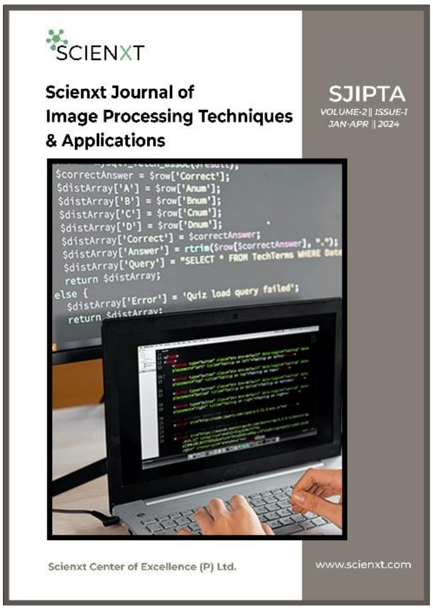

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A Review of image mosaicing using harris corner detection techniques

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Abstract:

Image Mosaicing algorithm based on random corner method is proposed. An image mosaicing is a method of combining multiple photographic with overlapping fields of view to produce a segmented panorama of high resolution image. The output of image mosaic will be the combination of two input images. In this paper we are using three step image mosaic methods. The first step is taking two input images and finding out the corners in both the images, second step is removing out the false corner in both the images and then by using homography we find its matched corner pair and we get final output mosaic. The experimental results show the proposed algorithm produces an improvement in mosaic accuracy, efficiency and robustness.

A technique for creating a single, larger image from several smaller ones of the same scene is called image mosaicing. The union of the two input images will be the image mosaic's output. Algorithms for image-mosaicing are used to create mosaiced images. The technique of image mosaicing is essentially broken down into five stages. This comprises the following: image registration, feature point extraction, calculating homography, warping, and blending an image. Different corner detection algorithms are employed in the process of feature extraction. This corner generates a mosaic image that is both effective and informative. In order to create 3D images, computer vision, and medical imaging, satellite data, and military automatic target recognition, image mosaicing is frequently employed.

1. Introduction:

The technique known as "image mosaicing" combines split images—which are created by scanning distinct areas of a single, large document image with an overlapping region—to create a single, comprehensive image of the document. It involves joining two or more photos to create a brand- new, expansive image. In any instance, a portion of the required scene can be captured in one go if the camera's resolution, the photography angle, etc. are restricted. The scene can then be obtained by repeatedly photographing it such that a portion of the image overlaps, then mosaicing the images. In this way, it is even possible to make a 360-degree panorama image.

When creating an image mosaic, two input images are combined to create a single, big image. The resultant mosaiced image is this combined single image.Feature extraction is the initial stage of Image Mosaicing. Both of the input photos' features are found during feature extraction. The geometric alignment of a collection of photographs is referred to as image registration.The many data sets may be made up of two or more digital photos captured from various sensors at various times or from various angles of the same scene.

The following classes can be used to broadly categorize registration methods: Algorithms that employ images' pixel values directly include correlation methods, frequency domain methods, Fast Fourier transform based (FFT-based) methods, feature-based methods, and algorithms that use high- level features like identified portions of image objects and relationships between image features, such as graph-theoretic methods.After registration, the next step is picture warping, which can be creatively applied in addition to repairing deformed images. Using registration transformations, the images are positioned suitably on the larger canvas to produce the final mosaiced image. Image Blending is the technique which modifies the image gray levels in the vicinity of a boundary to obtain a smooth transition between images by removing these seams and creating a blended image. Blend modes are used to blend two layers into each other.

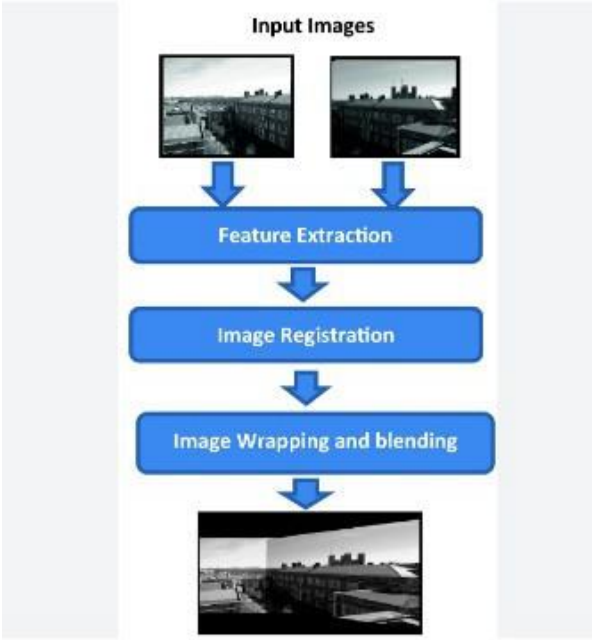

Figure.

