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Survey Report to Track Generic Non-Rigid and Deformable Objects under Occlusion

Jemilda.G[1]
Department of Computer Science and Engineering
JayarajAnnapackiam CSI College of Engineering
Nazareth, Tamil Nadu – India

Dr. Baulkani.S[2]
Department of Electronics and Communication Engineering
Government College of Engineering
Tirunelveli, Tamil Nadu – India

Abstract: ***Object tracking is a well studied problem in computer vision and has many practical applications. The problem and its difficulty depend upon several factors such as the knowledge about the target object, its quantity and type of parameters being tracked. Although there has been some success with building trackers for specific object classes such as human, face, mice etc. Tracking generic objects has remained challenging issue because an object can drastically change its appearance when deforming, rotating out of plane or when the illumination of the scene changes. Especially in the videos which are not clear in its original form i.e. the video which requires enhancement and its quality has to be improved. Here in the proposed work different algorithms are carried out to detect the generic objects such as the non-rigid objects and the deformable objects which are in occlusion, (i.e. in a cluttered environment) not only in the images which contain some sort of objects but also from the images which contains numerous objects which are unseen so as to improve the tracking efficiency. By doing this, the objects which are non rigid and changing in nature can also be predicted in a perfect manner so that the computational complexity can be reduced, reliability, accuracy, and efficiency can be improved.***

Key words: Deformable Objects; Generic Objects; Non-Rigid Objects; Object Tracking; Occlusion.

I. INTRODUCTION

Object tracking depend on several factors such as the amount of prior knowledge about the target object and the number and type of parameters being tracked. Tracking generic object is a challenging task in video processing and computer vision because an object can drastically change appearance when deforming, rotating out of plan or when the illumination of the scene changes. The overall motion of an object can be described by the combination of a global motion and local deformations, the so – called deformation. The task of tracking is to locate and segment the object from the background at each frame of the image sequence. It has the ability to deal with the single object difficulties such as occlusion with background changing appearance, illumination, non rigid motion and the multi object difficulties such as occlusion between objects and object confusion. It has wide applications such as video surveillance, event detection, activity recognition; activity based human recognition, fault diagnosis, anomaly detection, robotics, autonomous navigation, dynamic scene analysis, path detection, human computer interaction, virtual reality, object navigation and others.

II. TRACKING METHOD

Tracking methods can be divided into four major categories: region based, model based, active contour based and feature based. Region based algorithms detect motion region by subtracting the background from the current image. These algorithms cannot work well when there are multiple moving objects. Model based algorithms track objects by matching several models of vehicles. Active contour tracking algorithms track objects by their contours. These algorithms provide more efficient description of objects than region based algorithms and the computational complexity is reduced. But the inability to segment vehicles that are partially occluded remains. Feature based algorithms track objects by extracting their features.

III. Review of Literature Survey

Boris Babenko et al. studied the problem of tracking an object in a video by giving its location and the classifier is trained to separate the object from the background. They also stated that the generic object tracking is a challenging one because an object can change appearance when deforming, rotating out of plane or when the illumination of the scene changes. Also, object tracking depends on several factors such as the amount of prior knowledge about the target object and the number and type of parameters being tracked. But this paper focuses on the problem of tracking an arbitrary object with no prior knowledge other than its location.

The three components of a tracking system used are:

A. An appearance model which can evaluate the likelihood at particular location.
B. A motion model which relates the locations of the object over time.
C. A search strategy for finding the most likely location in the current frame.

The goal of this paper is to develop a more robust way of updating an adaptive appearance model and to handle partial occlusions without drift. When an object undergoes partial occlusion, instead of supervised learning, multiple instance learning avoids drift problems and therefore it is more robust. The disadvantage of this paper is if an object is completely occluded for a long period of time or if the object leaves the scene completely, object tracking cannot be performed.

Badri Narayan Subudhi et al. proposed an algorithm which includes two schemes for moving object detection and tracking:

A. Spatio-temporal spatial segmentation.

B. Temporal segmentation.

To obtain a Spatio-temporal spatial segmentation, a compound Markov Random Field (MRF) model and Maximum-A-posteriori Probability (MAP) estimation techniques are used. They are used to determine the boundary of the regions in the scene accurately with faster execution time. For temporal segmentation, label frame difference based Change Detection Mask (CDM) is used. The proposed approach provides a better spatial segmentation compared to the other JSEG, edgeless and edge based methods. It is used to determine the foreground and the background parts and the effect of silhouette is reduced. Moving object detection in a video is the process of identifying different object regions which are moving with respect to the background. It is used to find speed/ velocity, acceleration and position of the object at different time.

