A REVIEW ON AUTOMATED IMAGE MOSAIC USING PCA

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***Abstract*— When image capturing devices are not able to accommodate image in a single frame then the technique used to join number of images taken sequentially is called image mosaicing. In other words, it is normally used to make up a seamless and high resolution image with a set of partial images. So the image mosaic is an increasingly popular field of research. In general, there are two basic steps of image mosaicing. First is Image Alignment and second is Image Stitching. This project introduces an emerging image mosaicing technology based on PCA i.e. Phase Correlation Algorithm. In this paper, correlation-based scheme is used which operates in the Fourier domain for finding the transformed coordinates (translational parameters) and use it for Image Mosaicing.**

***Index Terms*—About four key words or phrases in alphabetical order, separated by commas.**

I. INTRODUCTION

Technique of image mosaic for restoring images with larger visual angle and more reality plays an essential role in detecting more information from the image. In fact, to the limit of objective conditions, i.e. equipments or weather, images are usually unable to reflect the full scene, which makes it more difficult to further process the image. The general task of image mosaic is building images in way of aligning series of images overlapping in space. Compared with single images, scene images built in this way are usually of higher resolution and larger vision.

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Image mosaic is to composite two or more overlapped images into a seamless wide-angle image through a series of processing and is widely used in remote sensing, military matters and medicine, etc. When taking these photos, it's difficult to make a precise registration due to the differences in rotation, exposure and location.

Image mosaic aims to combine a set of images, normally overlapped, to form a single image as shown in the following figures.




Figure 1 Figure 2 Figure 3 Figure 4

Figure 1 and Figure 2 are the input images, while Figure 3 and Figure 4 are mosaiced images. The image mosaic techniques are widely used in remote sensing, medical imaging, and military purposes and so on. Now days, many smart phones are equipped with the mosaicing application which helps user in many different ways. The image mosaicing technique can be broadly classified into feature-based and frequency-based techniques. Feature-based method uses the most similarity principle among images to get the parameters with the help of calculation cost function. Method based on the frequency domain transforms the image from spatial domain to frequency domain, and get the relationships of through Fourier transformation. In frequency domain there are methods like phase-correlation, Walsh transform, etc. Image mosaic has been efficiently and precisely applied to areas such as industry, military, and health care.

II. LITERATURE SURVEY

The original image alignment algorithm was the Lucas-Kanade algorithm. The goal of Lucas- Kanade is to align a template image to an input image, where is a column vector containing the pixel coordinates. If the Lucas-Kanade algorithm is being used to compute optical flow or to track an image patch from time to time, the template is an extracted sub-region (a window, maybe) of the image [1].

Algorithms for aligning images and stitching them into seamless photo-mosaics are among the oldest and most widely used in computer vision. Frame-rate image alignment is used in every camcorder that has an “Image Stabilization” feature. Image stitching algorithms create the high-resolution photo-mosaics used to produce today’s digital maps and satellite photos. They also come bundled with most digital cameras currently being sold, and can be used to create beautiful ultra wide-angle panoramas.

An early example of a widely used image registration algorithm is the patch-based translational alignment (optical flow) technique developed by Lucas and Kanade [1]. Variants of this algorithm are used in almost all motion-compensated video compression schemes such as MPEG [3]. Similar parametric motion estimation algorithms have found a wide variety of applications, including video summarization [4][5], video stabilization [8], and video compression [9][10]. More sophisticated image registration algorithms have also been developed for medical imaging and remote sensing. In the photogrammetry community, more manually intensive methods based on surveyed ground control points or manually registered tie points have long been used to register aerial photos into large-scale photo-mosaics [11]. One of the key advances in this community was the development of bundle adjustment algorithms that could simultaneously solve for the locations of all of the camera positions, thus yielding globally consistent solutions [12]. One of the recurring problems in creating photo-mosaics is the elimination of visible seams, for which a variety of techniques have been developed over the years [13]-[17].

In film photography, special cameras were developed at the turn of the century to take ultra wide-angle panoramas, often by exposing the film through a vertical slit as the camera rotated on its axis [18]. In the mid-1990s, image alignment techniques were started being applied to the construction of wide-angle seamless panoramas from regular hand-held cameras [19]-[22]. More recent work in this area has addressed the need to compute globally consistent alignments [23]-[25], the removal of “ghosts” due to parallax and object movement [26][27], and dealing with varying exposures [28]. (A collection of some of these papers can be found in [29].) These techniques have spawned a large number of commercial stitching products [30][31], for which reviews and comparison can be found on the Web.