2. Feature extraction:

A feature in an image is a piece of information that is important for resolving a computational job associated with a particular application. Edges, blobs, ridges, and corners/interest points are the different feature kinds. Points where two picture portions are separated by a boundary or edge are called edges. An edge can generally have practically any shape and can have connections. While corners have a local two-dimensional structure, edges are one-dimensional structures. They referred as point-like features in an image. There are various edge detection techniques, which uses Roberts operator, Sobel operator, Laplace operator and the Prewitt operator. They are several features which we mentioned above, that may be used for detection and matching, and certain criteria are used to justify the type of feature chosen. These criteria are that the features should be unique, able to be detected without difficulty, and have a good spatia distribution over the images. It has been found that corners form their own class of feature as the property of being a corner is hard to define mathematically. Therefore we introduce Harris Corner detector in our mosaic framework.

3. Harris corner detection algorithm:

In 1988, Chris Harris and Mike Stephens created this algorithm as a low-level processing step to help scientists who were attempting to construct interpretations of a robot's surroundings from sequences of images. Harris and Stephens were particularly interested in interpreting the surroundings from photos taken by a single mobile camera by employing motion analysis techniques. Just as Moravec, they required a We wanted to track both corners and edges between frames, but we had a mechanism to match matching spots in consecutive image frames. The combined corner and edge detector was created by Harris and Stephens in response to the shortcomings of the Moravec operator. In terms of detection and repeatability rate, the outcome was a much more acceptable detector, although it required a large increase in computing time.

An image's local detecting window is created. The average intensity variation that happens when the window is moved slightly in a different direction is calculated. The window's center point is now extracted as the corner point. If we examine the intensity levels inside a narrow window, we may quickly understand the point. Any orientation shift of the window produces a significant change in look. Corner detection is done with a Harris corner detector.

After moving the window if the area is level, there won't be any variations in intensity in any direction. There won't be an intensity shift along the edge direction if an edge region is discovered. However, there will be a noticeable shift in intensity in every direction if a corner is identified. The Harris corner detector provides a calculator. Method for figuring out if the area is flat or if a corner or edge exists. The Harris corner approach, which is scale variant and rotationally invariant, is particularly beneficial in finding more features. Regarding the shift's

$$E(u,v) = \sum_{xy} w(x,y)[I(x+u, y+v) - I(x,y)]^2 \quad (1)$$

alteration in intensity [u, v].

Where w(x, y) is a window function, I(x + u, y + v) is the shifted intensity and I(x, y) is the intensity of the individual pixel of the image. For small shifts [u,v] we have the following approximation

$$E(u,v) \cong [u,v] M \begin{bmatrix} u \\ v \end{bmatrix} \quad (2)$$

Where M is a 2x2 autocorrelation matrix computed from image derivatives: Measure of corner

$$M = \sum_{xy} w(x,y) \begin{bmatrix} I_x^2 & I_x I_y \\ I_x I_y & I_y^2 \end{bmatrix} \quad (3)$$

response:

Let λ1, λ2 be the Eigen values of matrix M. The Eigen values form a rotationally invariant description. There are three cases to be considered: 1. If both λ1, λ2 are small, so that the local auto- correlation function is flat, the windowed image region is of approximately constant intensity. 2. If one Eigen value is high and the other low, so the local auto-correlation function is ridge shaped, then only local shifts in one direction (along the ridge) cause little change in M and significant change in the orthogonal direction; this indicates an edge. 3. If both Eigen values are high, so the local auto-correlation function is sharply peaked, then shifts in any direction will result in a significant increase; this indicates a corner.

