

Title: Review and establishing the boundaries of map-based localization in autonomous driving

Level: Master

Keywords:

Map-based localization, particle filter, autonomous driving

Supervisor: Naveed Muhammad, **Co-supervisor:** Yar Muhammad

Skills required:

Programming and mathematical skills

Description: Autonomous vehicles, like other robots, need to localize themselves in order to navigate. While satellite navigation systems such as GPS can provide such vehicles with localization information, the GPS information might not always be available. One robust technique for vehicles to localize is using particle filter, given a map of the environment.

This thesis project consists of a thorough literature review of map-based localization techniques that have been used in autonomous driving. Despite their robustness, such methods have their own limitations. After a thorough literature review, you will establish what are limitations and challenges exist in such methods in terms of richness of available maps and the exteroceptive sensing capability of vehicles etc. For this purpose, you will employ the literature research as well as real-world datasets.

Some relevant literature:

[1] J. Levinson and S. Thrun, "Robust vehicle localization in urban environments using probabilistic maps," 2010 IEEE International Conference on Robotics and Automation, Anchorage, AK, 2010, pp. 4372-4378, doi: 10.1109/ROBOT.2010.5509700.

[2] Jesse Levinson, Michael Montemerlo, Sebastian Thrun, "Map-Based Precision Vehicle Localization in Urban Environments", Proceedings of Robotics: Science and Systems, 2007.

[3] Philipp Ruchti, Bastian Steder, Michael Ruhnke, Wolfram Burgard, "Localization on OpenStreetMap Data using a 3D Laser Scanner", Proceedings of International Conference on Robotics and Automation (ICRA), 2015.