**Project Proposal**

**Project Title:**

Robust Driver Assistance System based on Computer Vision

**Description:**

An Advanced Driver Assistance System (ADAS) are systems developed to enhance vehicle safety and assist the driver in avoiding collisions and accidents by providing alerts and warnings when necessary. These systems are further expanded upon in the development of autonomous vehicles. Various features are being offered in modern vehicles such as adaptive cruise control, automotive navigation which is used in applications like self-parking, driver drowsiness detection and collision avoidance systems. Few of these features such as lane detection and departure warning, traffic signs recognition and vehicle detection and proximity warning systems can be developed by applying the concepts of Computer Vision on real-time footage.

**Goal:**

In this project, I plan to develop a driver assistance system using Computer Vision based detection and tracking algorithms. The features that I plan to implement over the next three months are:

1. A robust lane detection and tracking system, which identifies the current lane and tracks it in real-time, despite bumping into challenging scenarios like worn markings or other distracting objects like shadows or other vehicles
2. Traffic signs identification and recognition system

Furthermore, if time permits based on the progress of the project, I plan to develop a vehicle detection system which would inform the driver about their proximity from various vehicles and if they are arriving or departing from their current lane.

**Methodology:**

The methodology that I plan to follow is

1. Identify possible lane markings and develop lane hypotheses based on their calculated confidence
2. Grouping together various lane hypotheses and curve fitting a line through the most probable hypothesis to display the left and right lane boundaries, thus displaying the current lane
3. Similarly, identify possible traffic signs by applying a classifier algorithm on a dataset of images
4. Recognize and display the identified traffic sign as a warning

This will be done by comparing between various detection and tracking algorithms to find the most optimal one based on higher detection rates and lower false-alarm rates on a short video captured from a dashboard camera (dash-cam). I have identified a few datasets of dash-cam videos to be used for training and testing purposes. Links have been provided below

1. <http://ftp.pets.rdg.ac.uk/pub/PETS2001/DATASET5/TESTING/>
2. <http://mi.eng.cam.ac.uk/research/projects/VideoRec/CamVid>
3. <http://gavrila.net/Datasets/Daimler_Pedestrian_Benchmark_D/Daimler_Mono_Ped__Detection_Be/daimler_mono_ped__detection_be.html>

The above-mentioned detection and tracking algorithms will be implemented using OpenCV library functions which are based on C++. The comparison will be done based on higher detection and lower false-alarm rates, which are defined respectively as the number of frames with lane-markings/traffic signs detected per unit time and number of frames with lane-markings/traffic signs detected incorrectly per unit time, on a series of test case scenarios to find the most optimal one.

**References:**

1. X. Miao, S. Li, H. Shen, *On-board lane detection system for intelligent vehicle based on monocular vision*, International Journal on Smart Sensing and Intelligent Systems, vol. 5, no. 4, Dec. 2012

Abstract:

The objective of this research is to develop a monocular vision system that can locate the

positions of the road lane in real time. First, Canny approach is used to obtain edge map from the road image acquired from monocular camera mount on vehicle; Second, a matching process is conducted to normalize the candidates of road line; Third, a searching method is used for reinforce potential road lines while degraded those impossible ones; Forth, a linking condition is used to further enhance the confidence of the potential lane lines, and a K-means cluster algorithm is employed to localize the lane lines; Finally, a on board system is designed for experiment. The proposed system is shown to work well under various conditions on the roadway. Besides, the computation cost is inexpensive and the system's response is almost real-time.

1. Siniša Šegvic, Karla Brkic, Zoran Kalafatic, *Exploiting temporal and spatial constraints in traffic sign detection from a moving vehicle*, Machine Vision and Applications, vol. 25, no. 3, pp 649-655, Apr. 2014

Abstract:

This paper addresses detection, tracking and recognition of traffic signs in video. Previous research has shown that very good detection recalls can be obtained by state-of-the-art detection algorithms. Unfortunately, satisfactory precision and localization accuracy are more difficultly achieved. We follow the intuitive notion that it should be easier to accurately detect an object from an image sequence than from a single image. We propose a novel two-stage technique which achieves improved detection results by applying temporal and spatial constraints to the occurrences of traffic signs in video. The first stage produces well-aligned temporally consistent detection tracks by managing many competing track hypotheses at once. The second stage improves the precision by filtering the detection tracks by a learned discriminative model. The two stages have been evaluated in extensive experiments performed on videos acquired from a moving vehicle. The obtained experimental results clearly confirm the advantages of the proposed technique.