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Panoramic Image Formation Using Corner Detection On Image Grids

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***Abstract*— Today, creating panoramic images becomes important task for many scientific research, business decisions and entertainment applications. The goal of this paper is to implement the approach to create full view of mosaics from colour image sequences through corner detection. The complete methodology is divided into various phases: a) Contrast Adjustment and Noise Reduction, b) Grid Formation, c) Registration of image grids, d) Selection of Control Points (Corners), e) Stitching. The methodology of panoramic image creation can be applied on noisy and low contrast image grids. The process starts with 2-grids that can be extended as per the requirements of the images. The registration is done among geo-referenced grids of the images. The stitching is performed among the corners in the grids. These corners are the control points of the mosaiced image. At the end, panoramic image is received which can be used for further analysis. The mosaiced image is free from geometric de-formation.**

***Keywords*— panoramic image, image mosaicing, image registration, contrast adjustment, noise reduction.**

I. INTRODUCTION

The aim of computer vision is to understand and interpret the information represented by the images. Information from many images can be combined into one image to aid for better understanding of what they represent. Image mosaicing is a technique which enables to combine together many small images into a one large image, from which more information can be collected easily. A mosaic is an assemblage of two or more overlapping images (tiles) used to create a continuous representation of a predefined area. For image mosaicing Geo-referenced images are used to construct the mosaic and software is used to automatically place each image in its correct position. There are many application area where image mosaicing is used . Some of them are: Tele-reality application, Robotics, Medical Applications, Satellite Imaging, geological and archaeological surveys, ecology studies, environmental damage assessment and detection of temporal changes in system, GIS. The features required in an image mosaicing are accuracy in joining the image, the ability to adjust colors, the simplicity of usage, and flexibility in its application.

The steps in image mosaicing are:

- Image Registration
- Feature Extraction
- Homography Compution
- Image Wrapping
- Image Blending

The main problem of image mosaicing is a combination of following problems:

- Geometric deformations
- Image registration
- Seams in image mosaics

A. Geometric Deformation

Geometric deformation determines the transformations that align images to be combined into a mosaic. This may be Euclidean (Rigid body) transformation, a similarity transformation, affine or, in the most general case, projective transformation.

B. Image Registration

Image registration or image alignment is a fundamental task in image processing to overlay two or more images used. Registration methods can be loosely divided into following classes:

- algorithms that use image pixel values directly *i.e.*, correlation method.
- algorithms that use frequency domain method *i.e.*, Fast Fourier transform based methods (FFT)
- algorithms that use low level feature such as edges and corners *i.e.*, feature based method.
- algorithms that use high level features such as identified (parts of) object or a relation between features *i.e.*, graph theoretic methods.

C. Seams in image mosaic

This is very critical for any image mosaicing technique. Image mosaicing involves a combination of images which have overlapping regions. The cut and paste process involves selecting this region in mosaics. There are two ways to determine this region.

- Using colour/gray scale information from all constituent images for the region of overlap (median, average, etc.)
- Selecting a region from one of images.

Method (i) requires accurate alignment over the entire image area, otherwise resulting mosaic will be blurred. The method (ii) requires alignment only along the seams. This is more useful in cases where camera motion, scene geometry and imaging condition are challenging.

The paper proposes a methodology to generate mosaiced image.

II. PROBLEM IDENTIFICATION

Many image mosaicing Techniques are designed and implemented to generate a panoramic image. Each technique is developed to deal with following problems arises during image mosaicing:

- *Global Homogrpahy:* Global configuration involves calculation of the transform (homography), which aligns two images.
- *Image Perception:* Image perception level is also considered as it can affect the analysis process.
- *Local Homography:* Even after good global configuration, some pixel might not align in the two images. This might cause ghosting or blur in the blended image.
- *Image Selection:* Automatic selection of images to blend from a given set of images.
- *Image blending:* After one of the images has been transformed using the homography calculated above a decision needs to be made about the color to be assigned to the overlapping regions. Blending also becomes important when there exists a moving object in the images taken.
- *Auto exposure compensation:* Most cameras have an automatic exposure control. The images taken can therefore be of variable brightness in the overlapping region which might cause the mosaic to look unrealistic.
- *Seamlines:* When images are mosaiced, a seam line can be seen. This can reduce the accuracy of the algorithm.
- *Simplicity:* The algorithm should be simple to understand and to implement.

