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Customized Smart Object Detection Using Yolo and R-CNN In Machine Learning

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ABSTRACT

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'.
Object tracking is an important task in computer vision and has numerous applications in fields such as surveillance, robotics, and autonomous driving. In this project, we aim to develop an object tracking system using Python and the OpenCV module. The system consists of two modules: "Browse System Videos" and "Start Webcam Video Tracking." The first module allows the user to select a video file from their system to track objects in, while the second module tracks objects in real-time using the user's webcam. Our system uses a combination of computer vision techniques, such as color thresholding and blob detection, to detect and track objects in the video or webcam feed. By developing this system, we hope to demonstrate the potential of Python and OpenCV for object tracking applications and inspire further development in the field.

Keywords : OpenCV, Video Tracking, Machine Learning, Start Webcam

I. INTRODUCTION

Object detection is a key field in Artificial Intelligence, allowing computer systems to "see" their environments by detecting objects in visual images or videos. Object detection is often called object recognition, object identification, and image detection, and these concepts are all synonymous.
Object detection is the process of detecting a target object in an image or a single frame of the video. Object detection will only work if the target image is visible on the given input. If the target object is hidden by any interference it will not be able to detect it.

Problem Statement:

- 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.

Motivation: 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).

II. LITERATURE SURVEY

- Joseph Redmon, Santosh Divvala, Ross Girshick, Ali Farhadi presented You Only Look Once: Unified, Real-Time Object Detection which is a fast and simple approach to detecting real time images was introduced in this paper as You Only Look Once. The model was built to detect images accurately, fast and to differentiate between art and real images. In comparison with Object detection techniques that came before YOLO, like R-CNN, YOLO introduced a single unified architecture for regression go image into bounding boxesand finding class probabilities for each box. This meant that YOLO performed much faster and also provided more accuracy. It could also predict artwork correctly.
- Chengji Liu, Yufan Tao, JiaweiLiang, Kai Li1, YihangChen presented Object Detection Based on YOLO Network in which a generalized object detection network was developed by applying complex Degradation processes on training sets like noise, blurring, rotating and cropping of images. The model was trained with the degraded training sets which resulted in better generalizing ability and higher robustness. The experiment showed that the model trained with the standard sets does not have good generalization ability for the degraded images and has poor robustness. Then the model was trained using degraded images which resulted in improved average precision. It was proved that the average precision for degraded images was better in general degenerative model compared to the standard model.
- Wenbo Lan, Jianwu Dang, Yang-ping Wang, Song Wang presented Pedestrian Detection Based on YOLO Network Model. The network structure of YOLO algorithm is improved and a new network structure YOLO-R was proposed to increase the ability of the network to extract the information of the shallow pedestrian features by adding passthrough layers to the original YOLO network. The YOLO v2 and YOLO-R network models were tested on the test set of the INRIA dataset. The experimental results show that the YOLO-R network model is superior to the original YOLO v2 network model. The number of detection frames reached 25 frames/s, basically meeting the requirement of real-time performance.
- Rumin Zhang, Yifeng Yang presented An Algorithm for Obstacle Detection based on YOLO and Light Filed Camera. An obstacle detection algorithm in the indoor environment is proposed which combines the YOLO object detection algorithm and the light field camera and will classify objects into categories and mark them in the image. The images of the common obstacles were labelled and used for training YOLO. The object filter is applied to remove the unconcern obstacle. Different types of scene, including pedestrian, chairs, books and so on, are demonstrated to prove the effectiveness of this obstacle detection algorithm.

III. EXISTING SYSTEM

In existing system, 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 and R-CNN used together.

IV. 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".

Purpose of Proposed System:

In this project using python and OPENCV module we are detecting objects from videos and webcam.

The goal of object tracking is to locate and track an object's movement over time in a video. This is typically done by selecting an object in the first frame of the video and tracking it as it moves throughout the subsequent frames. Object tracking can be challenging due to changes in lighting, occlusions, and object appearance changes.

This application consists of two modules such as 'Browse System Videos' and 'Start Webcam Video Tracking'.

- 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.

