Object Detection using Open CV and Deep Learning

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Abstract - Object Detection using SSD (Single Shot Detector) and MobileNets is efficient because this technique detects objects quickly with fewer resources without sacrificing performance. In this, every class of item for which the classification algorithm has been trained generates a bounding box and an annotation describing that class of object. This provides the foundation for creating several types of analytical features such as the volume of traffic in a certain area over time or the entire population in an area is real-time detection and categorization of objects from video data. Keywords: Object Detection, OpenCV, SSD.
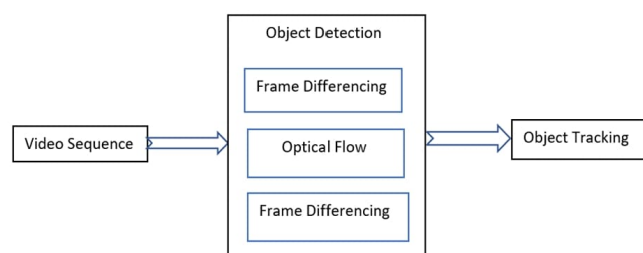
1. INTRODUCTION

Fig. 1 Basic block diagram of detection and tracking.

Fig 1. Shows the block diagram of object detection and tracking. Object detection is a computer technology that deals with finding instances of semantic items of a specific class (such as individuals, buildings, or cars) in digital photos and videos. It is related to computer vision and image processing [1]. In this paper, we worked in a python environment with SSD and MobileNets as the algorithms. Different methods are – Frame differencing, Optical flow, and Background subtraction. Tracking and Detecting algorithms are defined by extracting the features of video and images for security applications [2]

[3]. Features are extracted using CNN and deep learning [4]. Section II describes the algorithms that we have used SSD and MobileNets algorithm, section III explains a method of implementation that includes both object detection and object tracking, and section IV describes simulation results and analysis.

2.OBJECT DETECTION AND TRACKING ALGORITHMS

A. Single Shot Detector (SSD) Algorithm.

SSD is a popular object detection algorithm that was developed in Google Inc. [1]. It is based on the VGG-16 architecture. Hence SSD is simple and easier to implement. The core of SSD is box offsets and predicting category scores for a pre-fixed set of standard bounding boxes using minimal convolutional filters applied to feature maps. To achieve high detection accuracy, the system generates predictions at various scales from feature maps at various sizes, explicitly separating predictions by aspect ratio [5]. These design features lead to high accuracy and simple end-to-end training, even on low-resolution input images, further improving the accuracy vs speed trade-off. Confidence in object detection is a measure of in which manner confidence the system is when

The predicted object is compared with the actual object.

B. MobileNets Algorithm.

The MobileNet model is completely based on depthwise separable convolutions that could be a variety of factorized convolutions that factorize a regular convolution into a depthwise convolution and a 1×1 convolution known as a pointwise convolution. For MobileNets the depthwise convolution applies one filter to every input channel. The

pointwise convolution then applies a 1×1 convolution to mix the outputs of the depthwise convolution [2]. A standard convolution both filters and combines inputs into a brand new set of outputs in one step. The depthwise separable convolution splits this into 2 layers, a separate layer for filtering and a separate layer for combining. This resolution has the impact of drastically reducing computation and model size.

3. MODES OF IMPLEMENTATION

A. Object Detection

1) Frame Differencing: It is detecting the difference in frames of consecutive pictures taken from the camera or the video. It is a technique for detecting motion and identifying moving and stationary objects in a visual scene. Nishu Singla [14] created a frame differencing technique, which is an algorithm that uses a fixed surveillance camera to observe motion in a visual scene and detect moving objects. The model used this technique to take an image from a stationary camera and sequence it. In their paper, Gupta et al. [6] proposed three approaches for detecting motion in a visual scene. To recognize the moving item in the video frames, background subtraction, frame difference, and self-organizing background subtraction (SOBS) are used.

2) Optical Flow: The pattern of apparent mobility of picture objects between two consecutive frames induced by the movement of an object or camera is referred to as optical flow. It's a two-dimensional vector field in which each vector is a displacement vector indicating the movement of points from the first to the second frame.

3) Optical flow is based on the following assumptions:
(1)Between frames, the pixel intensities of an item do not vary. (2)The mobility of neighboring pixels is similar. Optical flow estimation tries to assign to every pixel of the current frame a two-component speed vector indicating the position of an identical pixel within the reference frame. There are many optical flow estimation algorithms identified within the literature. in keeping with the taxonomy planned in [7], we can cluster algorithms within the following categories: region-based matching, differential (Lucas-Kanade[5]), and energy-based algorithms
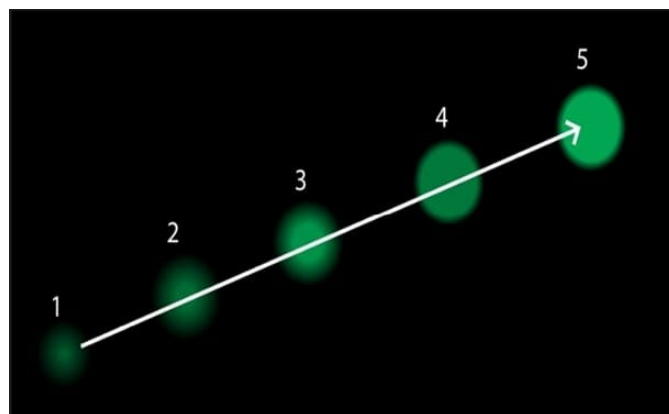

Fig. 2 Example image of Optical Flow.

