Master thesis project

Automatic detection of secondary task involvement in driver video data from a large-scale naturalistic driving database

Thesis title

Automatic detection of secondary task involvement in driver video data from a large-scale naturalistic driving database

Contact information:

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Keywords

Automatic video annotation, video feature extraction, secondary task of drivers

Requested experience

- Interest in the field of computer vision
- Intermediate knowledge in computer graphics and image processing
- Previous knowledge of machine learning approaches for feature extraction is advantageous
- Advanced programming skills in an object-oriented language (preferable C++)

Workplace

This is a master thesis work at Chalmers University of Technology, within the group Crash Analysis and Prevention in the Department of Mechanical and Maritime Sciences (Division Vehicle Safety). The workplace will be SAFER in the Lindholmen Science Park on the Lindholmen Campus.

Thesis objectives

- Become acquainted with state-of-the-art in automatic video annotation tools
- Identify safety relevant secondary task engagement in naturalistic driving videos
- Implementation of detection algorithm for chosen secondary tasks
- Testing and evaluating the implemented algorithm

Highlights

- Possibility to work on naturalistic driving data
- Application of machine learning techniques on a real-world problem

Number of students	*Scholarship provided to the student(s)*
1-2	-

Background

In terms of driving safety, driver distraction from attending secondary tasks is a large risk for traffic accidents. However, drivers chose to divert their attention to secondary tasks for several reasons. The development of driver assistance, and automated vehicles specifically, is intensifying this problem. To better understand the secondary task involvement in driving and to evaluate its risk, data is collected in large-scale naturalistic driving studies. The challenge for using this data remains in the high effort for annotation which requires time consuming video examination.

The advancements in feature extraction from image processing show promising results to enable automatic video annotations. There are, for example, approaches to detect posture and gesture of humans by extracting human body skeleton features from images (Jianhao Ding, 2010). Furthermore, the gaze direction of drivers indicates to some extend potential side tasks such as looking at a cell phone. State-of-the-art methods for head and eye tracking can be applied to existing videos to roughly estimate the gaze direction and identify such incidents. Methods of this kind are present in the Dlib C++ library.

Objective

The master thesis is intended to explore the potential of image processing and feature extraction to identify secondary tasks involvement by the driver in video data. There is a large naturalistic driving database existing. Also, interesting new approaches in computer graphics are identified. The main objective is to apply (implement and test) feature extraction algorithms on driver video data to identify secondary task involvement.

Thesis work

The student(s) will work with video data (partly already manually annotated for learning algorithms) and get support in the method choice for feature extraction. Potentially several methods will be explored. The algorithm is to be implemented and tested with the video data in a small sample first. The performance will be evaluated in testing on a larger data sample.

1. Literature review on feature extraction relevant for secondary task involvement while driving.
2. Determine method and secondary task to be explored.
3. Video data retrieval and pre-processing for machine learning algorithm.
4. Implementation of algorithm for learning and recognizing pre-defined features.
5. Training algorithm and testing on small data sample.
6. Evaluation and testing on larger data sample and potentially adaptation of the algorithm for improvements.
7. Write and present thesis report.

References

Jianhao Ding, Y. W. (2010). Extraction of Human Body Skeleton Based on Silhouette Images. *International Workshop on Education Technology and Computer Science.*