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A SURVEY ON HIERARCHICAL IMAGE REGISTRATION

Ann Therese Francy*

D.Raveena Judie Dolly*

Renu Maria Mathews*

Abstract: *This paper proposes an adaptive image registration via hierarchical voronoi subdivision. At earlier times image registration is difficult for images which are of large size and high resolution. In this a mutiresolution method which changes resolution adaptively based on local image detail is analyzed. Voronoi subdivision is used to divide the image into regions for reducing the geometric difference between two images. Apart from the previous methods refining the correspondence by template matching and also for finding the missed correspondence is done. This method is a hierarchical one which adapts its block size according to the local image details.*

Keywords: *Image registration, Reference image, Sensed image*

*Department of Electronics and Communication Engg, Karunya University, Coimbatore, Tamilnadu, India

1. INTRODUCTION

Image registration is the matching two images so that corresponding coordinate points in the two images correspond to the same physical region of the scene being imaged [6]. These two images may be referred to as reference image (which is fixed) and sensed image or target image (which has to be changed).These images may be of single modality or multimodality.

Image registration techniques can be classified as intensity based and feature based image registration. In Intensity based image registration [11] the intensity pattern in the two images are compared. This can be obtained by the maximization of mutual information, correlation, and template and pixel intensities. Feature based [12] approaches are used to find the distinct features of two images. These features are points, curves or a surface model. Feature based image registration can handle complex between image distortion and will be faster because they will not match every single voxel in the image but rely on relatively small number of features. In this paper we are uses feature based image registration.

During image registration there will many problems depending to the data and the images. Three major types of variation are distinguished. The first type is the variation due to the differences in acquisition which cause the images to be misaligned. The variations of second type are those which are also due to differences in acquisition, but cannot be modeled easily such as lighting and atmospheric conditions. The third type of variation is differences in the images that are of interest such as object movements, growths, or other scene changes.

Correlation based matching [7] is used to find the correspondence between images if the small geometric difference.Multiresolution method is used to find the correspondence between images with large geometric difference. In this method it will use the points at one lower resolution is used to find the correspondence at the next higher resolution. The main drawback of these methods is that it will consider all the images same irrespective of the image details but the complexity also increases. So a mutiresolution method which changes its block size according to the image details is addressed.

In this a progressive subdivision algorithm is used. The control points which is obtained by the SIFT [8] descriptor is find out in the low resolution. Then subdivide the image into

voronoi regions .Then find out the correspondence between points in that region at next resolution. This will repeat until it reaches the highest resolution. Correspondence is obtained by using RANSAC [9] and affine transformation [10].

2. LITERATURE SURVEY

Bhat et al. [3] proposed a method for computing a dense pixel correspondence between two images of a scene containing multiple large rigid motions. In this each motion is modeled by homography or by a fundamental matrix. In this piecewise image registration is used. The methodology used is shown in Fig 1.

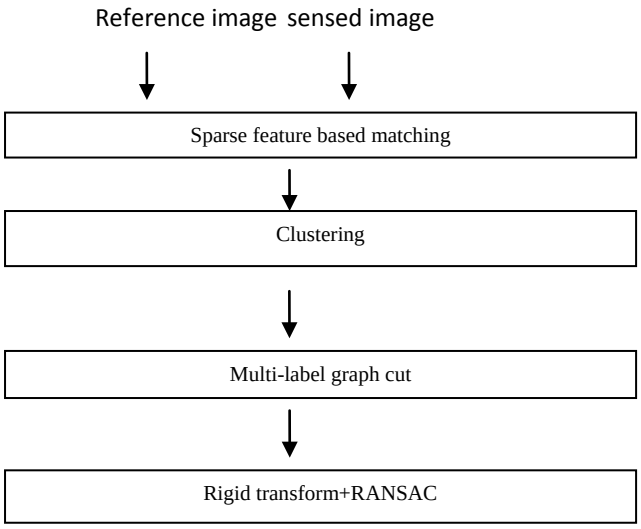

Fig.1.Flow of computation

The main advantages of this method are that it can able to handle large motions of both 3D objects and 3D plane. Also they can recover the depth information for every independently moving object in the scene, and they found out that for some images homographies alone can perform well. The main advantage of this paper is the combination of fundamental matrices with homographies to model motion. The main drawbacks of this paper are they fail to produce good results for low resolution images. This method cannot handle non-rigid objects or piecewise rigid motion, it also fails when the occluded/exposed regions are visually similar to other parts of the same.

X. Liu [5] proposed a method for the registration of remote sensing images with steerable pyramid transform and robust SIFT features. In this automatic image registration technique which is based on steerable pyramid transform and RSIFT is used. This technique can used to

register images with large variations of scale, rotation, and illumination of the images. The methodology used is shown in Fig 2.

The main advantage of this method is it can useful for registering remote sensing images. This will be more stable and robust under large rotations and image noise. By automatic image registration it can reduce the manual errors. The drawback of this paper is that the accuracy of the proposed algorithm is affected by the view point difference between two images in some degree. So a more robust descriptor for image registration should be constructed.

A. C. Cole-Rhodes [2] proposed mutiresolution registration of remote sensing imagery by the optimization of mutual information using stochastic gradient. In this they are using a search strategy based on two similarity measures mutual information and correlation. They also make a comparative study of two similarity measures, and stated that mutual information is better. The methodology of wavelet based mutual information is shown in fig 3.

