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Real time object Identification, training and matching via surf algorithm methods

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Abstract— In this research paper we present new method for object identifying, training and matching objects within an dynamic scene Moving objects detection in dynamic scenes is a hard but essential task in a number of applications such as video or moving space, vehicle detection, video confining, intelligent motion tracking and intelligent target identification. It becomes difficult due to factors such as background motion, illumination change, and real-time requirement so here we proposed new and efficient SURF algorithm for real time object identification it's training and matching The work provides the directions for improvement of the given view based recognition algorithm and suggests other possible ways to perform the object matching with higher quality

Keywords— object identification, training, matching ,SURF algorithm

I. INTRODUCTION

The field of image recognition and processing has gained sufficient interest among wide range of specialists: from mathematicians to software engineers. High attention is caused by possible great potential of image recognition and matching applications not only in computer science but also in medicine, education, military, entertainment and navigation, thus covering a wide range of users For moving-object tracking, a particle filter method works well for tracking moving objects by stand cameras, but it is not appropriate for tracking moving objects by moving cameras. Moving cameras often have sudden and shaking movement, which can cause image blur and large position changes, resulting in tracking failures. A new algorithm is proposed to overcome the tracking failure caused by sudden movement, and to track the moving object with correct position and size.

Computer vision research includes several important topics, one of which is detecting and tracking moving objects detection and tracking moving objects. After many years of research on steady cameras, many sophisticated detecting and tracking algorithms have been developed. Currently, as cameras are becoming less and less expensive, almost everyone has a camera particularly on moving platforms. However, these algorithms for steady cameras are not suitable for moving cameras because the assumptions for both applications. In explicit object detection tasks, the objective is to find an object like a book from a book shelf or a commodity from a store. Whereas in an implicit task, the objective would be to perform higher level tasks like crossing a road, interacting with friends, etc. Two state of the art algorithms Scale Invariant Feature Transform (SIFT) and Speeded-Up Robust Features (SURF) are studied and their qualities are measured and based on the results of these tests the best algorithm, SURF, is chosen for building a realtime object identi_cation application. Feature detection is the process where we automatically examine an image to extract features, that are unique to the objects in the image, in such a manner that we are able to detect an object based on its features in different images. This detection should ideally be possible when the image shows the object with different transformations, mainly scale and rotation, or when parts of the object are occluded.

Feature detection and image matching represent two important tasks in photogrammetry. Their application continues to grow in a variety of fields day by day. From simple photogrammetry tasks such as feature recognition, to the development of sophisticated 3D modeling software, there are several applications where image matching algorithms play an important role. Moreover, this has been a very active area of research in the recent decades and as indicated by the tremendous amount of work and documentation published around this. As needs change and become more demanding, researches are encouraged to develop new technologies in order to fulfill these needs.In this tenor, is worth mentioning that many methods published with source code satisfy the everyday needs of photogrammetry and computer vision including feature detection, matching and 3D modeling.This latter task has been an ongoing research topicin computer vision and photogrammetry for many years now.Obtaining 3D models is considered in many cases the ultimate purpose of feature detection and subsequent matching. More than a decade ago, the applications associated with 3D models and object reconstruction were mainly for the purpose of visual inspection and robotics. Today, these applications now include the use of 3D models in computer graphics, virtual reality, communication and others.But achieving highly reliable matching results from a pair of images is the task that some of the most popular matching methods are trying to accomplish. But none have been universally accepted. And it seems that the selection the adequate method to complete a matching task significantly depends on the type of image to be matched and in the variations within an image and its matching pair in one or many of the following parameters:

Parameters	**Time required**	
Feature detection	000	ms
Descriptors extraction	000	ms
Descriptors indexing	000	ms
Descriptors matching	000	ms
Detect Outliers and GUI	000	ms
Min matched distance	000	ms
Max matched distance	000	ms
Vocabulary Size	000	ms

