CSE463 Lab Assignment 3

Deadline: 25th March 11:59PM

Submission instructions:

- Open a folder in Google Drive and name it as- ID_Name_Lab3
    a. For Q1, upload the **pizza image and the sandwich/cake image**.
    b. For Q2, upload **original cat image, transformed cat image, output image** with matched descriptors, and **dog image.**
    c. For Q3, **upload the original and final output image**.
    d. Upload an ipynb file containing all your code. (Mandatory)
    e. Upload a **PDF** consisting of the codes & screenshots of the outputs of each code (Optional)
- Share the link of the folder in the submission form. (Make sure the folder is accessible(**Anyone with the link**)
- Submission Link:

QUESTION 1

Can Harris Find Corners on a Pizza? 🍕

Take an image of a **pizza** (with interesting toppings).

1. **Steps**:
    - Apply the Harris Corner Detection algorithm to the image. (3)
    - Analyze the results:
        - Does it detect corners on the **pepperoni slices**? (1)
        - Are the crust edges identified as corners? (1)
        - How does the algorithm handle the "cheese texture"?(1)
2. **Analysis**:
    - Explain why the algorithm might struggle with circular shapes or irregular toppings. (2)
    - Replace the pizza with a perfectly square sandwich or a triangle-shaped slice of cake. Compare the results—what kind of food makes Harris the happiest? (2)

QUESTION 2

The Case of the Shape-Shifting Cat 🐾🐈‍⬛

Scenario:
A mischievous **shape-shifting cat** has escaped the virtual zoo and is causing chaos on the internet. The cat has been transforming its appearance to evade detection by the zookeepers! Your task is to help track it down using advanced image processing techniques.

Part 1: The Cat's Trickery
The shape-shifting cat loves to transform. To simulate its tricks, perform the following transformations on an image of the cat: (2)

1. **The Shrinking Spell**: Scale the cat image down—now it's small enough to hide under a digital couch!
2. **The Teleportation Act**: Translate the cat image by shifting it horizontally and vertically.
3. **The Twisting Tail Move**: Rotate the image (e.g., by 45° or 90°)—it's trying to confuse its pursuers!
4. **The Sunbeam Glow**: Brighten the image dramatically—it's pretending to be a glowing angel.

Part 2: Deploying SIFT the Cat Tracker
SIFT (Scale-Invariant Feature Transform) is your **digital pet tracker**. Use it to:

1. Extract the **key points and descriptors** from both the original and transformed images of the cat. (2)
2. **Match the key points** between the images to prove they're the same shape-shifting MEOW🐈. (2)
3. Visualize the matches by drawing lines between the corresponding points on the two images. (1)

4. This clever cat doesn't stop at shape-shifting—it's been spotted disguised as a **dog**! Try using SIFT on two completely different images (e.g., a cat and a dog). Does it confuse the two? Write a short note explaining whether SIFT can handle such a devious disguise. (3)

QUESTION 3

Take an image containing a road with lane markings and circular traffic signs. Your task is to detect **lane lines** using the **Hough Line Transform** and detect **traffic signs** using the **Hough Circle Transform**.

Instructions:

1. **Load and preprocess the image (2)**
    - Convert the image to grayscale.
    - Apply Gaussian blur to reduce noise.
    - Use Canny edge detection to find edges.
2. **Detect Lane Lines using Hough Line Transform (3)**
    - Define appropriate values for rho, theta, threshold, min_line_length, and max_line_gap.
    - Use cv2.HoughLinesP() to detect straight lane lines.
    - Draw the detected lane lines on a copy of the original image.
3. **Detect Traffic Signs using Hough Circle Transform (3)**
    - Use cv2.HoughCircles() to detect circular traffic signs.
    - Tune the parameters (dp, minDist, param1, param2, minRadius, maxRadius) for better detection.
    - Draw the detected circles on the same image.
4. **Display the final output (2)**
    - Show the original image with detected **lane lines (in blue)** and **traffic signs (in red circles)**.