

## Machine Learning for Urban Dynamics Prediction

### Research questions

In recent years, autonomous driving has drawn the great interest of researchers and applications. In our research group of Mobile Robotics, we investigate the problems of autonomous vehicle navigation in complex urban environments. In this context, situation understanding is a prerequisite requirement to perform safe and legible trajectories. While navigating in crowds, an autonomous vehicle needs to track and predict the trajectories of surrounding traffic agents. This process is crucial for quick decision-making. However, urban dynamics modeling and prediction are challenging problems since urban scenarios are usually dense and highly dynamic. This work will contribute towards solving these problems by adopting novel methods in Machine Learning.

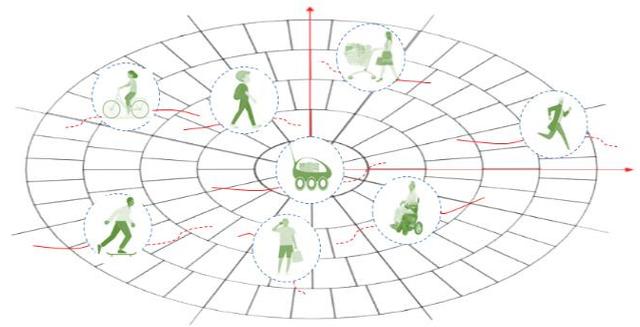


Image: Autonomous vehicle in urban dynamic environment

### Research Methodology

Firstly, a literature review of learning methods for multi-agent multi-step process modeling and prediction is conducted. Next, a study case design for urban dynamic environment modeling and prediction is formulated. Then, practical work will be carried out to implement some of those state-of-the-art methods. Based on this knowledge and experience, a new learning method will be developed for the specific study case by adopting novel algorithms in machine learning for improvement of prediction accuracy, training time, parallel computation, and transfer learning. Model training and evaluation will be carried out on a powerful computer, while the final pre-trained model will be then tested on low-cost hardware for real-time autonomous robot running.

### Objectives and expected Results

This work aims is to develop a new model for trajectory prediction, which can be applied for real-time autonomous navigation in urban environments. The scope of the work can be adjusted following the individual interests and type of work.

### Requirements

- Previous programming experience in at least one programming language
- High motivation in Machine Learning and Autonomous Driving
- Very good English skills
- Independent and proactive working attitude
- Optional: experience in Python, Pytorch/Tensorflow

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### Type of work:

Project Work / Bachelor Thesis, Master Thesis