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A Review Paper on Performance Improvement of Image Mosaicing using Super Resolution Technique

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Abstract: ***Image mosaicing is one of the most important subjects of research in the area of Image Processing. It is a technique in which numbers of sequentially taken images are stitched when image capturing device is not capable to take a picture within a single frame. Furthermore, the super-resolution is a technique that is used to provide higher resolution and it prevents image distortion while zooming process. We take an overview of various image mosaicing methods including the super-resolution technique.***

Keywords: Image Registration, Image Blending, Super Resolution, Interpolation

I. INTRODUCTION

Image mosaicing is a technique which is composed of several images which are captured as a sequence of images. The mosaicing can be achieved by identifying the geometric relations among several images. These geometric relationships can be visualized as the transformations which are used to relate the different image coordinate systems. By applying the suitable transformations and merging the overlapped regions of such warped images, it may be possible to generates a single image which seems equal to a single image of the same location or the object which covers the entire visible surface area of the scene. This stitched image is nothing but the image 'mosaicing'. Whereas, Super Resolution(SR) technique enhances the overall resolution of an image. Some of the SR techniques like optical SR in which the limit of diffraction of the image is transcended; while other methods like in geometric SR; the resolution of digital image capturing sensors is become enhanced.

II. LITERATURE REVIEW

It is very clear that the field of view of a camera will always be smaller than the field of view of a human eye, because of which objects with larger size or larger in number cannot be captured by the camera in a single image. With a view to overcome such problem, a wide field of view of camera is required which is can be obtained by 'fisheye' lens but it can be a partial solution and can be used in limited applications. The drawback of such a lens is that the distortion and the quality of the captured image cannot meet the requirements. Therefore, a lot of research work is going on to remove this drawback, and there are two procedures which are present to overcome this drawback for the ordinary or conventional cameras. In first method, combined version of two or more fixed cameras and mosaicing of images [1] is used, and in second method, images are stitched using a single camera which has rotation mechanism [2].

A simple example which expresses image mosaicing is shown in the fig.1 below:

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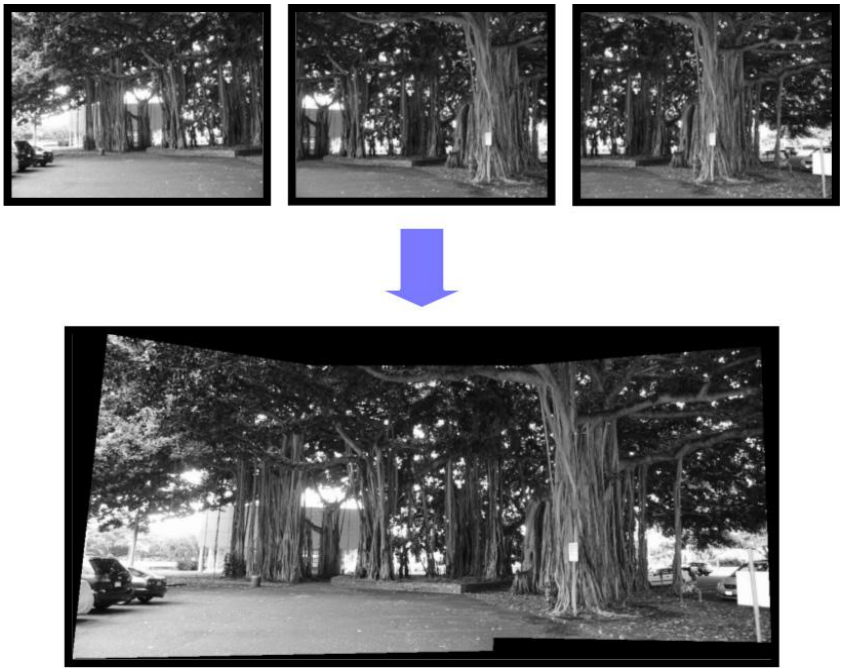

Fig.1

Image mosaicing is conceptualized by two procedures: - (i) Image Registration (ii) Image Blending.

A. Image Registration

It is a technique which is used to determine the relationship (Ex. Geometric relationship) among the images of same locations or positions. In this procedure, the alignment of two images is made which are acquired by the single or more than one camera, at various time instants or from various locations. To provide registration of images, we have to obtain transformation to achieve the alignment of the images with reference image [3].

The steps needed to be followed in image registration [4] are as under:

1. Feature Detection: It detects the objects that are necessary in both references as well as captured images.
2. Feature Matching: It establishes the correspondence between the detected features of captured and reference images.
3. Transform Model Estimation: It estimates which type of mapping functions are suitable and its required parameters to align the captured image with the reference image.
4. Image Resampling: It transforms the frequency domain image into spatial domain using the mapping functions.

