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Recognition and Tracking of Moving Objects Under Video Surveillance Using Matlab

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ABSTRACT

Now-a-days its becoming very important to know about any information in a digital way in order to avoid crimes and mischief activites. Conventional methods that are used now do have limited advantages we have to check for every minute information in thorough way. By using this method, we need not put effort of many hours over monitors, instead it gives the complete information about what, how and when that happened over there. This method shows how to perform automatic detection and motion-based tracking of moving objects in a video from stationary camera. Detection of motion-based tracking are important components of many computer vision applications including activity recognition, traffic monitoring and automotive safety The problem of motion based object tracking can be divided into two parts:
[1]Detecting moving objects in each frame.
[2]Associating the detections corresponding to the same object over time.
For instance in a video surveillance system that aims to identify people based on their motion information, it is essential to accurately detect the moving objects and then use a robust algorithm to track them. In terms of accuracy and efficiency, the proposed method is shown to be highly accurate in determning the number of moving objects and also fast in tracking them in the scene.

Keywords : Background, Foreground, Histogram, Gray scale image, Shadow removal, Morphological operations.

I. INTRODUCTION

The area of automated surveillance systems is currently of immense interest due to its implications in the field of security. Surveillance of vehicular traffic and human activities offers a context for the extraction of significant information such as scene motion and traffic statistics, object classification, human identification, anomaly detection, as well as the analysis of interactions between vehicles, between humans, or between vehicles and humans. A wide range of research possibilities are open in relation to visual surveillance and tracking.

The efficiency of object tracking in non-surveillance applications is demonstrated by applications such as animal detection and identification in videos. A key step in all of the above is the abi2lity to track a particular object or objects in successive frames. In our research, the primary task is to track vehicles in static camera video as a precursor to future research in intelligent analysis of traffic patterns and detection of anomalous behaviour by vehicles on the road.

Automatic tracking of objects can be the foundation for many interesting applications. An accurate and efficient tracking capability at the heart of such a system is essential for building higher level vision-based intelligence. Tracking is not a trivial task given the non-deterministic nature of the subjects, their motion and the image capture process itself. The goal of the work is

(a) To set up a system for automatic segmentation and tracking of moving objects in stationary camera video.
(b) To make significant improvements in commonly used algorithms.

The process of automatic tracking of objects begins with the identification of moving objects. We use an improved background subtraction method in conjunction with a novel yet simple background model to achieve very good segmentation. Once the moving pixels are identified, it is necessary to cluster these pixels into regions, which we refer to as blobs, so that pixels belonging to a single object are grouped together. Single moving objects are often incorrectly separated into two or more sub regions because of lack of connectivity between pixels, which usually occurs due to occlusion from other objects (e.g., trees). A blob merging module to merge close-by blobs is implemented.

Having established individual moving objects, the next task in tracking is to achieve correspondence between the blobs in one frame andthose in the next. Since we work with real-life data, the algorithm is designed to be robust to real-life tracking issues like occlusion, appearance and disappearance of objects, and abrupt change in speed, location, and orientation of objects. The robust tracking system has been satisfactorily tested on various static camera scenes involving both humans and vehicles. An image sequence captured by a still camera is the input to the system. We first perform motion segmentation to extract moving blobs in the current frame. Some blobs that are very small and are likely to be noise are deleted. Due to partial occlusion, some moving objects get incorrectly segmented into two or more separate blobs. Using color and position information, such blobs are merged.

Significant improvements are brought into the basic tracking system by using the velocity of moving objects as an important factor in the tracking algorithm that consists of object segmentation in image sequences, background modeling, and tracking approaches.

Object detection is mainly done to make the computer intelligent and to understand its surrounding environment and respond accordingly. It finds its applications in the field of medicine and also surveillance. This can be mainly done through the machine learning algorithms. Object recognition and finding its position and orientation can be done by inbuilt toolboxes in the **Matlab** software. Mat lab provides the chance to combine many of its inbuilt toolboxes to get the desired results. Mat lab documentation is very much useful to know the information about any function 0and the toolbox. Matlab combined very useful and complicated codes which are very useful for the solving the real time problems and provided them like Mat lab app's to which we can directly give the input and get the required output. Now a days object detection is very much useful and not only object detection, providing the vision to the computer is a very useful task to develop a robot.

