Prof. Dr. Alena Otto
Lehrstuhl für BWL: Management Science/Operations and Supply Chain Management
Universität Passau

GPOM – Friday, June 25th, 2021

Schedule

	Stream A: Health Care & Routing (Main Room)				Stream B: Production, Retail & Service Management (Breakout Room 2)			
Time		**Speaker** Supervisor	**Title**	**Session Chair**		**Speaker** Supervisor	**Title**	**Session Chair**
08:30-08:45	Check-in of participants							
08:45-09:00	**Welcome – short introduction of chairs and participants**							
09:00-09:45	L	**Philipp Reinhard** Ulrich Küsters	Identifikation der Corona-Netto-Effekte der ersten Welle in Bayern	Jens O. Brunner	L	**Kai Jungel** Maximilian Schiffer	Structured-Learning Based Online Optimization for Autonomous Mobility-on-Demand Systems	Maximilian Schiffer
09:45-10:30	L	**Steffen Heider** Jens O. Brunner	Allocation Scheduling with Resource Synchronization and Uncertain Surgery Durations: A Two-Stage Stochastic Programming Approach		L	**Dai Trong Pham** Gudrun Kiesmüller	Joint Planning of Repair Kit and Technician Transportation	
10:30-10:35	**Q&A time breakout rooms**							
10:35-10:45	Coffee break							
10:45-11:15	S	**Christian Jost** Rainer Kolisch	Routing-Aware Contractor to Customer Matching	Heinrich Kuhn	S	**Lena Riesenegger** Alexander Hübner	Retail Replenishment, Assortment and Shelf Space Model for Perishable Products Considering Customer Substitution and Space-Elasticity	Alena Otto
11:15-11:45	S	**Markus Frank** Heinrich Kuhn	Vehicle Routing in Slow Logistics Parcel Delivery		S	**Baturhan Bayraktar** Rainer Kolisch	Dynamic Flexible Mixed-Model Assembly Layouts	
11:45-12:30	L	**Mansour Zarrin** Jens O. Brunner	Homogeneity and Best Practice Analyses in Hospital Performance Management: An Analytical Framework		L	**Christina Liepold** Maximilian Schiffer	Modeling Partial Production Capacity Sharing in Production as a Service Settings	
12:30-12:40	**Q&A time breakout rooms**							
12:40-12:45	**Closing**							
12:45-13:00	Professors meeting		Participants networking in breakout rooms					

Abstracts

Short presentations

Routing-Aware Contractor to Customer Matching

Christian Jost
Lehrstuhl für Operations Management,
TU München

Supervisor: Rainer Kolisch

Abstract: In today's service industries, many companies outsource a significant amount of on-site work at customer locations (e.g. maintenance or product consulting) to self-employed agents. In this setting, the company pays the agent for each served customer and reimburses travel costs. While the company may assign customers to dedicated agents, she is by law not allowed to interfere with the agent's operative decision when to visit the customers and in which order. Accordingly, it is the company's goal to provide an agent to customer allocation that induces efficient operations on the agent's side. Here, the question remains whether such an allocation is achievable with a myopic assignment or if the allocation should consider the agent's underlying routing problem. Against this background, we study a multi-period vehicle routing problem that anticipates the agent's routing decision and determines an optimal customer to agent assignment. We apply our methodology to a real-world instance with 20,000 customers and 600 agents.

Retail Replenishment, Assortment and Shelf Space Model for Perishable Products Considering Customer Substitution and Space-Elasticity

Lena Riesenegger
Lehrstuhl für Supply and Value Chain Management,
TU München

Supervisor: Alexander Hübner

Abstract: Assortment decisions and the definition of an efficient replenishment policy are essential for retailers to maximize their profits, and at the same time, to prevent food waste. Assortment and replenishment decisions are interrelated and further restricted by limited shelf space. A simultaneous planning approach is needed to ensure effective solutions enabling both maximum profits and minimum waste. We address this problem and formulate the Capacitated Replenishment, Assortment and Shelf Space Problem (CRASP) for an integrated planning. By considering customer substitution as well as age-dependent and space-elastic demand, we aim to reduce the amount of food waste produced, while maximizing expected profits. We solve the CRASP using a tailored heuristic that simultaneously determines order-up-to levels, assortment decisions and assigned shelf space for multiple products. Our approach is the first in the field to jointly account for multiple

perishable products, two-sided substitution, space-elasticity, limited shelf space and age-dependent demand.

