At the Chair of Logistics and Supply Chain Management of TUM School of Management, we are looking for an interested and qualified student to conduct his/her

Project Study

on the topic

Tackling the ASML Production-Inventory Challenge using Deep Reinforcement Learning

ASML is the world's largest supplier of lithography machines for the semiconductor industry. The recently published ASML Production-Inventory Challenge provides an opportunity to develop state-of-the-art policies for a realistic supply chain problem in the industry. While the problem considered in this research challenge is not directly derived from ASML's operational setting, it captures the fundamental challenges inherent to planning challenges in high-tech low-volume manufacturing. The developed methodologies and insights, therefore, are expected to enhance practical planning processes at ASML.

The features that make this problem particularly challenging compared to stylized problems in literature are the following: Demand is highly uncertain and non-stationary, often influenced by business cycles, while extensive production lead times necessitate planning based on long-term forecasts. At the same time, tight production capacity constraints across multi-tier supplier networks add to the complexity of decision-making. Given the extreme cost of products and resources in this high-tech industry, even slight inefficiencies in inventory planning can have significant financial consequences, reinforcing the need for efficient solution methodologies.

The aim of this thesis is to develop a Deep Reinforcement Learning (DRL) approach to learn competitive policies for the ASML production-inventory challenge. DRL has proven to be able to deal with inventory problems that are too complex for simple heuristic approaches. Thus, it is a promising method to tackle the ASML research challenge.

Key project tasks:

- Analyze the problem structure and understand the provided simulation
- Develop a DRL-based approach to the production-inventory challenge
- Evaluate the algorithm under a wide range of environmental conditions

Requirements:

This thesis is suitable for master's students in Management and Technology. The ability to work independently, as well as analytical skills, are required. Profound programming skills in Python and good knowledge of reinforcement learning are required. Knowledge of inventory management is beneficial but not required.

Earliest begin: March 2025

Supervisor: Patrick Helm

Application: Email with curriculum vitae and transcript of records to logtheses.log@mgt.tum.de