Examplar Method For Image Inpainting

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***Abstract*—Image has become an important part of our life. The image inpainting is a technique of removing the unwanted part of image without disturbing its overall structure. The inpainting of the low resolution images are simpler than that of the high resolution images. In this system low resolution image is kept under different super resolution image inpainting methodologies and then results of all these methodologies are combined to form the highly inpainted image. For this purpose our system uses the super resolution algorithm which is responsible for inpainting of single image.**

Keywords- Examplar-based inpainting, single-image super-resolution.

I. INTRODUCTION

Image has become useful phenomenon for many research field. In old days images are only used for capturing memories. But now images have changed their face. Images may be two-dimensional, like photograph, and can be three-dimensional, likes statue. They may be captured by optical devices – such as cameras, mirrors, lenses, telescopes, microscopes, etc. and natural objects and phenomena, such as the human eye or water surfaces. Today, images can be used for encryption, processing, authentication, sharing etc. purpose. But the main aim of image is still being preserve i.e. to store the memories. Sometimes useful images get discarded or deleted due to extra part or distortion in image. Here super resolution algorithm is used which is used to guess and fill in the lost image information to restored image or painting seems as natural as its original version. First the object in the required target area is removed by inpainting. The output thus obtained is given as input to a super-resolution algorithm to recover details on missing areas. Exemplar-based inpainting is used to remove objects that are not required. It is desirable to use a Super-resolution algorithm since inpainting produces a low resolution (LR) image.

Initially inpainting is used for scratch removal. The next applications include removal of object, text and other automatic modification of images. The object removal is a process to remove objects from images and fill the hole by taking information from the surrounding area pixels. The inpainting is process of replacing the corrupted part of the image by using the various effective image inpainting techniques which can able to fix and recover the small defects occurring inside the image.

This technique do changes in the image which will not recognize by the observer. Here we introduce an algorithm for automatic inpainting of digital image, and replicate the basic techniques used by existing restoration methods. The image inpainting technology play an important role in computer graphics and has many applications such as old films renovation, object removal in digital photos, super-resolution, red eye alteration, compression, coding image and transmission. This method restores lost/selected parts of an image using the background information in a visually possible way. So the use of image inpainting is not only to recover the original image, but also to create some image that has a close appearance with the original image.

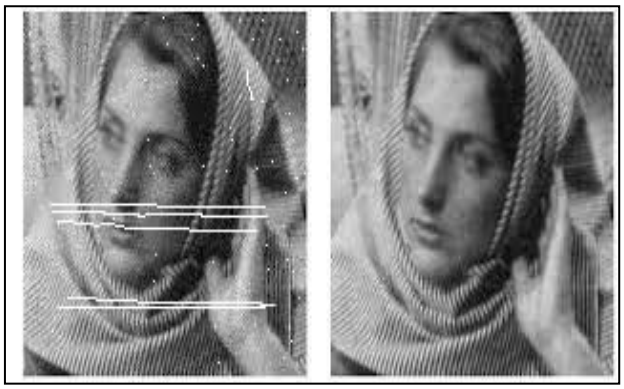

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Figure 1. Before and after inpainting.

The purpose of region completion varies from remove-undesired object to improve the quality of the image. The process of removing objects from images starts with mask out the undesired object, making the area where the object previously occupies a gap. Then the gap will be filled using graphical techniques.

The examplar based SR, correspondences between HR and LR patches are learned from a group of HR-LR patches known as Dictionary and then applied to a low resolution image to recover its higher resolution version. SR methods consider Super Resolution image reconstruction as a deblurring problem and solve the inverse problem using Bregman iterations. The HR image is estimated based on some prior knowledge about the image in the form of regularization. A new regularization method based on multi scale morphological filters is proposed.

II. LITERATURE SURVEY

This section shows existing inpainting technique and their work. These techniques are separated into the diffusion based or the examplar based techniques. These techniques are having some limitation so it leads to the development of hierarchical approach of super-resolution based inpainting.

A. *M. Bertalmio, G. Sapiro, V. Caselles, and C. Ballester, "Image inpainting,"[1]*

This paper shows that image inpainting is only used for filling the some loosed portion of the image. But this method is not suitable for high quality images. It uses patch based inpainting. The area at which the inpainting algorithm is to be apply is selected here manually by the user. Here this area is marked as the sigma notation. The sigma is nothing but the masking done on the image.

Figure 2. Traditional image inpainting.

In this masking is removed by using Efros and leungs algorithm. This method is responsible for filling the losses inside the image but this feeling is not reasonable [1].

