Video Object Detection

AI Model Development

Time: 60 mins

Introduction

In this class, the student/s will learn to detect the objects from an video. Student/s will learn about cv2.VideoCapture().

New Commands Introduced

- cv2.VideoCapture()   Reads the video which is passed to it as a parameter

- video.read()   Reads the video in frames. Returns two values, a boolean
                                        that denotes the frame was read successfully and an image
                                        representation of the frame as an array.

Vocabulary

- Frame: Frame is a single image or part of a video. A video is made up of multiple frames or images viewed in succession at a particular speed. A video viewed at 24 frames per second would contain 24 images viewed in a second.

Learning Objectives

Student/s should be able to:
- **Recall** how to detect an object in an image.
- **Demonstrate** how to detect an object in a video
- **Explain** the concepts of video processing and object detection.
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Activities

1. **Class Narrative:** *(2 mins)*
   - Brief the student/s about detecting different objects from the video. Highlighting the objects with boxes and it's displaying label with percentage of accuracy in identifying the object.

2. **Concept Introduction Activity:** *(5 mins)*
   - Let the student/s play the explore-activity to detect objects in an image.
   - Guide students to download yolov3.weights file from https://pjreddie.com/media/files/yolov3.weights or copy and paste the file from previous class folder.
   - Using the slides, explain that the student/s will learn:

- to read the input video.
- to detect objects in videos and alternate the color of the highlighting box and add label.
- to play, pause and restart a video.

3. **Activity 1:Read the Input Video:** *(12 mins)*

   Teacher Activity: *(6 mins)*.
   - Explain the process of reading a video by splitting it into images using a while loop.

   Student Activity: *(6 mins)*
   - Guide the student/s to read a video by splitting it into images using a while loop.

4. **Activity 2: Detect Objects:** *(12 mins)*

   Student Activity: *(12 mins)*
   - Guide the student/s to detect sports ball and person in a video using the YOLO model.
   - Guide students to change the color of the bounding box and label in alternating frames.

   Probing question: How many values can a function return in Python?
   Expected answer: in Python a function can return more than one value, each of them can be assigned into multiple variables in a single line of command.

5. **Activity 3: Highlight the Object:** *(12 mins)*

   Student Activity: *(12 mins)*

   - Explain how the concept of game states can be used to play, pause and stop videos.
   - Guide the student/s to pause, play, and stop a video using keyboard controls.
   - Explain the use of waitKey() to wait for the user to press a key on the keyboard.

6. **Introduce the Post class project:** *(2 min)*
   - Apply the concept of detecting objects in videos to detect a car in a video.

7. **Test and Summarize the class learnings:** *(5 mins)*
   - Check for understanding through quizzes and summarize learning after respective missions.
   - Summarize the overall class learning towards the end of the class.

8. **Additional activities:**
   - Encourage the student to restart the video
   - Encourage the student to detect as many objects as possible in a video.

9. **State the Next Class Objective:** *(1 min)*
   - In the next class, student/s will learn to track objects in videos.

U.S. Standards:

CSTA: 2-AP-11, 2-AP-12, 2-AP-13, 2-AP-14, 2-AP-19

Links Table		
Activity	**Activity Name**	**Link**
Class Presentation	Video Object Detection	https://s3-whjr-curriculum-uploads.whjr.online/7d7a71c1-0efb-419e-8fa9-117f57dba4f8.html
Explore Activity	Video Object Detection	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C67-SAS-BP
Teacher Activity 1	Read Video	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C67-TAS-BP
Teacher Activity 1 Solution	Read Video Solution	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C67-TAS
Student Activity 1	Read Video	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C67-SAS-BP
Teacher Reference: Student Activity 1 Solution	Read Video Solution	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C67-SAS
Student Activity 2	Detect Objects	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C67-SAS-BP
Teacher Reference: Student Activity 2 Solution	Detect Objects Solution	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C67-SAS
Student Activity 3	Play, Pause, and Stop	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C67-SAS-BP
Teacher Reference: Student Activity 3 Solution	Play, Pause, and Stop Solution	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C67-SAS
Student's Additional Activity 1	Restart the Video	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C67-SAS-BP
Teacher Reference: Student's Additional Activity 1 Solution	Restart the Video Solution	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C67-SAS
Student's Additional Activity 2	Detect all Possible Objects in the Video	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C67-SAS-BP
Teacher Reference: Student's Additional Activity 2 Solution	Detect all Possible Objects in the Video Solution	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C67-SAS
Post Class Project	Detect the Car	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C67-PCP-BP
Teacher Reference: Post Class Project Solution	Detect the Car Solution	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C67-PCP