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A PATH FOR HORIZING YOUR INNOVATIVE WORK

SHADOW REMOVAL TECHNIQUE FOR TRACKING OBJECT DETECTION IN MOTION ESTIMATION

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Abstract: The main objective of this project is to develop multiple human object tracking approach based on motion estimation and detection, background subtraction, shadow removal and occlusion detection. A reference frame is initially used and considered as background information. While a new object enters into the frame, the foreground information and background information are identified using the reference frame as background model. Most of the times, the shadow of the background information is merged with the foreground object and makes the tracking process a complex one. The algorithm involves modeling of the desired background as a reference model for later used in background subtraction to produce foreground pixels which is the deviation of the current frame from the reference frame. In the approach, morphological operations will be used for identifying and removed the shadow. The occlusion is one of the most common events in object tracking and object centroid of each object will be used for detecting the occlusion and identifying each object separately. Video sequences will be captured and will be detected with the proposed algorithm. The algorithm will works efficiently in the event of occlusion in the video sequences.

Keywords: Object tracking, Background Subtraction and Shadow removal

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INTRODUCTION

Object tracking, by definition, is to track an object (or multiple objects) over a sequence of images. Object tracking, in general, is a challenging problem. Difficulties in tracking objects can arise due to abrupt object motion, changing appearance patterns of the object and the scene, non-rigid object structures, object-to-object and object-to-scene occlusions, and camera motion. Tracking is usually performed in the context of higher-level applications that require the location and/or shape of the object in every frame.

In Computer Vision, object tracking is considered as one of the most important tasks. Various methods have been proposed and reported both in academia and industry at large numbers for real-time applications.

1.1 Object Tracking

The object tracking methods may broadly be categorized as

- Template-based,
- Probabilistic and
- Pixel-wise.

While the template-based method represents the object in a suitable way for tracking, the probabilistic method uses intelligent searching strategy for tracking the target object. Also, the similarity matching techniques are used for tracking the target object in pixel-based methods. However, among all the above said approaches, the template-based approach is found to be suitable for many real-time applications.

1.1.1 Template-based

In this category of tracking methods, similarity of the predefined target is being calculated with the object translation. However, for object transformations such as translation, rotation and scaling this method often fails. This is due to the fact that the procedures of selection of target object as constant size templates. For handling this difficult issue, varying templates are used. The inclusion of background pixels into the template introduces the problem of positioning error and the positioning error continuously getting added while updating the template.

1.1.2 Probabilistic approach

While tracking non-rigid objects, the probabilistic based tracking methods have given better performance. In one of the probabilistic method, the factors such as motion detector, region tracker, head detector and active shape tracker have been combined for tracking the pedestrian. The assumption made in this method is that there are no people moving in the background. Since, this method uses contour as one of the feature, initial contour definition is difficult for the complicated contour target object.

Object tracking is also performed by predicting the object position from the past information and the predicted current position. These types of methods combine both statistical computation and the parameter vector [1, 2, 3]. However, for real-time object tracking systems, it is found to be difficult for constructing the proper feature vectors. This method has been extended by Khan, et al. [1], for dealing with the problem of interacting targets.

1.1.3 Pixel based approach

In contrast to model-based tracking methods, the pixel-wise tracking methods are data-driven methods. In pixel-wise tracking method, prior model of the target is not required. A parallel K-means clustering algorithm [4] has been used by Heisele, et al. [5, 6] for segmenting the color image sequence and moving region is identified as target. However, the method is computationally expensive due to large number of clusters. Similarly, another K-means based autoregressive model has been proposed and the clustering is performed only to the positive samples. Thus, the tracking failure can't be detected and the failure recovery may not be possible. For tracking, the image pixels are divided as target and non-target pixels and K-means clustering algorithm is applied on these pixels .However, these methods can't deal with the appearance changes of the target object such as size, pose, etc. In addition, the computational cost is proportional to the number of non-target points.

It is understood from the above discussion that pixel-based methods are robust against the background interfusion methods. In this kind of method, the failure detection and automatic failure recovery can be carried out effectively.

