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

Master thesis

on the topic:

Large Scale Machine Learning Systems for Maritime Logistics

One topic that is underexplored in the Maritime Shipping domain is the topic of ship refueling, also known as Bunkering. Bunkering purchasing problems typically involve big data, (i.e. 500 vessels, 40,0000 port of calls, governed by 750 contracts [1]). Bunkering presents a stochastic optimization problem, where a shipping liner must decide where to re-fuel the ship on a designated route in between each intermediate port-of-call. Fuel prices can be governed by various stochastic progress. Each Liner is constrained by predetermined schedules and must ensure that enough there is enough fuel to travel in between each intermediate port of call. The Liner can choose the port selection, the refuel amount, and the speed of the ship, which affects fuel consumption. The decision process for these types of problems is typically solved using large scale stochastic programming [3] or mixed integer programming [2].

We would like to continue on the previous work on Bunkering optimization, by introducing competitive multi-agent optimization, introducing stochasticity into the system (i.e., weather conditions, mechanical failures, etc.). And most importantly introducing the novel application of Monte Carlo Tree Search for any well-defined large scale MDP in the Bunkering problem domain, to examine whether applications of such technology will have an impact on producing more robust solutions for prescriptive online bunkering decisions in Maritime Logistics.

Key project tasks:
- Literature review on relevant fields of study
- Implementation of machine learning models in Python or Kotlin (JVM) - The recommended software package is mctreesearch4j [4].
- Systematic comparison of selected model performances.
- Analysis of results and implications.

Requirements:

The thesis is for students of the Master in Management and Technology with a focus on Operations and Supply Chain Management. Experience with Python, Java, Kotlin, and/or Gurobi is a plus. The thesis should be written in English.

Begin: as soon as possible

Advisor: Larkin Liu

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