An Application of a Deep Learning Algorithm for Automatic Detection of Unexpected Accidents under bad CCTV monitoring conditions in tunnels

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ABSTRACT

In this project, Object Detection and Tracking System (ODTS) in combination with a well-known deep learning network, Faster Regional Convolution Neural Network (Faster R-CNN), for Object Detection and Conventional Object Tracking algorithm will be introduced and applied for automatic detection and monitoring of unexpected events on CCTVs in tunnels, which are likely to (1) Wrong-Way Driving (WWD), (2) Stop, (3) Person out of vehicle in tunnel (4) Fire. ODTS accepts a video frame in time as an input to obtain Bounding Box (BBox) results by Object Detection and compares the BBoxs of the current and previous video frames to assign a unique ID number to each moving and detected object. This system makes it possible to track a moving object in time, which is not usual to be achieved in conventional object detection frameworks. A deep learning model in ODTS was trained with a dataset of event images in tunnels to Average Precision (AP) values of 0.8479, 0.7161 and 0.9085 for target objects: Car, Person, and Fire, respectively. Then, based on trained deep learning model, the ODTS based Tunnel CCTV Accident Detection System was tested using four accident videos which including each accident. As a result, the system can detect all accidents within 10 seconds. The more important point is that the detection capacity of ODTS could be enhanced automatically without any changes in the program codes as the training dataset becomes rich.

1.INTRODUCTION

Object detection technology has been successfully applied to find the size and position of target objects appearing on images or videos. Several applications have appeared mainly in self-driving of vehicles, CCTV monitoring and security system, cancer detection, etc. Object tracking is another area in image processing to be achieved by unique identification and tracking the positions of identified objects over time. However, to track objects, it is necessary to define object class and position first in a firstly given static image by object detection. Therefore, it can be said that the results of object tracking should be deeply dependent on the performance of the object detection involved.

This object tracking technology has been successfully utilized for tracing of targeted pedestrian and the moving vehicle, accident monitoring in traffic camera, criminal and security monitoring in the certain local area of concern, etc. In the traffic control field, a case study on analysis and control of traffic conditions by automatic object detection has carried out in this paper. The summaries are given as follows. According to, an on-road vehicle detection system for the self-driving car was developed. This system detects

vehicle object and classifies the type of vehicle by Convolutional Neural Network (CNN). The vehicle object tracking algorithm tracks the vehicle object by changing the tracking center point according to the position of the recognized vehicle object on the image. Then, the monitor shows a localized image like a bird's viewpoint with the visualized vehicle objects, and the system calculates the distance between the driving car and the visualized vehicle objects. This process of the system enables to objectively view the position of the vehicle object so that it can help assistance of the self-driving system. As a result, it can localize the vehicle object invertical1.5m, horizontal0.4mtolerance at the camera.

In, another deep learning-based detection system in combination with CNN and Support Vector Machine (SVM) was developed to monitor moving vehicles on urban roads or high ways by satellite. This system extracts the feature from the satellite image through CNN using the satellite image as an input value and performs the binary classification with SVM to detect the vehicle BBox. Besides, Arinaldi, Pradana, and Gurusinga developed a system to estimate the speed of the vehicle, classify

vehicle type, and analyze traffic volume. This system utilizes BBox obtained by object detection based on videos or images. The algorithm applied to the system was compared with the Gaussian Mixture Model SVM and faster RCNN.

Therefore, in this paper, an attempt is made for generate an object detection & tracking system (ODTS), that can obtain moving information of target objects by combining object tracking algorithm with the deep learning-based object detection process. The full ODTS procedures will be described in details in the following section. Also, the tunnel accident detection system in the framework of ODTS will be taken into consideration. This system is used for detecting accident or unexpected events taking place on moving object and target local region on CCTV.

A lean implementation of a tracking-by detection framework for the problem of multiple object tracking (MOT) where objects are detected each frame and represented as bounding boxes. In contrast to many batch-based tracking approaches, this work is primarily targeted towards online tracking where only detections from the previous and the current frame are presented to the tracker. Additionally, a strong emphasis is placed on efficiency for facilitating real time tracking and to promote greater uptake in applications such as pedestrian tracking for autonomous vehicles. The MOT problem can be viewed as a data association problem where the aim is to associate detections across frames in a video sequence. To aid the data association process, trackers use various methods for modelling the motion and appearance of objects in the scene.

