

Objectives:

- Learn to use OpenCV
- Learn to capture live video using OpenCV
- Learn to process live video
- Learn to detect features
- Learning to track a known object

Instructions:

- Use OpenCV and a webcam to complete this assignment.
- Combine the result of all five functions of Task 2 into one video.
- Combine all baseball frames into one video
- Submit YouTube links of your videos on Learning Suite.

Task 1: Acquire and Display Live Video

- Install all required packages including OpenCV.
- Download the sample code from Learning Suite and make necessary changes.
- Use the sample code (with simple GUI) or your own code to complete this task.
- Set up your system to capture and display live video in a window and save the video.
- Nothing to be submitted for this task.

Task 2: Real-time Feature Detection 70 points

- Use your code in Task 1 and add five feature detection functions to demonstrate real-time image processing.
- Functions to be implemented include binarization, Canny, corner and line detection, and absolute differencing.
- (10 points) Point the camera to yourself. Display the binarized video (grayscale) as the result of binarization that outputs
$$\text{dst} = 0 \text{ if } \text{src} < \text{low threshold or } \text{src} > \text{high threshold}$$
$$\text{dst} = 255 \text{ otherwise}$$
Use sliders or selected keys to adjust lower and upper thresholds when recording.
- (10 points) Point the camera to yourself. Display Canny edges.
Use sliders or selected keys to set lower and upper thresholds when recording.
- (20 points) Download and print a copy of the chessboard image. Move the chessboard paper in front of the camera. Detect corners using the OpenCV sub-pixel corner detection function. Display corners.
Use sliders or selected keys to adjust parameters when recording.
- (10 points) Move the chessboard paper in front of the camera. Detect lines using the OpenCV line detection function. Display lines.
Use sliders or selected keys to adjust parameters when recording.
- (10 points) Use two image buffers, one for storing the previous frame and one for capturing the current frame. Use an OpenCV absolute difference function to calculate the difference image. Display the difference image.
- (10 points) Use OpenCV findContours function to locate objects in the video and draw a bounding box for each large object.

Task 3: Real-time Tennis Ball Detection 30 points

- Download the baseball image sequence from the assignment on Learning Suite.
- Read one image at a time and process it to locate the baseball. Draw a rectangle or superimposed color to ball area (of the original image) to indicate the location of the baseball.
- This task will be graded based on the accuracy of **finding and showing the center of the ball**.
- Methods to be considered include, but are not limited to, simple thresholding, differencing, and edge detection.
- Generate a short video from the resulting image.