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Real-Time Object Detection using Yolov9c and Flask Web Application

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Abstract
Deep learning is widely used for advanced applications of image and video processing with high performance levels. Deep learning neural networks make use of the higher levels of accuracy in prediction and dynamic data analysis. Deep neural network has shown its extraordinary performance in different task of computer vision and machine learning tasks. These types of networks often require large sets of labeled data for training and involve high computational complexity. This poses considerable challenges for the development and deployment of deep neural networks in realtime systems. In The proposed research work we analyzes the custom object-public sector car and state government car detection and tracking system. Images frames from video sequence are used to detect moving vehicles based on Yolov3 object detection algorithm with darknet frame work to trained own custom data model. And results display on webpage using Flask Web Framework. This deep learning method showed better classification and detecting rate compare to background subtraction techniques. The percentage evolution of object detection rate is discussed in final result.
Keywords: Object, Yolov3, Detection, ML

Introduction

Object detection is a technology that detects the semantic objects of a class in digital images and videos. One of its real-time applications is self-driving cars. In this, our task is to detect multiple objects from an image. The most common object to detect in this application is the car, motorcycle, and pedestrian. For locating the objects in the image we use Object Localization and have to locate more than one object in real-time systems. There are various techniques for object detection, they can be split up into two categories, first is the algorithms based on Classifications. CNN and RNN come under this category. In this, we have to select the interested regions from the image and have to classify them using Convolutional Neural Network. This method is very slow because we have to run a prediction for every selected region. The second category is the algorithms based on Regressions. YOLO method comes under this category. In this, we won't select the interested regions from the image. Instead, we predict the classes and bounding boxes of the whole image at a single run of the algorithm and detect multiple objects using a single neural network. YOLO algorithm is fast as compared to other classification algorithms. In real time our algorithm process 45 frames per second. YOLO algorithm makes localization errors but predicts less false positives in the background.

Existing System

In the current landscape of object detection systems, existing solutions typically involve the deployment of pre-trained deep learning models for object detection tasks. These models, such as Faster R-CNN, YOLO (You Only Look Once), and SSD (Single Shot MultiBox Detector), have demonstrated significant success in detecting objects in images with high accuracy and efficiency.
However, existing object detection systems often require users to have a certain level of technical expertise to deploy and utilize these models effectively. They may involve complex setup procedures, including installing dependencies, configuring model parameters, and managing

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computational resources, which can be challenging for users without a background in machine learning or computer vision.

DISADVANTAGES OF THE EXISTING SYSTEM:

- Limited Accessibility
- Scalability Challenges
- Resource Intensive

Proposed System

The proposed object detection web application aims to address the limitations of existing systems by offering a user-friendly, accessible, and scalable solution for detecting objects in images. Unlike traditional object detection systems that require technical expertise to deploy and utilize, the proposed system provides a simple and intuitive web interface that allows users to upload images and visualize object detections with ease.

At the heart of the proposed system lies a robust object detection model based on state-of-the-art deep learning techniques, such as Faster R-CNN, YOLO, or SSD. This model is pre-trained on large-scale datasets and fine-tuned for improved accuracy and efficiency in detecting objects across a wide range of categories. By leveraging deep learning, the proposed system can automatically learn and extract meaningful features from images, enabling accurate and reliable object detection.

The web application is designed to be highly scalable, capable of handling large volumes of image data and user requests. It utilizes modern web development technologies and frameworks, such as Flask for the backend and HTML/CSS/JavaScript for the frontend, to ensure optimal performance and responsiveness. Additionally, the system can be easily deployed on cloud infrastructure, providing flexibility and scalability to meet varying demands.