Architecture diagrams:

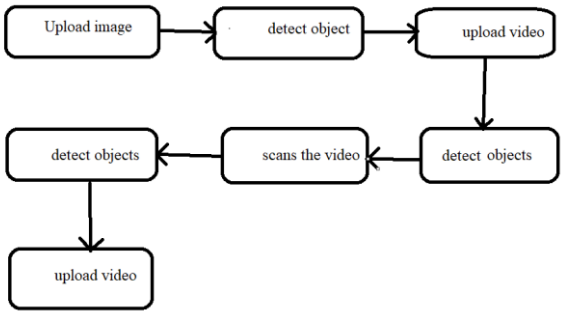


Fig. 1: Architecture Diagram

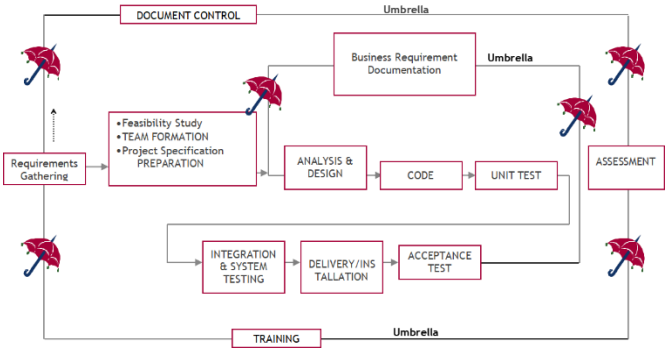


Fig 2. Umbrella Model

V. IMPLEMENTATION

OpenCV will use following algorithms to track object in videos 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 70 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".

Meanshift and Camshift: These are algorithms for locating the maxima of a density function. They are also used for tracking.

Single object trackers: In this class of trackers, the first frame is marked using a rectangle to indicate the location of the object we want to track. The object is then tracked in subsequent frames using the tracking algorithm. In most real life applications, these trackers are used in conjunction with an object detector.

Multiple object track finding algorithms: In cases when we have a fast object detector, it makes sense to detect multiple objects in each frame and then run a track finding algorithm that identifies which rectangle in one frame corresponds to a rectangle in the next frame.

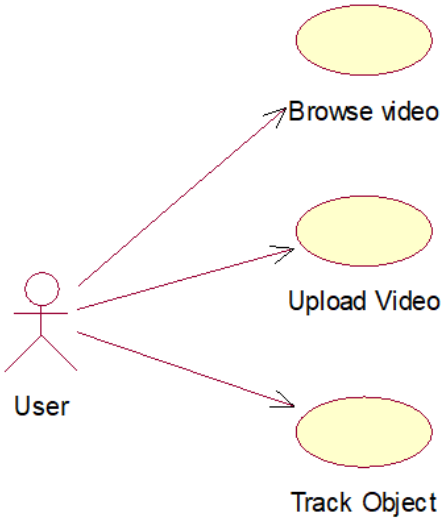
Module description:

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.

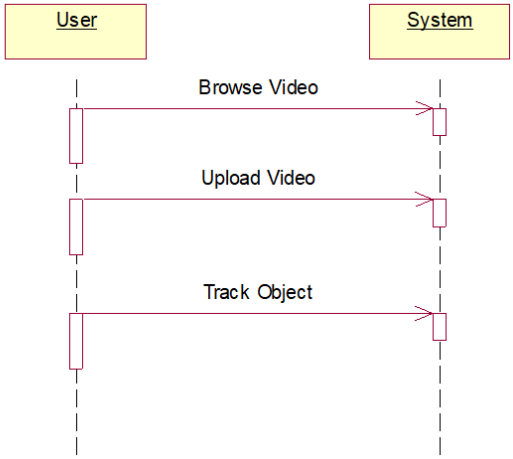
Start Webcam Video Tracking: Using this module application connect itself with inbuilt system webcam and start video streaming, while streaming if application detect any object then it will surround that object with bounding boxes, while playing press 'q' to stop web cam streaming.

UML Diagrams:

