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Acquisition of high resolution geo objects Using image mosaicking techniques

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Abstract

Remote sensing on-boardsatellite techniques have been demonstrated to be powerful tools for monitoring the earth's surface. Image mosaicking aligns multiple overlapping images of a same scene into a larger image of high resolution. In this paper, the feature extraction is based on SIFT and SURF technique. These techniques produce an efficient mosaicked image output as compared with other methods. From these algorithms the efficiency of PSNR and MSE value is 40%. It has been active research in finding disaster areas, computer vision and computer graphics, military target purposes.

Key words: SIFT (Scale invariant feature transform), SURF (Speeded up robust features).

1. Introduction

Image mosaicing is the alignment of multiple interconnected images to create a larger scene of aligned images. It is defined as a special case of scene reconstruction where the images are related to planar homographs only. An Image Mosaic is created from a sequence of images and it can be obtained by understanding geometric relations between images. Then these images are applied for warping operation where the overlapping
regions are merged and warped.For this technique two input images are taken and these images are fused to form a single large image.This single image is the output of mosaiced image.

The first step in Image Mosaicing detected in both input images. In image registration the geometric relations between the images is established and analyzed. Registration methods can be divided into four algorithms:1)image pixel values are using directly,2)the frequency domain,3) use of low level features,4)and use of high-level features .The next step is image warping and blending where distorted images are corrected and also modifies the gray levels of images in boundary to obtain a seamless blended image. In image mosaicking the most important is quality and time efficiency of the algorithm used.

Moroni et al. (2012) proposed a method that deals with the robust and efficient algorithm for automatically combining misaligned images of a multiple scene into a single composition. The algorithm, together with the 2D fast Fourier transforms, provides an particular value of the displacement of images and then these images are accounting for rotations and changes of scale.

A. Mosaicing Model

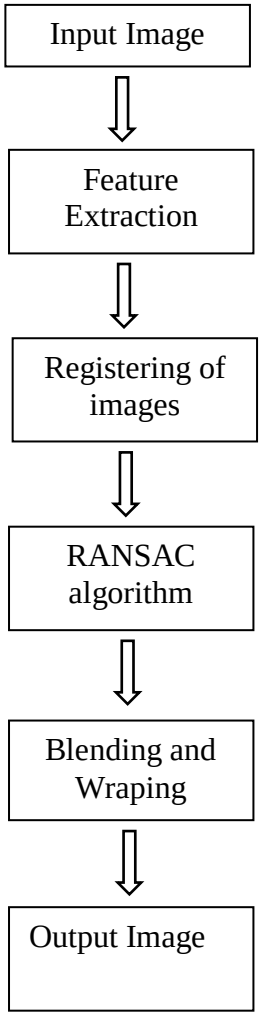

Figure 1 - Block diagram of mosaicing model.

2. Feature extraction

Feature extraction is the first and foremost step in mosaicking technique where the features are taken from the input images.Inside the image, features are to be taken as patches for matching the purpose of extraction.For perfect feature matching, corners are to be matched to provide quantitative measurement (Joshi and Sinha, 2013). The advantages of corners are that they are more suitable one when the orientations are changed. The another most important feature of corner is that if there is a corner in image than it's neighborhood will show a change in intensity. Corners detection algorithms are used to detected the corners in image.Some of the corner detection algorithms are Harris Corner detection Algorithm (Zhang et al., 2014).Scale Invariant Feature Transform(SIFT),FAST algorithm, Speeded-up robust feature(SURF), Smallest Univalue Segment Assimilating Nucleus (SUSAN), Principal Component Analysis (PCA-SIFT).

