Study of Image Stitching using various models

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Abstract

Image stitching is one of important technologies in image processing field. Image stitching is ideally suited for applications such as image stabilization, summarization, and the creation of panoramic mosaics. The principle of image stitching technology is making the multiple images together into a panoramic image with a high-resolution according to the image overlaps. This paper discusses various models to stitch the images seamlessly.

I. Introduction

The automatic construction of large, high-resolution image mosaic is an active area of research in the fields of photogrammetry, computer vision, image processing, and computer graphics. Image mosaics can be used for many different applications. The most traditional application is the construction of large aerial and satellite photographs from collections of image. More recent applications include scene stabilization and change detection, video compression and video indexing, digital video, virtual reality, medical image processing, military reconnaissance, computer graphics and so on. [1, 3]. Image stitching is a technique to merge a sequence of images with limited overlapping area into one blended picture [2].

The main aim of image stitching is to find a visually acceptable or seamless blending from the input images with their corresponding overlapping regions [4]. The automatic creation of large high resolution image mosaics is a growing research area involving computer vision and image processing. Mosaicing with blending can be defined as producing a single edgeless image by putting together a set of overlapped images. Image stitching combines a number of images taken at high resolution into a composite image. The composite image must consist of images placed at the right position and the aim is to make the edges between images invisible. The quality of stitching is therefore expressed by measuring both the correspondence between adjacent stitched images that form the composite image and the visibility of the seam between the stitched images [5]

Even in medical imaging for better clinical diagnosis, a composite image needs to be formed starting from its component images. A complete panoramic image cannot be captured in a single scan. The input is a set of n *images* (I1, I2… I*n*), where any two neighbors having a common area, can be merged together for obtaining a panoramic view [6]. In 2009, Abhinav Kumar, Raja Sekhar Bandaru *et al* proposes an algorithm which automatically aligns and stitches the component medical images (fluoroscopic) with varying degrees of overlap into a single composite image. The alignment method is based on similarity measure between the component images. The technique is intensity based rather than feature based. It works well in domains where feature based methods have difficulty, yet more robust than traditional correlation. Component images are stitched together using the new triangular averaging based blending algorithm.

Image stitching typically includes image alignment, and image fusion or blending [3, 4]. The goal of image alignment is to find corresponding point pairs in the overlapping region of two input images. Image blending combines the two aligned images seamlessly [4]. After stitching the images requires a maximum degree with the original image to near, information integrity, the pictures are clear, distortion as small as possible and there is no obvious suture line [7].

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Image mosaic techniques can be mainly divided into two categories: Feature-based methods, and Featureless methods. Feature-based methods assume that feature correspondences between image pairs are available, and utilize these correspondences to find transforms which register the image pairs. Features can be found more repeatedly and matched more reliably than traditional methods. Because feature-based methods have higher accuracy [2]. Featureless methods discover transforms for image registration by minimizing a sum of squared difference (SSD) function that involves some parameters [1].

Feature-based image stitching process [8].

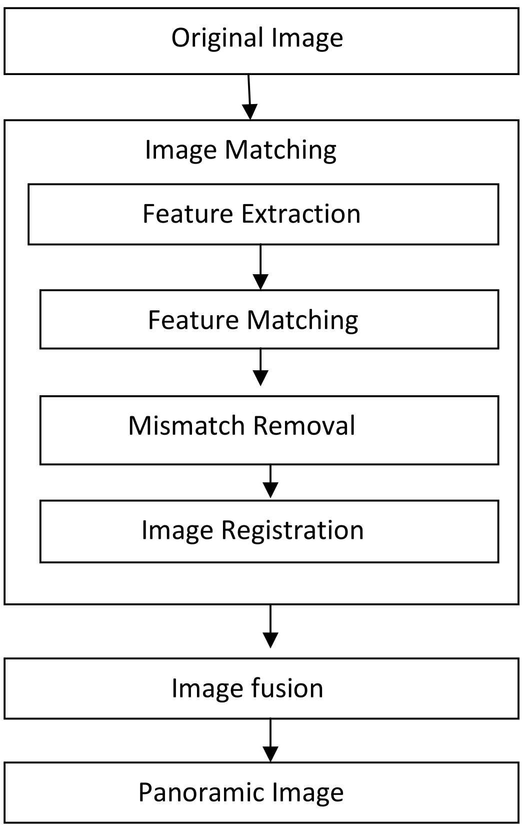

Fig.1 Stitching process

II. Image Stitching based on SIFT features

The algorithm of image stitching based on SIFT features uses the invariable local features to select interest points and then calculate the homography applying these point matches. The images in the same viewpoint but in different directions can be related by Homography [2].

