# Object Tracking

AI Model Development

**Time:** 60 mins

# Introduction

In this class, the student/s will learn to detect the basketball and trace its trajectory.

# New Commands Introduced

- tracker = cv2.legacy.TrackerCSRT_create()        Loads the tracker

- tracker.init(image,boxes[i])        Initializes the tracker

- Import math        Imports math library

- cv2.circle()        Draws circle

# Vocabulary

- Object tracking is an application of deep learning where the program takes an initial set of object detections and develops a unique identification for each of the initial detections and then tracks the detected objects as they move around frames in a video.

# Learning Objectives

Student/s should be able to:
- **Recall** how to process an image using the open cv library.
- **Demonstrate** how to plot the trajectory for the basketball.
- **Explain** the concepts of detecting the goal when the ball touches the basket.
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# Activities

1. **Class Narrative:** *(2 mins)*
   - Brief the student/s about improving the basketball detection system by tracking the path of the ball to detect the goal.

2. **Concept Introduction Activity:** *(5 mins)*
   - Let the student/s play the explore-activity to track the basketball.

Note: Ask students to download and extract required files, install requirements and add yolov3.weights in each activity file.
- Using the slides, explain that the student/s will learn:
  - to add a tracker
  - to trace the basketball
  - to detect the goal

3. **Activity 1:Add a Tracker :** *(12 mins)*

   **Teacher Activity:** *(6 mins)*.
- Explain the process of loading and initializing the tracker.
- Demonstrate to the student/s how to update the tracker information and draw a box.

   **Student Activity:** *(6 mins)*
- Guide the student/s to  load, initialize the tracker and draw the box on successful tracking.

4. **Activity 2: Trace the Basketball:** *(12 mins)*

   **Teacher Activity:** *(6 mins)*
- Explain to students how to find the create the goalTrack() function to track the ball.
- Explain how to get the center of the bounding box and draw the circle for everyframe.
- Demonstrate how to display all circular dots to represent a trajectory using for loop..

   **Student Activity:** *(6 mins)*
- Guide the student/s to create the goalTrack() function to track the ball
  Probing question: What is the use of the cv2.cvtColor() function?
  Expected answer: Changes the color of the image to grey scale image.

5. **Activity 3: Detect the Goal:** *(12 mins)*

   **Teacher Activity:** *(6 mins)*
- Explain the student/s to calculate the distance between basket and basketball and notify the basket when the distance between them is less.

   **Student Activity:** *(6 mins)*

- Guide the student/s to  calculate the distance between basket and basketball and notify the basket when the distance between them is less.

6. **Introduce the Post class project:** *(2 min)*
- Students will create the tracker to track the car in the 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 change the color of the bounding box based on its distance from the goal.
- Encourage the student to draw a dotted line for the trajectory.

9. **State the Next Class Objective:** *(1 min)*
   - In the next class, student/s will learn to detect the hand and identify the finger which can be used to control gestures.

# 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 | Object Tracking | https://s3-whjr-curriculum-uploads.whjr.online/145f1691-7608-4214-b33e-bc53193e28a5.html |
| Explore Activity | Object Tracking | https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C68-SAS-BP |
| Teacher Activity 1 | Add a Tracker | https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C68-TAS-BP |
| Teacher Activity 1 Solution | Add a Tracker | https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C68-TAS |
| Student Activity 1 | Add a Tracker | https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C68-SAS-BP |
| Teacher Reference: Student Activity 1 Solution | Add a Tracker | https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C68-SAS |
| Teacher Activity 2 | Trace the Basketball | https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C68-TAS-BP |
| Teacher Activity 2 Solution | Trace the Basketball | https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C68-TAS |
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| Student Activity 3 | Detect the Goal | https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C68-SAS-BP |
| Teacher Reference: Student Activity 3 Solution | Detect the Goal | https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C68-SAS |
| Student's Additional Activity 1 | Recolor the Bounding Box | https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C68-SAS-BP |

| Teacher Reference: Student's Additional Activity 1 Solution | Recolor the Bounding Box | https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C68-SAS |
|---|---|---|
| Student's Additional Activity 2 | Style the Trajectory | https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C68-SAS-BP |
| Teacher Reference: Student's Additional Activity 2 Solution | Style the Trajectory | https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C68-SAS |
| Post Class Project | Track the Car | https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C68-PCP-BP |
| Teacher Reference: Post Class Project Solution | Track the Car | https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C68-PCP |