Background Subtraction

Typically, the common approach for discriminating moving object from the background scene is *background subtraction*. The idea is to subtract the current image from a reference image, which is acquired from a static background during a period of time. The subtraction leaves only non-stationary or new objects, which include the objects' entire silhouette region. The technique has been used for years in many vision systems as a preprocessing step for object detection and tracking.

Background subtraction is a central component of many computer vision systems, used for detecting moving objects in videos. The main idea of this approach is that of detecting the moving objects from the difference between the current frame and a reference frame ("background image" or "background model") and threshold the results to generate the objects of interest. Existing methods for background modeling may be classified as either predictive or non-predictive. Predictive methods model the scene as a time series and develop a dynamical model to recover the current input based on past observations The second class of methods (called non-predictive density based methods) neglect the order of the input observations and build a probabilistic representation of the observations at a particular pixel.

Implementation

3.1 Design

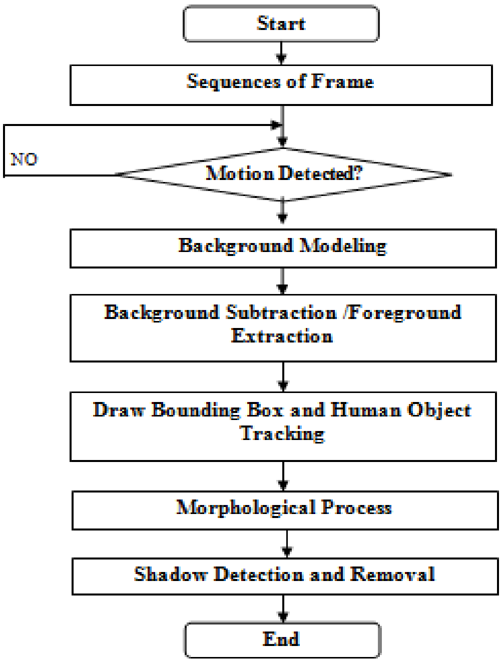

Figure 4.1 Data Flow Diagram.

3.1.1 System Process

There are several different algorithms and methods for object tracking, and shadow removal. The original aim of this dissertation was to use for object tracking and shadow detection and removal.

- **Reading of frame from a video sequence**

In the very first step background information extract from some initial frames of video sequences. The *aviread* function constructs a multimedia reader object that can read video data from Multimedia file. The object created by *aviread* is used for reading the video file so that frame can be extracted from it and the processing can be done on each of the frame.

- **Background reference image**

A background reference image is required for the process of shadow removal. It will be used to as reference to every new frame which will result in the outline of objects and their shadows. The first frame of every video can be used as the background reference image. The background reference need not be necessary that it will be first frame of the video sequence. It may be one of the other frames also. The background reference image is stored in a variable matrix which will be used in further processing of the image.

- **Background Subtraction**

The basic scheme of background subtraction is to subtract background reference image from the initial frame, which is acquired from a static background during a period of time that models the background scene. Typically, the basic steps of the algorithm are as follows:

Background modeling: Constructs a reference image representing the background.

Gray Scale Image: Convert the result of subtracting matrix in to gray scale image.

Threshold selection: Determines appropriate threshold values used in the subtraction operation to obtain a desired detection rate and binary image.

Subtraction operation or pixel classification: Classifies the types of a given pixel belongs to i.e., the pixel is the part of background (including ordinary background and shaded background), or it can be a moving object. Label the image from binary image.

Experimental Results

The experimental results are presented to show that the proposed methods can achieve promising performance in background subtraction and foreground object extraction. This system detects and tracks the moving objects exactly. In this approach, the background scene is modeled using a set of background image frames, which basically consists of 5-30 consecutive frames. The object pixels are segmented out from its background followed by post-morphological process such as dilation and erosion to eliminate noisy pixels thus producing better results.

Fig. Proposed Background Subtraction and Shadow Removal Algorithm

CONCLUSION

In this paper, an approach capable of detecting motion and extracting object information which involves human as an object has been described. The algorithm involves modeling of the desired background as a reference model for later used in background subtraction to produce foreground pixels which is the deviation of the current frame from the reference frame. The deviation which represents the moving object within the analyzed frame is further processed to localize and extracts the information.

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