The detail of this algorithm is [2].

(1). Choose an image as referenced one.
(2). Find the feature matched in the neighboring images.
(3). Calculate the homography H of the two images.
(4). Apply H to warp and project the image 2 to the same coordinate system as the image1, and then process image 2 and stitch them seamlessly.

III. Image Stitching Using Simplified SIFT

A simplified SIFT feature is used which was which was further improved through the histogram smoothing and two-way match. The improvement increased the robustness of the simplified SIFT feature and reduced the dimension of the feature vectors, so that we can improve the stitching algorithm in real time. Since SIFT features are invariant under rotation and scale changes, our system can handle images with varying orientation and zoom [3].

The improved simplified SIFT feature to image stitching is used. In order to enhance the robustness, the gradient direction histogram was smoothed using Gaussian filter. The matching method was also improved to eliminate the error matching and many-to-one match. When computing transformation matrix, we used RANSAC algorithm to improve computational accuracy. Finally, two pictures were integrated by the method of fading out [3].

IV. Medical Image Seamlessly Stitching by SIFT and GIST

An approach to stitch images fast and with high quality. Image alignment algorithms can discover the correspondence relationships among images with varying degrees of overlap. For image alignment, authors must first determine the appropriate mathematical model relating pixel coordinates in one image to pixel coordinates in another by use of SIFT. In this process, SIFT is used to look for the trait points, and uses RANSAC to delete the wrong points. RANSAC enables reliable matching of panoramic image sequences despite rotation, zoom and illumination change in the input images. For image stitching, choosing a final compositing surface onto which to warp and place all of the aligned images and also develop algorithms to seamlessly blend overlapping images, even in the presence of parallax, lens distortion, scene motion, and exposure differences [9]

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V. Automatic Image Stitching Using SIFT

This topic concerns the problem of automatic image stitching which mainly applies to the image sequence even those including noise images. And it uses a method based on invariant features to realize fully automatic image stitching, in which it includes two main parts: image matching and image blending. As the noises images have large differences between the other images, when using SIFT features to realize correct and robust matching, it supplies a probabilistic model to verify the panorama image sequence. Addison to have a more satisfied panorama image, it uses a simple and fast blending method which is weighted average method [10].

Algorithm of the automatic stitching [10]

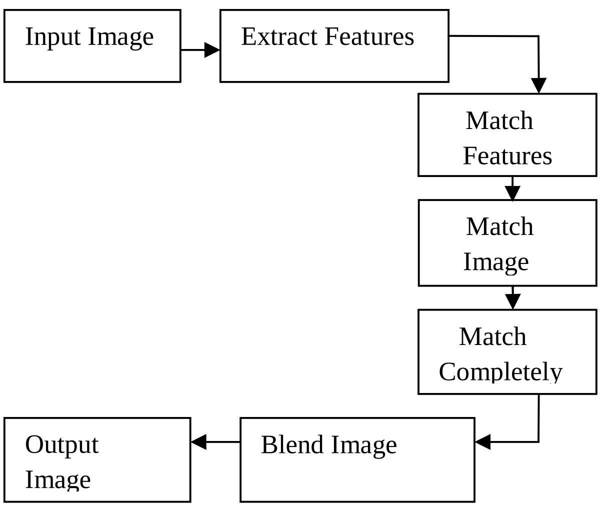

Fig.2 Automatic Stitching Process

VI. Image Stitching using ASIFT

A fully affine invariant image comparison method based approach to panoramic image stitching has been used. This has several advantages over traditional approaches. Because of the features we take, our use enables reliable matching of panoramic image sequences despite rotation, zoom and illumination change in the input images. Also develops the geometry of the problem and motivates our choice of invariant features, describes the image alignment algorithm and also introduce the image matching methodology (RANSAC) [11]

The method begins with the ASIFT feature extraction. Then match the points we get from the images. After matching, fix the rotation problem first and zoom the picture after that, all of these based on the ASIFT match information. Cylindrical projection will be done to continue the easy map [11]

Pipeline of stitching as shown below [11]