Figure 1: Parameters Used in Object detection

II. LITERATURE SURVEY

SURF's detection scheme is based on the concept of automatic scale selection, proposed by Lindeberg in 1998 . In this work, Lindeberg experimented with using the determinant of the Hessian matrix for a 2-D Gaussian, as well as the Laplacian (i.e. the Hessian's trace), to detect blob-like structures in images. Mainly motivated by Lindeberg's the authors of SURF chose the determinant of Hessian as their target feature. Other well-known feature schemes include the famed Harris corner detector (which relies on eigenvalues of the second moment), the entropy-based salient region detector proposed by Kadir and Brady [8], and the edge-based work of Jurie and Schmid . Furthermore, SURF's detector extends on Lowe's idea of using the Difference of Gaussian as an approximation of the Laplacian of Gaussian filter. SURF's authors have released a closed-source implementation of this feature scheme, written using C++ and without any dependencies .This implementation have since been integrated into the widely-used Open Source Computer Vision library (OpenCV). Prior to its integration, a team in UK used OpenCV to write an open-source C++ version of SURF, based on the previous work of authors' publications.

III. IMPLEMENTATION DETAILS

In the implementation part we gives first about the SURF algorithm and the Improved SURF algorithm. SURF Algorithm involves two steps: first is to find the interest point, second is to build the descriptor to find the key points within an image as shown in Figure 1, there are four steps involved. 1) Calculate the integral of an image. 2) Compute the Hessian matrix. 3) Descriptor can be built in two steps: firstly, orientation assignment, secondly, compute sum of Harr-wavelet responses.

1. **Detection** Automatically identify interesting features, interest points this must be done robustly. The same feature should always be detected regardless of viewpoint.

2. **Description** Each interest point should have a unique description that does not depend on the features scale and rotation.

3. **Matching** Given and input image, determine which objects it contains, and possibly a transformation of the object, based on predetermined interest points.

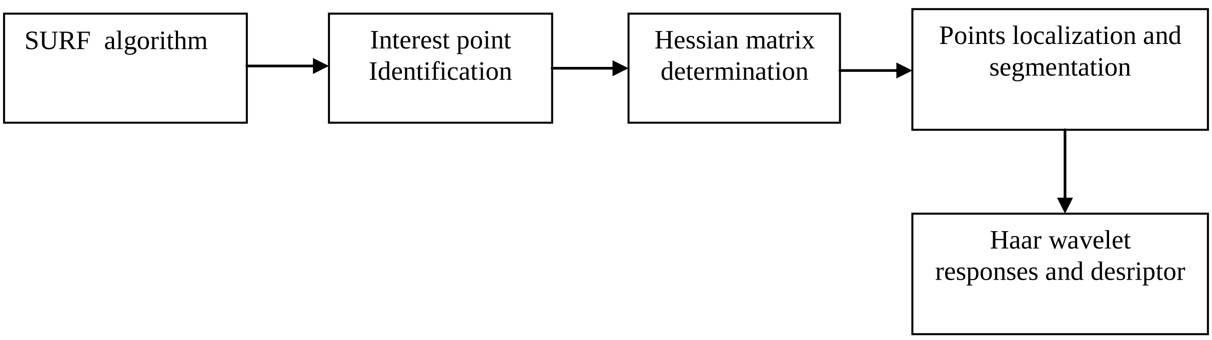

Figure 2.Flow chart of Algorithmic description

The selection criteria of interest point detection method is to identify corners, blobs, T-junction or any other point that repeats frequently inside the image. The determinant of hessian has been used to select the location and the scale of the interest points. Given a point x = *(x, y),* the Hessian matrix in x at scale σ is defined as follows

$$H(p,\sigma) = \begin{bmatrix} L_{xx}(p,\sigma) & L_{xy}(p,\sigma) \\ L_{xy}(p,\sigma) & L_{yy}(p,\sigma) \end{bmatrix}$$

Here H is the Hessian matrix, L is the image found by convolving input image with the Gaussian 2nd order derivative at point x. The SURF descriptor consists a distribution of Haar wavelet responses. After selecting the interest points, the neighborhood of every interest point is represented by a feature vector which contains the orientation and descriptor vector. To approximate orientation, haar wavelet responses have been taken in *x* and *y* direction and weighted with a Gaussian, then these responses has been considered as vectors along the horizontal and vertical direction respectively. Finally, a new vector has been calculated in order to represent the orientation of the interest point.

