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An innovative method for stitching the images for panoramic view

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Abstract: *An image stitching method panorama gives serious issues with respect to distortion when collaborating long similar sequential images. To solve the distortion enhanced approach is proposed in this work, adding the alteration of the way sequential referred image and adding a head an approach that can calculate the transformation matrix[3] for any image with in the sequence to put for alignment[11] with the referred image with in the same space of coordinate area. Apart from this the enhanced stitching approach selects the next preceding image automatically based on the matched output points with respect to number of SIFT[10] approach. With regular stitching methodology and enhanced stitching[8] methodology , by comparing these two our approach decreases the SIFT features ROI detected area of the referred image. Our practical results shows theenhanced approach cannotonly initiate the efficiency of stitching on image processing and also drastic reduction of thepanoramic distortion[10][14] issues. This resu lts the plain non distorted panoramic image output.*

Keywords: *ROI(Region of interest) , SIFT(scale invariant feature transform), distortion,stitching, image align ment.*

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I. Introduction:

Similar images alignment or stitching is a method of attaching similar sequence of images alltogether, and combined overlapping areas, which leads to nice panoramic non distorted image. Image stitching has become trend process in the area of computer of image processing computer vision and in all graphics. The hand camera is with low level resolution and small vision where as image stitching can get high quality and highly resolute image which leads panoramic image with hand device.

The main and first step is image registration in image stitching process. The smoothness and quality of image stitching mainly depends on this image registration. Based on the different approaches of image registration processes the image registration process can be divided into two models, feature based and region related image registration**[2][4]**. Region based registration finds the relation between same dimensional blocks among the input image and referred image and calculates their similarity degree**[9][11]**. When image is tilted or resizing, this approach will not give proper result. When the textures of image is too weak and strong the result shows drastically will give stitching errors. Feature image registration approach uses computational or mathematical methods to discover abstract description of the features of the main and useful pixel information by comparing descriptive features to discover the related connection between the input and referred image. Whereas the regular feature detection**[1][5]** methods like Susan operator and Harris corner does not have the invariance properties. So a fixed feature detection method is proposed for image stitching was Scale invariant image feature extraction and this one got great performance from perspective distorted images, different direction and rotation, different scale.

Mainly this work concentrates on image registration approach and fetches SIFT features to develop panorama model of image stitching. The main goal of image stitching is to transform various source images with overlapping**[3]** ROI(areas) among each other to combine in the horizontal and vertical coordinate system by using transformation matrixes. So it is mandatory to selected referred coordinate system. The regular makes the process panoramic**[7][10]** images with the inline ordered image line of sequence which stitches from left to right with step wise process. The seed or first image is chosen as a referred image . Preceding images selected for stitching as next referred images with regular stitching process. This leads to problem of matching errors with preceding stitched imagewith referred image, which will give maximum distortion with the large images and effects panoramic result. The enhanced method which proposed in this work which develops the image registration for preceding images in the flow of sequence and computes the transformation matrix among the preceding images and chooses the Centre image as the referred image. Based on the transformation matrix of all preceding images the enhanced approach can innovates image anywhere in the sequence of transforms with the

coordinate distance of the referred image. So all images in the sequence can be clubbed to the same coordinate process after doing all stitching process. The practical output proves the enhanced method decreases the distortion issues of panoramic images with great time saving of the stitching process and enhances the image stitching quality.

SIFT method: This algorithm first proposed in 2004 by Brown and Lowe and from then they were keep on proposing this algorithm on image stitching process. This algorithm is fast in finding the features and gives invariant with the resized and rotated image or on illuminated one. This approach finds the points in DOG space**[3][10][4]** on image. Each and every sampling pixel point will be compared with preceding threshold(8) points of the discovered of same scale and 18 nearest or neighbor points of preceding scale factor. The discovered extreme points are selected as the candidate points. To improve the stableness of the key points , normalize the parameters of DOG operation on the basis of Taylor formula to get the accurate position of scaling factor. Next process to eliminate low contrast points and also unstable points at edges and corners to improve the stability of matching points. At neighbor key points the gradient**[1][13]** orientation of points and pixels is calculated by histogram and distribute the peak orientation with respect to histogram for the key points to give the characteristic of rotation invariant.