A. Scale Invariant Feature Transform (SIFT)

SIFT Algorithm is Scale Invariant Feature Transform which is an corner detection algorithm and it is used to find the features in an input image to find similar objects in adjacent images. In image features this algorithm produces key-point-descriptors (Srinath and Ravikumar, 2014). When the two images are in the process of finding features then the result will be two keypoint descriptors and then it will be given as input to the Nearest Neighbour Search(NNS) and produces a matching point.SIFT undergone four phases such as: Scale-space construction, Scale-space extrema detection, define localization, assigning of orientation,estimate keypoint descriptors. The first phase of scale space extrema detection is used to identify the interest points (Moroni et al., 2012). It finds over all scales and image locations by using a difference-of Gaussian(DOG) function.Key-points are the important one to determine features and it will be selecting based on the stability.In Orientation assignment,SIFT [15] computes the direction of key gradients around the stable area.If more number of features are extracted form SIFT then it is done applying Best Bin First(BBF) algorithm for determining the initial matching points between input frames or patches. To remove the unwanted corners which does not belong to the overlapping area, RANSAC algorithm is used. It removes the false matches in the image. Stitching is the final process to obtain a final output mosaic image (Moroni et al., 2012). In stitching process, each pixel in every scene is verified and compared it with second frame. SIFT algorithm to Rahman et al. (2013) is rotational and scale invariant and it is very useful for object detection in images with high resolution. It is a efficient algorithm for image comparison but it is slow. The running time of a SIFT algorithm is large where it takes more time to compare two images.

B. Speeded up Robust Features (SURF)

The Speed-up Robust Feature detector

(SURF) consists of three feature steps as detection, Description and Matching. SURF is used to find image interest points by using Hessian matrix (Prados et al., 2012). In this matrix, eigen values are showing the direction of curve (gradient) of the image. A descriptor window which is in square shape and arranged with a size of 20 centered on each interest point and orientation based on the derived rotation and divide the descriptor window into 4 x 4 sub-regions.these methods are used to find the major features in the image pairs. SURF is widely used in the computer vision community. SURF for Adel et al. (2015) has proven its efficiency and robustness than invariant feature localization.

3. Finding homography

Homograph for Zhang et al. (2014) is used to mapping between two spaces which is used torepresent the correspondence between twoimages of the same area. It's widely useful for images where multiple images are taken from a camera which having a fixed camera Centre ultimately warped together to produce a panoramic view.

The RANSAC algorithm is for fitting of models in the presence of outliers. The algorithm as,

1. Select N data randomly
2. Estimates parameters X
3. Finds how many data items fit the model with parameter vector X and make this as K.
4. If K value is good enough then quit the process.
5. Repeat the process until get more data.

Here K has to be depends on the percentage of data whose values are equal to the structure being fit and how many structures we have in the image. If there are more number of structures then, remove the fit data and redo RANSAC.

4. Image blending and wraping

Image Warping is the process of digitally working an image such that any shape of images are slightly distorted.It is used to finding faults in the image distortion as well as for creative purposes. These images are to be transformed in many ways,then pure wraping means that points are mapped to points without changing the colors.

The final step is to blend the pixels colors in the overlapped region to avoid the seams. Weighted averaging color values are simplest one to blend the overlapping pixels (Prados et al., 2012). Mostly alpha factor has been used for alpha channel whose values are 1 at the center pixel and becomes 0 after decreasing linearly to the border pixels. Where at least two images overlap occurs in an output mosaic then we will use the alpha values to compute the color at a pixel in image.

5. Experimental results

The feature matching is done by SIFT and SURF algorithm of finding the perfect matches between image pairs. The training image has different orientations and dimensions.

The below figure 2 and figure 3 shows that the images are processed by SIFT algorithm where detecting the interest points (blue color) or regions of providing descriptors.

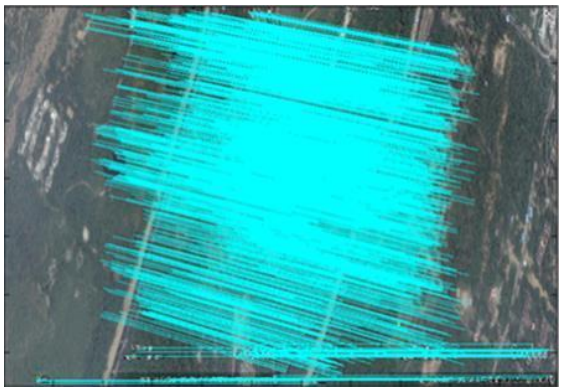

Figure 2 Image erode of matching result using SIFT. Blue lines are valid matches.