II. PROPOSED ALGORITHM

Along with the normal image processing techniques we will be using the some intelligent systems to detect objects and it completely depends on the features of the object but not on the shape or the color of the object, therefore it will be the most efficient and precise algorithm it will not have the unnecessary noise and there is no need of extra steps to avoid this noise and this make the algorithm so simple and user understandable. As we are using the intelligent training system it can be used to detect any kind of the object. Here after tuning the program to be more precise we can expect a correct output without any noise. Here the components we use are camera, computer installed with Matlab and a database to store data

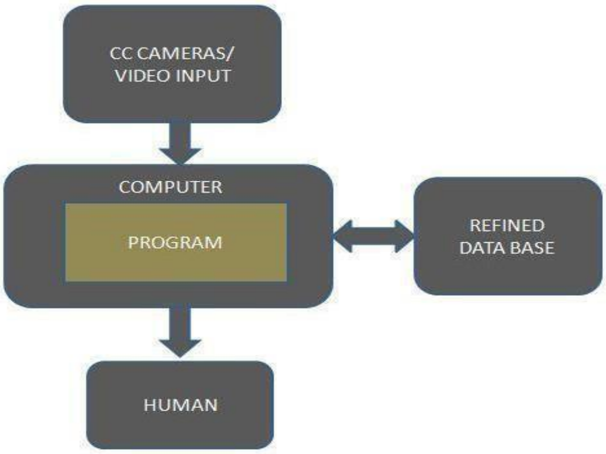

Fig 1: Proposed Algorithm

A. OBJECT DETECTION AND RECOGNITION

Object recognition and recognition are used to locate, identify, and categorize objects in images and video. Computer Vision System Toolbox provides a comprehensive suite of algorithms and tools for object detection and recognition. The system toolbox is a suite of several machine learning, feature-based, and motion-based techniques for object detection and recognition.

1) B.OBJECT CLASSIFICATION

You can detect or recognise an object in an image by training an object classifier using pattern recognition algorithms that create classifiers based on training data from different object classes. The classifier accepts image data and assigns the appropriate objector class label. Computer Vision System Toolbox provides algorithms to train image classification and image retrieval systems using the bag-of-words model. The system toolbox also provides feature extraction techniques you can use to create custom classifiers using supervised classification algorithms from Statistics and Machine Learning Toolbox.

C. SYSTEM REQUIREMENTS

Implementation is the stage of the project when the theoretical design is turned into a working system. Thus it can be considered as the critical stage in achieving a successful new system and in giving the user, confidence that the new system will work and be effective.

The implement stage involves careful planning, investigation of the existing system and its constraints on implementation, designing of methods to achieve change over and evaluation of change over methods.

III. METHODOLOGY

An image sequence captured by a still camera is the input to the system. We first perform motion segmentation to extract moving blobs in the current frame. Some blobs that are very small and are likely to be noise are deleted. Due to partial occlusion, some moving objects get incorrectly segmented into two or more separate blobs. Using color and position information, such blobs are merged. The Object Tracking module tracks these moving objects over successive frames to generate Object Tracks

Tracking is the process of locating a moving object or multiple objects over time in a videostream. Tracking an object is not the same as object detection. Object detection is the process of locating an object of interest in a single frame. Tracking associates detections of an object across multiple frames.

Tracking multiple objects requires detection, prediction, and data association.

Detection: Detect objects of interest in a video frame.

Prediction: Predict the object locations in the next frame.

Data association: Use the predicted locations to associate detections across frames toform tracks.

A. OBJECT DETECTION

Selecting the right approach for detecting objects of interest depends on what you want to track and whether the camera is stationary.

1) Detect Objects Using a Stationary Camera

To detect objects in motion with a stationary camera, you can perform background subtraction using the vision. Foreground Detector System object. The background subtraction approach works efficiently but requires the camera to be stationary.

2) Detect Objects Using a Moving Camera

To detect objects in motion with a moving camera, you can use a sliding-window detection approach. This approach typically works more slowly than the background subtraction approach. To detect and track a specific category of object, use the System objects or functions described in the table.

Object detection technique is an important task in any tracking algorithm to detect the interested object in either each frame of video or from that frame where the object first show up on video. Then again some object detection system makes utilization of worldlyinformation resister from the frame sequence to decrease the amount of false detection. For object detection, there are few regular object detection techniques depicted.

