**Vehicle Detection Model using OpenCV and Python**

## **Introduction:**

I love the idea of smart cities. The thought of automated smart energy systems electrical grids one touch access ports it is an enthralling concept honestly it is a dream for a data scientist and I am delighted that a lot of cities around the world are moving towards becoming smarter.

One of the core components of a smart city is automated traffic management. And that got me thinking could I use my data science chops to build a vehicle detection model that could play a part in smart traffic management.

Think about it if you could integrate a vehicle detection system in a traffic light camera you could easily track a number of useful things simultaneously:

* How many vehicles are present at the traffic junction during the day
* What time does the traffic build up?
* What kind of vehicles are traversing the junction heavy vehicles, cars etc.
* Is there a way to optimize the traffic and distribute it through a different street

We can easily detect and recognize objects from complex scenes in a flash. Translating that thought process to a machine however requires us to learn the art of object detection using computer vision algorithms.

## **Essential Concepts you should know about Video Object Detection:**

There are certain key concepts you should know before getting started with building a video detection system. Once you are familiar with these basic concepts you would be able to build your own detection system for any use case of your choice. So how would you like to detect a moving object in a video. Our objective is to capture the coordinates of the moving object and highlight that object in the video.

### **Frame Differencing:**

A video is a set of frames stacked together in the right sequence. When we see an object moving in a video it means that the object is at a different location at every consecutive frame.

If we assume that apart from that object nothing else moved in a pair of consecutive frames then the pixel difference of the first frame from the second frame will highlight the pixels of the moving object. Now we would have the pixels and the coordinates of the moving object. This is broadly how the frame differencing method works.

### **Image Thresholding:**

In this method the pixel values of a grayscale image are assigned one of the two values representing black and white colors based on a threshold. If the value of a pixel is greater than a threshold value it is assigned one value else it is assigned the other value.

### **Finding Contours:**

The contours are used to identify the shape of an area in the image having the same color or intensity. Contours are like boundaries around regions of interest.

### **Image Dilation:**

This is a convolution operation on an image where in a kernel (a matrix) is passed over the entire image.

## **Using OpenCV and Python:**

In our project we will using the [computer vision library OpenCV](https://www.analyticsvidhya.com/blog/2019/03/opencv-functions-computer-vision-python/?utm_source=blog&utm_medium=vehicle-detection-opencv-python) a lot in this implementation and python.

### **Import Libraries:**

1. import os
2. import re
3. import cv2 # opencv library
4. import numpy as np
5. from os.path import isfile, join
6. import matplotlib.pyplot as plt

## **End Note:**

In this project we learned how to use the frame differencing technique to perform moving object detection in videos. We also covered several concepts and topics around object detection and image processing. Then we went on to build our own moving object detection system using OpenCV.

I am sure that using the techniques and methods learned in this article you would build your own version of object detection systems.