III. PROBLEM FORMULATION

In this paper, the researcher identified the problems associated with the image mosaicing technique. On the basis of these problems the researcher formulated the problem for the research as follows:

"The algorithm should be designed that can generate mosaiced image from multiple geo-referenced images with the capabilities of being simple, free from seams and good perception level."

IV. METHODOLOGY

Fig. 1, in this paper represents the proposed methodology to find mosaiced image, which has following steps:

A. Input Image Sequence

Two color image sequences are input to the system. Each image is of .JPEG or .JPG format. These images can be degraded by the environmental effects or of low contrast. These image sequences are geo-referenced in nature.

B. Contrast Adjustment & Noise Reduction

Due to environmental effects noise is added to the image which degrades the quality and perception level of the image ,i.e. the image requires the noise reduction techniques. In the thesis, Gaussian filter is used to filter the noise. Image can also be of low contrast , so this type of image is processed by histogram equalization technique which is simple and effective.

C. Grid Formation

After making images degradation free, these images will be divided into grids. The number of grids depends on the application and two image sequences. The both images are divided into atleast 2 grids.

D. Grid Registration

Now, the grids of these 2 images are registered using geometric transformations.

E. Feature Extraction

In this step, the feature is extracted in the grids, which wraps the images. Here, Harris corner detection process is implemented. This detection process is simple and can be implemented on the images easily. The corners are the very basic feature of any image.

F. Image Wrapping

Now the grids are wrapped according to the features extracted.

G. Image Blending

At last the all grids are blended in order to avoid seams in the mosaiced image. Two types of blending techniques are implemented and compared.

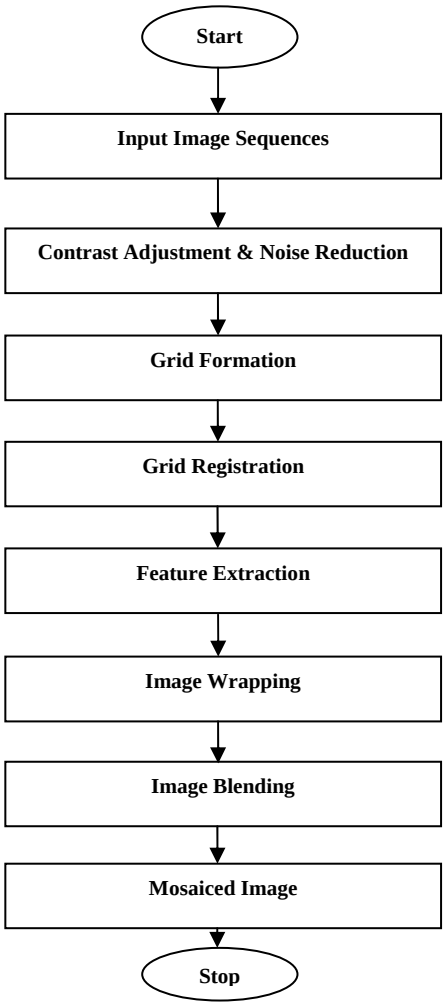


Figure 1. Flow Chart of Proposed Methodology

V. EXAMPLE

- *Input Image Sequences:* Fig. 2 Following images are in .JPG format. Image one is referenced image.
- *Contrast Adjustment & Noise Reduction:* This step is not required as these images are of good quality.
- *Grid Formation:* Fig. 2 (a) and (b) are divided into 2 grids, as shown in Fig. 3 (c), (d) and Fig. 4 (e), (f).

(a) (b)

Figure 2. A Park Images to be mosaiced, (a) First Image, (b) Second Image

(c) (d)

Figure 3. Grids of the first image of Fig. 4.2 (a), (c) Left Grid, (d) Right Grid

(e) (f)

Figure 4. Grids of the second image of Fig. 2 (b), (e) Left Grid, (f) Right Grid

- *Grid Registration and Feature Extraction:* This can be performed on the basis of Fig. 3 (c), (d) and Fig. 4 (e), (f). The Fig. 7 shows the 10 features those are extracted from the images.
- *Image Wrapping and Blending:* The following figure shows the result of these steps, see Fig. 5 and Fig. 6.