ADVANTAGES:

Accessibility
Scalability
Accuracy

Literuature Survey

You Only Look Once: Unified, Real-Time Object Detection, by Joseph Redmon. Their prior work is on detecting objects using a regression algorithm. To get high accuracy and good predictions they have proposed YOLO algorithm in this paper [1]. Understanding of Object Detection Based on CNN Family and YOLO, by Juan Du. In this paper, they generally explained about the object detection families like CNN, R-CNN and compared their efficiency and introduced YOLO algorithm to increase the efficiency [2]. Learning to Localize Objects with Structured Output Regression, by Matthew B. Blaschko. This paper is about Object Localization. In this, they used the Bounding box method for localization of the objects to overcome the drawbacks of the sliding window method [3].

Results

In this project using python, yolov3 (You Only Look Once v3) and OpenCV algorithms we are detecting objects from video and images. Yolov3 is a famous object detection algorithm developed by Washington university, this algorithm generate yolov3 weight model using python Deep Learning algorithm called CNN (Convolution Neural Networks). This algorithm is pre-trained with all images and assign unique class name to each unique images and then generate a model, this algorithm convert each images into layers and then for each layer extract features and add weight to the model, due to all possible features from single image another image with some related features can also be predicted. Whenever we are giving new image then that image will be applied on pre-trained weight model to get best accuracy matching image label.

You are asking to detect object without using any pre-trained model and it is highly impossible as all Deep Learning CNN networks works by using pre-trained models only.

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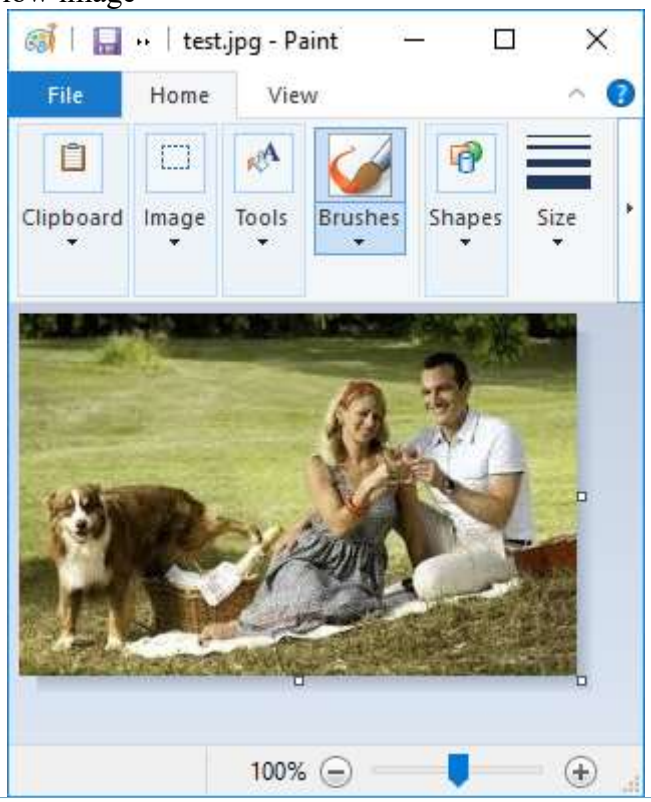
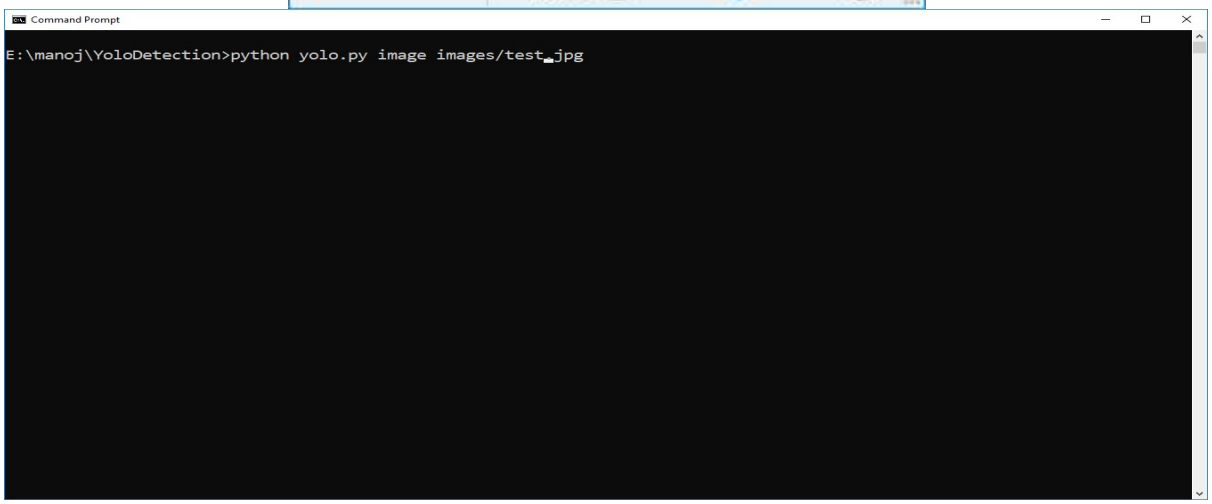
To run this project you need to use below commands
python yolo.py image images/test.jpg
In above command python is the software name and yolo.py is the program name and 'image' means we want application to detect object from image and 'images/test.jpg' is the input image. Similarly for videos instead of image we need to pass video with video path.
python yolo.py video images/video5.mp4
When we are giving video then it will take time to extract all frames from video for object detection and then create a new video called 'newvideo.avi' in the same code folder. If it's taking long time then you can press CTRL+C to stop execution and then you can play 'newvideo.avi' file.
Screen shots
For testing I am using below image





