General Article

Super Resolution based In-Painting for Digital Images

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Abstract

The purpose of this review paper is to show how an unwanted object is removed from the existing digital image, increase the resolution and repair the image etc. The proposed system will use two algorithms- 1. In-painting algorithm and 2. Super Resolution algorithm. In-painting is the process of reconstructing lost or deteriorated part of images based on background information. Image in-painting fills the missing or damaged region in an image, utilizing information of its neighboring region. In-painting algorithm has numerous applications. Such as, it can be used for restoration of old films and object removal in digital photographs. Super resolution reconstruction algorithm 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 images. Hence, the proposed system can be used for reconstructing the missing portion of images in order to make it more legible, restore its unity and super resolve the quality of the image.

Keywords: Exemplar-based In-painting, Image Processing, In-painting, Super Resolution, Image editing etc…

1. Introduction

Image processing is any form of signal processing for which the input is an image, such as a photograph. The output of image processing maybe either an image or a set of characteristics or parameters related to the image. Since the wide application of digital camera and the digitalization of old photos, in-painting has become an important process, which is to be operated on digital images. More than scratch removing, the in-painting techniques are also applied for object removal and text removal. Furthermore, they can also be observed in applications like image compression and super resolution.

Image in-painting is the art of filling the missing data in an image. The purpose of in-painting is to reconstruct missing region in a visually plausible manner so that it seems reasonable to the human eye. There have been several approaches proposed for the same. In the digital world, in-painting (also known as Image Interpolation) refers to the application of sophisticated algorithms to replace lost or corrupted part of the image data (mainly small region or to remove small defect) (Le Meur, O *et al*, 2011).

The goal of super resolution is to create a high resolution image from one or more low resolution image. Methods of super resolution can be broadly classified into two methods: 1. Classical multi-image super resolution 2. Single image super resolution. In the classical multi-image super resolution a set of low resolution images of the same scene are taken. Each low resolution image imposes a set

of linear constraints on the unknown high resolution intensity values. If enough low resolution images are available, then the set of equations becomes determined and can be solved to create the high resolution image.

2. In-painting

In-painting is the art of restoring lost parts of the image and reconstructing them based on background information. This has to be done in an undetectable way. The term in-painting is derived from the ancient art of restoring images by professional image restorers in museums etc. (http://en.wikipedia.org/Inpainting) Digital image in-painting tries to imitate this process and perform the in-painting automatically.

(a) Original data   (b) Inpainting   (c) Output Image
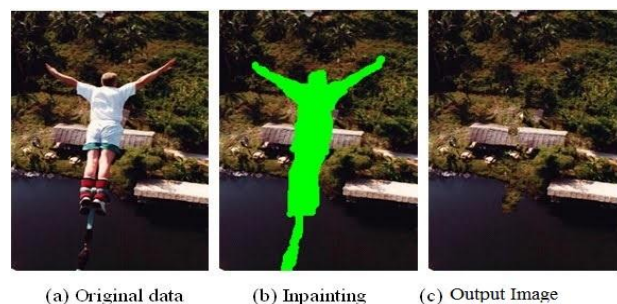
Figure 2.1: Image In-painting (Le Meur, O *et al*, 2011)

Figure 2.1 shows an example of this technique where a man (manually selected as target region) is removed and replaced by information from the remaining background information of the image. The algorithm automatically

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does this in a way that it looks "reasonable" to human eye. Another use of image in-painting is in creating special effects by removing unwanted objects from the image. Unwanted object may range from microphones, ropes, some unwanted person and logos, stamped dates and text etc. in the image.
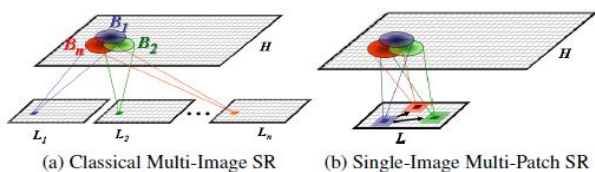
3. Super Resolution

Image super resolution refers to image processing algorithms which produce high quality, high resolution (HR) images from a set of low quality, low resolution (LR) images. This algorithm is applied on an image if blur remains in the image after performing in-painting. To understand what super resolution is, an example is shown in figure 3.1.

