

Behavior modeling of Vulnerable Road Users

Internship at TNO, department Integrated Vehicle Safety

Introduction

Although most current Collision warning and avoidance (CW/A) systems and development primarily focus on occupant safety, over 44% of the total road fatalities in the Netherlands in 2009 are vulnerable road users (VRUs) [1]. The performance of CW/A systems can be significantly improved by including predictions of collisions of VRUs by implementing behavior models of different road users. Furthermore, the overall performance of CW/A systems can be further improved by including the behavior of both cars and VRUs. In [2] a mathematical method is presented regarding a CW system that is particularly designed for VRUs. The results showed a probabilistic CW system based on simple probability density functions. In continuation of the work in [2], filtering, sensor fusion and target tracking are added to the preprocessing part [3]. To obtain accurate collision probability estimation relevant and reliable inputs are required for the estimation models. Also, behavior models for different road users are added in [3] that can be used for a VRU CW system. However, these models are currently based on a limited dataset and estimations on physical parameters. Improving these models will lead to a more accurate collision probability and thereby improve CW/A systems.

Your assignment

The assignment is twofold:

1. Improve the current probabilistic model for behavior prediction of cyclists:
 - a. Literature review and study current model.
 - b. Perform a short sensitivity analysis to determine the relevant parameters.
 - c. Write a test plan to determine the missing parameters.
 - d. Perform & organize the required tests.
 - e. Fit a probabilistic model which predicts the behavior of a cyclist as function of all relevant parameters.
2. Develop a probabilistic model for behavior prediction of pedestrians:
 - a. Literature review and model development.
 - b. Perform a short sensitivity analysis to determine the relevant parameters.
 - c. Write a test plan to determine the missing parameters.
 - d. Perform & organize the required tests.
 - e. Fit a probabilistic model which predicts the behavior of a pedestrian as function of all relevant parameters.

References

- [1] Statistics Netherlands (CBS), *Opnieuw dalend aantal verkeersdoden*, www.cbs.nl, April 2010 (in Dutch).
[2] T.H.A. van den Broek, J. Ploeg. *Collision Warning System based on Probability Density Functions*, WIT 2010 - 7th International Workshop on Intelligent Transportation, pp. 141-148, 2010.
[3] E. van Nunen, T. van den Broek, M. Kwakkernaat, D. Kotiadis, *Implementation of Probabilistic Risk Estimation for VRU Safety*, WIT 2011 – 8th International Workshop on Intelligent Transportation, pp. 149-155

Contact

Arend Schwab, 06 2852 7539

a.i.schwab@tudelft.nl

<http://bicycle.tudelft.nl/schwab/>

Ellen van Nunen

Phone: 088 86 65807

Email: ellen.vannunen@tno.nl

Hanno Schouten

Phone: 088 86 65792

Email: hanno.schouten@tno.nl

