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Object Tracking using SVM Classifier

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Abstract:

An Object tracking was a complicated challenge in the field of computer vision which traces a specific target such as a human or other changing or moving target in the video flow of fundamental images. This Object tracking will be useful in the parking of cars or any vehicles which is useful for the applications of security purposes like surveillance, radio astronomy etc. Once if an object has been locked then the tracking model for an object should be trained with an attributes like size, shape, colour, position etc. Now, the model which was trained will be used to track the object specified in a pool of images or in a video stream. There exist difficulties due to the closures in the images while the object is in tracking., i.e., the speed of a vehicle, shape, and the motion of the camera. Numerous methodologies exist today for tracing of the object and this paper focuses a machine learning procedure called SVM for achieving the higher exactitudes for tracing in an object.

Keywords: Object detection, SVM (Support Vector Machine), Tracking, Training

1.Introduction

Support Vector Machine (SVM) is a relatively simple Supervised Machine Learning Algorithm used for classification and/or regression. It is more preferred for classification but is sometimes very useful for regression as well. While many algorithms can be used in the machine learning framework, they have their unique characteristics, advantages, disadvantages, and best use practices that data scientists need to understand before applying them to solve important business problems. Among these algorithms is an old, widely respected, sophisticated algorithm known as Support Vector Machines. SVM classifier is often regarded as one of the greatest linear and non-linear binary classifiers. SVM regressors are also increasingly considered a good alternative to traditional regression algorithms such as Linear Regression Basically, SVM finds a hyper-plane that creates a boundary between the types of data. Object tracing is one of a several applications leveraging the benefits of artificial intelligence (AI). In simple terms, object tracking tracks an object of interest. Before understanding how the SVM algorithm works to solve classification and regression-based problems, it's important to appreciate the rich history. SVM was developed by Vladimir Vapnik in the 1970s. As the legend goes, it was developed as part of a bet where Vapnik envisaged that coming up with a decision boundary that tries to maximize the margin between the two classes will give great results and overcome the problem of

overfitting. Everything changed, particularly in the ’90s when the kernel method was introduced that made it possible to solve non-linear problems using SVM. This greatly affected the importance and development of neural networks for a while, as they were extremely complicated. At the same time, SVM was much simpler than them and still could solve non-linear classification problems with ease and better accuracy. In the present time, even with the advancement of Deep Learning and Neural Networks in general, the importance and reliance on SVM have not diminished, and it continues to enjoy praises and frequent use in numerous industries that involve machine learning in their functioning .Examples include tracking a person via a video surveillance camera for security reasons, tracking an unidentified flying object in the sky, tracking a planet or a comet in night sky from the captured frames of a telescope, tracking a parked vehicle in a huge parking lot, etc. Video captured from the cameras act as input to the object tracking system and various object tracking methods exists. Deep learning (DL) is becoming popular in object tracking-based applications; however, it requires significant processing power and may not be practical for simple or small-scale applications. In this paper machine learning techniques such as, SVM is used to perform object tracking which do not require compute to the extent that deep learning does and still perform reasonably well for object tracking.

1.1.Histogram of Gradients

Histogram of Oriented Gradients, also known as HOG, is a feature descriptor like the Canny Edge Detector, SIFT (Scale Invariant and Feature Transform) . It is used in computer vision and image processing for the purpose of object detection. The technique counts occurrences of gradient orientation in the localized portion of an image. This method is quite similar to Edge Orientation Histograms and Scale Invariant Feature Transformation (SIFT). The HOG descriptor focuses on the structure or the shape of an object. It is better than any edge descriptor as it uses magnitude as well as angle of the gradient to compute the features. For the regions of the image, it generates histograms using the magnitude and orientations of the gradient well-known approach in the field of computer vision, Histogram of Gradients (HOG) can provide feature descriptions for any given image.

Figure 1.1: Histogram of gradients overview

2.Support Vector Machine

Machine learning involves predicting and classifying data and to do so we employ various machine learning algorithms according to the catalog. Support vector machines (SVM) is a classifier that is non-probabilistic in nature and the classification happens through a hyperplane. The simplest form of SVM is a linear SVM whose

hyperplane is linear and the other could be the nonlinear SVM which uses a kernel trick to perform the classification.