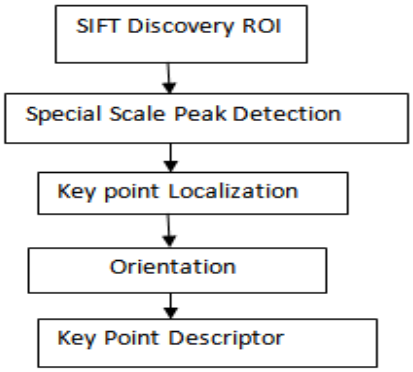


Fig1: SIFT detection model

(Random Sample Consensus)**[7][11]** model: This algorithm computes the attributes of the mathematical model with respect to random sampling approach. through with all the iterations with all new random combinations of sampled data pixels until the mathematical approach that can give proper explanation or adapt for all distributed data found. For each and every feature point of the image , it searches the matching points based on the least Euclidian distance**[2][10]** with k-d tree structure. This type of coordination mapping space relationship among the matching points will be represented by 3 × 3 transformation matrix**[3][7]**. This work intension is to use this algorithm to get the transformation matrix among the matching points and finds the matching images which are mapped to same coordinate spaces with the transformation matrix information. With this work the all the images taken by hand camera with the same horizontal plane. So matched transformation matrix is affine matrix model.

II. Literature Survey:

In the last few years, there are many researchers implemented and proposed various panorama image stitching systems. For example, Levin and Weiss **[15]**introduced several formal cost functions for the evaluation of the quality of image stitching. This approach is established in various applications, including generation of panoramic images, object blending, and removal of compression artifacts. The aim of a panorama image stitching algorithm is to produce a visually plausible mosaic with two desirable properties. First one is the image stitching should be as similar as possible to the input source images, both geometrically and photo metrically. Then second one is the seam between the stitched images should be undetectable. While these requirements are widely acceptable for visual examination of a stitching result, their definition as quality criteria was either limited in previous approaches. Researchers presented several cost functions for these requirements, and define the panorama image stitching as their optimum. The image stitching quality in the seam region is measured in the gradient domain. The mosaic image should contain a minimal amount of visible seam artifacts.Scale Invariant Feature Transform (SIFT) algorithm **[16]**is a robust algorithm produced by Lowe in 1999, it is able to extract invariant features from the images at different scales. SIFT has been applied in many fields since it was put forward. These features focusing on speed by using some algorithm like image registration, object recognition, camera calibration and image retrieval. SIFT features are invariant to image scale, rotation, addition of noise,

change in viewpoint and illumination. Limitation of SIFT is that it extract 128-dimentional feature vector for each interest point which causes huge computation of feature matching. To overcome this problem Bay proposed SURF (Speeded-Up Robust Features)[**[17]**in 2006.

III. Regular model of stitching:

Approach1:
Input: n subsequent images (S0 , S1, S2, S3, ...Sn-1) who is having the overlapping features
Output: A panoramic output image.

- Chose the S0 and S1 images from the image set S to compute extract the SIFT features subsequently
- Chose the first(S0) image in the inline of sequence as the referred image and preceding one as seed or new input image. Use SVM as (KNN) k-nearest neighbour model to search common or matched features among new input image and referred image with respect to least Euclidean distance.
- Based on the matched featured points use the RANSAC approach calculate and make the affine matrix **A**, which can be transformed new image into the space of coordinates of the referred image. Apply L-M approach to for the proper optimize the affine matrix **A** .
- use the optimized A for transformation of the new image.
- Get the optimal seam among affine result and the referred image. with the seam add them together to get the stitched output., **Stitch**.
- Add the **Stitch** into S to replace the new input image and referred image. In the next iterating process Stitch is chosen as new referred image.
- All the above steps will be repeated till all the images subsequence is processed in S which will result the panoramic image.

Where as in this regular stitching model, every time when one level of stitching is finished, the size of the referred image will go to increase. The area of overlapping among new input image and referred image spaces for minute portion of images comparing with the whole referred image area. So computing SIFT features**[9][4]** of points on whole referred image will take maximum system resources and also registration time, in addition the model of regular approach stitching algorithm to chose the next new input image is in loop is single one. Every time when preceding image is chosen as a new input it will not provide priority to the area of overlapping area or matching features among the input image and referred image. So if any matching errors occurs and those matching errors will continue in the iteration with each every stitch process. So final output is heavily distorted.

Proposed Method: In this method of image stitching process the accuracy of image registration will take its own initiative to give the quality of the panoramic image. The result would be affine matrix which one was the proposal for the image registration.

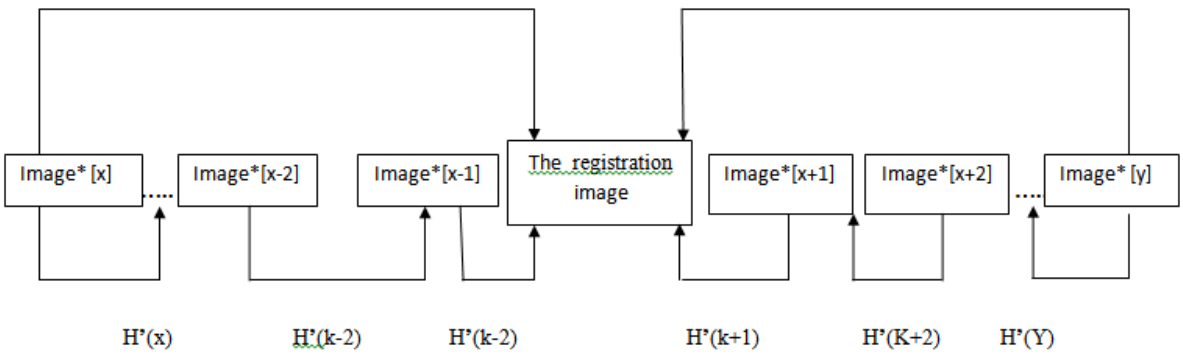


Fig 2:The image stitching would be affine matrix process.