(i)Point detectors - One of the object detection technique is point detector. This detector are generally used for discover fascinating point from the video frame which have an expressive surface in their particular area. An alluring nature of an interesting point is its invariance to changes in enlightenment and camera perspective. In literature, regularly utilized interesting point detectors incorporate Harris detector, Moravec's detector, SIFT detector, KLT detector.

Background Subtraction - Another object detection technique is background subtraction. Object detection could be achieved by building a representation of the scene called the establishment display and after that running across deviations from the model for every one approaching frame. Any basic change in a picture district from the establishment model means a moving object. The pixels constituting the territories encountering change are checked for further process of frame. This methodology is insinuated as the Background subtraction. There are diverse schedules for establishment subtraction as discussed in the outline are Hidden Markov models (HMM), Frame differencing Region- based (or) spatial information and Eigen space decomposition.

Segmentation - Another object detection technique is segmentation. The goal of frame segmentation is to divide the picture into perceptually comparable areas. In every segmentation algorithm, it addresses two issues, the criteria for a great allotment and the strategy for attaining productive dividing.

B. OBJECT PREDICTION

To track an object over time means that you must predict its location in the next frame. The simplest method of prediction is to assume that the object will be near its last known location. In other words, the previous detection serves as the next prediction. This method is especially effective for high frame rates. However, using this prediction method can fail when objects move at varying speeds, or when the frame rate is low relative to the speed of the object in motion.

A more sophisticated method of prediction is to use the previously observed motion of the object. The Kalman filter (vision.KalmanFilter) predicts the next location of an object, assuming that it moves according to a motion model, such as constant velocity or constant acceleration. The Kalman filter also takes into account process noise and measurement noise. Process noise is the deviation of the actual motion of the object from the motion model. Measurement noise is the detection error.

To make configuring a Kalman filter easier, use configureKalmanFilter. This function sets up the filter for tracking a physical object moving with constant velocity or constant acceleration within a Cartesian coordinate system. The statistics are the same along all dimensions. If you need to configure a Kalman filter with different assumptions, you need to construct the vision.KalmanFilterobject directly.

C. DATA ASSOCIATION

Data association is the process of associating detections corresponding to the same physical object across frames. The temporal history of a particular object consists of multiple detections, and is called a track. A track representation can include the entire history of the previous locations of the object. Alternatively, it can consist only of the object's last known location and its current velocity.

D. OBJECT TRACKING

In our implementation, we perform object tracking by finding correspondences between tracks in the previous frame and blobs in the current frame. After the moving objects have been segmented as blobs, the next task is to find correspondence between tracks of previous frame and blobs of current frame.

Most commonly, a match matrix is calculated for the tracks and the blobs, and the best matches are calculated from the match matrix. Each row in the match matrix corresponds to a track from the previous frame and each column corresponds to a blob from the current frame. Each element in the matrix is, thus, the degree of match between a track and a blob. The values entered in the matrix are usually the distance (Euclidean or Manhattan) between a track and a blob. For instance, in the match matrix consists of the weighted sum of Euclidean distance in position in Y and X coordinates.

The smaller the distance, the better the match. In our system, each element in the match matrix is the sum of the Euclidean distance in position values (Y and X coordinate values) and the Euclidean distance in colour values (R, G, and B values). The values for Y and X values are normalized against the maximum Y and X dimensions of the images,respectively. Similarly, R, G, and B values are normalized against their maximum possible value, which is 255.

IV. BRIEF DESCRIPTION

Detection of moving objects and motion-based tracking are important components of many computer vision applications, including activity recognition, traffic monitoring, and automotive safety. The problem of motion-based object tracking can be divided into two parts:

1. Detecting moving objects in each frame
2. Associating the detections corresponding to the same object over time

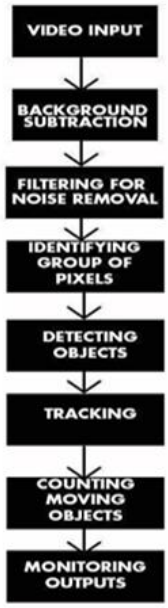

Fig 2: Flow of Operation

A. Input Video

The input video format is avi. avi stands for audio video interleave. An AVI file actually stores audio and video data under the RIFF (Resource Interchange File Format) container format. In AVI files, audio data and video data are stored next to each other to allow synchronous audio- with-video playback. Audio data is usually stored in AVI files in uncompressed PCM (Pulse-Code Modulation) format with various parameters. Video Data is usually stored in AVI files in compressed format with various codecs and parameters. The aviread, aviinfo functions are mentioned to read the input video avi format. This

Algorithm is tested with input video file having 120 frames.