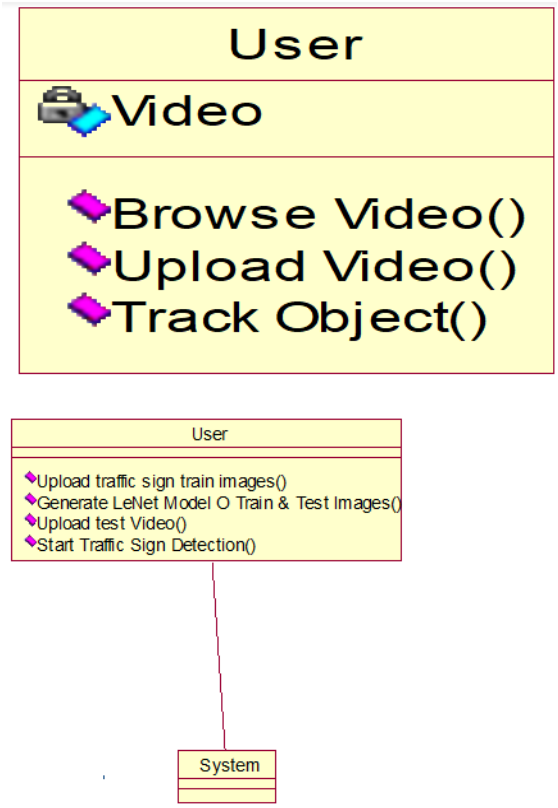
a. Use case Diagram



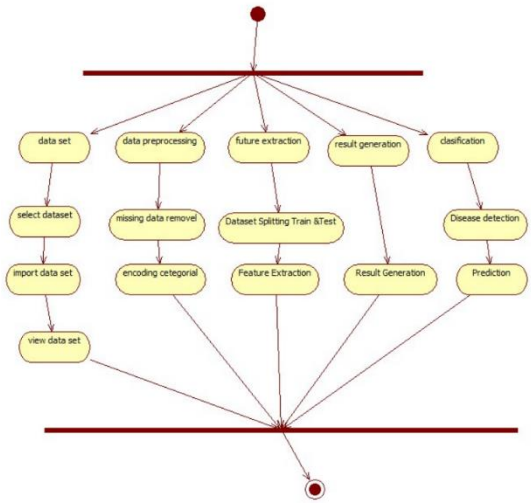
b. Sequence Diagram



c. Class Diagram



d. Activity Diagram



VI. REQUIREMENT SPECIFICATIONS

SOFTWARE TOOLS

OPERATING SYSTEM : Windows: 7 or newer

LANGUAGES USED : Python 3.7

HARDWARE TOOLS

PROCESSOR : Pentium –III

SPEED : 2.4 GHz

RAM : 512 MB (min)

HARD DISK: 20 GB
FLOPPY DRIVE : 1.44 MB
KEY BOARD : Standard Keyboard
MONITOR : 15 VGA Colour

FUNCTIONAL REQUIREMENTS

- Object detection, where the algorithm classifies and detects the object by creating a bounding box around it.
- Assigning unique identification for each object (ID).
- Tracking the detected object as it moves through frames while storing the relevant information.
- Functional requirements for a secure cloud storage service are straightforward:
- The service should be able to store the user's data.
- The data should be accessible through any devices connected to the Internet.
- The service should be capable to synchronize the user's data between multiple devices (notebooks, smart phones, etc.).
- The service should preserve all historical changes (versioning).
- Data should be shareable with other users;
- The service should support SSO and should be interoperable with other cloud storage services, enabling data migration from one CSP to another.

NON-FUNCTIONAL REQUIREMENTS

- Scalability: System should be able to handle a large number of users. The system is capable enough to work properly.
- Speed: The application should be fast. It should not slow down with the increase of number of users. Search functionality should be fast to enable better end-user experience. The system should be quick enough to be able to respond to user actions with a short period of time.
- Usability: User interface should be simple and clear to break to understand to any user. At every step of this project user seems to be familiar with the interfaces as they are easy to use.
- Availability: The system should be available at every moment to the user. It should be ensured that there should be minimum or no downtime to ensure better user experience for students.
- Reliability: The system should be reliable and yield correct results if a user performs any actions. Also, if the farmer uploads a image, the system should ensure that the correct message is delivered to the correct destination without any loss of content.
- Testability: The application is tested for validation, uploading images, message structures and works fine.

VII. ADVANTAGES

- Here we can detect the object for uploaded video file.
- It is extremely fast compared to other real time detectors which came before it as it uses a Unified Model where the detection is seen as a single regression problem and there is no complex pipeline, just a neural network run on the image.
- YOLO has learnt generalized representations of objects. It successfully differentiates natural images against art work.
- It is more accurate than existing system.

VIII. DISADVANTAGES

- Small object detection, such as a flock of birds, is a problem as there is a spatial restriction on bounding boxes with each cell being able to predict only two boxes and have one class.
- Problems when generalizing objects of abnormal aspect ratios and configurations.
- Loss function will treat the errors of small or large bounding boxes as same.

IX. APPLICATIONS

- Enables successful segmentation of intra-retinal layers—even with low-quality images containing speckle noise, low contrast, and different intensity ranges throughout—with the assistance of the ANIS feature.
- This system can be applied in the areas of surveillance system, face recognition, fault detection, character recognition, etc.

X. CONCLUSION

In this project, 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.

XI. FUTURE WORK

Features either the local or global used for recognition can be increased, to increase the efficiency

- Features either the local or global used for recognition can be increased, to increase the efficiency of the object recognition system.
- Geometric properties of the image can be included in the feature vector for recognition.
- Fully occluded object cannot be tracked and considered as a new object in the next frame.

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