Approach2: The Improved Stitching process
Input: n subsequent images (S0 , S1, S2, S3, ...Sn-1) who is having the overlapping features
Output: A panoramic output image

- Perform image registration on all preceding images. (a) Assume all subsequent images are ***Si*** and ***Si1*** , ***i∈ [1, n-1]*** , use ***SVM(KNN)*****[3][14]**approach to find matching SIFT feature points among ***Si*** and ***Si1***with respect to least Euclidian distance, and then save the matching feature points and count of matching points in two different arrays ***flist*** and ***nlist*** .(b) based on the matching features data set ***flist*** compute the affine matrix which can be transformed from the space coordinates of the image ***Si-1*** to the space coordinate of ***Si*** and then save affine matrix to ***hlist***.(c) Do the step a to finish the next image registration**[10]** to subsequent images.

- ***K***indicates the center index of the dataset ***S***. Take ***Sk*** as the referred image According to array ***nlist***, chose the image which is having the large matching points with respect to Sk which is next new image.
- Based on the index of the offset of the new input image the array ***hlist***, computes the affine matrix ***A*** among the new input image and referred image based on the formula**[7][13]**.
- Utilize the L-M approach for the optimization of the affine matrix ***A***.
- Search the optimized seam among affine transformation output in the previous step and the referred image then with the seam add them together to obtain ***I result***.
- Add the ***Iresult*** into ***S*** for the replacement of the new input image and referred image. So the stitched result I result becomes the new mid image of the image sequence ***S***.
- Repeat the above step 2 for continuous iterations to implement the next level until there should be only one image in ***S***.

SIFT Block diagram: The main aim of the SIFT**[1][4]** is enhance the edge/corner detection approach, which could not be solved with shortcoming invariability. By using this approach all computations is made within the scale space, with three attributed features and models are finding extreme values with in the range of scale, Direction assignment, part of the image description. Using the scale value space SIFT**[10][4]** finds the implication with simulating the fluctuation in distance allows one image at a time which has to be transformed into more recognizable data which can be utilized to find the strong features which is with Gaussian scale space addition of scale space function ***L***.

$$L(u, v, \sigma) * I(u, v)$$

$$G(u, v, \sigma) = 1(e^{-(u^2+v^2)/2\sigma^2})/2\pi\sigma^2$$

Gaussian scale equation

In this * is the convolution, ***L(U,V)*** is the image input is an attribute of Gaussian function, the larger this value the more with fuzzy the image changes. ***U*** is the horizontal much fuzzy the image will be changed .***U*** is the coordinate of horizontal v is the coordinate on vertical of the image. To establish the dimensional space the approach is DOG(Difference of Gaussian filter)**[3][11]**. The main idea is to use two different variances of DOG(Gaussian filters) to process the main image, which can lead to two different variances Gaussian filters to process the original image, resulting into two images which will have different fuzzy levels.

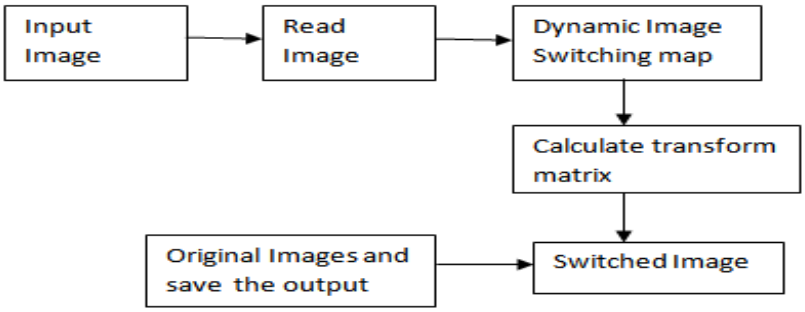


Fig3: Flow of the DOG

With the process of connecting image , among two one image is stabilized at the beginning with geometric transformation matrix and alters the other image with respect to horizontal moving, enlarging , reducing and rotating etc to discover the best fit position of connecting to stitch of the seed or first image in order to make the mathematical relationship coordinates of the pixels among the images. The distinguish of transformation is done among affine and transmission**[3][12]** conversion. This work uses affine transformation model for pixel transformation among the images. Affine is with 2 dimensional matrix A with six unpredicted attributes, where the relevant relationship of pixel with coordinates with both left and right images are presented. To predict six unknown attributes an equation with even number is needed. To make such equation it is required that point pairs earlier result will be used with first 3 sets as inputs (n<=3) . If the approach is over determined an approach Eigen value should be used to find the least error. If incorrect points then it would be poor matching quality.