It was achieved by two different ways:

A. Motion detection/change detection is the process of identifying changed and unchanged regions when the camera is fixed and the objects are moving.

B. Motion estimation is the process of estimating the positions of the moving object and here both the objects and the camera may move.

So the change information based scheme has less computational burden and gives more accuracy and hence it is more viable for real time implementation.

Jehoon Lee et al. discussed the object tracking problem into two parts:

A. Segmentation process in which a weighted depth map for object extraction via the Bhattacharyya gradient flow is defined.

B. Filtering process in which global position of the object is estimated via particle filtering and active contours.

A reliable algorithm is designed to track deformable targets by combining particle filtering and geometric active contour models. The particle filtering is used for estimating the motion of the object and tracking of its deformations is achieved by

active contours. Region based active contours driven by the Bhattacharyya gradient flow is used for object segmentation due to its robustness against noise and its ability to deal with cluttered environments. An on-line shape learning method based on Principal Component Analysis (PCA) is used which allows the tracker to detect the disappearance and the reappearance of a target. The limitations are, it will fail if the object reappears with an unexpected shape and it will lose the target, if the unexpected object occludes the target or appears with a similar shape to the tracked object.

Amir Salarpour et al. described all moving objects and used Kalman filter to track the vehicles.

The two problems considered in tracking systems are:

1. Prediction
2. Correction

Prediction is used to predict the location of an object using Kalman filter. Mean-shift was combined with it to predict the search region. Correction is used to identify the object within designated region. The algorithm can be distinguished from its surroundings. The features such as color, distance and shape are used to represent the objects being tracked which play a major role in tracking performance. The color information alone is not sufficient because color varies due to light changes and road conditions. Robust tracking performance can be gained by shape information when color information becomes less reliable. The distance information is used to find the location of an object. The algorithm acts correctly in clutter scene and controls problem of multi object tracking such as appearance and disappearance of objects, occlusion and missing of a vehicle. The advantages of using this algorithm is it minimizes the computation time and increases the efficiency of traffic control systems.

Nicolas Papadakis et al. focussedon the silhouette tracking which aims at extracting successive segmentations by introducing an energy involving a temporal consistency between visible and occluded parts of the objects using optical flow estimations, through a system of predictions. The predicted areas are separated into good and bad parts with respect to the final segmentation and the objects are represented with visible and occluded parts which handle partial and complete occlusions.

The energy is minimized using a graph cuts optimization. The energy function which contains new terms allows tracking and segmenting visible and occluded parts of an object.

MosalamEbrahimi et al. is concerned with the components of the object recognition pipeline namely feature detection, feature description and feature tracking. It leads to simpler pipeline and easier to implement. To speed up feature detectors and feature tracking, adaptive sampling concept is used to combine tracking and recognition resources. It uses less memory.

Feature based visual object recognition is a dominant approach in computer vision. In a conventional feature-based pipeline, local features are detected, a local descriptor is computed and descriptors are queried which is then used by a classifier.

The most popular feature detectors and descriptors is the Scale Invariant Feature Transform (SIFT). It is computed in two main stages:

A. Using a detector followed by a descriptor

B. Using a filter

The performance benefits of these two visual methods are:

A. To speed up FAST corner detector, adaptive sampling can be used
B. To speed up feature tracking and object recognition, an adaptive descriptor based on Binary Robust Independent Elementary Features (BRIEFs) can be used.

The two main advantages are it is simple and generic. It does not prevent us from using other algorithmic or implementation wise optimization methods.

Zhaoxiang Zhang et al. addressed the problem of model based object recognition. A local gradient based method is proposed to estimate the 12 shape parameters and three pose parameters.

The shape parameters are set up as prior information and used for vehicle recognition. The pose parameters are needed to determine the vehicle pose and used for vehicle localization.

Model based vehicle localization and recognition plays an important role in vehicle detection, tracking, recognition, high-level trajectory analysis and semantic interpretation.

Previously, 2D geometric primitive features such as edge points, edge lines, vertices and conic sections are extracted and recognition is achieved by 2D – 3D correspondence and pose determination but they are time consuming and error prone.

To achieve model – based localization, the 3D – model is projected into an image plane so that fitness between projections based on the distance error can be evaluated directly but they are not robust to noise and occlusion.

