Particle Filter Based Object Tracking

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I. INTRODUCTION

In many vision-based systems, tracking moving objects is an important task. The rapid growth of the cancer cells as the high-powered computer, or when, as in wound healing loss, high quality and cheap video cameras, video analysis and automatic object tracking algorithm generated a lot of interest in increasing the availability requirement [1]. Automatic video surveillance applications, based motion detection, video indexing, human-computer interaction, transport control, navigation and vehicle are. Object tracking is still a challenge due to restrictions or incomplete information about the picture. Detect and track objects of learning process, there are some difficulties in the model. This article is designed to track multiple objects using both a background modeling techniques and particle filter.

A. Object Tracking

Tracking the image plane as it moves around the scene to assess the speed of an object can be defined as the problem. In other words, a Tracker tracked objects in a video for the different frame provides continuous label. In addition, depending on the tracking domain, such a tracker item [1] orientation, area, or shape, the object can provide focused information. Object tracking and segmenting an object of interest from a video sequence in order to extract useful information, speed, orientation, etc., to keep track of the occlusion process.

B. Feature Selection for Tracking

Feature is the uniqueness property of the object, so it can be easily specific in the feature space. Object representation is closely related to feature selection [1]. Hence selecting the right feature plays the main role in tracking. Right feature play main role in tracking as follows:

- Edges: Boundaries of object generate strong changes in image intensities. To identify these changes edge detection is used.
- Optical Flow: Each pixel in the optical flow field, which defines the displacement vectors of the translation, is a dense area. Optical flow is generally used as a feature in motion-based segmentation and tracking applications [1].
- Texture: Surface properties such as smoothness and regularity, which quantifies the intensity is a measure of the difference.

C. Object Representation

In the case of tracking an object in the water bubbles, in road vehicles, sea boat, like people walking on the road, anything can happen. Appearances can be used to represent objects and their size. For tracking, the shape of the appearance object can be representing as below:

- **Points**: The object is represented by a point, that is, the centriod or by a set of points; suitable for tracking objects that occupy small regions in an image.
- **Primitives Geometric Shapes**: Object shapes is represented by a rectangle, ellipse, etc.
- **Object silhouette and contour:** Contour representation defines the boundary of an object .The object called an inside contour object silhouette.
- **Articulated shape models:** Articulated objects are composed of body parts that are held together with joints.
- **Skeletal models**: The object of the building can be removed by applying the changes to the object silhouette medial axis.

D. Object Detection

Detection of moving objects in video images is very important. Automatic monitoring system of moving objects detection needs efficient algorithms. The common way to minus the current image of the background is the simple background subtraction. Below, several object detection techniques are

- Point detectors: In this technique, the image is considered to be in the region of interest.
- Segmentation: In this, image is partitioned into similar regions.
- Background Subtraction: It means extraction of object from current image and the background [8].

E. Particle Filter

Particle filter is a recursive Bayesian filter by Monte Carlo simulation is a technique to apply. The idea is to represent the

pdf with a set of random samples with associated weights and to compute estimates based on these samples and weights. Particle filters are Sequential Monte Carlo (SMC) methods. Monte Carlo methods are simulation based methods which provide a convenient approach to computing the posterior distributions.

II. Literature Survey

There is much work on the field of object tracking and particle filtering in a video past decade. Some work done has been discussed one by one below.

Md. Zahidul Islam1 [2] puposed that The shape similarity between a template and estimated regions in the video sequences can be measured by their normalized cross-correlation of distance transformation. The particle filter is based on the size of the distance transformed edge features. Template by selecting any object in a video sequence is created and each frame is updated instantly. The observation model is used to measure the observation likelihood of the samples and this is an important concern for object tracking

Ming-Yu Shi [3], In this paperMoving platforms propose a method of moving object detection. The method is composed of moving blob detection and robust moving object detection results to shape purification steps. Three frames by fusing the motion area information, moving around, found the right conditions. Next, intensity, R, and G color spaces background model using motion compensation, as well as the size of the objects involved are sophisticated in the background subtraction procedure. By combining blob moving and relevant background information, alignment errors can be effectively eliminated from the background model being adapted to prevent foreground pixels.

Massimo Piccardi [4], In this paper, several different methods have been proposed in recent years and its benefits and limitations of both the novice and the expert can be confusing. To overcome this problem, the paper speed, memory requirements, and accuracy based on a review of the methods and provides a basic classification. the methods reviewed, simple methods such as the running Gaussian average or the median filter offer acceptable accuracy while achieving a high frame rate and having limited memory requirements.

Jaward, Mihaylova, Canagarajah and BullT [5], The proposed particle filter (PF) measurement uncertainty of the handles, the joint probabilistic data association (JPDA) is based on a data association technique embeds. Algorithm for dealing with partial occlusions and is able to fix the tracks after the temporary loss. Data calculated for associations prospects participate in the calculation of the probabilities of the number of items. We aim to show the different real-world video sequences with missing evaluate the performance of the proposed filter. We currently manage and track of the number of objects in the frame in the same frame number of objects are handled using the possibilities.

Deepak Gambhir and Meenu Manchanda [6],Proposed, an efficient tracking algorithm which automatically segments the moving object and uses color as the key feature to track. Color is used because it is robust against changes in shape, scale and rotation. The multiplicative mask which is obtained by multiplying the initial mask with the adaptive threshold mask segments the desired object accurately while simultaneously reduces the shadowing pixels, false object pixels and noisy pixels. Munsell Color matching function matches the moving object along the sequence of frames. Kalman filter efficiently tracks the position of the moving object in successive frames. Multiple objects can also be tracked by using the proposed algorithm with multiple Kalman filters.