The algorithmic format of image registration is as follows in fig. (2):

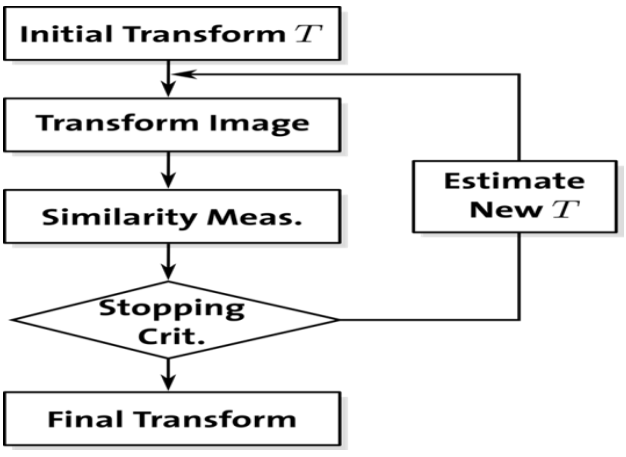

Fig. (2)

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B. Image Blending

After performing image registration, now it is needed to remove the lines of the image boundaries. Image blending is used to provide seamless look without cut and without boundaries of the composite images. Interpolation method is used to obtain image blending with re-sampling. To achieve this, the overlapped region (with the help of line of cuts) should be found and value of each pixel should be written according to the distance from the each images. The classification of image mosaicing methods is shown below given in [5].

1. Correlation methods: It directly uses the pixel value.

2. Fast Fourier transform methods: It uses frequency domain.

3. Algorithms with lower level features which detect edges and corners.

4. Algorithms with higher level features which include identified parts of image objects, etc.

Image blending after performing the registration gives the result as shown in below fig. (3).As shown in this figure, the resultant image obtained by blending the individual images of three projectors possesses no overlapping regions, lines and dark patches.

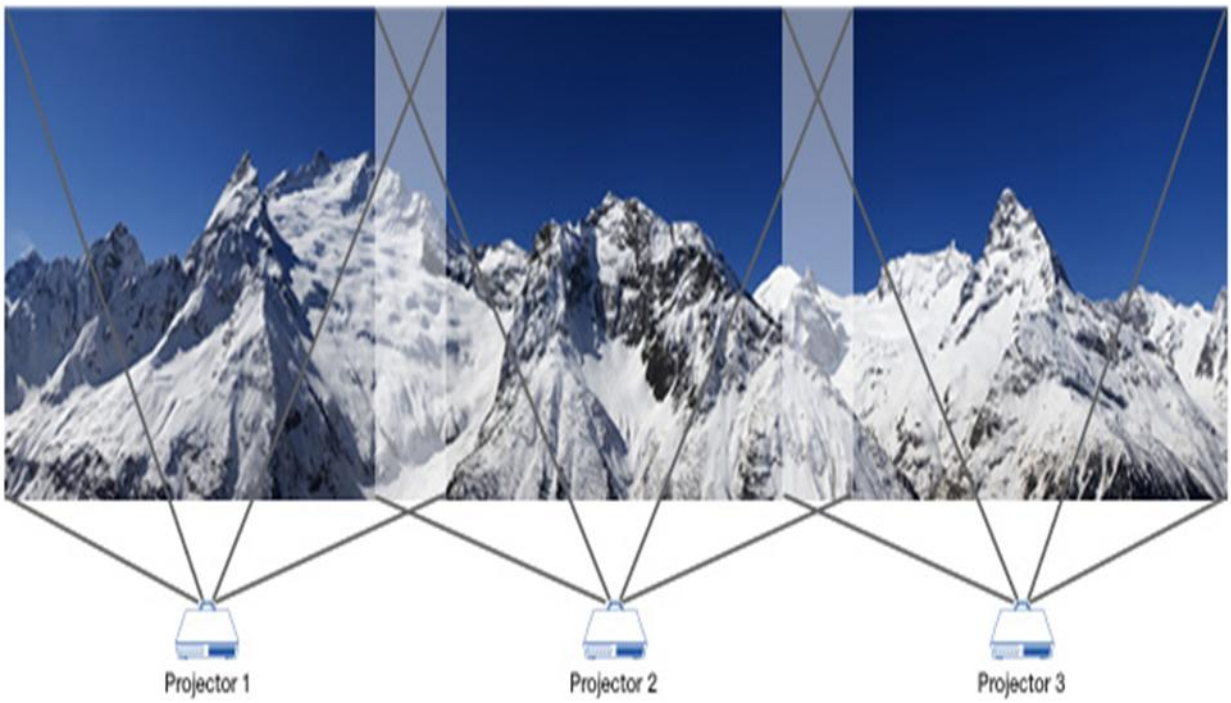

Fig. (3)

These are some of the basic steps for performing image mosaicing. Now the idea behind the performance improvement using super-resolution is given below.