So prior information for fitness evaluation are used instead of redundant examples and evolutionary computing instead of hypothesis – test based strategy to generate a large number of models based on the deformable model and to choose the best model and position by iterative evolution and the problem is solved in an optimization framework.

LingfeiMeng et al. narrated an object tracking using high resolution multi spectral satellite images with multi – angular look capability. In the moving object estimation step, the moving objects are identified on the time – series images. Detecting moving objects is calculated by frame difference. Then the target modelling step is done by extracting both spectral and spatial features. The target is defined as the interested object to be tracked. The spectral feature is defined as the target's Probability Density Function (PDF) and is estimated by discrete densities and m – bin histograms in which the background pixels are eliminated by reducing the background occlusion effect. The spatial feature is defined as the geometric area of the reference target surface in the window region and is estimated by pixel count.

In the target matching step, the target is indicated as a sliding window over other image sequences.The Bhattacharyya distance and histogram intersection are used for spectral feature matching and pixel count similarity is used for spatial feature matching.

The main advantages are:

A. Better tracking accuracy due to the usage of both spectral and spatial features.

B. Applied in the research areas such as object velocity estimation and traffic control.

The limitations are:

A. Difficult to identify identical objects visually with small geometric size in the image sequences.

B. Tracking small objects in a denser scene is difficult.

LingfeiMeng et al. illustrated the Sparse Representation (SR) based tracking method to track the objects robustly due to the factors such as pose variation, illumination change, occlusion, background clutter and partial or full occlusion which is the effective one. To solve the problems like high computational cost due to trivial occlusion template and difficult in adopting object features due to raw template object representation, Kernel Sparse Representation (KSR) based tracking algorithm is used. Multiple object features such as spatial color histogram and spatial gradient – orientation histogram are used by multi – kernel fusion. The visual object tracking is formulated as a SR problem in which each object is represented by a set of templates. To tackle the occlusion and corruption problems, a set of trivial templates are used. To decrease computational cost, an accelerated proximal gradient approach is used. To increase tracking accuracy, multi – kernel fusion based SR is proposed.

The main advantages of KSR with multi – kernel fusion are:

A. It is less sensitive to partial occlusion, illumination variation and object deformation.

B. It speed up atleast 4 trivial templates as compared with the SR based methods.

C. It achieves a complementary effect in object representation.

The limitations of this method are;

A. It fails to track the object whose appearance is very similar to its local background.

B. It cannot track the object which is long – term entirely occluded.

C. It cannot achieve superior results for fast moving object.

D. It is hard to achieve real – time speed.

Longyin Wen et al. proposed a robust spatio – temporal context model based tracker to complete the tracking task in unconstrained environments. The temporal appearance context model captures the historical appearance of the target to prevent the tracker from drifting to the background in a long – term tracking. The spatial appearance context model integrates contributors around the target to build a supporting field. Using this method, more stable and effective tracking is achieved.

Spatio – Temporal context model based Tracker (STT) consists of temporal and spatial context models. For temporal context model, a subspace learning model is proposed to represent the target with low – dimensional feature vectors. For spatial context model, local contextual information is viewed by considering the relationships between the target and its surrounding contributors by boosting method.

IV. CONCLUSION

It is concluded from the above papers that the local spatial context model gives better result for identifying the moving object in the video file and this approach achieves lowest tracking error and highest overlap rate. The spatial correlation not only tracks the object but also reduces the time complexity.

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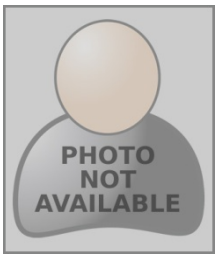
AUTHOR(S) PROFILE

G. Jemilda received the B.E. degree in Computer Science and Engineering from Dr. SivanthiAditanar College of Engineering, Tiruchendur in 1999, and the M.Tech. degree in Computer Science and Engineering from Dr. M.G.R. University, Chennai in 2006. She has been working as a Faculty in Computer Science and Engineering in JayarajAnnapaciam CSI College of Engineering, Nazareth-628617 since January 2007. She is currently a Research Scholar in Information and Communication Engineering in Anna University, Chennai. Her current research interests include Image Processing, Data Structure and Computer Networks. Shee has already published 6 papers in internationally reputed journals and 5 papers in refereed conferences.



Dr. S. Baulkani has been working as an Associate Professor in Government College of Engineering, Tirunelveli, Tamil Nadu, India. Her research interests are Distributed Networks, Digital Image Processing, Data Mining, VLSI Design and Embedded System.