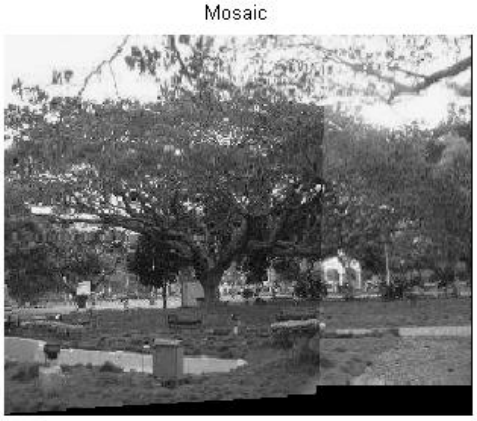


Figure 5. The Mosaiced Image of a Park

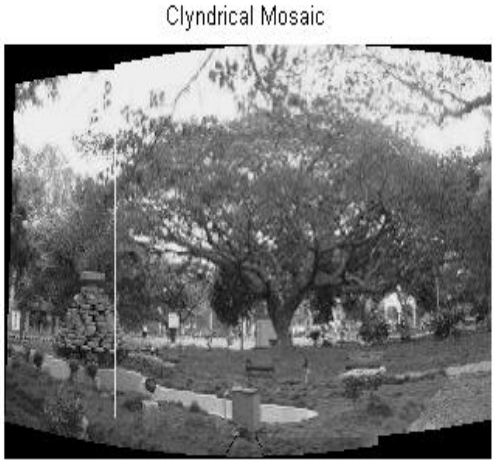
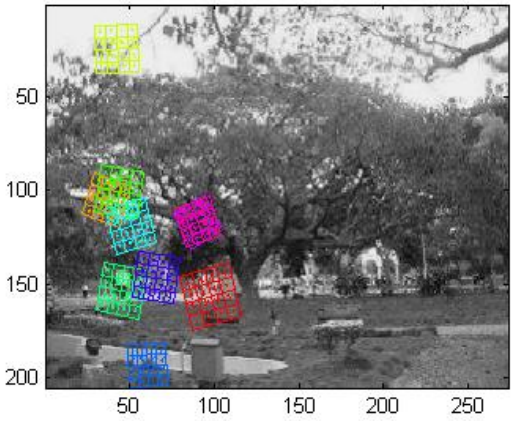
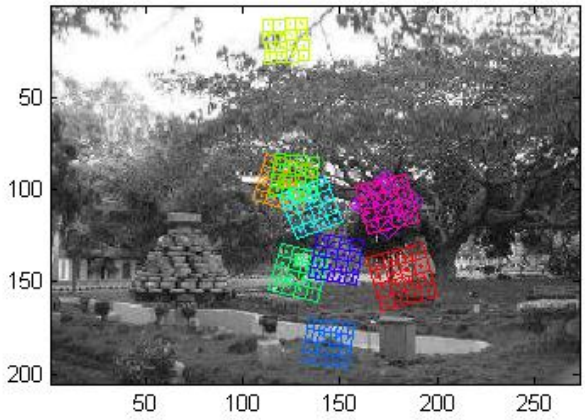


Figure 6. The Cylindrically Mosaiced Image of a Park



(g)



(h)

Figure 7. The features Extracted from Images in Fig. 2, (g) from First Image, (h) from Second Image

VI. CONCLUSION

The paper proposed a methodology, in order to achieve the desired objectives and to find the solution of problems associated with an Image Mosaicing Techniques while producing a panorama of mosaiced image. The proposed methodology designed to fulfil main objective to generate mosaiced image from multiple geo-referenced images with the capabilities of being simple, free from seams and good perception level.

The proposed methodology of panoramic image creation can be applied on noisy and low contrast image grids. The process starts with 2-grids formation and followed by the registration, the stitching of the corners in the grids. At the end, panoramic image is received which can be used for further analysis. The researcher compares the results of simple mosaicing and cylindrical mosaicing.The panoramic image is free from abnormalities to give large viewing area images from sequences of images. The mosaicing is done by feature extraction, corner, in the proposed methodology. Image enhancement techniques are used to improve the mosaiced image according to the human perception.

VII. FUTURE WORK

The proposed methodology provides better results, but still has some improvements to be done. The work can be done in order to generate mosaicing results in RGB color format and to improve the performance of cylindrical mosacing.

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