Using above command running yolo from image, after running above command will get below screen

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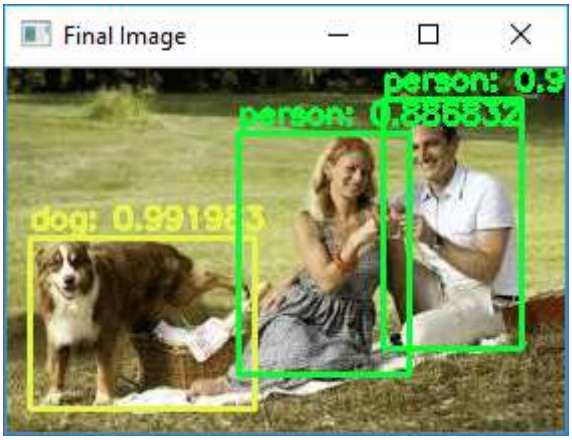
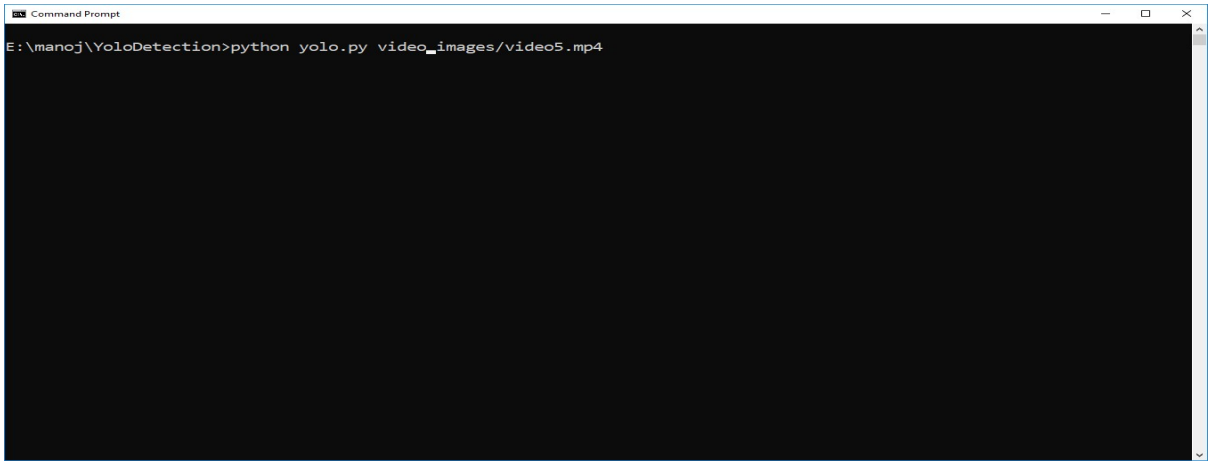
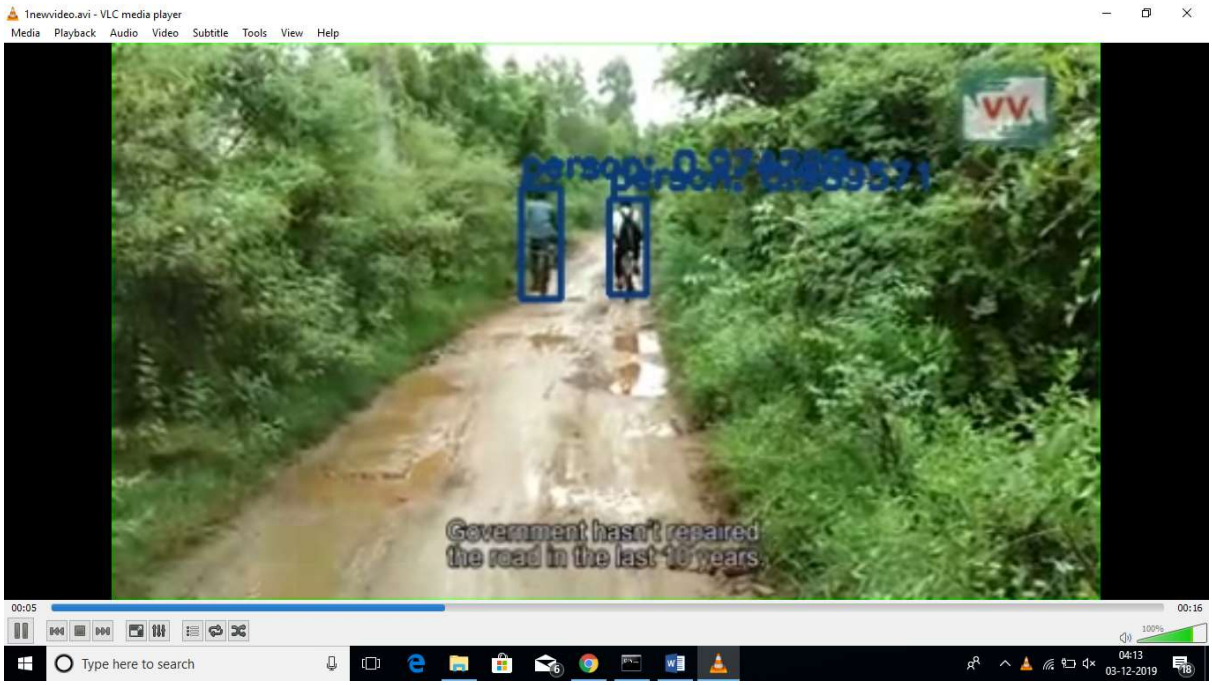


Use below screen command to run with video



After running above command it will start generating new video when we play will get below screen



Conclusion

In this paper, we proposed about YOLO algorithm for the purpose of detecting objects using a single neural network. This algorithm is generalized, it outperforms different strategies once generalizing from natural pictures to different domains. The algorithm is simple to build and can be

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trained directly on a complete image. Region proposal strategies limit the classifier to a particular region. YOLO accesses to the entire image in predicting boundaries. And also it predicts fewer false positives in background areas. Comparing to other classifier algorithms this algorithm is much more efficient and fastest algorithm to use in real time.

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