B. *D. Tschumperlé and R. Deriche, "Vector-valued image regularization with PDEs: A common framework for different applications [2].*

Here vector valued algorithm is used for eliminate the diffusion in image. The image is passed through three steps named as functional minimization, divergence expression, oriented laplaciouns respectively. As it uses some mathematical calculations to inpaint the image, but it is not efficient to represent the flows of large image.

Figure 3. Image inpainting using PDE.

C. *T. Chan and J. Shen, "Variational restoration of non-flat image features: Models and algorithms,"[4]*

Here author had states a novel examplar based Image Inpainting method with an increased priority term which defines the filling sequence of patches in the image.

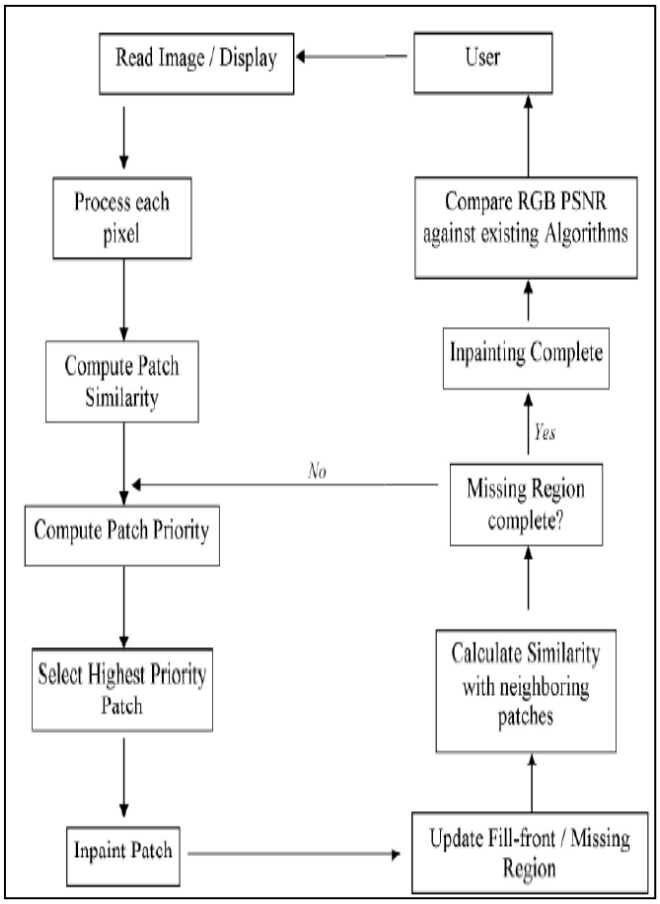

Figure 4. Examplar based inpainting

Inpainting method is based on patch generation by propagating the image patches from the source region into the interior of the target region patch by patch. This method uses a cross isophote diffused PDE to constrain the processing order; so, it has a good linear structure preserving property. Here the size of exemplar is dynamically calculated by the local pixel information; the seams and block effects are removed by the PDE. Because the examplar-based model could not be used for complex geometric structures completion, the novel model adopts a bi-directional diffused PDE to assist the completion procedure.

D. *I. Drori, D. Cohen-Or, and H. Yeshurun, "Fragment-based image completion,"[5]*

This method is used for image completion that interleaves a smooth approximation with detail completion by example fragments. Our method iteratively approximates the unknown region and fills in the image

by adaptive fragments. This completes the image by a composition of fragments under combinations of spatial transformations. It follows the principles of figural simplicity and figural familiarity. Thus, an approximation is generated by applying a simple smoothing process in the low confidence areas. The approximation is a rough classification of the pixels to some underlying structure that agrees with the parts o1f the image for which we have high confidence.

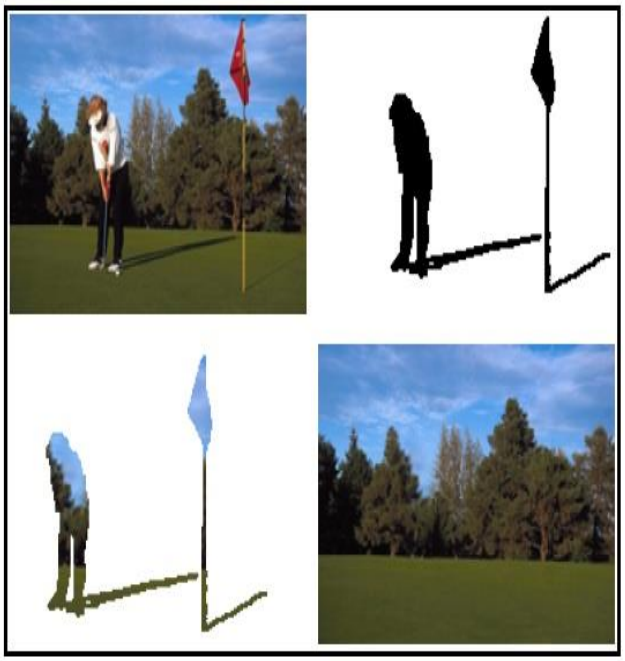

Figure 5. Algorithm for fragment based inpainting.

