INTERNATIONAL UNIVERSITY OF APPLIED SCIENCES

PROJECT REPORT

Task for Course: DLBAIPCV01 – Project: Computer Vision

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1. TASK

You can choose from the following tasks for your project report. Please choose one of them to work on in your project report.

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1.1 Task 1: Monitoring Health Protocols Against COVID-19 in Indoor Public Spaces

Background: The COVID-19 pandemic has changed the modern world, and the way people interact with each other. Many countries have enforced protection measures through lockdowns and other means, such as face masks and social distancing in indoor public spaces, among others.

Task: Develop a computer vision system that can perform the following tasks:

- Detect humans in a monocular video sequence using state of the art (SoA) deep learning human detection algorithms.
- Estimate an approximate distance between people and decide if they are preserving the minimum social distance or not. Since no physical measure is available, derive it approximately from a person's height.
- Detect if people are wearing masks or not given the social distance between them. A face mask detection algorithm should be used in this case. If people are very close to each other but are wearing a mask, then these people meet the protocol introduced in that country.
- Once the previous points have been satisfied, the final output of the computer vision system should determine the person(s) in the video that do not follow the health protocol introduced in their country.

Evaluate each step of the proposed system on different scenarios, starting from video sequences showing a few people and then progressively testing it on more crowded indoor environments. Use datasets publicly available for research and/or you capture an original video sequence of people moving close to each other. Include a link to a video presenting the output of the developed system in the report. You can upload the video on YouTube, OneDrive or any other secure cloud provider. Make the video available only if the link to the video is provided. Any programming language(s), computer vision framework(s) and open-source libraries can be used.

Introductory literature:

Papers with Code (2022).
https://paperswithcode.com/
Opencv (2023). *Open Computer Vision Library*.
https://opencv.org/

1.2 Task 2: Recognizing Objects in Video Sequences

Background: Object recognition is a task that is performed instantly and effortlessly by the human visual system. The eyes take a snapshot of the real world, which is then sent to the visual cortex of the brain through the optic nerve for processing and analysis. This part of the brain is then able to answer questions such as where, what and how an object looks like at a specific point in time. From a computer vision perspective, the eyes of a human are replaced by cameras and the visual cortex from a computer that is able to process the images captured by the camera and answer similar questions using machine learning algorithms. These questions are critical to be answered in modern computer vision applications such as autonomous driving using advanced driving assistance systems (ADAS), object recognition systems that detect abnormal behaviors in public spaces, medical applications etc.

Task: Develop a computer vision system that takes as input a video sequence and returns the same showing the position, shape and name of the objects present in the video. This requires running an object detection and object segmentation algorithm. As there is a lot of research done in this area, there are many recent state of the art (SoA) computer vision algorithms that can be tested and evaluated using publicly available datasets with ground truth information. Evaluate three SoA approaches, with respect to validity, reliability and objectivity on one representative dataset. Also, present a qualitative analysis of the different SoA approaches in the report. Any programming language(s), computer vision framework(s) and open-source libraries can be used. At the end of this evaluation, present the best SoA system in a video sequence. The link to the video should be provided in the report. You can upload the video on YouTube, OneDrive or any other secure cloud provider. Make the video available only if the link to the video is provided.

Introductory literature:

Opencv (2023). *Open Computer Vision Library*.
https://opencv.org/

1.3 Task 3: Vehicle Detection, Tracking and Speed Estimation

Background: Predicting high speed is very important for preventing potential accidents. Approximately 1,3 million people die each year because of road traffic crashes according to the World Health Organization.

Task: Develop a speed tracking system that detects cars on a highway and estimates their speed over time (i.e., km/h or miles/h). If a car exceeds a predefined speed limit, the system should trigger an alert about that car. This could be drawing a red box around the car, for example. There are many algorithms available that can be used for detecting and tracking cars. However, the quality of each of these algorithms in terms of accuracy may vary. A comparison of three state of the art approaches and how their accuracy affects the speed prediction should be addressed in the report. The approach used for deriving the speed of a vehicle should also be addressed in the report. Any programming language(s), computer vision framework(s) and open-source libraries can be used for the development of the speed tracking system. At the end of this evaluation, capture the speed tracking system on a video sequence, the result of which should be provided as a link in the report. You can upload the video on YouTube, OneDrive or any other secure cloud provider. Make the video available only if the link to the video is provided.

Introductory literature:

World Health Organization (2022). *Road Traffic Injuries*.
https://www.who.int/news-room/fact-sheets/detail/road-traffic-injuries.

2. ADDITIONAL INFORMATION FOR THE EVALUATION OF THE PROJECT REPORT

When conceptualizing and writing the project report, the evaluation criteria and explanations given in the writing guidelines should be considered.

3. TUTORIAL SUPPORT

In this project report task, several support channels are open; as the student, it is your responsibility to select your preferred support channel. The tutor is available for technical consultations and for formal and general questions regarding the procedure for processing the project report. However, the tutor is not required to approve outlines or parts of texts and drafts. Independent preparation is part of the examination work and is included in the overall evaluation. However, general editing tips and instructions are given in order to help you get started with the project report.