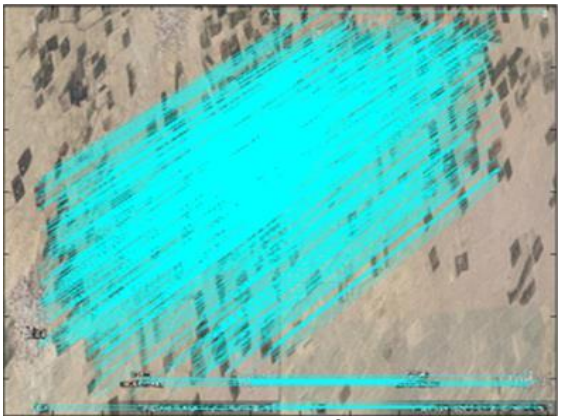

Figure 3 Image shara of matching result using SIFT. Blue lines are valid matches.

The below figure 4 and figure 5 shows that the input images are processed by SURF algorithm which detects the descriptors in image pairs.

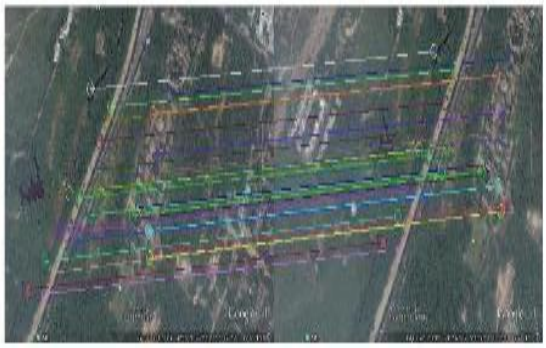

Figure 4 image shara of matching result using SURF.

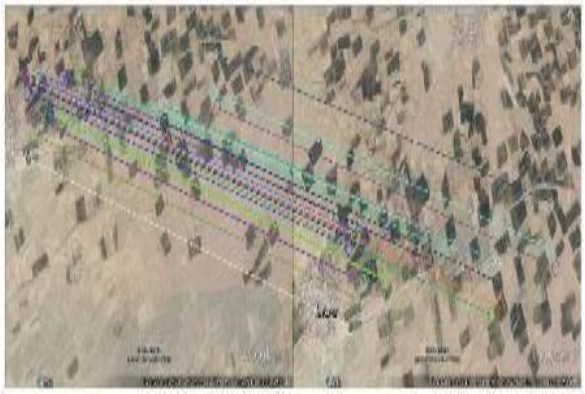

Figure 5 image shara of matching result by SURF algorithm.

These performances are determined by using MSE and PSNR parameters as,

Table 1- Comparison of parameters using SURF

Parameters	Image erode	Image shara
PSNR	15.90	18.09
MSE	21.00	22.01

Table 2 - Comparison of parameters using SIFT

Parameters	Image erode	Image shara
PSNR	30.39	30.45
MSE	74.82	92.09

Here the values are calculated using formula of PSNR and MSE. When compared with both values SIFT is more efficient than SURF. In future a new algorithm to be developing to achieve higher efficiency.

6. Conclusion

The algorithm works well for geographic images and the position of overlaps are extracted in an efficient manner. When comparing of both feature matching detection SIFT algorithm gives an efficiency of 40% and SURF algorithm 20%.The obtained results prove SIFT preforms better than SURF and the number of key points can be located easily in scale invariant feature transformation. The limitation of this algorithm is that the obtained key points will be merged with each other and area matching is found to be difficult. The features are extracted and registered from the input and the results are simulated and analyzed using MATLAB.

In future, the feature feathering technique will be used for easy extraction and calculate more number of keypoints and also to minimize the limitation of SIFT algorithm andmatching of images can be done easily to obtain more resolution images.

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