

# ENPM673 Perception for Autonomous Robots (Spring 2024)

## Project 1 (Part-1)

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### Submission guidelines:

- This homework is to be done and submitted individually.
  - Your submission on ELMS/Canvas must be two files:
    - a. Google Colab (.ipynb) file
    - b. Google Colab (.pdf) file (Convert the same .ipynb file to a .pdf file)
  - following the naming convention ***YourDirectoryID\_project1\_part1.pdf***.
  - Submit both the files in one attempt.
  - If your email ID is **abc@umd.edu** or **abc@terpmail.umd.edu**, then your Directory ID is **abc**.
  - Provide detailed explanations for each step using text cells in Google Colab.
  - Ensure the code is well-formatted for readability.
  - Comment on each section (preferably every 2 lines) of the code to explain its purpose and functionality.
  - Include relevant output images within the text cells where required.
  - Include explanations to illustrate the results effectively.
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### Problem 1:

Video Link: [here](#)

In the provided video footage, a black object is thrown against a wall. Your objective is to develop a Python script to detect and plot the pixel coordinates of the center point of this thrown object throughout the video. Follow the steps outlined below:

- 1) Read the video and extract individual frames using OpenCV. [15]
- 2) Loop over each frame to extract the pixels of moving object (Hint: Use color). [20]
- 3) Calculate the centroid of the object in every frame (doesn't have to be very precise). [15]
- 4) Assume TOP LEFT corner of the frame as 0,0 and accordingly use 'Standard Least Square' to fit a curve (parabola) through the found centroids in part 3. [20]
- 5) Given that x axis value is 1000, find the y axis value for calculated equation in part 4. [10]
- 6) Capture any one frame from the video (which shows the object) and plot the obtained equation. [20]

### Important Notes:

- OpenCV library can be utilized ONLY for accessing video frames, displaying frames or videos, and saving frames or the final video.
- Usage of any built-in functions for finding the object or finding the centroid is prohibited and will not be considered as valid submission. (stick to using numpy)
- Graph fitting (step 4) cannot be done with any readily available functions.

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