Driver Monitoring System for Outside World Context

Dissertation Research Project - 2nd Semester
Contribution and Results

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1 Contribution of the thesis

This thesis aims to improve the Advanced Driver Assistance Systems (ADAS) for monovision embedded devices.

We are proposing a solution based only on visual input for estimating the distances between our vehicle and the surrounding objects and also a warning system for the driver when the vehicle it's crossing the white continuous lane.

Using for development a Snapdragon processor with a hardware accelerator integrated, our main focus during this thesis will be the trade-off between model complexity/accuracy and inference time. Another frequently encountered problem during researching stage was the lack off support for certain tensor operations to be accelerated on the device.

Those types of problems are regularly experienced when developing Computer Vision system for embedded devices.

Our solution will be based on Deep Learning architectures and Computer Vision methods.

This representing a stacked multi-network approach for various tasks followed by a feature mask interpolation algorithm as a fail-safe mechanism in case of losing detected objects for short intervals of time in dynamic contexts and certain cases.

We'll summarize our ideas in the following lines:

1. A **base network** used for object detection over different classes
2. Three **stacked neural networks** used over the base network for solving various tasks such as:
    - Estimating the distance between our vehicle and the detected objects
    - Detecting the objects in front of the vehicle, invariant to the camera position on the windshield
3. A computer vision interpolation algorithm for predicted bounding boxes used for lane detection

During this thesis, we will also present the encountered problems for each approach used and the thought process for solving those problems quantified in different indicators and evaluation metrics.

2 Results

After presenting the training and optimization process with the respective validation metrics, our final results will be presented in real world environment.

Examples can be seen below in Figures 1 and 2.

Figure 1: Safe Distance Warning - Pedestrians Example

Figure 2: Lane Departure Warning - Example