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B A C H E L O R T H E S I S

for

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Feature Selection from Sensor Time Series for Learning from Demonstration

Problem description:

Learning from Demonstration (LfD) is an approach that allows to intuitively transfer task knowledge from humans to robots by demonstrating the task at hand e.g. via teleoperation or kinesthetic teaching. The gathered sensor data during a task demonstration can be described by a large set of generic features, such as measured forces acting on the end effector or minimal distances of the robot towards objects or important landmarks. Feature selection (FS) is the process of determining a minimal subset of task relevant features by eliminating redundant or uninformative features from the initial set. Since the search space of many ML setups, like Reinforcement Learning, scales exponentially with the number of features, FS is highly important to achieve sufficient performance in real world robotic tasks that involve a high dimensional state-action and feature space. FS approaches can be divided into filter [1, 2] and wrapper methods [3], which are employed in a separate step prior to the actual learning algorithm or integrated into a learning algorithm, respectively. The focus of the thesis project is set on FS from unlabeled sensor time series, where the following tasks are to be conducted:

Tasks:

- Literature research on feature selection with focus on time series data
- Implementation of at least two different algorithms for FS from unlabeled sensor time series, employing e.g. the approaches of [1], [2] or [3]
- Evaluation of the performance of the implemented approaches regarding elimination of redundant and irrelevant features

Bibliography:

- [1] Davide Bacciu. Unsupervised feature selection for sensor time-series in pervasive computing applications. *Neural Computing and Applications*, 27(5):1077–1091, 2016.
- [2] Fabrizio Bonacina, Eric Stefan Miele, and Alessandro Corsini. Time series clustering: A complex network-based approach for feature selection in multi-sensor data. *Modelling*, 1(1):1–21, 2020.
- [3] Ruohao Xu, Mengmeng Li, Zhongliang Yang, Lifang Yang, Kangjia Qiao, and Zhigang Shang. Dynamic feature selection algorithm based on q-learning mechanism. *Applied Intelligence*, pages 1–12, 2021.

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