TU Clausthal

Abschlussvortrag Masterarbeit Merlin Korth

„Generalizability of Deep Reinforcement Learning of Dispatching Tasks in Job-shop Manufacturing“

Strengthening the generalization capability of reinforcement learning agents has the potential to narrow the gap between simulation and reality. In doing so, the reinforcement learning agent learns to abstract about the choice of actions in certain states of the training environment to take the best possible action from a possibly unknown but to some extent similar action space in a different but similar state of the test environment. While reviewing related work on generalization in reinforcement learning, it can be found that generalization of reinforcement learning-based approaches has not been much investigated in the context of dispatching tasks in job-shop manufacturing systems compared to, e.g. control tasks and gaming. Approaches considered in similar domains often include domain randomization as a key concept to achieve generalizability. In the field of natural language processing, transformers have shown that they are able to generalize to the input of the communication partner and provide similar answers to a wide range of similar questions.
In this thesis, a transformer-based approach called Gated Transformer-XL, is investigated to enable the generalizability of dispatching tasks in job-shop manufacturing. Furthermore, three different reinforcement learning-based approaches (DQN, PPO, RecPPO) trained with domain randomization are compared to determine the ability to generalize dispatching tasks in job-shop manufacturing. The results show that although the transformer-based approach is able to achieve the smallest generalization gap, however, further investigations of the learning behavior, to enhance the overall performance and to further narrow the generalization gap are needed.

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