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Deep Learning Techniques for Object Tracking from Video

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ABSTRACT

Trend towards highly-automated driver assistance systems strongly depends on the performance of environmental perception systems. Increasingly, greater attention is paid to sensor data modelling , because more The measurement information can be gained with a good understanding of the hardware. Radar sensors are cost-efficient and thus often used for kinematic object tracking. Current techniques for the utilization of high-resolution radar sensors for object extent estimation, usually model the spatial occurrence of radar detections using statistical approximations. Although providing fast calculation speeds, the obtainable accuracy is not sufficient, especially when low-cost hardware is used. In this work, we propose a radar model which is based on approximations of every functional abstraction layer of radar sensors, from the electromagnetic wave distribution to the digital signal processing. This approach allows an inherent and generic modelling of the spatial detection probability of the environment, regardless of its exact content and avoiding any complexity issues. Consequently, the interaction between measurements of multiple vehicles can be accurately modelled . Additionally, various details like the antenna diagram and underbody reflections are included.

INTRODUCTION

- Many problems in computer vision were saturating on their accuracy before a decade. However, with the rise of deep learning techniques, the accuracy of these problems drastically improved.
- One of the major problem was that of image classification, which is defined as predicting the class of the image.
- There is no object detection in existing system by using Opencv

Deep learning has gained a tremendous influence on how the world is adapting to Artificial Intelligence since past few years. Some of the popular object detection algorithms are Region-based Convolutional Neural Networks (RCNN), Faster- RCNN, Single Shot Detector (SSD) and You Only Look Once (YOLO).

In this project using python and OPENCV module we are detecting objects from videos and webcam. This application consists of two modules such as „Browse System Videos‟ and „Start Webcam Video Tracking‟.

.PROPOSED SYSTEM

- Dense Optical flow: These algorithms help estimate the motion vector of every pixel in a video frame.
- Sparse optical flow: These algorithms, like the Kanade - Lucas-Tomashi (KLT) feature tracker, track the location of a few feature points in an image.
- Kalman Filtering: A very popular signal processing algorithm used to predict the location of a moving object based on prior motion information. One of the early applications of this algorithm was missile guidance! Also as mentioned here, "the on-board computer that guided the descent of the Apollo 11 lunar module to the moon had a Kalman filter" . To detect the object for uploaded video file.

SYSTEM DESIGNING & ARCHITEC

Browse System Videos: Using this module application allow user to upload any video from his system and application will connect to that video and start playing it, while playing if application detect any object then it will mark that object with bounding boxes, while playing video if user wants to stop tracking then he need to press „q‟ key from keyboard to stop video playing.

Start Webcam Video Tracking: Using this module application connect itself with inbuilt system webcam and start video streaming, while streaming if application detect any object then it will surround that object with bounding boxes, while playing press „q‟ to stop web cam streaming.

Keyword
. Object Tracking
. Object Detection
. Deep Learning
. Video Compression
. Residual Frames
. Video Surveillance
. Privacy Protection
. HOTA

PRESENT WORK

In this work, we utilize an inexpensive compressed domain image representation already generated by the video compression codec: residual frames. Also known as the prediction error, residual frames are the difference between the prediction of a frame at time t+1 using the frame at time t and the original frame at time t+1. Residual frames not only have a low-storage cost but they also act as an information filter by only keeping the movement regions of interest (ROI) between two consecutive frames. In this research, we choose to work exclusively on the residual frames to train and test a deep learning-based object detector and tracker. This will allow us to not only store our data in the compressed format but also provide a privacy-friendly data source for deep learning-based object tracking. Deep learning-based object tracking trained and tested solely on residual frames is a new approach explored by this paper. This research‟s main contribution is to show that using residual frames as an image representation for a deep learning-based object tracking can be just as effective as using decoded frames while limiting the amount of private information leakage in a video stream.This paper is organized as follows. In Section 2, we detail the state of the art of combining data compression, data analysis and data protection. In Section 3 we put forward the utilized materials and methods by presenting the compression algorithm and both object detectors and trackers used. Then we introduce the HOTA evaluation metric, the different datasets that we have worked with, and the two experiments that have been conducted. In Section 4 we present the detailed individual results of the two experiments. Thereafter, in Section 5, we expose the benefits and drawbacks resulting from the two experiments, examine the privacy-friendly capabilities of our solution, and comment on key limitations that have impacted this research. Finally, in Section 6, we conclude the paper by summarizing the results and outcomes of our research and proposing several potential further work.

EXISTING WORK

The challenges of combining the two needs of video compression and video analysis is a topic that has already been addressed in the literature. The Moving Picture Experts Group (MPEG) recently created an ad hoc group dedicated to the standardization of Video Coding for Machines (VCM) (Duan et al., 2020). The VCM group‟s inception came after the realization that traditional video compression codecs were not optimal for deep learning feature extraction. The aim of the VCM group is to create a video compression codec tailored to machine vision rather than human perception. The proposed codec managed to achieve, at lower bit-rate costs, much better detection accuracy in most cases and more visually

- pleasing decoded videos than the High Efficiency Video Codec (HEVC). Another proposition within the same scope proposed a hybrid framework that combined convolutional neural networks (CNN) with classical background subtraction techniques (Kim et al., 2018). The proposed framework was made up of a two-step process. The first step was to identify the ROI using a background subtraction algorithm on all frames. The second step was to apply a CNN classifier to the ROI. They managed toachieve a classification accuracy of up to 85%.In addition, other works have also looked at taking advantage of already generated compressed domain motion vectors to improve the efficiency of deep learning networks. Researchers proposed to work on a CNN-based detector combined with compressed domain motion vectors to lower the power consumption of classical deep learning-based detectors (Ujiie et al., 2018). They utilized the inexpensive motion vectors already generated by the video compression codec to speed up the detection process in the predicted frames. Using the MOT16 benchmark, they obtained a MOTA score of 88% while also cuttinga CNN-based detector combined with compressed domain motion vectors to lower the power consumption of classical deep learning-based detectors . They utilized the inexpensive motion vectors already generated by the video compression codec to speed up the detection process in the predicted frames. Using the MOT16 benchmark, they obtained a MOTA score of 88% while also cutting the detection frequency by twelve times. Other researchers have also explored the use of the compressed domain motion vectors,buy concentratedtheir efforts on improving the efficiency of their CNN-based object tracker (Liu et al., 2019). They manage to achieve a tracker that is six times faster

CONCLUSION

- An accurate and efficient object detection system has been developed which achieves comparable metrics with the existing state-of-the-art system. This project uses recent techniques in the field of computer vision and deep learning.

A hope this blog has helped you gain a comprehensive understanding of the core ideas and components in object tracking and acquainted you with the tools required to build your own custom object detector. Get coding and make sure there are no strays in your front yard anymore ever!
For tracking arbitrary objects, the traditional method basically uses a separate video itself as a training set, and then learns the apparent model of an

object. Although this approach is successful, this online learning approach limits the richness of models that can be learned. Recently, many people have tried to explore the powerful expressive power of deep convolution networks. However, because the object is unknown in advance, a random gradient descent algorithm is needed to adjust the weight of the network every time, which seriously affects the speed of the tracking system. The problems in video tracking are often caused by many interference factors.

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