4. Computing homography:

4.1. RANSAC algorithm:

Making a calculation the third stage of image mosaicing is homography. Unwanted corners that do not belong in the overlapping area are eliminated in homography. Homography is done via the RANSAC algorithm. The acronym for "RANdom Sample Consensus" is RANSAC. It is an iterative process that uses a collection of observed data to estimate a mathematical model's parameters. Includes anomalies. It is a non-deterministic algorithm in that it can only reasonably provide a result with a given probability, and that likelihood rises with the number of allowable repetitions. Fischler and Bolles released the algorithm for the first time. The RANSAC algorithm is used to fit models robustly when there are numerous data outliers available. Considering the following hypotheses in the context of a fitting issue given parameters.

1. Parameters can be estimated from N data items.
2. Available data items are totally M.
3. The probability of a randomly selected data item being part of a good model is Pg.
4. The probability that the algorithm will exit without finding a good fit if one exists is P fail.

Then, the algorithm:

1. Selects N data items at random.
2. Estimates parameter x.
3. Finds how many data items (of M) fit the model with parameter vector x within a user given tolerance. Call this K.

4. If K is big enough, accept fit and exit with success.

5. Repeat 1.4 L times.

6. Fail if you get here

How big K has to be depends on what percentage of the data we think belongs to the structure being fit and how many structures we have in the image. If there are multiple structures than, after a successful fit, remove the fit data and redo RANSAC.

We can find L by the following formulae:

P fail = Probability of L consecutive failures

P fail = (Probability that a given trial is a failure) L

P fail = (1 - Probability that a given trial is a success) L

P fail = (1 - (Probability that a random data item fits the model)N)L

$$P_{fail} = (1-(P_g)^N)^L$$
$$L = log(Pfail)/\,log(1-(Pg)N)$$

5. Warping and blending:

5.1. Image warping:

To create an output composite mosaic, all of the input images must be blended and warped in the final stage. The technique of digitally altering a picture so that any shapes it contains are noticeably warped is known as image warping. In addition to being used for artistic effects like morphing, warping may also be utilized to fix visual distortion.Although there are many ways to alter an image, pure warping refers to that the colors remain unchanged when points are mapped to points. In essence, all we have to do is distort each of the input photos to a plane that is specified by one of them—the reference images. In this instance, the result is referred to as a composite panorama.

1. First we need to make out the output mosaic size by computing the range of warped image coordinates for each input image, as described earlier we can easily do this by mapping four corners of each source image forward and computing the minimum x, minimum y, maximum x and maximum y coordinates to determine the size of the output image. Finally x-offset and y-offset values specifying the offset of the reference image origin relative to the output panorama needs to be calculated.

2. The next step is to use the inverse warping as described above for mapping the pixels from each input image to the plane defined by the reference image, is there to perform the forward and inverse warping of points, respectively.

5.2. Image blending:

To avoid seams, the last step is to blend the colors of the pixels in the overlapped area. The simplest method now in use is feathering, which blends the overlapping pixels by weighted averaging color values. The alpha factor, also known as the alpha channel, is typically used. It starts at 1 at the center pixel and decreases linearly to the boundary pixels, when it becomes 0.

When there are two images, I1, I2, overlapping in the output image, each pixel (x, y) in image Ii is represented as Ii(x, y) = (αiR, αiG, αiB, αj), where (R, G, B) is the color values at the pixel. In this case, we will use the alpha values as follows to compute the color at a pixel in there.

We will compute the pixel value of (x, y) in the stitched output image as [(α1R, α1G, α1B, α1) + (α2R, α2G, α2B, α2)] / (α1+α2).

6. Conclusion:

Image stretching and creation are common uses for image mosaicing techniques. Several well-known algorithms have been examined in this study. The Harris corner detection method is rotationally invariant and robust. It is scale-variant, though. The FAST algorithm has an improved execution time and is invariant to both rotation and scale. However, it performs poorly when there is sound. The SIFT technique performs better when noise is present because it is both rotation and scale invariant. It has incredibly unique characteristics. It is hampered, although, by variations in lighting. Image Mosaicing techniques have a long history and evaluation methodologies. In this paper it was observed that to mosaic two different images there are four basic steps which are essential i.e. feature detection; feature matching, transformation and image fusion. After studying various feature detecting techniques, Harris Corner Detector was chosen as our tool for feature detection as it is invariant to rotation, scale, illumination variance and image noise.

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