Kim, Awan and Soh [7] ,Many of the proposed method combines both background modeling and object tracking particle filter. Background subtraction and particle filter Application: This method consists of two steps. Particle filter so efficiently background subtraction detection area is prohibited. Restricting the search area by background subtraction can control the particles focused on the relevant area only. It was achieved by updating particles based on likelihood function so that the new ones appear near the foreground.

Ján Valiska et al. [8] In this paper presented that a large part of the theory of Bayesian filters is dealing with objects tracking in video sequences. This contribution clarifies the tracking of different visual objects using particle filter based on color properties of these objects. The article compare particle filter object tracking using single color with filter that uses observation of object color distribution known as color histogram.

Chong Chen and Dan Schonfeld [9],In this paper, we introduced a method to estimate tracking and pose parameters within the framework of particle filtering. Our approach can be used to directly estimate the 3-D rotation parameters from 2-D image sequences without constructing a 3-D model or system training and learning prior to estimation. Corresponding SIFT points are used as features for pose estimation from successive images. the proposed approach to the solution of Sylvester's equation is equivalent to the classical SVD method for 3D-3D pose estimation.

Anup S. Sabbi et al.[10],This paper presents and compares two methods for tracking objects in a stereo camera system using particle filters which differ in the way they address the problem of stereo correspondence during the filtering process. In the first approach, two particle sets, one for each of the left and right stereo image frames are maintained and a mapping between the two sets is established by soft-stereo constraints. In the second method, the particles are tracked in three-dimensional space and mapped back into the image frames to make the observations.

Hongwei Ying [11], Object tracking based on color feature often fails in a complex background. To tackle this problem, a particle filtering object tracking approach based on local binary pattern and color feature is proposed in this paper. Local binary pattern texture textured gray image information in the neighboring region, the color histogram, a global description of targets in color image. These two features, such as particle filtering are combined under the frame, which is represented by the color and local binary pattern histogram is the target can be complementary to each other.

III. Proposed Work

In the proposed work object is tracked using particles on the object. A particle on the each frame is spared on it. Applying background subtraction the object is detected from

each frame and using Gaussian likelihood method particle is move and display in each frame. Particles filter based object tracking using background subtraction Fig.1 shows the below.

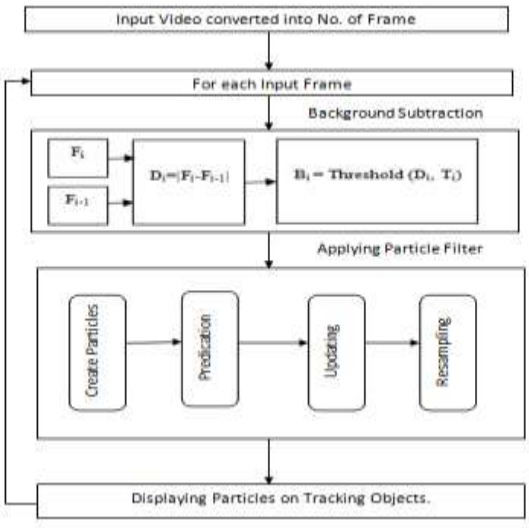

Fig.1.Block diagram of particle filter Based object tracking using background subtraction.

A. *Background Subtraction*

It is also known as foreground detection, an image is extracted for further processing of the foreground image processing and computer vision techniques in the field. Frame difference is the simplest form of background subtraction. The current frame Fi is subtracted from the previous frame Fi-1, and if the difference in pixel values for a given pixel Di is greater than a threshold Ts, the pixel is considered as a part of the foreground Bi.

|frame i – frame i-1 |> Ts.

B. *Particle Filter*

- Particle Filtering by Monte Carlo simulations to apply a recursive Bayesian filter is a technique Particle filter have become most popular technique for stochastic dynamic estimation problem including tracking .particle filter are applicable to nonlinear and non Gaussian problem.

Particle filter is needed to define the particle and its properties

Xk = {x, y, x^ ,y^},

- Create particle step consist of N particles creation which have random locations (x, y) and random velocities (x^, y^).

The step of prediction contains the modification of randomly generated particles using system model, which is in case of object tracking in video sequence equals

st = Ast-1 + wt-1;

Where, A defines deterministic and wt-1 stochastic part. This step occurs the change of particle position and its velocity based on mentioned system model.

• The next step is to look at the color of your posts and target specific particles on the basis of equality, value is the actualization. The degree of similarity to the target using the actual color and color difference is calculated as

D = C - Ctarget;

Where k = 1… N determines particle index, C is actual color (one dimensional vector) on position xk; yk and Ctarget is color of target. Scalar value of likelihood is obtained by

Lk = D' × D

Where D' is transposed matrix D. In this step is important to assign to particles, which position is out of video sequence frame boundaries, the lowest possible value, for example -Inf.

- In step of resampling, thanks to cumulative distribution of weights and generation of N random numbers, particles are resampled/rearranged, where particles with low weights are relocated to particle positions with higher weights.

Last part of tracking is particles displaying. The mean position of particles is the estimation of object position [8].

IV. CONCLUSION

Object tracking is effectively track the object using particle filter. The block diagram shows background subtraction and particle filter which is used to track the object based on color. Background subtraction is used to detecting foreground object. Particle filter perform effectively tracking.

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