

Image Mosacing for Image Stitching

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Abstract: *Mosaicing is one of the techniques of image processing which is useful for tiling digital images. In image processing, mosaic images are images made by joining together small tiles. Image Mosacing is a technique which enables to combine together many small images into one large image by using their feature as the source from which more information can be collected easily. Every scene is collectively combination of many small objects which can be called the features of a given scene. Each of this feature has a direction and a point from which it is viewed better than other positions. The simple mosacing algorithms aim only to assign the input images and stitch them together, but do not bother about the point and direction in which the features of the misaimed object are being viewed. The better the objects are visible, the more informative the image of the scene becomes.*

Keywords: Mosaic, Image Stitching, Blending, panorama.

1. 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. The field of view of the camera is intrinsically less than that of the human eye. Though there exists complex lens to increase the field of view, it would be good if we use the normal cameras to comprehend more information.

Image mosacing is a technique which enables to combine together many small images into a one large image from which more information can be collected easily. Image mosacing has been used since the development of photography to increase the field of view by passing together many small images taken from the camera. For generating a comprehensible mosaic, these images have to be first aligned to a certain reference image and then pasted together. Depending on the path which the camera takes while taking the images, aligning these images together may produce distortions (for ex. Elongation, contraction, viewing at an angle, etc) in them.

With the conventional mosacing algorithms only some parts of the scene being mosaiced can be viewed with minimal distortions. Later algorithms have been developed to reduce distortions over the whole of the image so that all parts of the image could be viewed with minimal distortions. But, these algorithms did not take into account the direction in which these objects are being viewed. A novel approach to incorporate the aspect of the viewing position of the objects in one of these algorithms has been presented in this paper.

Some of the basic problems in image mosaicing are the following:

1. Global alignment: Global Alignment involves calculation of the transform (homography), which aligns two images.

2. Local adjustment: Even after good global alignment, some pixel might not align in the two images. This might cause ghosting or blur in the blended image.

3. Automatic selection of images to blend from a given set of images.

4. 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.

5. 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.

2. Objective

Aim of the present work is “Images taken by normal camera can be used to create a larger field of view using a image mosacing program”. Image mosacing not only allow us to create a larger field of view using normal camera, the result can also be used for texture mapping of 3D environment such that users can view the surrounding scene with real images.

Objectives of the project are:

- To combine 4 images together.
- Change the contrast, motion blur, sharpen the image and to show 3D histogram of the output.

- To make GUI based program.

3. Mosacing Algorithms

There are two major types of mosacing algorithms:

- Which use a single center of projections(SCOP) camera
- Which use multiple center of projection(MCOP) camera.

Examples of SCOP are the simple cases which include panning motion of the camera while imaging any scene and the translation. For the panning motion, the resultant image looks like if it is pasted on the inner side of a cylinder. Hence, it is called a cylindrical mosaic.

Cylindrical mosaics are the most basic and simplest kind of mosaics. They do not need the computation of homography and just involve warping the images onto a cylindrical surface.

The problem with cylindrical and spherical mosaics is that they cause problems at poles of image. In all cases images are aligned pair wise, using a parametric transformation like an affine transformation or planar-projective transformation. a reference frame is selected, and all images are aligned with this reference frame and combined to create the panoramic mosaic. Aligning all frames to a single reference frame is reasonable when the camera is far away and its motion is mainly a translation and a rotation around the optical axis. Significant distortions are created when camera motions include other rotations. Hence, they are not widely used as they work for very restricted cases.

The second category of algorithms is much more robust and has many advantages over SCOP methods. They use only thin strips from the images and not the whole frames. Each strip is taken from an image defined by one of the MCOP. The advantage of MCOP methods over SCOP methods are as follows:

- In SCOP algorithms, the image are warped to a single reference frame. This results in shrinkage or expansion of the image. With MCOP method, this problem is resolved.
- Misaiming with whole frames can be a problem because it is almost impossible to accurately align complete frames due to lens distortion, motion parallax, moving objects, etc and results in ghosting when the mosaic is constructed. Also, if all images are aligned to one reference image, different reference images will give different mosaics, and as a result it becomes difficult to determine mosaicing manifold.

A commonly used MCOP method is the manifold projection method. This method simulates the sweeping of the scene with a plane using a one-dimensional sensor array.

4. Requirement Analysis

- 1) Define correspondences between the input images to be used in the mosacing.
- 2) Create a parameter file containing a correspondence matrix, the input images, and matrices containing the corresponding control points between images, the target image and the output file.
- 3) Read in correspondence matrix and check validity of it.
- 4) Read in target image.
- 5) Read in input image and store it.
- 6) For each valid entry in the correspondence matrix
 - Find and store the matching correspondence matrix.
 - Build transform matrix T.
 - Store T and T inverse in the transform matrix array.
 - Update correspondence matrix by adding T inverse.
- 7) For each empty entry in the correspondence matrix, set the transform matrix array to null.
- 8) Add the identity to the correspondence matrix and the transform matrix array.
- 9) Fill in the transform matrix by finding paths between all pairs of images.
- 10) Compute the size of the new mosaic image.
- 11) Compute the offset for the new image.
- 12) Create a new image of the appropriate size.
- 13) Copy the target image into the new image with the offset
- 14) For each pixel in the new image-
 - Loop through input images.
 - Compute the pixel value.
 - Combine values using feathering to get resulting value for pixel.
- 15) Write the new image to the image name specified in the parameter file.