Vehicle Routing in Slow Logistics Parcel Delivery

Markus Frank
Lehrstuhl für Supply Chain Management & Operations,
KU Ingolstadt

Supervisor: Heinrich Kuhn

Abstract: Slow Logistics aims to increase cost- and eco-efficiency by exploiting the time potential available in the supply chain. The concept can also be transferred to last-mile parcel delivery if the parcel-specific information of the latest possible delivery date is known and could yield more efficient tours and more balanced capacities. This results in a multi-periodic vehicle routing problem in which the optimal delivery date of each parcel has to be determined, taking into account routing, inventory and waiting costs and the available capacities in transportation and in the distribution center.

Dynamic Flexible Mixed-Model Assembly Layouts

Osman Baturhan Bayraktar
Lehrstuhl für Operations Management,
TU München

Supervisor: Rainer Kolisch

Abstract: Due to increasing customization, volatility and change in demand (e.g., through the trend towards e-vehicles), traditional assembly lines become less efficient. Assembly systems with flexible layouts, in which products are moved between the necessary work stations by automated guided vehicles (AGVs) are considered as alternative. In this work, we investigate the impact of changing demand on the configuration of the flexible assembly layouts. Three decisions are made in each period: the stations to be opened, the assignment of the tasks to opened stations, and the number of products following the predetermined AGV routes considering required tasks and precedence relationships. We consider the objectives minimizing the number of opened stations, number of task-station assignment changes and total flow time. We develop a mixed-integer linear programming model for this problem and test the model with 72 instances adapted from literature.

Identifying Covid-19 Lockdown Net Effects on the Demand of Grocery Store Sales

Philipp Reinhard
Lehrstuhl für Statistik und Quantitative Methoden der Wirtschaftswissenschaften,
KU Ingolstadt

Supervisor: Ulrich Küsters

Abstract: With the outbreak of the Covid-19 pandemic, a significant change in consumer behavior can be observed. This study analyses the changes in demand for 4,000 time series from a grocery store chain with over 300 stores. We focus on the period from 1 February 2020 to 31 April 2020, which includes the beginning of the pandemic and the first lockdown in Bavaria. Daily demand series strongly contaminated with special day effects were used to identify the net change of consumer behavior due to Covid. These non-equidistant time series were available for Bavaria, districts and stores across different product groups. Store and district-specific series were available for two Covid free years only. To identify the Covid net effects, we applied a sequential procedure. First, we identified trend, seasonal cycles, public holidays, special days, and weekday effects using longer series over ten years which were available only as aggregates for Bavaria. Second, we embed these effects partially into the store specific time series truncated to the Covid free period up to 31 January 2020. Third, the cumulated Covid free period effects were used to identify the net effects within the lockdown period. This yields a separation of regular effects from first panic shopping effects. Our method allows the assessment of the district and product group-specific changes in consumer behavior due to Covid-19 effects and lockdown measures.

Structured-Learning Based Online Optimization for Autonomous Mobility-on-Demand Systems

Kai Jungel
Lehrstuhl für Operations and Supply Chain Management,
TU München

Supervisor: Maximilian Schiffer

Abstract: Growing urbanization and climate change shape the challenges for future mobility systems, such as reducing congestion in urban areas and minimizing transportation-related pollution. Recently, autonomous mobility-on-demand (AMoD) systems have been vividly discussed as a promising concept to tackle these challenges. An AMoD system is a centrally-controlled fleet of self-driving vehicles that serves on-demand trip requests. Managing such a fleet requires assigning self-driving vehicles to trip requests. Against this background, we study an optimization approach for online real-time large-scale vehicle-to-request assignment problems that allow for efficient operation of an AMoD fleet by optimized dispatching decisions. Until now, such vehicle to request assignment processes only consider

online information and treat rebalancing of idle vehicles as a standalone optimization problem. In contrast, we incorporate the idea of rebalancing idle vehicles into the optimal assignment approach. We first show how to derive an optimal offline solution in polynomial time by constructing a problem-specific graph representation that allows us to derive a solution in polynomial time by solving a k-disjoint shortest path problem. We then use this algorithm to train a structured learning model that allows predicting the weights on the respective graph for a rolling horizon online solution approach. This allows us to devise an online algorithm that optimizes the vehicle-to-request assignment by anticipating future requests and their contribution to the overall objective. Finally, we test our approach on a real-world scenario of the New York Taxi data set and show that our approach outperforms existing state-of-the-art Bayesian sampling approaches by the number of satisfied customers and realized profit.

