**Project CS 686 – Proposal**

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Autonomous driving, in the past labeled as utopian and component of many films, seems to become more and more realistic. Not only the big car companies like Tesla, GM or Daimler do a lot of research in this area but also companies new to the industry like Google and Uber launched their own project to develop a self-driving car and both make enormous progress reaching this goal. For instance, the Google Car drove more than 1.5 million km on roads in the autonomous mode. But even if the Autopilot of Tesla create the impression that vehicles can drive autonomously, there is always a safety driver sitting in the car and supervises the reaction of the car. Making the safety driver redundant is the next step that needs to be done. But to ensure that the vehicle will always acts optimal and safe is a very difficult goal to reach.

The system architecture of a self-driving car is very complex and in general several processes are executed simultaneously to obtain a steering wheel angle and brake or accelerator commands. In one of the first steps sensors perceive the environment and information are fused to achieve a higher accuracy. Additionally, several techniques are applied to localize the vehicle in its surrounding. Once the perception is done, it is important to generate a desired trajectory, which keeps the vehicle on the driving lane and avoids obstacles. Afterwards, the deviation of the current position from the desired position is used as inputs for the controller which calculates a steering wheel angle as an output. How the steering wheel angle is obtained for a self-driving car is the problem this project will analyze. Path generation and trajectory tracking are widely discussed topics and the research and a detailed view on this topic would exceed the scope of this project. However, some approaches will be introduced to illustrate the difference between the typical procedures, which consist of these two steps, and new approaches which use neural networks to gain the steering angle from the pictures of the camera. This is called end-to-end learning and videos that show the environment while a human is driving the vehicle are used to train the network. The main goal is to introduce some approaches for path planning, trajectory tracking and end-to-end learning, compare the two-step method with the end-to-end method and discuss both advantages and disadvantages of each approach.

The following papers will be used to analyze this problem:

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| Bojarski | Explaining How a Deep Neural Network Trained with End-to-End Learning Steers a Car |
| Ziegler | Trajectory Planning for BERTHA a Local, Continuous Method |
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