The main advantage of this method is that it will provide a fast convergence rate in terms of iterations. This proposed method has to be improved since this is limited to run for fixed number of iterations only and also it is critical to for a correct result to be obtained at the coarsest level of decomposition also the algorithm fails at 16 pixels with the error increasing with the number of iteration.

B. Likar [1] proposed a hierarchical approach to elastic image registration based on mutual information. In this a combination of prior and floating information on the joint probability is made in order to improve registration. In order to increase the overall performance a correction of shading is done. In this they first progressively subdivide the image then it is locally registered and then elastically interpolated.

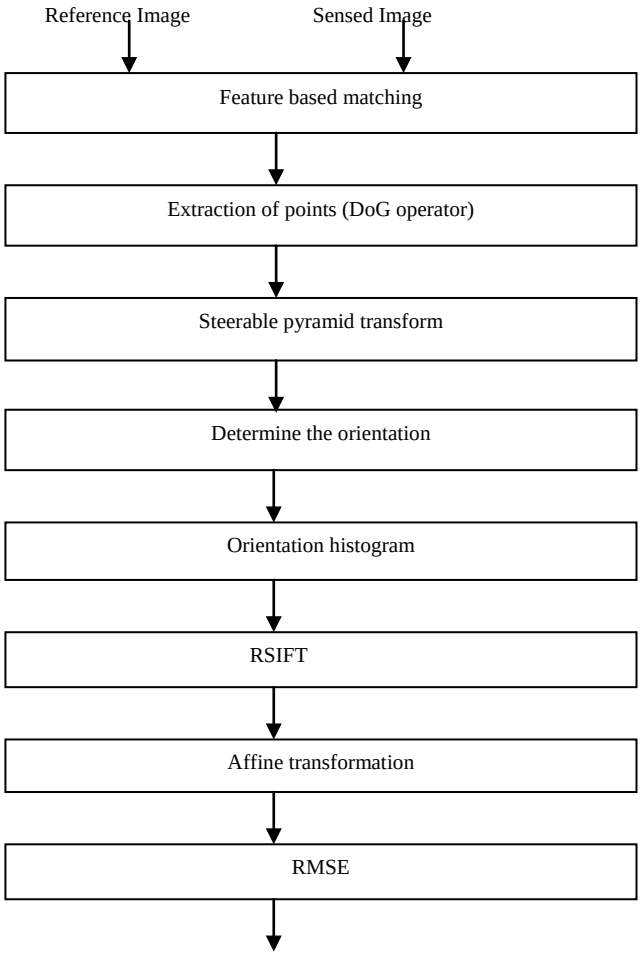

Fig 2.Flow of computation

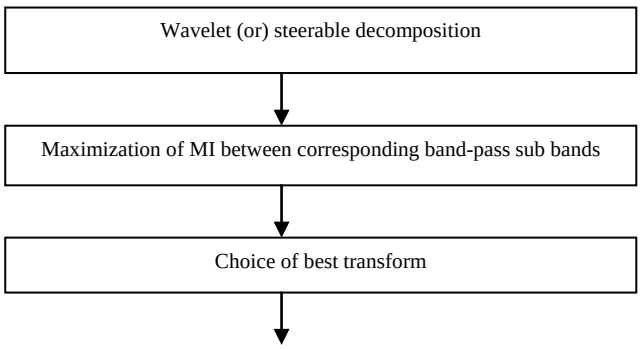

Fig 3.Flow of computation

T. Colleu [4] presents an algorithm for deformable image registration based on point features extracted from input images. The correspondence between points is then obtained by the RANSAC algorithm. It can detect the outliers effectively. The steps used can be shown below in fig 4.

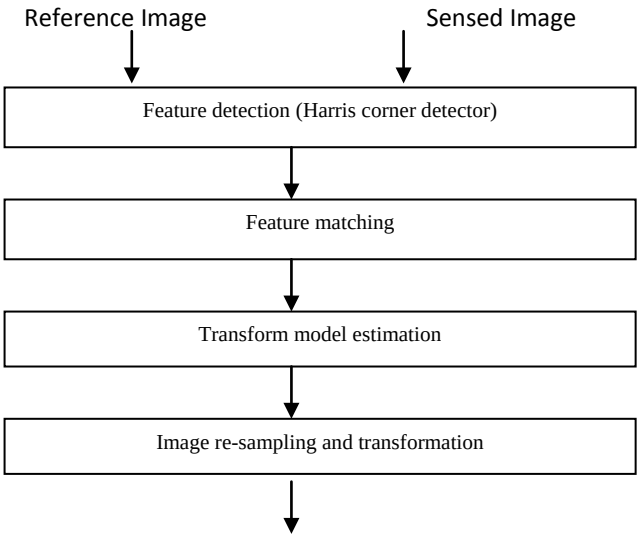

Fig 4.Flow of computation

In this the feature detection is obtained by using Harris corner detector. The initial correspondence is obtained by cross-correlation. The final correspondence is then obtained by using RANSAC method, and the refinement in the displacement field is obtained by multilevel B-spline approximation.

3. CONCLUSION

By surveying few previous papers it is understood that few methods have some disadvantages in certain areas. Some may fail to produce a good result at a low resolution, some cannot handle nonrigid objects, also fails when the occluded/exposed regions are visually similar to other parts of the same and some treat all areas in an image similarly when going from low to high resolution without regard to image content. So a hierarchical voronoi subdivision is used to register large sized images, with high resolution and large geometric difference.

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