Vehicle Lane-Change Prediction in Highways for Safety Assessment
MSc. Project Proposal at the Autonomous Multi-Robots Lab, Cognitive Robotics, TU Delft

Brief description: Future transport and mobility will be disrupted by innovations in Connected Automated Vehicles (CAVs), in which safety will be of the highest priority. In general, safety can be defined as the absence of unreasonable risk. Traditionally, traffic safety studies for car-car interactions relied on the records of reported vehicle crashes. Such studies have been effective to identify the factors influencing traffic safety and to draw realistic conclusions on the effectiveness of automotive applications such as Automated Emergency Braking and Forward Collision Warning. However, the dependency on crash records is a major limitation of this approach, as crashes are rare events and the records may not contain all information required for analysis [1, 2]. Furthermore, in dynamic uncertain environments, the safety assessment may be heavily influenced by surrounding vehicles, as well as environments. To address the vehicles interaction issue, this project aims to develop a deep neural network approach for vehicle lane-change prediction, better representing vehicle interactions in highways. Two connected projects are available:

A) Future safety-critical scenarios will be designed and analysed in a highly automated and mixed traffic environment in a traffic simulation platform. Based on these scenarios, new safety technologies for active systems will be developed, enhancing the interaction between vehicles.

B) Vehicle trajectory prediction [3]. The proposed approach may also apply to the vehicle trajectory prediction in different scenarios. In this project good knowledge of Python is desirable.

You will validate your approach with real-world vehicle trajectories data.

Desired qualities:
- Motivated and independent
- Good problem-solving skills
- Experience/interest in transport engineering
- Experience in Python programming

For further questions or to apply, please contact Dr. X. Wang <x.w.wang@tudelft.nl> or Prof. J. Alonso-Mora <j.alonsomora@tudelft.nl>. When applying, please provide a short motivation, up to date CV, a transcript of your current degree program and intended start date.

Group information: http://www.autonomousrobots.nl/

References:
[1] Mullakkal-Babu, Freddy A., et al. "Probabilistic field approach for motorway driving risk assessment." *Transportation Research Part C: Emerging Technologies* 118 (2020): 102716.
[2] Mullakkal-Babu, Freddy Antony, et al. "Comparative Safety Assessment of Automated Driving Strategies at Highway Merges in Mixed Traffic." *IEEE Transactions on Intelligent Transportation Systems* (2020).
[3] Zhu, Hai, et al. "Learning Interaction-Aware Trajectory Predictions for Decentralized Multi-Robot Motion Planning in Dynamic Environments." *arXiv preprint arXiv*:2102.05382 (2021).