REAL TIME INPAINTING USING SUPER RESOLUTION

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Abstract: In the past few years different methods has been introduced regarding image inpainting i.e. Diffusion and exemplar-based inpainting. Different algorithms are present today but more efficient algorithms are required. In this paper, using K-NN based exemplar method and Super-Resolution method inpainting is explained.

Keywords: Inpainting, Super-Resolution, Image Processing

1. Introduction

Image inpainting is the process of filling in missing parts of damaged images based on information gathered from surrounding areas For inpainting a damaged image or an ancient painting with missing regions is to guess and fill in the lost image information in such a consistent way that the restored image or painting seems as natural as its original version. Existing techniques can be categorized into two ways. The first category is diffusion-based method which tends to introduce some blur when the image is restored. The second category consists of exemplar based method which sample and copy finest matches texture patches from the known image neighborhood.

Super Resolution is a process that creates enhanced image quality from multiple low resolution images. In this, the estimation of high frequency details is the problem which are missing in the input image. The SR problem is ill-posed since multiple high-resolution images can produce the same low-resolution image. Solving the problem hence requires introducing some prior information. The prior information can be an energy functional de-fined on a class of images which is then used as a regularization term together with interpolation techniques. This prior information can also take the form of example images or corresponding LR-HR (Low Resolution - High Resolution) pairs of patches learnt from a set of un-related training images in an external database or from the input low resolution image itself.

2. Literature Survey

A. 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 variation 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. All the PDE based in painting models are more suitable for completing small, non-textured target region**.**

B. Texture Synthesis Based Inpainting

Texture synthesis based algorithms are one of the earliest methods of image inpainting. And these algorithms are used to complete the missing regions using similar neighborhoods of the damaged pixels. The texture synthesis algorithms synthesize the new image pixels from an initial seed. All the earlier inpainting techniques utilized these methods to fill the missing region by sampling and copying pixels from the neighboring area. For e. g, Markov Random Field (MRF) is used to model the local distribution of the pixel. And new texture is synthesized by querying existing texture and finding all similar neighborhoods. Their differences exist mainly in how continuity is maintained between existing pixels and inpainting hole. 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 exture retains the statistical properties of its root texture.

C. PDE based Inpainting

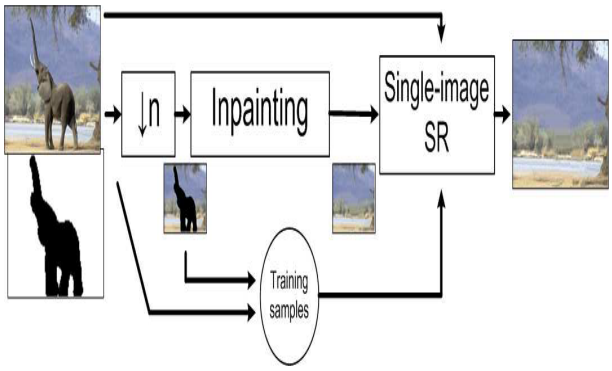
This algorithm is the iterative algorithm. The main idea behind this algorithm is to continue geometric and photometric information that arrives at the border of the occluded area into area itself. This is done by propagating the information in the direction of minimal change using isophote lines. This 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. Then inspired by this work proposed the total variation (TV) inpainting model. This model uses Euler-Lagrange equation and anisotropic diffusion based on the strength of the isophotes. This model performs reasonably well for small regions and noise removal applications. But the drawback of this method is that this method neither connects broken edges nor greats texture patterns. These algorithms were focused on maintaining the structure of the inpainting area. And hence these algorithms produce blurred resulting image. Another drawback of these algorithms is that the large textured regions are not well reproduced.

D. Exemplar based Inpainting.

The exemplar based approach is an important class of inpainting algorithms. And they have proved to be very effective. 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. According to the filling order, the method fills structures in the missing regions using spatial information of neighboring regions. This method is an efficient approach for reconstructing large target regions.

3. System Architecture



This system will be performing real time super resolution based inpainting. Initially the user will select the image on which he wants to perform editing. Then the region of interest is selected which user wants to edit. Then training samples are generated and dictionary is created. Once it is formed then the inpainting process begins and then eventually the desired image is formed.

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 In-painting

Inpainting 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.

5. Super Resolution

Super resolution (SR) is a class of techniques that enhance the resolution of an imaging system

4. Conclusion

In this paper, various image Inpainting techniques such as PDE based inpainting, exemplar based inpainting, texture synthesis based inpainting has been discussed. For each technique an explanation can be given which are used for filling the missing detail. Different limitation were found in each and every technique. The time essential for inpainting process depends on the size of the image and the region to be inpainted and it ranges from few seconds to minutes for larger images. The time analysis will be undertaken.

5. References

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