

Intelligent Signal Processing

End of Term Assignment

Exercise 1

	Total number of cars	Cars per minute
Traffic_Laramie_1.mp4	6	2
Traffic_Laramie_2.mp4	4	2

File Name and Duration:
Traffic_Laramie_1.mp4 2:57
Cars in 1st minute: 2
Cars in 2nd minute: 2
Cars in final minute: 2
Total number of cars: 6

File Name and Duration:
Traffic_Laramie_2.mp4 1:45
Cars in 1st minute: 2
Cars in final minute: 2
Total number of cars: 4

Analysis of Application

Both applications 1.1 and 1.2 utilizes the OpenCV library to analyze two traffic videos ("Traffic_Laramie_1.mp4" and "Traffic_Laramie_2.mp4"). It employs background subtraction, frame differencing, morphology operations, contour detection and my own tracking algorithm class, to identify and track moving cars, within a defined region of interest representing Main Street. Exercise 1.1 tracks all moving cars within Main Street, while Exercise 1.2 utilize the tracking class to uniquely identify each car, allowing us to count when a new car has entered Main Street's frame, that is heading towards the city centre. The tracking algorithm utilizes the mathematical concepts of Euclidean Distance and Centroids to achieve this tracking and counting. The detected and tracked cars are displayed using green rectangles.

Frame differencing and background subtraction

My code utilizes frame differencing and background subtraction techniques for detecting and tracking cars in the given camera recordings. Frame differencing is employed to highlight changes between consecutive frames, emphasizing moving objects and being able to track them. Initially, the video frames are captured and processed in a region of interest representing Main Street. The frames are converted to grayscale and then blurred using GaussianBlur to reduce noise. Subsequently, background subtraction is performed using the createBackgroundSubtractorMOG2 method, which models the background of the scene and identifies foreground objects. The resulting foreground mask highlights moving vehicles and eliminates static background elements. To further enhance object segmentation, morphological operations are applied as well, refining the shapes and providing more stable vehicle coordinates.

Contours are then extracted from the processed foreground, and the code iterates through each contour and identifies cars. A minimum contour area threshold is set to filter out small irrelevant objects like pedestrians and bicycles. Detected vehicles are outlined with bounding boxes, and the centroid of each vehicle is tracked using circles.