B. Background Subtraction

This proposed algorithm dynamically extracting the background from incoming all video frames, it is subtracted from every subsequent frame and compared with the background threshold. If is greater than the background threshold, it assumed as foreground otherwise it is background. The Background is updated in each and every frame.

C. Noise Removal

Following a segmentation of the image frame into moving and non-moving pixels, region growing is used to locate and identify each moving object. Each group of pixels that are connected to each other is labelled as one blob. An envelope is established around each object of interest by use of morphological erosion and dilation filters. The erosion-dilation operation also removes blobs that are very small and thus likely to be noise. Additional noise is filtered by ignoring blobs less than S pixels in size Dilation

Dilation is an operation that "grows" or "thickens" objects in a binary image. The specific manner and extent of this thickening is controlled by a shape referred to as a structuring element. In otherwords,The dilation operation usually uses a structuring element for probing and expanding the shapes contained in the input image.

2) Erosion

Erosion "shrinks" or "thins" objects in a binary image. As in dilation, the manner and extent of shrinking is controlled by a structuring element. Erosion operation is quite opposite to the dilation operation.

D. Histogram/Identifying Group of pixels

An image histogram is a graphical representation of the number of pixels in an image as a function of their intensity. Histograms are made up of bins, each bin representing a certain intensity value range. The histogram is computed by examining all pixels in the image and assigning each to a bin depending on the pixel intensity.. Image histograms are an important tool for inspecting images. They allow you to spot background and gray value range at a glance. Histogram is used to extract the background.

In a more general mathematical sense, a histogram is a function mi that counts the number of observations that fall into each of the disjoint categories (known as bins), whereas the graph of a histogram is merely one way to represent a histogram. Thus, if we let n be the total number of observations and k be the total number of bins, the histogram mi meets the following conditions:

E. Detect Objects

The detect objects function returns the centroids and the bounding boxes of the detected objects. It also returns the binary mask, which has the same size as the input frame. Pixels with a value of 1 correspond to the foreground, and pixels with a value of 0 correspond to the background.The function performs motion segmentation using the foreground detector. It then performs morphological operations on the resulting binary mask to remove noisy pixels and to fill the holes in the remaining blobs.

F. Labeling the moving object

After performing the morphological operations, the area of the moving object is calculated and labeling the moving objects with yellow color rectangle in the output.

G. Object Tracking

Object tracking decides the movement of the projection of one or more object in video frame plane. This movement is incited by the relative movement between the camera and the watched scene. It is truly characterized as, "Placing a moving object or different protests over a time of time utilizing camera" and actually as, "issue of assessing the trajectory or way of an object in the video frame plane as it moves around a scene". Object tracking could be connected in numerous regions like robotized observation, movement checking, human workstation connection and so forth. Challenges in the same region incorporate commotion in casings, complex item movement and shape, impediment, change in enlightenment and so on.

V. SIMULATION RESULTS

Fig 3: Input Normal video fig 4: Output Gaussian models

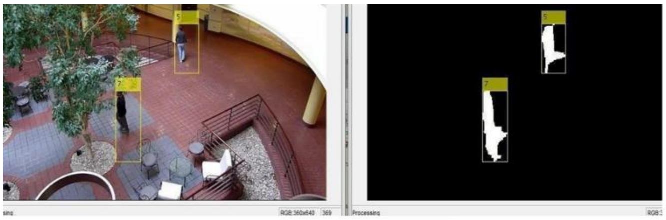

Fig 5: Input Normal video fig 6: Output Gaussian models

VI. CONCLUSION

For this project, we achieve with an object-tracking program that can automatically track multiple objects. We add intelligence to our program to track moving object automatically without being specified by users. It detects the motion, segments moving objects, and then tracks them in the frames following the first two frames. Tracking accuracy is quite good based on the result that moving objects are correctly tracked through the whole sequence.

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