While most of the above techniques work by directly minimizing pixel-to-pixel dissimilarities, a different class of algorithms works by extracting a sparse set of features and then matching these to each other [32]-[37]. Feature-based approaches have the advantage of being more robust against scene movement and are potentially faster, if implemented the right way. Their biggest advantage, however, is the ability to “recognize panoramas,” i.e., to automatically discover the adjacency (overlap) relationships among an unordered set of images, which makes them ideally suited for fully automated stitching of panoramas taken by casual users [33].

By the year 2011, at University of Victoria, Canada in Department of Electrical and Computer Engineering, Ioana S. Sevcenco, Peter J. Hampton and Pan Agathoklis proposed a method of seamless stitching of images based on a haar wavelet 2d integration [38].

Recently, Chengcheng Liu and Yong Shi proposed SIFT algorithm for image registration. SIFT algorithm is obtained by judging the feature points of local extreme, combined with neighbourhood information to describe the feature points to form a feature vector, in order to build the matching relationship between the feature points.

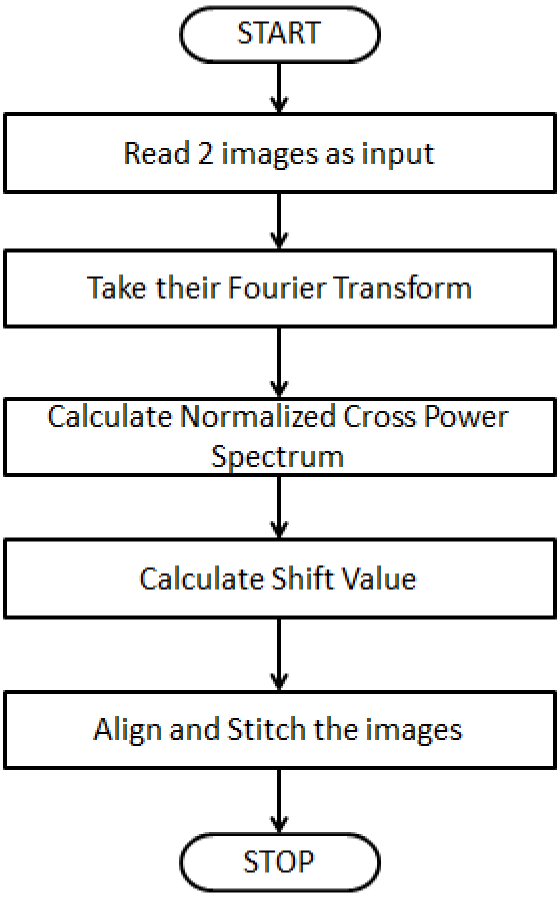
According to the comparison and analysis above, aiming at the mosaic between images that have larger scale difference, we try to synthesize the advantages both in frequency dispose and registration, a new robust method which includes the phase-correlation algorithm is proposed. We can get the factor of translation by cross-power spectrum in order to optimize the corner detection method. More importantly, this method can eliminate the non-adaptive weakness because of scale change. It is superior to other mosaicing techniques in terms of the calculation speed and applicability.

III. Methdology

From a given set of images with an overlapping portion, task is to combine them to form a single image which includes the information from all the given images.

By keeping following things in mind as an objective, we are expecting a best results from this approach of mosaicing.

- To propose a better mosaicing method, which can stitch scattered images together of the same scene (or target), so as to restore an image (or target) without losing a prior information in it.
- To increase an accuracy and reduce the time to mosaic the images which will shows better efficiency as compared to other mosaicing techniques.



Phase correlation algorithm uses the cross-power spectrum to registration images and is used to get the translation factor initially. Imagine there are two images I_1 and I_2, and the translation between them is as following:

$$I_2(x,y) = I_1(x - x_0, y - y_0)$$

The Fourier transformation:

$$F_2(u,v) = F_1(u,v) \cdot e^{-j(ux_0+vy_0)}$$

Cross power spectrum is:

$$\frac{F_1 * (u,v) F_2(u,v)}{|F_1 * (u,v) F_2(u,v)|} = e^{-j(ux_0+vy_0)}$$

We can get an impulse function $\delta(x - x_0, y - y_0)$ about the value of translation invariant x_0 and y_0 by using Fourier inverse transform to equation (3).

IV. Conclusion

A key feature of Fourier-based registration methods is the speed offered by the use of FFT routines. We have presented a successful method of automatically mosaicing binarised images taken with a low cost digital camera by using the phase correlation method. To reduce the computation time we correlated only the sub image of second image with the first image. The proposed algorithm has given the exact angle of rotation efficiently and the merged images are satisfactory.

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