion process is it introduces some blur, which becomes noticeable when filling larger regions.

1.2 .Texture Synthesis Based Inpainting:
These algorithms are used to complete the missing regions using similar neighbourhoods of the damaged pixels. The texture synthesis algorithms synthesize the new image pixels from an initial seed. And then strives to preserve the local structure of the image [3].

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 root texture .

1.3 Exemplar Based Inpainting:
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. 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.

II. LITERATURE SURVEY

Diffusion based Inpainting was the first digital Inpainting technique in which missing region is filled by diffusing the image data on or after the identified region into the missing region at the pixel point. Fundamentally these algorithms are based on the variation method and Partial Differential equation (PDE). The diffusion based Inpainting algorithm which may produces accurate results or filling the non-textured regions or comparatively lesser mislaid region. The drawbacks of the diffusion process are it initiates a number of blur, which becomes obvious when filling larger regions. Every PDE based inpainting models are more appropriate for carrying out small, non-textured target region.Models to exclaim losses in films from adjacent frames. The fundamental idea is to copy into the breach the right pixels from neighboring frames. The system cannot be applied to still images or to films where the regions to be inpainted span many frames. Hirani and Totsuka unite frequency and spatial domain information in turn to fill up a specified region with a selected texture.

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The method was mostly introduced for simple images, with only a few objects with stable gray-levels, and will not be appropriate for the examples with natural images presented. Masnou and Morel introduced a technique in recent times which enlarge these ideas, by an extremely inspiring general variation formulation for disocclusion and a practical algorithm not completely based on PDE's implementing some of the ideas in this formulation. The algorithm performs inpainting by amalgamation with geodesic curves the points of the authors, the regions to be inpainted are deficient to having effortless topology, e.g., holes are not isophotes lines of equal gray values incoming at the boundary of the region to be inpainted. Since reported by the allowed.

III.PROPOSED ARCHITECTURE

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 missing regions. However, rather than filling in missing regions at the original resolution, the inpainting algorithm is applied on a coarse version of the input picture.

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. We use a single-image SR approach. Given a low-resolution input image, which is the result of the first inpainting step, we recover its high-resolution using a set of training examples, which are taken from the known part of the input picture.

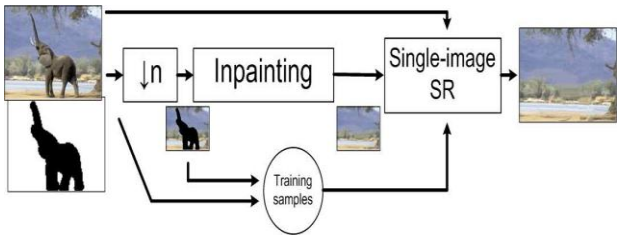

Fig 1: Architectural Design

The following steps are performed:
1. a low-resolution image is first built from the original picture;
2. an inpainting algorithm is applied to fill-in the holes of the low-resolution picture;
3. the quality of the inpainted regions is improved by using a single-image SR method.

System description-

1. Image Inpiainting-
In painting is the process of reconstructing lost or deteriorated parts of images .

2. Region Of Interest-
A region of interest (ROI) is a selected subset of samples within a dataset identified for a particular purpose.

3. Down Sampling-
Down sampling is the process of reducing the sampling rate of a signal.

This is usually done to reduce the data rate or the size of the data.

4. Image Restoration-
Image restoration is the operation of taking a corrupted/noisy image and estimating the clean original image.

- **Mathematical Model** :

Set theory Analysis

1. Let 'S' be the 'Super-Resolution-based Inpainting'.
S= {…….}
Set S is divided into 6 modules
S= {S1, S2, S3, S4, S5, S6}
S1= GUI Handler (GH)
S2= Image Preprocessor (IP)
S3= Database Manager (DM)
S4= Index Generator (IG)
S6= Histogram Builder (HB)

2. Identify the inputs.
Inputs = {X1, X2, X3, ……..Xn}
X1= Input Images
X2= Inplanting selection area
X3= Image Indexing

3. Identify the output as O.
Outputs= {Y1, Y2, Y3, ……..Yn}
Y1= Super resolution image
Y2= Inplant Image

Result:

Fig 2: Result

IV.CONCLUSION

In this paper we review the existing techniques of image Inpainting and super resolution. 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.

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