The methods employed by this paper were motivated through observations made on a recently established visual MOT benchmark. Firstly, there is a resurgence of mature data association techniques including Multiple Hypothesis Tracking (MHT) and Joint Probabilistic Data Association (JPDA) which occupy many of the top positions of the MOT benchmark. Secondly, the only tracker that does not use the Aggregate Channel Filter(ACF)detectorisal so the to pranked tracker, suggesting that detection quality

could be holding back the other trackers. Furthermore, the trade-off between accuracy and speed appears quite pronounced, since the speed of most accurate trackers is considered too slow for real time applications. With the prominence of

traditional data association techniques among the top online and batch trackers along with the use of different detections used by the top tracker, this work explores how simple MOT can be and how well it can perform. Keeping in line with Occam's Razor, appearance features beyond the detection component are ignored in tracking and only the bounding box position and size are used for both motion estimation and data association. Furthermore, issues regarding short-term and long-term occlusion are also ignored, as they occur very rarely and their explicit treatment intro duces undesirable complexity into the tracking framework

2.EXISTINGSYSTEM

In the existing system the data preprocess has dine with structured data. Even though data pre-processing consumes a large chunk of time in an ML pipeline, it is astonishing to see the inadequate amount of work done to automate it. For data preprocessing, it can be notedthat while the data preprocess approaches are adequate for structured data, work still needs to be done to assimilate on Structured data. We suggest the incorporation of data-mining methods as they can dealwith such unformed data. This can allow AutoML pipelines to create

models capable of learning from Internet sources. In feature engineering, it should be noted that most methods used until now adhere to supervised learning. However, dataset specificity is high, and therefore, AutoMLpipelines should be as generic as possible to accommodate the diverse datasets.Therefore, a gradual paradigm shift towards unsupervised.

DISADVANTAGES OF EXISTINGSYSTEM:

Feature Generation is not up to the mark where domain experts excepted results.

Most AutoML tools emphasize the performance but in the real world, that's just one aspect being covered in machine learning projects. So the companies can't compromise the computing plus storage specification sheet.

CASH(Combined Algorithm Selection and Hyperparameter) problem considers model selection and hyperparameters optimization as a single hierarchical parameter.

Algorithm:SmartML,J48, C50

3.PROPOSEDSYSTEM

In the proposed system we attempt is made for generate an object detection & tracking system (ODTS) with yolo, that can obtain

moving information of target objects with names by combining object tracking algorithm with the deep learning-based object detection process. It is assumed that ODTS has been trained enough to perform object detection properly on a given image frame. ODTS receives selected frames of video at specified time interval c and gains sets of coordinates, n BBoxs are detected. BBoxT of objects on the given image frame at the time T, fromthe trained object detection system. The corresponding type or class of each detected object BBoxT is simultaneously classified by the object detection module.

ADVANTAGESOFPROPOSEDSYSTEM:

We segment the AutoML pipeline into parts and review the contributions in each of these segments.

Weexplorethevariousstate-of-the-arttoolscurrentlyavailableforAutoML and evaluate them.

Weal so incorporate the advancements seen in machine learning which seems to be overshadowed by deep learning in recent years.
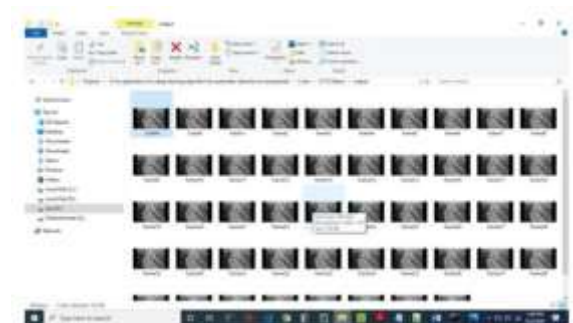
Algorithm:H2O-AutoML,LinearRegression,GradientBoostingRegressor

4.SCREENSHOTS

Output frames

Making Video

Object Detected

Accident Detected

5. CONCLUSION

This paper proposes a new process of ODTS by combining deep learning-based object detection network and object tracking algorithm, and it shows dynamic information of an object fora specific object class can be obtained and utilized. On the other hand, the object detection performance is important because SORT used in ODTS object tracking uses only information of BBox without using an image. Therefore, continuous object detection performance may be less needed unless the object tracking algorithm is relatively dependent on object recognition performance. And Tunnel CCTV Accident Detection System based on ODTS was developed. The experiments on training and evaluation of deep learning object detection network and detection of an accident of the whole system were conducted. This system adds CADA that

discriminates every cycle based on dynamic information of the car objects. As a result of experimenting with the image containing each accident, it was possible to detect the accidents within10 seconds. On the other hand, training of deep learning secured the object detection performance of a reliable Car object, and Person showed relatively low object detection performance. However, in the case of Fire, there is a high probability of false detection in the untrained videos due to the insufficient number of Fire objects. Nonetheless, it is possible to reduce the occurrence of false detections by simultaneously training objects that are No Fire.

6.REFERENCES

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