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RESEARCH ARTICLE

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AN ADAPTIVE SEAMLESS IMAGE MOSAICING THROUGH QUAD TREE TECHNIQUE

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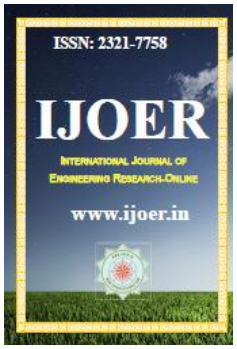


ABSTRACT
Image mosaicing is capturing of two or more images at different angles of the same scene and put together to generate a single image. In this paper, we propose a methodology called quad tree technique for generating image mosaicing. Our image mosaicing generating system splits an input image into many images and assembling these images into single image. However, the split images must satisfy the condition that they have overlapping region. Quad tree technique and the new approach, which we proposed, used to find the overlapping region of an image. Our algorithm outperform over other existing algorithm.

Keywords-image mosaicing; quad tree technique; methodology; image creation.

1. Introduction of Image Mosaicing

Rober Silver used the hand held digital camera and computer as a tool to create image mosaicing. A single continuous image made up of many images, if captured by different angles and having some overlapping region. Image mosaicing is useful for two conditions. First, when the image is beyond the scope of camera, it means image is very large. Second, when image can capture by single snap but it gives poor resolution.

At both the cases image mosaicing gives best result. In the first case, images must captured by different angles having some overlapping region. For finding overlapping region, the quad tree technique is used. After finding overlapping region, these image fuses along with overlapping region to make a single continuous image, which is seamless, called a seamless image mosaicing. In the second case, procedure is same for image mosaicing. Here mosaiced image gives better resolution than the image captured by single snap.

There are so many methods can used for image mosaicing like average pixel-to-pixel distance method and quad tree technique. The pixel by pixel is very complicated method because it finding overlapping region pixel by pixel. The quad tree technique is very precise method for finding the overlapping region because it reduces search space as well as time consumption. The average pixel-to-pixel distance method given below for finding overlapping region.

2. Average Pixel-to-Pixel Distance Method

In this method, comparing two images based on their pixels value. Each image have different RGB values and distance measure, the distance between two images, A and B, which are the same size, calculated as the average color difference at a pixel.

$$d(A,B) = \frac{\sum_{x,y=(m,n)} \sqrt{((rA(x.y) - rB(x.y))2 + (gA(x.y) - gB(x.y))2 + (bA(x.y) - bB(x.y))2)_{(x,y)=(0,0)}}}{m*n}$$

Where (x, y) is the coordinate of a pixel, m*n is the total pixel number for both images, and τ(x,y) is the value of primary color R of the pixel with the coordinate (x, y) of image A. According to this distance measure, each pair of pixels at the same location of two images compared according to the color value of each of three primary colors. The average distance of all pairs of pixels deemed as the

distance between two real images. This distance measure based on the spatial distribution of images when calculate their distance. The color distribution of images had not taken into consideration.

3. Introduction of Quad Tree Technique

Quad tree technique has used for image mosaicing. In quad tree technique, captured image can divided into four quadrants. Then each quadrant can divided into again four quadrants. This procedure continuous up to us gets overlapping region.

This approach shows hierarchical diagram called tree diagram. Therefore, this technique called quad tree technique. In quad tree technique, original image called as root image (level 1). After dividing the image into four quadrants, the portion contain in each quadrant called branch image (level 2 to N-1). After dividing branch image having overlapping portion into four quadrants, the last image called leave (level N). If we want to find specific leaf, we can find it very fast and simply.

In short, quad tree decomposed image into four quadrants and each quadrant of the four quadrants becomes a node in the quad tree. A larger quadrant is a node at a higher hierarchical level of the quad tree, and smaller quadrants appear at lower levels. The advantage of quad tree structure is that the continuous decomposition provides simple processing. The tree diagram is more convenient for processing. The quad tree representation shown as fallows-

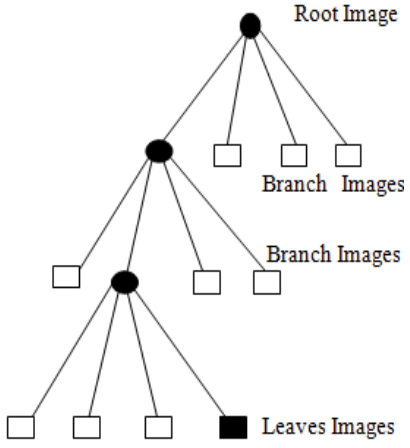


Figure 1: Quad tree representation

IMAGE MOSAICING GENERAT ON METHODOLOGY

In image mosaic generating methodology, the captured images must decompose into four quadrants by using quad tree approach for finding overlapping region. The image mosaicing generating methodology goes into two steps, first determines the correspondence points using quad tree technique and the second is to merge the adjacent split images. Consider two split images to be mosaiced i.e. image 1 and image 2. Each image divided into four quadrants as shown in figure 2 (a) and (b). After quad tree decomposing, following steps took place for finding the overlapping region:

Step 1: Quadrant 1 of the first image matched with all four quadrants of second image.