5. Image Mosaicing Methods

Mosaicing methods can be classified broadly into

1. Direct Method:

- Uses information from all pixels.
- Iteratively updates an estimate of homography so that a particular cost function is minimized.
- Sometimes Phase-Correlation is used to estimate a few parameters of the homography.

2. Feature Based Method:

- A few corresponding points are selected on the two images and homography is estimated using these reliable points only.

Direct Techniques

In direct technique, each pixel intensities of image are compared with each other. The main advantage of direct technique is that it minimizes the sum of absolute differences

between overlapping pixels. In this technique, each pixels are compared with each other so its a very complex technique. They are not invariant to image scale and rotation. Direct method optimally used the information gathered from the image alignment. It measures the contribution of every pixel in the image. The main disadvantage of direct techniques is that they have a limited range of convergence. Direct Method uses information from all pixels. It iteratively updates an estimate of homography so that a particular cost function is minimized. Sometimes Phase-Correlation is used to estimate the a few parameters of the homography.

Feature Based Method:

1. They are in general more accurate.
2. Can handle large disparities.
3. Convergence: Direct methods, may not converge to the optimal solution is the presence of local minima.
4. For reliable performance direct methods rely on feature based initialization.

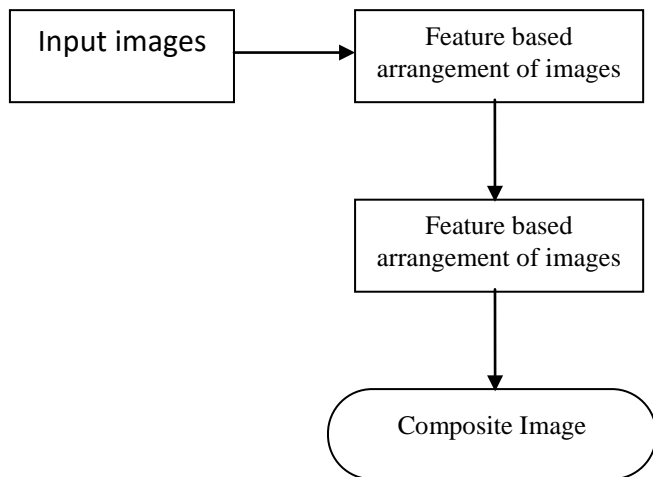


Fig: 5.1 Frameworks for Document Image Mosaicing

Some other methods includes-

Feature Extraction

In order to create our panorama, the general idea will consist in identifying common points between the two images and then projecting one of the images on top of the other in an effort to match those points. In order to identify those points, which we will be calling interest points, we have to use a simple interest point detector known as Harris Corners Detector.

Feature Matching

After our interest points have been detected, we need to correlate them somehow. For this, we will be using a maximum correlation rule to determine matches between our two images. The cross- correlation works by analyzing a window of pixels around every point in the first image and

correlating them with a window of pixels around every other point in the second image. Points which have maximum bidirectional correlation will be taken as corresponding pairs.

Homography

A homography is a projective transformation, a kind of transformation used in projective geometry. It describes what happens to the perceived positions of observed objects when the point of view of the observer changes. In more formal terms, a homography is an invertible transformation from the real projective plans to the projective plans that maps straight lines to straight lines.

RANSAC

RANSAC is actually an abbreviation for “Random Sample Consensus”. It is an iterative method for robust parameter estimation to fit mathematical models from sets of observed data points which may contain outliers. The algorithm is non-deterministic in the sense that it produces a reasonable result only with a certain probability, with this probability increasing as more iteration are performed.

Blending

After homography matrix has been computed, all that is left is to blend the two images together. To do so, we will be using a linear gradient alpha blending from the center of one image to the other. The gradient blending works by simulating a gradual change in one image’s alpha channel over the line which connects the centers of the two images.

6. Result

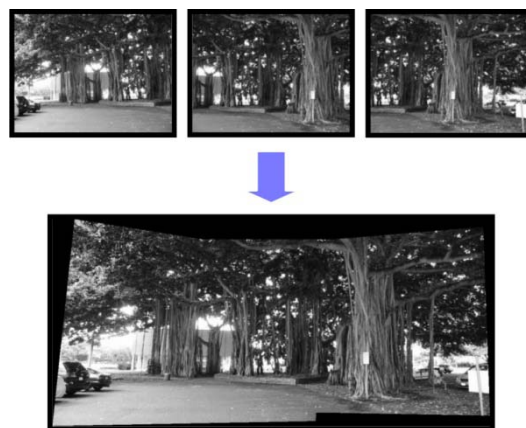


Fig-6.1 Mosaiced Image

7. Conclusion

Thus, with the help of these correlating images in mosaicing process we have obtained a wider view of the area. A 3D view of an area can also be created using mosaicing. Image mosaicing works best for planar and panoramic images. It is a technique which enables to join together many

small images into a one large image from which more information can be collected easily.

Beside this, there are some limitations which can be overcome in the future, they are

1. The range of transformation matrix can be increased.
2. Corresponding point picking can be automatic.
3. Contrast enhancement and contrast matching.

8. Applications

The most common mosaicing applications include constructing high resolution images using inexpensive equipment, creating immersive environments for effective information exchange through the internet. These applications have been extended towards the creation of completely navigatable “virtualized” environments by creating arbitrary views from a limited number of nodes. The reconstruction of 3D scene structure from multiple nodes has also been another active area of research.

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