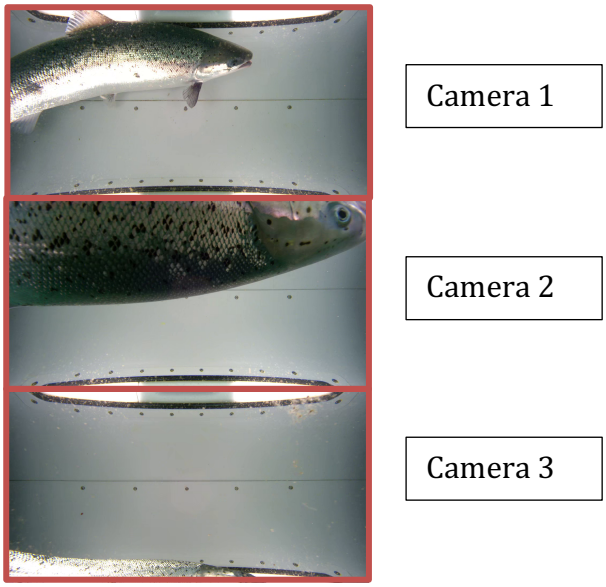
CS 423/523 Introduction to Computer Vision Project

Due Date: 9 January 2023

Fish Action Recognition

Description:

In this assignment, your goal is to count the fish passing within the given videos. Each video's ID and FPS is encoded in its names in the following format "**vid-<ID>-<FPS>.mp4**". Videos contain footage from 3 synchronized different cameras aligned around a circle by 120 degrees, looking at the same space underwater (you will see the same fish from each camera). Each camera has the same size in the picture frame therefore, you can extract each camera from a video by cropping the frames such that it is divided to three equal parts as given below.



Your algorithm should be counting the fish passing in both directions for each camera separately. In another words, you need to **report Camera-1 passes, Camera-2 passes and Camera-3 passes.** You particularly need to find the affine transformations between the key-points of fish in consecutive frames in the video. After you have obtained affine transformations of the whole video, you need to decide the direction of the fish passage for each different fish in the video (e.g. fish entered from: left, fish exited from: right).

Details:

You need the following tools/steps in order to complete this project:

- You need to find corners (key-points) in each frame with a corner detector of your choice.
- You need to describe these corners with a feature descriptor of your choice.
- You need to apply optical flow to the video to pick the corners that belong to the fish instead of the background.
- Match these corners in consecutive frames with an algorithm of your choice.
- Find the affine transformation between the matched corners with a suitable algorithm.
- Analyze the extracted affine transformations and report the direction of the fish passage in the following format per fish:
  1 left=5 right=38 // fish #1 entered from left at 5th frame and exited from right at 38th frame
  2 right=2 left=40 // fish #2 entered from right at 2nd frame and exited from left at 40th frame
  3 right=1 right=20 // fish #3 entered from right at 1st frame and exited from right at 20th frame

Important: **Your report is as valuable as the code you will submit. Your report should include the following :**

- Visualization of found corners before and after the elimination (corners that does not belong to a fish should be eliminated).
- Visualization of matched corners for an example consecutive frame pair.
- Visualization of Optical flow output of 4 example frames for the detected corners.
- Formal explanation (not the code but the algorithm/math) of the algorithms you have picked at each stage.

For CS523 students (bonus for 423 students):

In addition to the above, CS523 students must propose a method and assess its performance fusing the information from all 3 cameras. Therefore, instead of reporting fish passage direction for each camera, you need to report single fish passage for the whole video by combining the information you gather from all three cameras. **You need to finish the above steps first before doing this part.** You need to propose an approach to solve this problem, implement it and assess its performance. In your report you should be discussing the why your proposed algorithm was successful or not. Your grade will depend on your discussion and your reasoning of your proposition.

Grading:

Your Assignment will be disregarded if your code does not work, or a report is not submitted!
Your grade will be penalized 10 out of 100 points for each minor fix before running the code regarding the assignment details.

Submission Information:

Send all your source codes, saved network and Report file to the LMS. Your code should be clean and easy to read by possessing the following properties.

- *Clean structure:* The overall code should be neatly organized, where the related statements are grouped together with enough spacing among them.
- *Appropriate use of comments:* There should be comments explaining what the program, and different groups of statements are supposed to do. Don't overdo it.
- *Meaningful and consistent variable naming:* The names of variables should be meaningful with respect to the purpose and usage of these variables.

Submission: By uploading your code and report to LMS as a single ZIP archive. No other methods (e.g., by e-mail) accepted. (You may resubmit as many times as you want until the deadline).
Warning: DO NOT SHARE YOUR CODE WITH OTHERS. Your solutions are checked and compared against each other using automated tools. Any act of cheating will be punished severely. The code that does not compile will receive 0 points.
Also:

- Name your archive file uploaded exactly as requested. Your archive file must be named as **<NAME>_<SURNAME>_<STUDENTID>.zip.**
- Make sure that your program runs and gives the **expected output.**
- The first lines of your code must include your name, surname, student number, and department as a **comment**. An example comment is as follows:
  / Orhan Veli S0001 Department of Computer Science */*
- **Don't include your image and video files** in your archive

Good luck ☺