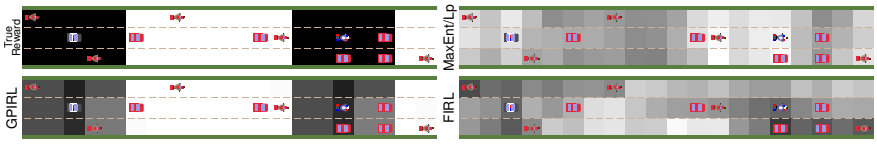
Karlsruhe Institute of Technology

Master Thesis / Bachelor Thesis

Maximum Entropy Inverse Reinforcement Learning for Lane Changes on Highways

In this thesis, inverse reinforcement learning (IRL) should be used to investigate which criteria are relevant for lane changing behavior on highways. IRL tries to infer the reward function that an expert optimizes from demonstrations. Therefore, trajectories are to be generated using a simulation environment. IRL is then used to learn the underlying reward function from these trajectories.



Reward functions of different IRL algorithms [3]

In general, there are infinitely many reward functions that can explain the given demonstrations. This thesis focuses on maximum entropy methods [1] to solve this underdetermined problem. In these approaches the reward function can be represented as a linear combination of predefined features [2] or as a Gaussian process [3]. The parameters are then optimized to explain the demonstrations without making additional assumptions on their distribution.
Existing approaches from the literature should be assessed and applied to the given scenario.

This sounds exciting? Then apply to us! Methods and scope of the thesis can be adapted to your interests and previous knowledge. The proposed thesis consists of the following parts:

+ Literature research about inverse reinforcement learning
+ Generation of expert trajectories is a simulation environment
+ Implementation of maximum entropy inverse reinforcement learning algorithms
+ Evaluation of the implemented methods

I am happy to answer any questions you might have. Feel free to ask for an appointment or directly ask at my office!

References

[1] Ziebart et al., “Maximum Entropy Inverse Reinforcement Learning”, 2008
[2] Boularias, Kober, and Peters, “Relative Entropy Inverse Reinforcement Learning”, 2011
[3] Levine, Popovic, and Koltun, “Nonlinear Inverse Reinforcement Learning with Gaussian Processes”, 2011

Institute of Measurement and Control Systems (MRT)
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Betreuer:
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Programming language(s)[1]:
Python advanced

System, Framework(s):
Linux

Required skills:
- Solid mathematical foundations
- Work on your own

Language(s):
German, English

For more information please contact:

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Or directly send in your application including your current grades as well as our questionnaire!

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[1] **skill levels:**

beginner	< 500 lines of code (LOC)
advanced	500 – 5000 LOC
proficient	> 5000 LOC