Figure 3.1: Super resolution
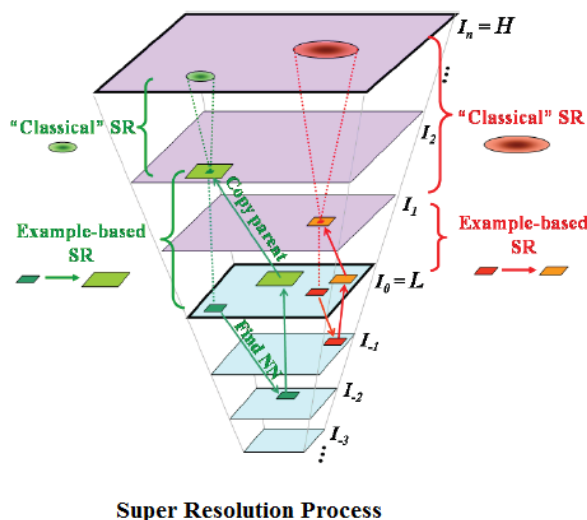(http://en.wikipedia.org/Superresolution)

The super resolution can be classified into two families of methods: 1) Classical multi-image super resolution 2) Single image multi-patch super resolution. Classical multi-image super resolution uses multiple images to find out the background images. It uses stitching method to find the background information. Single images multi-patch super resolution does not require multiple images to find out background information. It uses a simple Example based super resolution method to find out the background information of the image. Figure below shows both the super resolution methods.

Figure 3.2: Super resolution methods
(http://en.wikipedia.org/wiki/Image_processing)

Super resolution process is based on the low resolution image processing. As shown in figure 3.3, patches in the low resolution image L are searched in the down-scaled version of L. When a similar patch is found, its parent patch is copied to the appropriate location in the unknown

high resolution image with the appropriate gap in scale. A copied high resolution patch induces classical super resolution linear constraints on the unknown high resolution intensities in the target high resolution H.


Figure 3.3: Super Resolution Process
(http://en.wikipedia.org/wiki/Image_processing)

The support of the corresponding blur kernels are determined by the residual gap in scale between the resolution levels of the learned high resolution patch and the target resolution of H. Note that for different patches found in different scale gaps, the corresponding blur kernels will accordingly have different supports (Glasner, D. *et al*, 2009).

4. Proposed System

The following image shows the proposed system for implementing super resolution based in-painting for digital images. A simple step-by-step execution blocks are shown in the figure 3.4
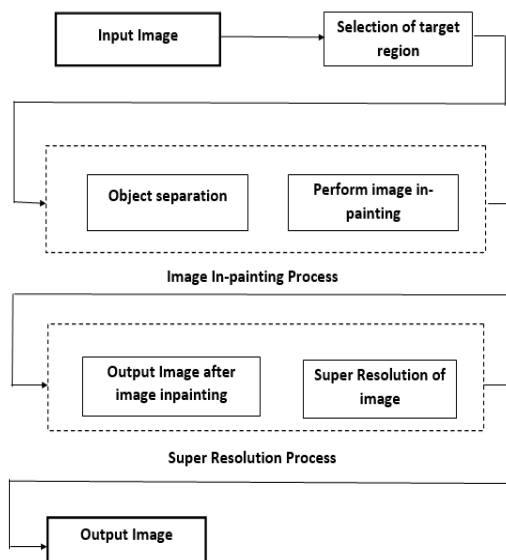
Figure 3.4: Block diagram of super resolution based in-painting

5. Future Scopes

1. In future this technique can be used to recover damaged old images completely which currently is not possible.
2. Real time image as well as video in-painting can be implements for traffic and security surveillances.

Conclusions

Image in-painting using super resolution will be better and will give better results than any other in-painting algorithms. This system can be used for removal of unwanted objects from the image, to recover the damaged old images and to super resolve the quality of the image.

References

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