CV2 Class02 of Unit01
Notebook Exercises #2

Assigned: 24/03/2023
Due: 10/04/2023

Objective:

- The purpose of the lab is to gain intuition of optical flow algorithms by using OpenCV with human action application.

- The lab is limited in scope and does not require training/testing a classifier.   It only requires that you run the code provided in the notebook and change parameters to observe the output.

- This is a brief exercise; some (or most) of which could possibly be completed with the lab period.   Your descriptions should be concise and not require a lengthy report. The exercise involves testing the code, making observations, and experimenting with minor changes to input parameters or optical flow algorithm choices.

Submission:

- The lab exercise consists of performing the following tasks The percentage of the points assigned to the lab exercise is given for each point.

- The submission should be in the form of a PDF file of your Jupyter Notebook output.

The Exercise

You should complete the following tasks (percent of the total notebook exercise grade is indicated).

1. (10%) **Understanding the code:** Review the code provided and explain each part of the code in your own words. The descriptions should be brief (maximum two sentences) and doesn't have to explain every line; it should be sufficiently succinct to show that you understand the code and what it does.

2. (10%) **Testing with provided datasets:**To further explore the use of human actions, you can either use the videos provided in the dataset or find other videos of human actions. Once you have these new videos, you should re-run the code provided above and analyze the PCA projection results. During the analysis, you should

observe which actions or situations lead to optical flow maps and trajectories that are clearly separated.

3. (20%) **Identifying strengths and weaknesses:** After completing the analysis of the PCA projection results, you should describe the strengths and weaknesses of the optical flow method based on your observations. Consider the following factors: the types of actions performed in the videos, the quality of the videos, the lighting conditions of the videos, and the complexity of the backgrounds in the videos. Describe how each of these factors could affect the algorithm's performance, including how they might impact the accuracy of the motion estimation or the robustness of the algorithm in handling different types of actions or backgrounds.

4. (40%) **Changing/Improving the algorithm:** Propose **ONE** modification to the existing optical flow algorithm code that could potentially improve its performance. This could involve *adjusting the optical flow parameters* or *changing the algorithm itself.* Other potential modifications could include preprocessing the video frames for the templates, such as resizing, denoising, or background subtraction, or using a different method for binarizing the optical flow maps. Be sure to explain why you are making this change and how it could improve the algorithm's performance.

5. (20%) **Observing the improvements (if any):**Once you have implemented your modifications to the optical flow algorithm code, you should test the code that produces the PCA projections and compare the new results with the original ones. You can do this by observing the optical flow frames and/or the resulting separation between LDA/PCA trajectories for each action. After comparing the results, you should briefly comment on the following:
   a. Did the modifications lead to an improvement in representing the movement in the video with the optical flow maps? This assessment will be qualitative.
   b. How did the modifications affect the performance of the LDA/PCA projection and the resulting 3D trajectories? This can be described intuitively or by observation, and should provide insight into how the modifications affected the accuracy or robustness of the algorithm.