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Enhance Panorama Image Instant Color Matching and Stitching

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Abstract: This paper presents a simple and efficient color and luminance compensation approach for image sequences to construct panoramic images on mobile devices. In this approach constant compensation co-efficient for adjacent images are computed from the corresponding pixels in the overlapping areas of the adjacent images in the linearized RGB color space. This can smooth color transition between adjacent images in the image sequence globally and reduce cumulative error in the color correction process. Image stitching is used to integrate information from multiple images with overlapping fields of view in order to produce a panoramic view with all the contents fitted into a single frame. Image stitching literature shows that image stitching is still a challenging problem for single and panoramic images. In recent years many algorithms have been proposed widely to tackle image stitching problem. In this paper we present a detail review of all the recent approaches proposed to tackle the image stitching issue. In addition we also discuss the image stitching process. We formulate stitching as a multi-image matching problem, and use constant. Local features to find matches between all of the images. Because of this our method is impervious to the ordering, orientation, scale and lamination of input images. It is also insensible to noise images that are not part of a panorama, and can recognize multiple panoramas in an unordered image dataset.

Key words:— Panorama, Image stitching, Multiple Constraint Corner Mapping, mobile panorama, photometric consistency, multiband blending.

I. INTRODUCTION

Image stitching is a sub branch of computer vision. Image stitching is basically combining two or more different images to form one single image that is panorama. The word panorama is derived from the Greek words ‘pan’ and ‘horama’. ‘pan’ means everything and ‘horama’ means to view, and thus it means all round view. Panorama images can be created in a variety of ways, from the first round painting in the 18th and 19thcenturies.The aim of stitching is to increase image resolution as well as the field of view people used image stitching technology in topographic mapping. A topographic map is a type of map characterized by large-scale detail and quantitative representation of relief, using contour lines. Typically, a camera is capable of taking pictures within the scope of its view only it cannot take a large picture with all the details fitted in one single frame. Panoramic imaging resolves this problem by combining images taken from different sources into a single image. Such images are useful for surveillance applications, video summarization, remote sensing etc. Image stitching algorithms create the high resolution photo mosaics used to produce today's digital maps and satellite photos. Creating high resolution images by combining smaller images are popular since the beginning of the photography. There should be nearly exact overlaps between images for stitching and common region between images. The images of same scene will be of different intensities, scale and orientation. The method for automatic matching fall broadly into two categories: direct and feature-based. The direct methods attempt to iteratively estimate the camera parameters by minimizing an error function based on the intensity difference in the area of overlap. The direct methods have the advantage since it uses all of the available data and hence can provide very accurate registration, but they depend on the illumination. On the other hand, feature-based methods begin by establishing correspondences between points; lines or other geometrical entities. Recently, the use of invariant features for object recognition and matching. These features can be matched more reliably than traditional methods. Since the feature-based methods have higher accuracy, some image stitching methods have been introduced and implemented. In this article, some satisfying stitching results have been obtained using the SIFT features based method.

Shows the main steps creating panoramic image.

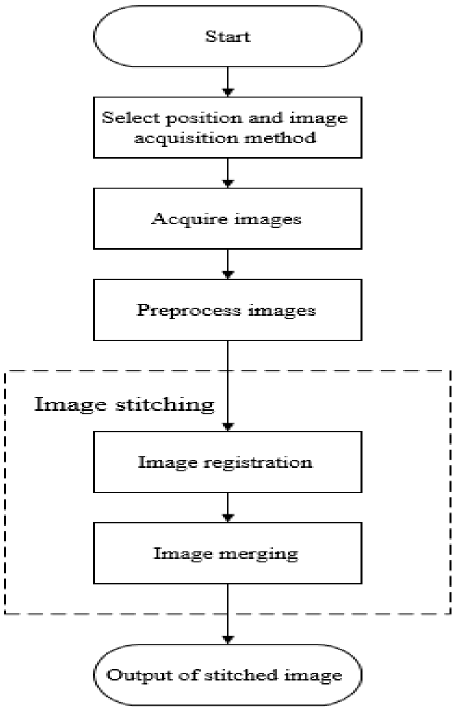


Figure 1: The flowchart of creating a panoramic image.

II SIFT ALGORITHM DETAILS

It is a key to match features in the images stitching. So the result of image stitching will be good if the interest points are found correctly. Among the local descriptors compared, SIFT features generally perform the best Because of the unreliability of many algorithm such as the algorithm based on area and based on feature pattern, the algorithm based on SIFT features is of importance. The algorithm of image stitching based on SIFT features uses the invariable local features to select interest points and then calculate the homograph applying these matching points. The images with the same viewpoint, but in different directions can be related by homography. The details of the algorithm are:

•Select a referenced image.