Where Lxx(p , σ) is the convolution of the Gaussian second-order derivative $\frac{\partial^2}{\partial x^2} g(\sigma)$ with the image I in point x, and similarly for Lxy (p , σ) and Lyy (p , σ) approximate the Hessian matrix with box filters. The box filters approximate second order Gaussian derivatives and the filtering can be performed using integral images with a very low computational complexity. And, the calculation time is independent of the filter size. Let Dxx, Dyy, and Dxy be the approximations of Lxx, Lyy, and Lxy, respectively. The weights w applied to the rectangular regions are kept simple for computational efficiency.

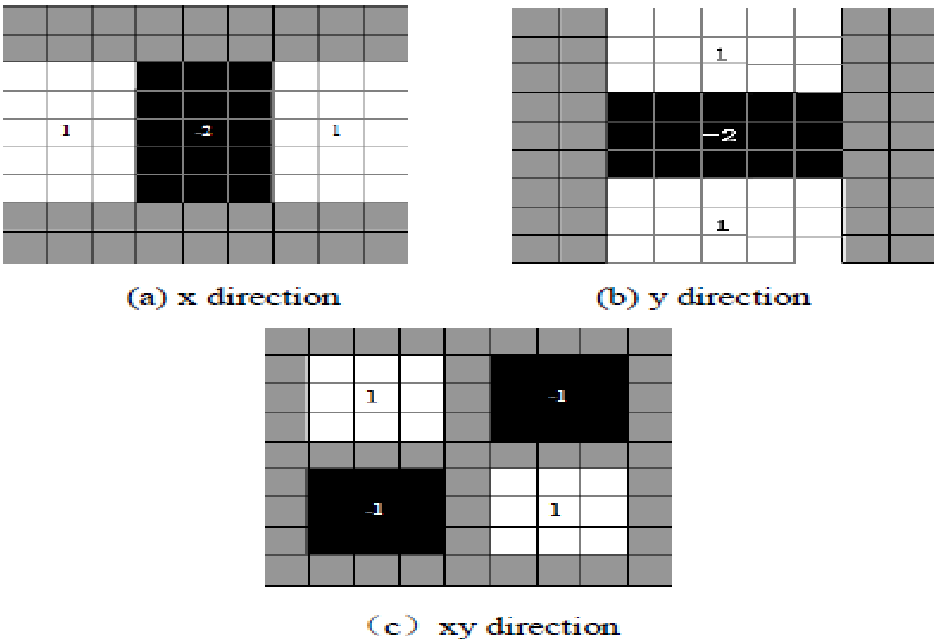

Figure.3 Multi-directional box filters

SURF is one of the most used scale and rotation invariant interest point detector and descriptor that helps to find discrete matches between two images which results image registration, object recognition and 3D construction kind of pattern recognition and machine vision works. The distinctive features of SURF than other image descriptors are uses of hessian matrix for detectors and selection of distribution based descriptors. The complete approach of finding SURF consists of three main steps: 1) Interest point detection (detectors), 2) determining feature vectors (descriptor) and finally, based on descriptor, 3) finding matches between a pair of images. In order to speed up both the detector and the descriptor steps, integral image has been used. The integral image at location *(x, y)* contains the sum of the pixels above and to the left of *(x, y)*. The main benefit of the integral image is, it requires only four array references to calculate the sum of the intensities of any rectangular area in the image. Besides rotation and scale, SURF is also robust for geometric and photometric deformation. The performance of SURF depends on the dimension of its descriptors.

IV. CONCLUSION AND FUTURE SCOPE

In this research, a strong method for moving object detection tracking and it's training in a dynamic scene using a adapted version of the improved SURF is presented. The images from videos are recorded using a moving camera attached to computer or any other device. This method is able to track the selected object while repeated entering the scene images for up to of 5 or 6 frames. This is can be possible because the colour feature and it's variance nature of the object is searched in the moving direction of the frame before this improved search applying the detection algorithm. This is more useful for a real-time application.

The result indicates that Improved SURF takes very less time compared to original SURF. But, it takes slightly less time than the current approach. The time computed is only for detecting the features and matching them for subsequent frames.

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