This paper present an iterative process that interleaves smooth reconstruction with the synthesis of image fragments by example. The process iteratively generates smooth reconstructions to guide the completion process which is

III. Proposed System

Here we are going to apply several numbers of techniques on input image. Finally the combination of all the result is generalized to produce output. Then the output produced is pass under separate super resolution method.

Super resolution algorithm takes two values as input either dictionary values or neighborhood values. The values which are store in the database during the scanning of the input image are known as dictionary values. And values which are calculated by the analysis of the all the adjacent pixel to that pixel to be examine are known as neighborhood values.

The super resolution algorithm search for pixel which can be best fit into the lossy area of the image which results to the efficient method output.

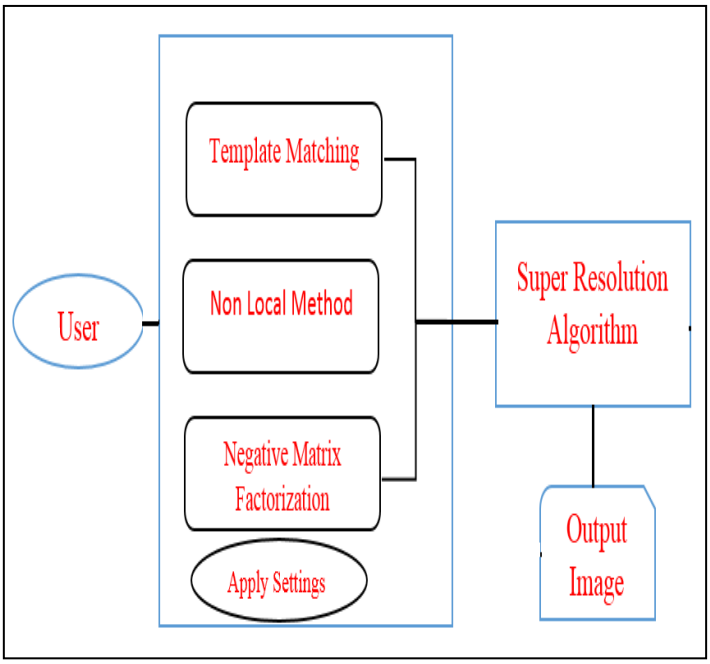

Figure 6. System Architecture

The propose methodology is combination of three basic techniques. Template matching, non-local method, negative matrix factorization. Template matching is a technique in digital image processing for finding small parts of an image which match a template image. It can be used in manufacturing as a part of quality control, a way to navigate a mobile robot, or as a way to detect edges in images. Non-local means is an algorithm in image processing for image de-noising. Unlike "local mean" filters, which take the mean value of a group of pixels surrounding a target pixel to smooth the image, non-local means filtering takes a mean of all pixels in the image, weighted by how similar these pixels are to the target pixel. This results in much greater post-filtering clarity, and less loss of detail in the image compared with local mean algorithms. Non-negative matrix factorization (NMF) has previously been shown to be a useful decomposition for multivariate data. Two different multiplicative algorithms for NMF are analyzed. They differ only slightly in the multiplicative factor used in the update rules.

IV. Algorithm Overview

Single Image super resolution algorithm is used reconstruct high resolution images. Here patch of higher resolution from sample database of stored patches is

picked and user for inpainting. The main steps are as below

a. Patch priority and filling order: The filling order defines a key of priority to every patch to differentiate the structures the textures.
b. Dictionary building: Here array is used to store the spatial coordinates of HR patches (DHR). Those of LR patches are simply deduced by using the decimation factor equal to 2
c. Texture synthesis: The filling process starts with the patch having the highest priority. Two sets of candidates are used to fill in the unknown part of the current patch.

V. Experimental Results

Two versions of proposed method are defined based on parameters. One uses down sampling factor of 4 in having patch size 5x5 and other is set to 2 having patch size 7x7.
Comparison with state of the art method:
Below figure illustrates proposed method as well as state of the art method.


a. Origional


b. Criminisi


c. Patch Match


d. Super Resolution

VI. Conclusion

The inpainting method included in this paper is able to give better output and it has ability of overcoming the limitations of the all existing work done by previous authors. It uses the super resolution algorithm to fills the gaps in the image by finding exact match of the pixel. Here we are combining multiple Image inpainting techniques so it can result in better and efficient output.

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