•Find the feature to be matched with the neighboring images.

•Calculate the hemography H of the two images.

- Apply H to warp and project the image (in the same coordinate system) as the image, and process the image and stitch them seamlessly.

1.1 Feature matching of images:

Because of collections of large images, where the geometric relationship between them is unknown, it is difficult to take into account the salient features of the images. In our analysis, we have used SIFT features and have obtained very good results [4]. The SIFT provides a set of features of an object that are not affected by the implications present in other methods, such as to object scaling and rotation. To aid the extraction of these features the SIFT algorithm is applied in a four stage filtering approach.

1.1.1 Scale-Space extremum detection:

This stage of the filtering attempts to identify those locations and scales which can be identified from different view of the same object. This can be powerful to achieved using "scale space" functions which under certain assumptions canbe approximated to a Gaussian function. The scale space is defined by:

$$L(x, y, \sigma) = G(x, y, \sigma) * I(x, y) \quad (1)$$

Where * is the convolution operator, G(x, y, σ) is an ariablescale Gaussian and I(x, y) is the input image. Various techniques can be employed to detect stable key point locations in the scale-space. The difference of Gaussians is one such technique to locate scale-space extremum, (D(x, y, and σ)) by computing the difference between two images, one with scale k times the other. The D(x, y,σ) is given by:

$$D(x, y, \sigma) = L(x, y, k\sigma) - L(x, y, \sigma) \qquad (2)$$

To detect the local maximum and minimum of D(x, y, σ) each point is compared with its neighbours at the same scale, and its neighbours up and down the scale. If the obtained value is a minimum or maximum for all these points the point is an extremum.

1.1.2 Key point Localization:

This stage attempts to eliminate more points from the list of key points by finding those that have low contrast or are poorly localized on an edge. This is achieved by calculating the Laplace, value for each keypoint found in stage. The location of extremum of z is given by:

$$z = \frac{\partial^2 D^{-1}}{\partial x^2} \frac{\partial D}{\partial x} \quad (3)$$

1.1.3*Orientation Assignment:*

This stage aims to assign a consistent orientation to thekey points based on local image properties. The key point descriptor can be represented to relative theorientation, which is achieved by the invariance under rotation. The approach is to find an orientation using the key point scale to select the Gaussian smoothed image L, and compute the magnitude and the orientation. An orientation histogram is formed from gradient orientations of sample points. Finally, using the histogram, orientation to the key points can be assigned.

1.1.4 Key point Descriptor:

The obtained vectors are known as SIFT keys and are used in a nearest-neighbours approach to identify possible objects in an image. The collections of keys which correspond to the model are identified. When three or more keys agree on the model parameters is evident in the image with high probability. Due to the large number of keys (SIFT) in an image of an object,substantial levels of occlusion are possible while the image is still recognized bythis technique.

III MULTI-BAND BLENDING

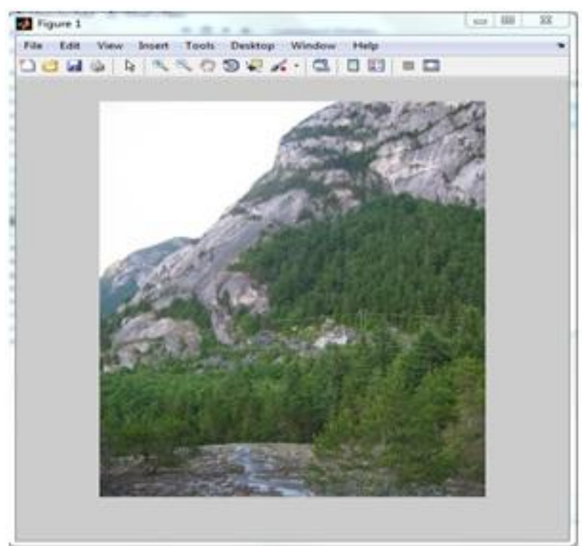
Ideally each sample (pixel) along a ray would have the same intensity in every image that it intersects. But in reality this is not the case .Even after gain compensation some images edges are still visible due to a number of unmodelled effects, such as vignetting (intensity decreases towards the edge of the image) parallax effects due to unwanted motion of the capital center, misregistration errors due to mismodelling of the camera and radial distortion and so on. Because of this a good blending strategy is important. From the previous step we have nImages $I^{i}(x, y)$ (i ϵ{1..n}) which, given the known registration, may be expressed in a common (spherical) coordinate system as $I^{i}(\Theta,\Phi)$. In order to combine information from multiple images we assign a weight function to each image W(x, y) = w(x) w(y) where w(x) varies linearlyfrom 1 at the centre of the image to 0 at the edge. W(x, y) = w(x) w(y) where w(x)varies linearly from 1 at the center of the image to 0 at the edge. The functions are also resample in spherical coordinates $W^{i}(\Theta, \Phi)$.A simple approach to blending is to perform a weighted sum of the image intensities along each ray using these weight functions.

