

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

Interdisciplinary Project

on the topic

Learning Multi-Product Inventory Policies Using Direct Backpropagation.

Inventory policies involving, for example, a reorder-point, base-stock level, and can-order point have been studied in the literature for over 70 years. Although only optimal in special cases, these simple policies often provide astonishingly good performance on complex problems. Furthermore, these policies are very transparent and easy to interpret, which is highly relevant to industrial applications.

Determining optimal parameters of these simple policies is however challenging because the search space grows exponentially in the number of products in the system. For simple systems, the gradients of the cost function with respect to the inventory parameters can be derived analytically. However, in more complex systems, this is not possible anymore. Recent developments in software and algorithm design have lifted this constraint, making gradient-based optimization feasible for complex problems on a large scale.

The goal of this IDP is to utilize direct backpropagation to learn simple inventory policies for complex problems on a large scale. This provides significant value to companies who face involved inventory problems while preferring to rely on interpretable and transparent replenishment policies.

Key project tasks:

- Implementation of a differentiable multi-product environment in PyTorch
- Implementation of a multi-product inventory policy in PyTorch
- Algorithm tuning to achieve stable convergence
- Analysis of results and derivation of implications

Requirements:

The project is suitable for master's students in Informatics who require an IDP for their studies. The ability to work independently, as well as analytical skills, are required. Profound programming skills in Python and good knowledge of deep learning are required. Knowledge of inventory management is beneficial, but not required. The relevant course to this IDP is "Inventory Management".

Earliest begin: May 2024

Supervisor: Patrick Helm

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