Super imposed image segmentation**[2][11]** approach first and second image divided into four similar parts **ABCD** for cutting process, retrieve **BC** to do stitching, decreasing to discover the feature points at the time. BC would be stitched to the use of image to the fig A fig BC fig C then, drastically improves operation speed.

$$A=\begin{bmatrix} m_0 & m_1 & m_2 \\ M_3 & m_4 & m_5 \\ 0 & 0 & 0 \end{bmatrix}$$

Transformation matrix

$$X_i'=m_0x_i+\ m_1Y_i+m_2$$

$$y_i'=m_3x_i+\ m_4Y_i+m_5$$

Negation equations

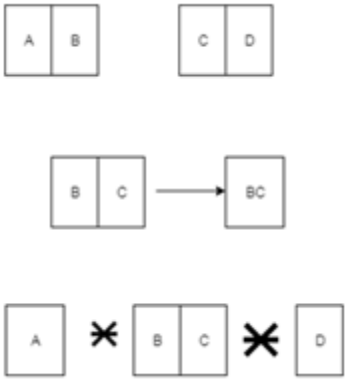
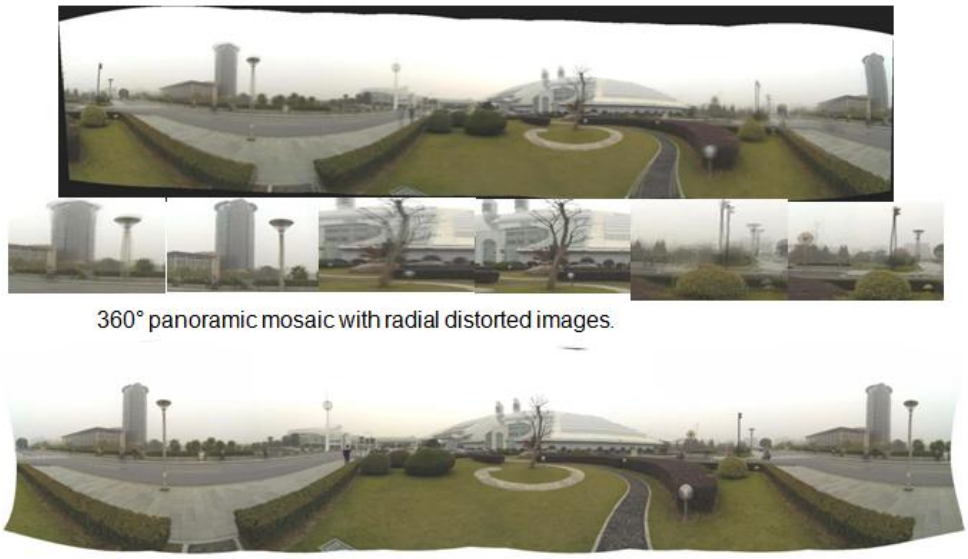


Fig4: Stitch criteria

Experimental results:



360° panoramic mosaic with radial distorted images.

360° panoramic mosaic with radial distorted images and final result with seamless composition This will help to produce image with more clarity.

Fig5:360· Panoramic seamless composition image

IV. Conclusion:

This work raises the number of matching features of SIFT by enhancing the existing method, decreasing the unwanted SIFT detection ROI area in the referred area also. Addition to this enhanced method initiates the stitching the panoramic stitch time efficiency and results high contrast and resolute with high quality panorama image. Compared with the existing method the enhanced method in this work starts stitch with middle position with in the image sequence. The referred image is middle image. After that it makes affinematrix**[10]** for any image in the image sequence to the referred image based on statistical model

information of affine transformation automatically between original and referred image. Enhanced method automatically chose the new input image to join the process of stitching with respect to number of statistical similar points of preceding images. Practically proved the enhanced method reduces the distortion in panorama.

Challenges in image Stitching: There are many challenges in image stitching such as, an image is often corrupted by noise in its acquisition and transmission, the cost of extracting features is minimized by taking a cascade filtering approach. Also very large number of images is needed for efficient indexing. Large amount of images may lead to high processing time, since each image needs some processing. The main challenge on image stitching is the using of handled camera which may lead to presence of parallax (ashift in apparent object position while observed from different angles of view), small scene motions such as waving tree branches, and large-scale scene motions such as people moving in and out of pictures. This problem can be handled by bundle adjustment. Another recurring problem in creating panorama is the elimination of visible seams, for which variety of techniques have developed over the years[18].

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