$$I^{linear}(\Theta, \Phi) = \frac{\Theta^{n}_{i=1} I^{i}(\Theta, \Phi) w^{i}(\Theta,\Phi)}{\Theta^{n}_{i=1} w^{i}(\Theta, \Phi)}$$

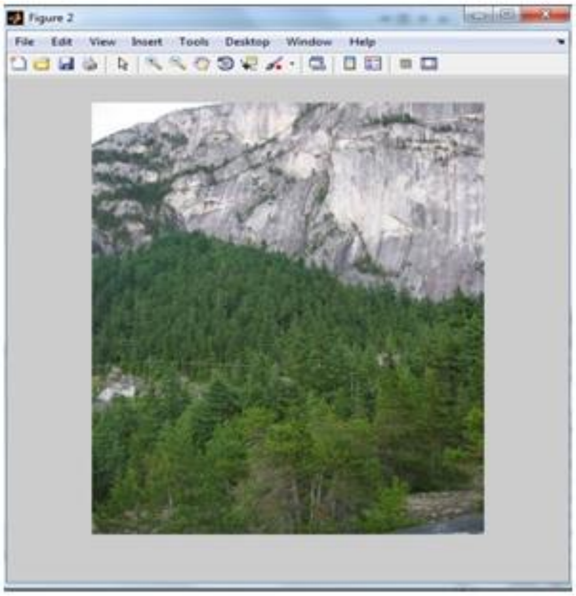
Where $I^{linear}(\Theta, \Phi)$ is a composite spherical image formed using linear blending. However, this approach can cause blurring of high frequency detail if there are small registration errors. To prevent this we use the multiband blending algorithm of Burt and Adelson [BA83]. The idea behind multi-band blending is to blend low frequencies over a large spatial range and high frequencies over a short range.

IV EXPERIMENTAL RESULTS OF IMAGE STITCHING

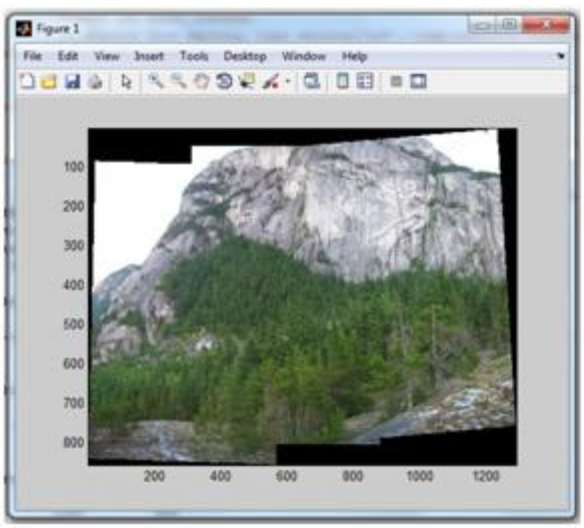
After calculating H, we transform the image 2 into the same coordinate system as image 1 according to the equations introduced. Due to transformation; lots of information about the image can be lost. In our work, after the transformation the coordinates of the image 2 are recorded and the two images are stitched directly. Using the above method, complex algorithms and unnecessary calculation can be avoided and higher graphics resolutions can be obtained. The illumination of the two original images is different, but the stitching result is not affected because the SIFT features are insensitive to illumination, oriental and scale. The results are shown in:



(a) Image



(b) Image



(C) Original panorama images and blended result

V. CHALLENGES OF 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 (a shift 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 a variety of techniques have been developed over the years.

VI.CONCLUSION

This work carried out in this paper, considers the detection and extraction of Key points by using SIFT algorithm. From our analysis it was found that SIFT Key point features are highly distinctive and invariant to image scaling and rotation. It provides correct matching in images when subjected to noise, viewpoint and illumination changes. The created panorama image can be used for many applications like face detection, Digital sign boards in Shopping Mall, Railway Station and so on.

From our work, we conclude that the SIFT features to transform images allows to stitch them in an accurate way. The SIFT feature ensures smooth transformation between Images with different illumination and orientation and it can also overcome the difficulty of matching in vertical direction. High accuracy and better effect are obtained from the method based on SIFT features in image stitching. Since we have stitched the two images by using the coordinates of the image after transformation instead of interpolation, unnecessary calculation has been avoided. Since the carried out work has tedious calculations the speed of stitching images is a bit slow. The aim of the future work is to find an efficient way to simplify the algorithm.

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