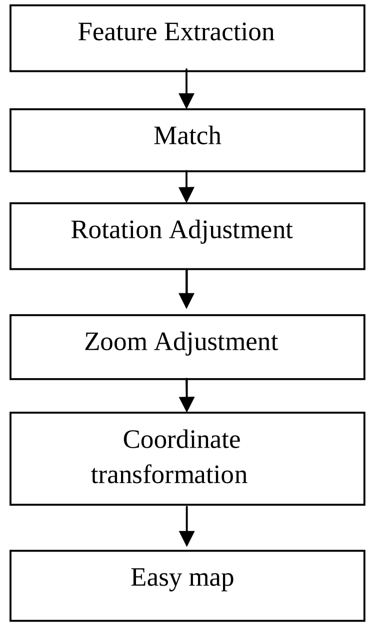

Fig.3 Pipeline of Stitching

VII. Image Stitch Algorithm Based on SIFT and MVSC

Based on scale-invariant feature transform (SIFT) and mean seamless cloning (MVSC), an image stitching algorithm is presented, to improve the quality of the panoramic stitching image. Using SIFT algorithm to extract between benchmark images (await matched image) and follow-up images (with the baseline image match the image) of the feature points, identifying locations and directions, using 128 dimensional vector to describe features point. Using the nearest neighbor method to achieve two images feature point matching, identify overlap regions. Using SIFT algorithm to provide benchmark images and follow-up images to determine the source cloning domain and target cloning domain of the MVSC. Using the mean value coordinates to achieve the pixel to interpolate from the source cloning domain to target cloning domain. Finally, using MVSC algorithm to achieve the two images stitching [7].

The stitching image's two key technologies are the image registration and image fusion. Image matching is the base of image fusion, and image fusion is the key image of stitching. The image matching algorithm of the calculation amount is generally very large, so the image stitching technology

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development depends largely on the image quasi-technological innovation. The traditional image fusion method mainly in the time domain through the arithmetic operations to achieve integration, The MVSC algorithm is the direct use of an image A set of overlapping domains AB source fusion domain and another image B, a duplication of domain AB domain fusion clone set as a goal, to complete smooth seamless, seamless image stitching, This process has accelerated speed and improved image stitching image stitching quality [7].

Image Stitching Algorithm [7].

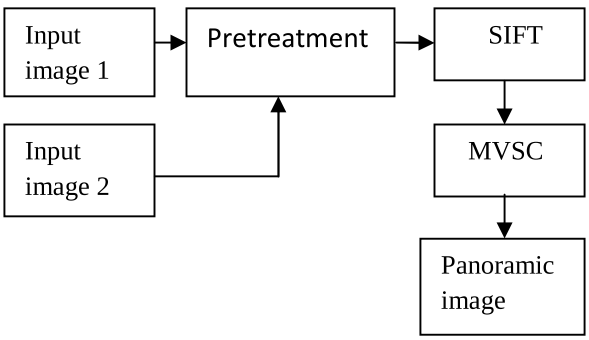

Fig.4 Image Stitching Process

Algorithm steps are as follows [7].

(1) Input image and pre-processing.
(2) Using SIFT algorithm extracts the input image feature points, and determine the position and direction of feature points, using 128-dimensional vector of the feature points to describe it.
(3) The SIFT feature vector after generating two images, use the nearest neighbor Euclidean distance of feature points and the sub-neighbor Euclidean distance of feature points than the right alignment for the feature points. BBF algorithm uses a higher probability to search the nearest neighbor points, and sub-neighbor points [20].
(4) Using RANSAC algorithm picks up feature points collection, remove wild points, and filter with quasi point criteria are met SIFT alignment point right.
(5) Upon the registration of SIFT points to calculate the image transformation parameters, give for the next seamlessly cloning provide the basis.
(6) According to the SIFT algorithm provide overlapping regional information to determine the source cloning domain and target cloning domain of the MVSC.
(7) Build the mean coordinates to achieve pixel from the source cloning domain to the target cloning domain interpolation.
(8) Finally, using this article MVSC algorithm to achieve image stitching to get panoramic images.

VIII. Automatic Image Mosaic System Using Steerable Harris Comer Detector

The first step in image stitching is to search for the overlap region or similarity within the images. This is done by extracting the feature points within the images using a feature point detector such as Harris, SUSAN. Then compare the feature points are to look for any matching pair. Based on the matching, transformation parameters are generated to transform the images into the same coordinate system that are agreed by each other. Finally, the images are ready to be stitched together [12].

Image mosaic process flow [12].

