# Description

## Frame differencing

Frame differencing is the simplest technique where it can be used to see which parts of the video are moving by checking the difference between successive frames. The moving object is detected by the difference in pixels between frames where the highlighted areas are places that have changes. To prevent inconsistency, the two comparing frames must be both in grayscale when finding the differences. Morphological operations such as thresholding and dilation will help to remove noise so that it can help to reduce the probability of false detection.

## Background subtraction

Background subtraction can also be used to detect moving objects where it will compare the moving parts of the video to a background image and foreground image. The foreground objects are found by isolating them when comparing it to the frame where there are no objects present and find the difference. The moving object is detected if the difference in the value of two frames is greater than the present threshold value which is predefined using the first few frames of the video.

# Analysis of the application

## Task 1

The application detects and tracks cars on the recording when the moving cars is found on the main streets. The application is based on frame differencing and enhanced it with background subtraction. The application will first find the background model by calculating the median of selected frames from the video. Then, it will find the difference between each frame and the background model found earlier, this is also considered as a form of background subtraction. Then, thresholding is used to get a binary image for the resulting frame. To remove the noise, we apply morphological operations like dilation to complete the detection and segmentation of the moving objects. Then we find the contours for each frame and get the minimum x and y coordinates and the width and height for each contour. The rectangular boxes will be drawn on the object detected when the area of the bounding boxes is more than 6000. The application will detect all the moving car found on main street even if the car is in stationary state. However, it will sometimes detect cars that are close to each other as one moving object.

## Task 2

The application counts the number cars that move from city's downtown to the city centre by background subtraction. The background subtraction algorithm used is k-nearest neighbour. The background object will detects the shadow found for the moving object and display it as grey pixels. After the background subtraction algorithm applied to each frame, the foreground mask is extracted. Then dilation and erosion is used to get the object blobs. The application proceeds to convert the frame to a binary frames and identify the moving cars by finding the contours and filter out the non-moving car object. For each moving car, the information is stored with the movingbox function in an array. For each of the bounding  box, the direction of the moving car will be found, and it will be counted when it left the screen from the left. The car per minutes is found by the difference in the time when the first car appear and the last car left the screen.

The table below are data that generated by the application:

| | | Total Number of Cars | Cars per Minute |
|---|---|---|---|
| **0** | Traffic_Laramie_1.mp4 | 6 | 3.47 |
| **1** | Traffic_Laramie_2.mp4 | 4 | 3.85 |