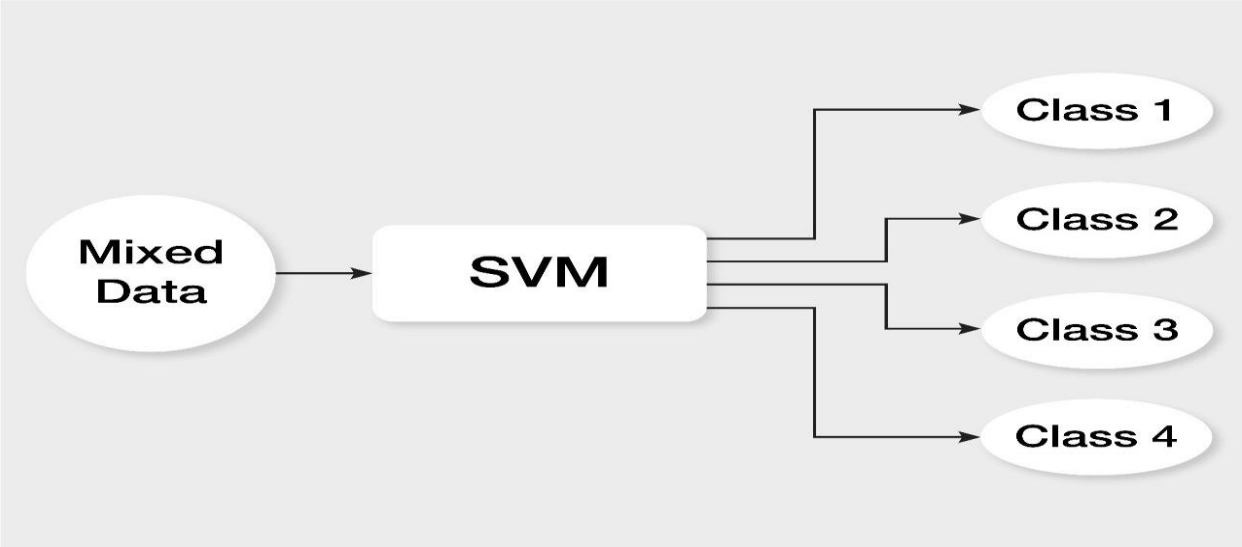

Figure 2.1: SVM Classifier

3. Implementation of SVM classifier

Loading the video and division into frames

The video frame catalog called dragon baby catalog was taken with 20 video frames of which 8 video frames are used as training catalog and 8 of the video frames are used as testing catalog. Figure 3.1 shows the steps to load the video frames into the MATLAB program and details the reading of ground truth data for those 8 video frames for training. The ground truth data is loaded into a cell array and mapped to each video frame that is read which highlights the object of interest in each frame.

```
sf = dir('C: \DragonBaby\img\*.jpg');

nl=length(sf);

 fileID = fopen('C:\DragonBaby\drag_gt.txt');

 gt = textscan(fileID,'%f %f %f %f','Delimiter',',');

fclose(fileID);

vf=[ ]; v1=[ ]; v2=[ ];

for u = 1:10
```

Figure 3.1:Loading of video frames.

Figure 3.2 shows the 8-video frame dragon baby catalog for training where the head of the baby is the object of interest, and all other parts of the image are background.

Figure 3.2: Loading the dragon baby catalog training images

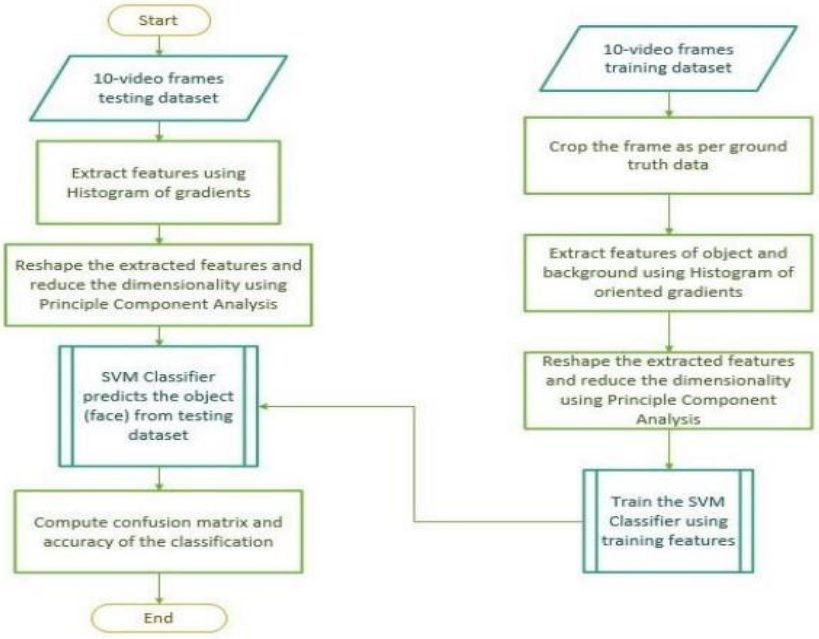

Figure 3.2; Flowchart of object tracking using SVM

Figure 3.2 details the flowchart of the algorithm that is used to track objects using support vector machines. The support vector machine gets modelled, and a decisive boundary is formed based on trained features and the formed decision boundary classifies the testing catalog features into foreground and background.

4. Results and Discussions

Object tracking is an application of deep learning where the program takes an initial set of object detections and develops a unique identification for each of the initial detections and then tracks the detected objects as they move around frames in a video. The object tracking is performed on a given set of testing video frame images as shown in Figure below. The object detection is performed as pattern recognition task by extracting the features of the testing images using HOG and then passing the extracted features to the trained SVM classifier. Here the objective is to perform object detection and analyze the classification technique which is support vector machine.

Figure 4.1: Testing video frame catalog consisting of 8-frames

Figure 4.2: Object (Baby head) tracking using SVM classification

5.Conclusion

Using SVM classifier we have shown the tracing or tracking of a baby head from a video frame of 8 number and the experimental results were satisfactory. Any Data Scientist involved in developing predictive models must have a decent knowledge of the working of Support Vector Machine. SVM is easy to understand and even implement as the majority of the tools provide a simple mechanism to implement it and create predictive models using it. SVM is a sophisticated algorithm that can act as a linear and non-linear algorithm through kernels.

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