4) Background Subtraction: Background Subtraction is a frequently used approach for using static cameras to generate a foreground mask (i.e., a binary picture comprising the pixels belonging to moving objects in the scene). As the name implies, BS computes the foreground mask by subtracting the current frame from a background model that contains the static component of the picture or, more broadly, everything that may be called background gave the observed scene's features[7]. The two primary stages of background modeling are Background Initialization and Background Update. An initial model of the background is computed in the first phase, and that model is updated in the second step to respond to changes in the scene.
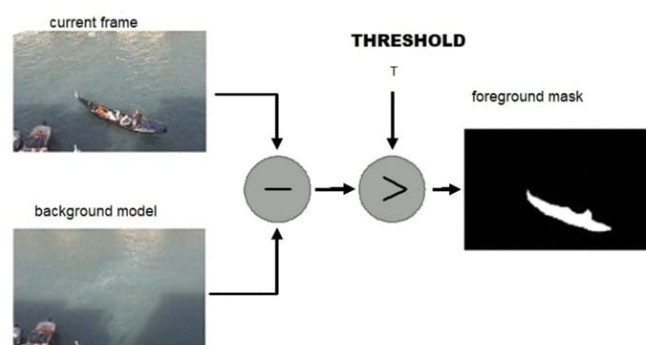

Fig. 1 Example image of Background Subtraction.

The background subtraction method was able to handle variations in local illumination, such as shadows and highlights, as well as changes in global illumination. The background model was statistically modeled on each pixel in this approach. The brightness distortion and chromaticity distortion were utilized to identify shading backdrop from regular background or moving foreground

objects in computational color mode [8].

B. Object Tracking

This technique will allow us to track the object on the screen through the bounding box. Due to changes in object velocity, object tracking is one of the most important fields of research. Feature selection, in particular, is critical in object tracking. Object identification, traffic control, human-computer interaction, gesture recognition, and video surveillance are only a few of the uses. Many approaches concentrate on using a tracking algorithm to smooth the video sequence and address tracking difficulties such as object movement and appearance. In tracking for video surveillance applications, these algorithms use object shape, color, texture, item of interest, and motion in several directions s[9]. There is an improved version of "detection with dynamics" which tracks objects based on time [1].

4. RESULTS

Based on a python program that was developed for the SSD algorithm and implemented in OpenCV [10]. OpenCV is run in Ubuntu IDE. The model was trained for some basic objects. The following are the outcomes that are obtained after successful object detection and tracking of objects in a video sequence provided by the camera.
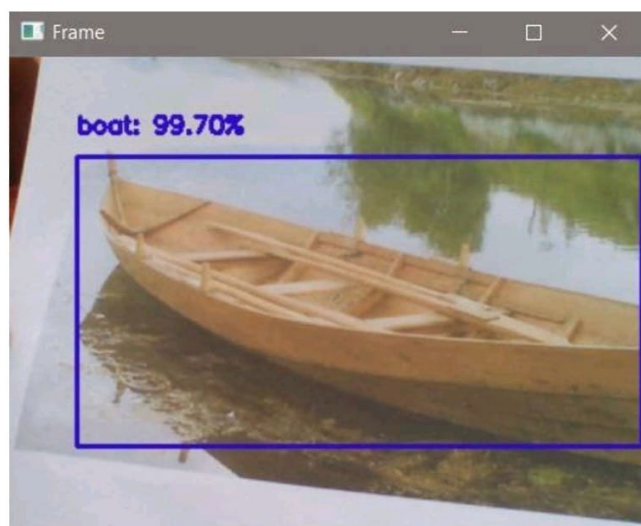

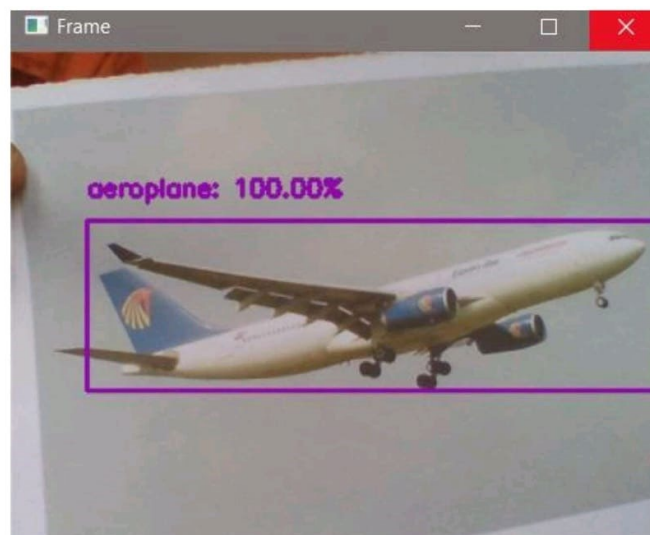Fig. 4 Object detection of Boat Image

Fig. 5 Object detection of Aero plane Image

5. CONCLUSIONS

This model showed good detection and tracking results on the objects that had been trained. The main objective of the SSD algorithm was fulfilled with detection and tracking. This real-time object detection can help in various ways by detecting groceries for automated billing, and detecting ammunition for security purposes. This model can be easily deployed in CCTVs, cameras, military drones and other surveillance devices to detect objects and track them.

6. ACKNOWLEDGEMENT

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