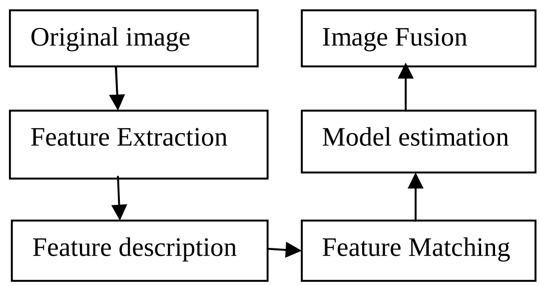

Fig.5 Image mosaic process

Fig.5 shows image mosaic process flow, that is started by extracting the feature points in the two images. The feature detection contains significant structural information pixels. Feature point detection effects the success of feature matching. Different feature point detectors and their invariant [12].

IX. Image Stitching Algorithm based on Feature Extraction

A new image stitching technology based on feature points matching is researched. It is different as region-based image stitching, feature-based image stitching technology estimates the transformation between the images by the distinctive feature of image but not the all information of image. In the premise of ensuring the quality of stitching, this algorithm reduced the computational and had some

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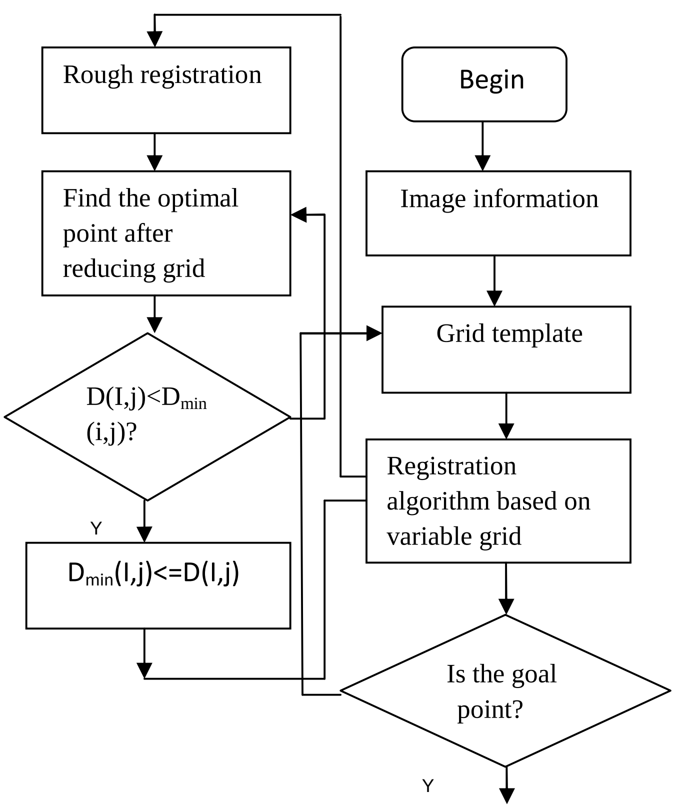
practical value. The main idea of this method is detecting the image's edge, and then extracting the feature points for its edge point. The third step is searching the suture point from the corresponding feature point which is used to determine the matching location of the image. Finally, the algorithm is used to achieve the seamless stitching of image [13].

X. Stitching Technique of Medical Infrared Images

For the medical infrared images, because the generated noise during taking photograph is small and the frequency of lens rotating is low, the registration method based on grid is adopted [14].

Fast registration Algorithm Based on Grid

First of all, a point A is selected in overlap region being not close to the edge of the second image, and the distance of point A to the edge of image should be more than half of the grid height. When the extracted grid template according to the point A as the center of grids moves in the first image, the corresponding pixel RGB values of two images at same grid points are obtained. The quadratic sum of difference of corresponding RGB values in two images are computed to find the location of minimum value, which is the best registration point [14].



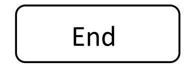


Fig.6 The block diagram of image registration algorithm based on grid template

XI. Image Fusion

The aim of image fusion is to eliminate the discontinuities of light intensity and color, which reduces the intensity mutation in image at the stitching site by smoothing transition. In order to make the stitching region smooth and improve the image quality, the fade-in and fade-out fusion method is used to realize the gradual transition of color resulting in avoiding the blur and obvious boundary [14].

