Tracking of Multiple Object on Aerial Videos using Image Registration

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Abstract— Image Registration is one of the important area in Digital Image Processing and hence it is used in most of the image processing applications. In a registration process, we have two or more images among them, there is a reference image and the other is sensed image. The task is to compare the images with each other and the image which is developed is called as registered image. Here, the tracking is performed on the basis of SIFT or SURF features extracted from the images. The purpose of a tracking is to determine the location or direction of a target in a moving or steady state. Other than this the SIFT or SURF features are used for registration of images. The background subtraction is used for detection and particle filter is used for tracking.

Key words: Image Registration, Tracking, Detection, Background Subtraction, RANSAC, SIFT, SURF

I. INTRODUCTION

Now a days, the image processing is used in most of the applications such as security, medical science, utility applications, tracking systems and many more applications. The main area of Image Processing which is Image Registration is used in most of the applications in which the matching of multiple images are performed. However, the Image Registration may perform the operation comparing the one image which is reference image with the other images. The reference image is also called as sensed image which is evaluated from multiple images.

Before applying the registration process, the half work is divided on the basis of evaluating Robust Estimation and Mixture Model. The Robust Estimation is widely used in Image Registration for detecting the outliers. The Robust Estimation is applied on Optical Flow of Image Processing to detect and remove the outliers. But these model estimation offers the poor performance. In general, the Robust Estimation based on Mixture Model is applied and then characterize the detected outliers in some specific probability distribution.

II. LITERATURE SURVEY

A. *Image Registration[7]:*

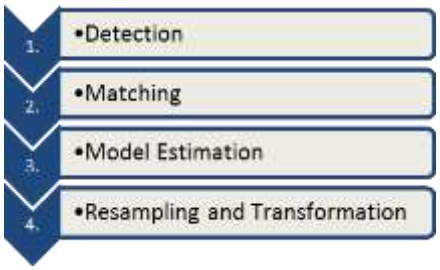

Fig. 1: Steps for Registration of Image

For the better observation, the images are aligned geometrically. The process of mapping the points from one image to corresponding other images called as Image Registration. Various Image Registration techniques are used for matching of multiple images. The various techniques are extrinsic registration method in which artificial object are used for registration and because of external hardware it does not need complex algorithm and hence the computation speed is good. Another method is surface matching method which is used for mapping rigid body where only surface level image are estimated. The registration is performed by extracting the points from contours of one image to a surface model and extracted form contours of another image. Besides of these methods the another image registration technique is correlation method which is useful for monomodel images fro the comparison of several image for one object. Soft computing based method such as Artificial Neural Network (ANN), Genetic Algorithm, Fuzzy Logic, etc. Another main approach for image registration is registration done by using feature points such as SIFT, SURF and now a days the new method used is FAST method.

1) Tracking using Image Registration

In the literature there are various works dealing with the Image Registration for tracking in different applications: In 2014, H. Zhou, H. Kong, J. M. Alvarez, D. Creighton and S. Nahavandi have proposed a fast approach for detecting and tracking a specific road in aerial videos[1]. They used Adaptive Gaussian Mixture Model (GMM) to describe road color distribution and homography based tracking to track road geometrics. They developed an efficient technique to estimate the homography transformation between two frames. They conduct an experiment on videos captured by Unmanned Aerial Vehicles (UAV).In 2014, Wenbei Mao, Jin Zheng and Bo Li have proposed a navel patch based object tracking algorithm which combines Harris – SIFT and features of color histogram to handle the partial occlusion problem[2]. Harris and SIFT vector can represent steady parts of an object when it is partially transformed or occluded and also filtering out invalid patches of the object. They used Patch-based color histogram which takes spatial information into account and is guided by patch selection which provides a richer description of the object than the traditional color histogram. In 2014, Liu Yang, Wang Zong-li, Cai Bei-gen have proposed the traffic video surveillance system combining target level and feature level tracking[3]. For target level tracking they used Mean Shift Algorithm is a traditional target level tracking with no adaptation to vehicle scale and orientation change. This article shows the combination of SURF (Speed Up Robust Feature) with Mean Shift Algorithm. Feature Point Scale and Orientation Information is used to make the algorithm with scale and orientation adaptability. In 2014, Trupti Chaudhari, Sanika Patankar and Jayanti Kulkarni have proposed an algorithm aerial images using orthogonal moment invariant[4]. In this the reference image and referred image are resized to same size and converted to grey scale. Further the corner points are detected in both reference and input frames by using Harris corner and selected as control points for registration. In 2014, Abdelrahman Eldesokey and Mohomed ElHelw have

proposed MCS tracker[5]. In their framework there are two phases: target detection and target tracking. In target detection subtraction of background and thresholding are performed for extracting moving targets. In the registration is done by using FAST feature and Luckas Kanade optical flow is used for searching the corresponding feature points in frames and RANSAC is used for estimation of parameters of homography matrix that define transformation from one frame to another.