Super Resolution

Super-Resolution (SR) is a very important field of research which is used for image re-construction. The main advantage of SR technique is that it overcomes few of the limitations of resolution which maybe originated from low-cost image capturing sensors; e.g. cameras used in mobiles or for the ones used in surveillance. It also allows the improved capability of high-resolution applications such as LCDs. Such a technology that provides enhanced resolution can be essential in the real time applications like medical imaging and satellite imaging. In both these applications, it is difficult to obtain required results or

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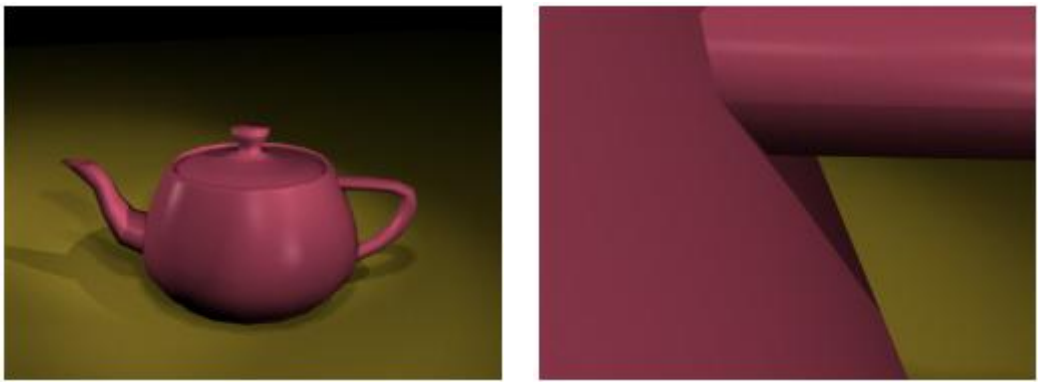
observations from low quality images. There are several approaches are developed in order to obtain super resolution. In Conventional approaches to generate an SR image, more than one low resolution images of the same location or object are required. The objective of super resolution is considered as the process of developing or generating a high resolution image by the fusion of low resolution images, based on the observation model that correlates the resultant image with high resolution to the low resolution images.

A basic re-construction concept for SR is that the recovered image should reproduce the observed low-resolution images by applying the same generation model. However, SR image reconstruction creates problem generally because of less number of low resolution images, poor registration, unknown values of blurring operators and the result from reconstruction constraint is not unique. There are several methods are determined to overcome this problem, as given in [6], [7], [8].



(a) ***(b)***

Fig. (4)

Fig. (4) as shown above explains about the rough glimpse of the output of the super-resolution technique. In this figure, fig.(a) represents the original image and fig.(b) represents the output image or reconstructed image after performing super resolution technique. It can be easily seen that even after zooming to a great extent, image quality is not much distorted. This is the reason for which it is very popular in medical as well as satellite applications.

Thus, the reconstruction-based super-resolution algorithms have a drawback that they may degrade if there is requirement of large magnification factor or in the case of insufficient number of available input images. In these cases, the result may lack important details [9].

In order to overcome such difficulties, another type of SR approach is determined which is derived from interpolation [10], [11], [12]. There are few interpolation methods which are based on interpolation. They are Bilinear or Bicubic interpolation methods which generate smooth images with ringing and jagged artifacts, but interpolation by exploiting the natural images will generate more efficient outcomes.

There is another type of SR category which is derived from machine learning techniques that attempts to capture the co-occurrence between the patches of low and high resolution images. [13] suggested an example-based learning method which is applied to generic images. In such images, the low-resolution to high-resolution prediction is examined by using Markov Random Field (MRF).

These are the categories using which we can perform super-resolution technique. The use of category depends upon the application or the required result we want to obtain.

III. Conclusion

In this paper, I have mentioned the basic concepts used for image mosaicing and super-resolution. My future work is to apply both these techniques on satellite images. There are many recent operating systems are providing image mosaicing or

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panorama facility but very few of them are providing super-resolution and even SR technique is not provided on panoramic images. Thus, my future work is based on providing super-resolution on panoramic images.

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