Step 2: Quadrant 2 of the first image matched with all four quadrants of second image.

Step 3: Quadrant 3 of the first image matched with all four quadrants of second image.

Step 4: Quadrant 4 of the first image matched with all four quadrants of second image.

The matched quadrants go for further division because the overlapping region present in these quadrant. The process of subdivision of the image is repeated until the exact overlapping region we getting.

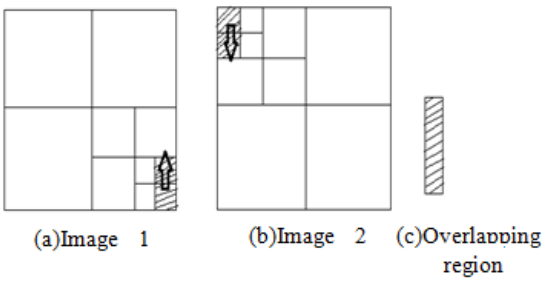
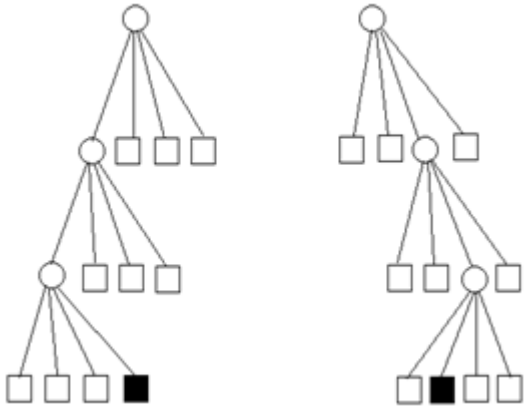


Figure 2: Two Split Images with some overlapping region

Step 1, step 2, and step 3 did not show any result but step 4 shows overlapping region. In step 4, quadrant 4 of image 1 matched with quadrant 2 of second image. Therefore, quadrant 4 of first image and quadrant 2 of second image further sub-divided for best match. The process of sub-division going continuously up to the exact overlapping region will found.



(a) (b)

Figure 3 (a) : Quad tree representation of Image 1.
Figure 3 (b) : Quad tree representation of Image 2.

Figure 3 (a) and (b) shows quad tree representation of Image 1 and Image 2. The circle shows the overlapping region contain in it and rectangle shows the overlapping region do not contain in it. The overlapping portion contain in both images. So that, both images subdivided into four quadrants i.e. upper left, upper right, lower left lower right. The lower left quadrant of Image 1 and the upper right quadrant of Image 2 contain overlapping portion. Therefore, lower left quadrant of Image 1 and upper right quadrant of Image 2 further go for sub-division. The process of subdivision of the quadrant is repeated until the exact overlapping region we getting. Finally, upper left sub-quadrant of Image 1 matched with lower left sub-quadrant of Image 2. Dark rectangles showed the exact overlapping sub-quadrants.

Let R represent the entire image region and select a predicate Q. Image 1 and Image 2 are the part of entire image having regions Ri and Rj respectively. Two regions Ri and Rj are merged only if

Q(Ri Ú Rj) = TRUE.

IMAGE CREATION

Different methods used for image creation. After finding the overlapping region or corresponding point between two images by quad tree technique, those images have same or different intensity. Same intensity images were mosaiced by taking average of pixels value of overlapping region and convert such that the overlapping regions coincide with each other. Different intensity images were mosaiced by taking brightness difference between overlapping regions and that brightness difference added to second image. Therefore, the mosaiced image looks like a continuous image (without seam).

Sometimes above-mentioned methods are not perfect because it shows some mismatch. Here homograph is necessary because it projecting multiple images onto a common image plane and aligning their coordinate systems. Therefore, we used Random Sample Consensus (RANSAC) algorithm to eliminate the mismatch.

The RANSAC algorithm selects a random subset of eight correspondences to compute an exact rectification with linear methods. Then it checks how many other points qualify as inliers (matches) under the resulting rectification. A rectification made from valid point correspondences will qualify many other correspondences as inliers, while one made from invalid points will not. The rectification that passes the most correspondences is to be correct, and we use its inliers as valid correspondences. This procedure repeated thousands of times to ensure that we achieve a good result with high probability. But insuring that no outlier (mismatches) points have originally participated in the homograph computation.

EXPERIMENTAL RESULT

Experimental result shows the image is beyond the scope of camera captured by different angles having some overlapping region (10% to 50%) of same scene. The image mosaiced generating methodology generates a seamless mosaiced image.

1) Two images with overlapping region can represented as fallows-

Figure (a): Spit Image 1 Figure (b): Spit Image 2

Figure 5 : Seamless Mosaiced Image

Conclusion

1. We have presented a successful method of image mosaicing by using the quad tree technique where images taken with a low cost digital camera.
2. To reduce the computation time as well as complexity, quad tree is useful.
3. The mosaiced image is continuous (seamless) by using RANSAC algorithm.

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