III. PROPOSED METHODOLOGY

In the proposed system, the tracking system is performed on the four approaches. First is Image Registration using extracted feature points Here is a comparison of feature points extraction algorithm which is SIFT and SURF feature point extraction. After the feature points are extracted the outliers present in the images are detected and remove. These outliers are also called as occlusion and the method used for removing outliers is RANSAC method which abbreviated as RANdom Sample Consensus. Third step is to detect the object the Background Subtraction is used It will detect the multiple object moving around the scenes. Fourth and most important section is tracking of objects which are detected in object detection. The tracking is done by the particle filtering which is performed on the basis of creating multiple models for one variable or object before moving to another variable or object. The Layering Filter is best yet because of it completes the model estimation process for one variable i.e. it does not leave any calculation behind any object hence it will used for proposed system for better tracking.

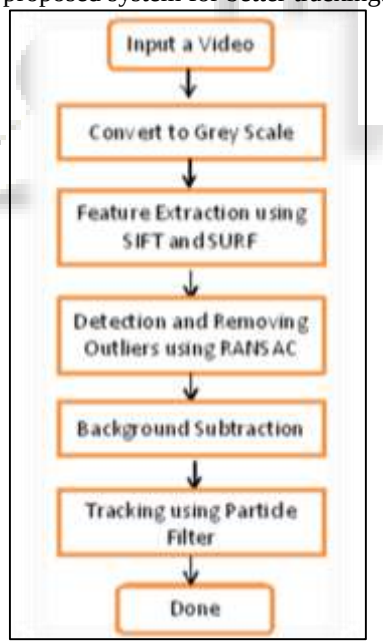

Fig. 2: Flow of process of system

1) Convert to Grey Scale:

The Color image is converted to grey scale by assigning the grey value to each RGB value of each pixel of the image.

Fig. 3(a): Color image

Fig. 3(b): Grey scale Image

In Fig. 3.b there is a grey scale image which is converted from color image shown in Fig. 3.a.

B. SIFT[10]:

Scale Invariant Feature Transform (SIFT) is an algorithm for Image Features Generation which are invariant to feature translation, scaling and rotation and somewhat different to illumination changes and affine projection.

The SIFT Features can be calculated as:

- Key Point Detection
- Key Point Localization
- Orientation Assignment
- Point Descriptor

The block diagram for SIFT algorithm is shown in Fig.3.

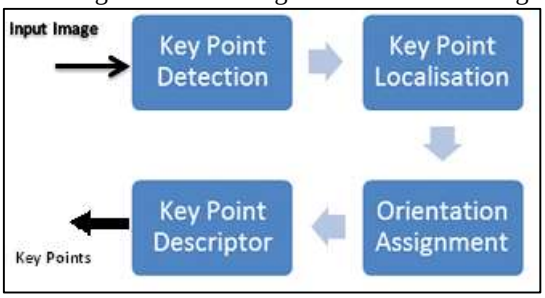

Fig. 4: Block Diagram of SIFT Algorithm

C. SURF[9]:

The idea to extract features of SURF algorithm is similar to SIFT algorithm. However SURF has other outstanding characteristics, it not only cab speed up the calculation but also the matching rate is significantly improved. It can calculate the corresponding matrix easier and reduces the increasing errors.

1) Flow/Process of SURF Algorithm:

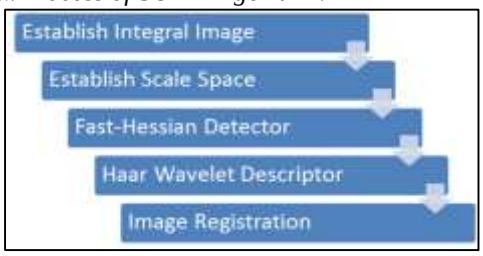

Fig. 5: Flow/Process of SURF

D. RANSAC[6]:

RANSAC is a process of eliminating the outliers from the image. The outliers are nothing but the occlusion available in the image which is caused due to improper capturing of image by camera and also the camera and scene movement.

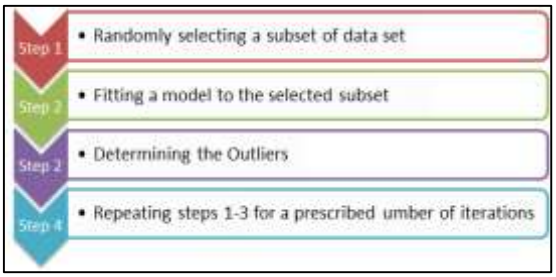

Fig.6. RANSAC Model Estimation

E. Background Subtraction[8]:

The process is simply create the background model by using the first frame as a reference. After the model is established the process start by comparing the frames with the model. After comparing if there is any object is detected which has moved from one position to another position is high lightened and the background will be in black.

Fig. 7(a): Grey Image

Fig. 7(b): Background Subtractied Image

F. Tracking using Particle Filter[8]:

Fig. 8: Results of Tracking

IV. RESULTS AND CONCLUSION

A. Results:

Video Frames	Matching Feature Time	
	SIFT (in s)	SURF (in s)
10	1977.005	1857.221
15	2004.005	1892.433

Table 1: Comparison of SIFT and SURF

B. Conclusion:

In this paper the tracking system is proposed on the basis of SIFT or SURF feature points and particle filter method. Before tracking the image registration is performed on the basis of feature points extracted by SIFT or SURF feature points. The matching feature time of these two extraction

algorithm is shown in Table 1. The number of frames are 10 and 15 given for to perform the extraction and matching of points. As shown in Table 1, the SIFT feature performs slow as respect to SURF algorithm, hence the conclusion is that the SURF method is fast than SIFT method in case of matching point time.

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