Allocation Scheduling with Resource Synchronization and Uncertain Surgery Durations: A Two-Stage Stochastic Programming Approach

Steffen Heider
Lehrstuhl für Health Care Operations / Health Information Management,
U Augsburg

Supervisor: Jens O. Brunner

Abstract: Scheduling surgeries in a hospital is a challenging task for operating theater managers and surgeons. Many resources, e.g., rooms, surgeons, nurses, anesthetists as well as machines need to be scheduled simultaneously and need to be available at defined times of each surgery. Uncertain time of surgical sub procedures only increases the complexity. In practice, this problem is usually split in smaller subproblems where specialties are assigned to rooms and necessary resources are attached to a room, allowing specialties to schedule and sequence their surgeries independently. We present a two-stage stochastic programming model using a Benders decomposition approach to minimize idle time, overtime, and cancelled surgeries. We determine the surgery sequence and starting time for each resource including breaks and resource dependent available times, allowing for an individual patient sequence for each resource. We show that we can solve small and medium size instances to optimality.

Joint Planning of Repair Kit and Technician Transportation

Dai T. Pham
Lehrstuhl für Operations Management,
TU München

Supervisor: Gudrun P. Kiesmüller

Abstract: Motivated by the problem facing many home-attended maintenance service providers, this paper considers the joint optimization problem of spare parts planning and scheduling a single technician with stochastic requests and spare part demands. While most of the existing literature focuses on either spare parts restocking or route planning, the real-world planning task often requires simultaneous consideration of both problem aspects. We

present mathematical formulations for the joint optimization problem under both single-period and multi-period settings. We also propose a solution approach for the multi-periods rolling-horizon setting using heuristic search and simulated look-ahead procedure. To evaluate the performance of the proposed method, we conduct a series of numerical experiments and compare the results with a myopic approach, which utilized no stochastic information in the planning process. Results demonstrate the effectiveness of farsighted planning using the look-ahead procedure. The proposed method is also flexible and can be further extended to other problem settings with additional attributes.

Homogeneity and Best Practice Analyses in Hospital Performance Management: An Analytical Framework

Mansour Zarrin
Lehrstuhl für Health Care Operations / Health Information Management,
U Augsburg

Supervisor: Jens O. Brunner

Abstract: In the traditional DEA framework, it is assumed that the hospitals are functionally similar and therefore homogenous. Consequently, any identified inefficiency of hospitals is supposedly due to their inefficient usage of inputs in producing the outputs. However, the difference in efficiency scores might be caused by the non-homogeneity of hospitals that can be defined in two forms: semantic non-homogeneity and scale non-homogeneity. Another issue of the traditional DEA framework is its lack of predictive capabilities, despite it being frequently used as a benchmarking tool. This study aims to develop and evaluate a framework for analyzing hospital performance by combining two complementary modeling techniques. Specifically, we employ artificial neural networks to perform heterogeneity and best practice analyses on a large dataset containing more than 1,200 hospitals in Germany. The framework enables a decision-maker not only to predict the best performance but also to explore whether the differences in relative efficiency scores are ascribable to the heterogeneity of inputs and outputs.

Modeling Partial Production Capacity Sharing in Production as a Service Settings

Christina Liepold
Lehrstuhl für Operations and Supply Chain Management,
TU München

Supervisor: Maximilian Schiffer

Abstract: The Industry 4.0 paradigm encompasses the notion of production as a service (PaaS), which revolutionized production by transforming the process of resource utilization into a shared on-demand service. PaaS establishes resource control and collaboration through cloud computing and service-oriented technologies; its approach is to establish intermediaries to coordinate supply and demand of idle production capacities via horizontal

collaboration. Particularly smaller enterprises profit from PaaS as it enables them to actively participate in the procurement process without depending on established long-term supplier contracts. Currently, practical implementations of PaaS combine multiple steps to connect buyers and suppliers through a platform; each demand request is treated individually, and, afterward, the pool of suppliers is contacted by the intermediary. Against this background, we provide a novel approach of optimization-based PaaS modeling: a combinatorial exchange model for shared idle production capacities among multiple buyers and sellers. This partial production capacity sharing approach adapts the winner determination problem from procurement auction settings. We use this first model for partial production capacity sharing to analyze all parties' payoffs, the influence of market size, and the supplier-buyer ratio.