XII. Conclusion

Jing Xing and Zhenjiang Miao (2007) discuss that SIFT features allows transformation of images in an accurate way. It ensures smooth transformation between images with illumination and orientation differences, and can also overcome the difficulty of matching in vertical direction. Higher accuracy and better effect are obtained from the method. Zhu Qidan and Li Ke (2010) reduces the dimensions of SIFT feature, enhanced the matching accuracy and the real-time performance of the stitching images. The stitching picture quality has achieved good visual results, and this method can save 50% of the time. SIFT and MVSC received the exactly matching of the feature points, and achieved the perfect image fusion. (Zhen Hua, Yewei Li and Jinjiang Li (2010)). Mahesh and Subramanyam M .Y. (2012) propose that the method performs better matching scores. So it can be concluded that proposed method is effective compared to Harris and Susan comer detection methods. Yi Zhuang, Xinrong Hu *et al* (2009) prove that is a relatively new method of calculation of image stitching which improves the efficiency of algorithm. Yu Wang and Mingquan Wang (2010) propose that the searching speed is improved for the combination of rough registration and precise registration. Further, the fade-in and fade-out fusion method is employed to remove the seams in the stitching images, which improves the fusion effect. So, the discussed stitching technique has the advantages of fast registration and gradient fusion, which results in the seamless stitching effect.

XIII. References

1) Yang zhan-long Guo bao-long, "IMAGE MOSAIC BASED ON SIFT", *International Conference on Intelligent Information*

Hiding and Multimedia Signal Processing (IIHMSP),pp.1422-1425, 15-17 Aug ,2008

2) Jing Xing, Zhenjiang Miao, "An Improved Algorithm on Image Stitching based on SIFT features", *Second International Conference on innovative computing, Information and Control (ICICIC)*, pp. 453, 5-7 Sept, 2007

3) Zhu Qidan and Li Ke, "Image Stitching Using Simplified SIFT", *International Conference on Information and Automation (ICIA)*, June 20 - 23, pp.1134-1137,2010

4) Wei Wang and Michael K. Ng, "A Variational Method for Multiple-Image Blending" *IEEE Transactions on Image Processing*, Vol. 21, NO. 4, pp.1809-1822,APRIL 2012

5) Vladan Rankov, Rosalind J. Locke, Richard J. Edens, Paul R. Barber and Borivoj Vojnovic, "An algorithm for image stitching and blending", *SPIE*, vol. 5701, pp. 190--199 ,2005

6) Abhinav Kumar, Raja Sekhar Bandaru, B Madhusudan Rao, Saket Kulkarni, Nilesh Ghatpande, "Automatic Image Alignment and Stitching of Medical Images with Seam Blending" *World Academy of Science, Engineering and Technology*, pp.110-115, Issue 41, May 2010

7) Zhen Hua, Yewei Li, Jinjiang Li, "Image Stitch Algorithm Based on SIFT and MVSC", *Seventh International Conference on Fuzzy Systems and Knowledge Discovery (FSKD)*, Vol. 6, pp.2628-2632, 10-12 Aug ,2010

8) Jubiao Li and Junping Du, "Study on Panoramic Image Stitching Algorithm", *Second Pacific-Asia Conference on Circuits, Communications and System (PACCS)*, Vol. 1, pp.417-420, 1-2 Aug ,2010

9) ZHAO Xiuying, WANG Hongyu, WANG Yongxue, "Medical Image Seamlessly Stitching by SIFT and GIST", *International Conference on* E-Product E-Service and E-Entertainment (ICEEE), pp. 1-4, 7-9 Nov, 2010

10) Yanfang Li, Yaming Wang, Wenqing Huang, Zuoli Zhang, "Automatic Image Stitching Using SIFT", *International conference on Audio, Language and Image Processing (ICALIP)*, pp.568-571, 7-9 July, 2008

11) Chu Bin, Jiang Dalin, "Panoramic Image Stitching using ASIFT", *Fourth International Conference on Multimedia Information Networking and Security (MINES)*, pp.216-219, 2-4 Nov. 2012

12) Mahesh, Subramanyam M .Y. , "Automatic Image Mosaic System Using Steerable Harris Comer Detector", *Machine Vision and Image Processing (MVIP)*, pp. 87-91, 14-15 Dec. 2012

13) Yi Zhuang, Xinrong Hu, Jianchun Wang, "The Implement of an Image Stitching Algorithm based on Feature Extraction", *Second International Conference on Education Technology and Training (ETT)*, pp.327-330, 13-14 Dec, 2009

14) Yu Wang and Mingquan Wang, "Research on Stitching Technique of Medical Infrared Images", *International Conference on Computer Application and System Modeling (ICCASM)*, Vol. 10, pp.490-493, 2010

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