המחלקה להנדסת תעשייה
הפקולטה להנדסה ע"ש איבי ואלדר פליישמן
אוניברסיטת תל אביב

יום עיון מחקרי

2025

חוברת תקצירים ומידע

תוכן עניינים ◄ ◄ ◄ ◄

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הפקולטה להנדסה ע"ש איבי ואלדר פליישמן
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תוכנית יום עיון 2025

9:00-9:10 – התכנסות ודברי פתיחה	
מושב א׳ **9:10-10:00**	**אילן אסטרוגו -** בהנחיית פרופ' טל רביב ופרופ' יוסי בוקצ'ין Grid-based sorting: Centralized online algorithm **נועם שינה –** בהנחיית פרופ' ערן טוך Detecting Deceptive Design Patterns in Mobile Apps **גל נריה -** בהנחיית פרופ' מיכל צור The Dynamic Two-Stage Order Fulfillment Problem
10:00-10:15 - הפסקה	
מושב ב׳ **10:15-11:05**	**טל בוחניק -** בהנחיית פרופ' עירד בן-גל Identifying Coordinated Groups in Social Networks via Frequency Analysis **יניב לויכטר-** בהנחיית פרופ' נטע רבין וד"ר מור כספי Simulation-Based Optimization for Enhancing Preparedness of the Israel Fire Department **שי מתוק –** בהנחיית פרופ' עירד בן-גל Identifying Social Media Bots and inauthentic users
11:05-11:20 - הפסקה	
מושב ג׳ **11:20-12:10**	**נעם פרינץ -** בהנחיית ד"ר רעות נחם Multi-Session Appointment Scheduling Using Reinforcement Learning **מאיה ריינר -** בהנחיית פרופ' ארז שמואלי Multi-Layer Stress Assessment Using Smartwatches and Smartphones **יניר צדיקריו -** בהנחיית ד"ר מור כספי Optimizing Recharging Depot Location in a Robotic Delivery Service Extended by Public Transportation
12:10-12:45 – הפסקה	
12:45-13:00	**הסברים כלליים על המסלול הישיר לתואר שני** מיועד למועמדים למסלול ישיר וכן לסטודנטים לתואר שני שעוד לא בחרו נושא לעבודת גמר
13:00-14:00	**מפגש עם סטודנטים ותיקים** מעבדה 424 קומה 4 בניין וולפסון

תקצירים ◄ ◄ ◄

Grid-based sorting: Centralized online algorithm

By: Ilan Estrugo
Advised by: Prof. Tal Raviv and Prof. Yossi Bukchin

High-throughput sorting facilities require significant investment in costly resources, including labor, space, and equipment. The rapid grow of e-commerce, coupled with economic and technological advancements in recent decades, has intensified the demand for sorting technologies with increased throughput and improved cost/performance ratio.

In this work, we investigate sorting systems that utilize grids of four-way conveyors (4WCs), where items can move freely in up to four cardinal directions from each array cell to its neighbours. In such systems, items enter the grid at designated input cells and are transferred in a sequence of steps to their target output cells and eventually to destination bins. The grid-based approach enables multiple items to move simultaneously, offering the potential for significantly higher throughput compared to traditional conveyor-based sorting technologies. However, operating grid-based sorting systems requires solving complex, real-time, parallel decision-making challenges. A naive, myopic operational policy is susceptible to possible deadlocks, where items block each other from reaching their destinations. To address this, we propose a novel centralized online algorithm that ensures deadlock-free operation. The algorithm models item movements within the grid using a time-expanded graph (TEG). Upon an item's arrival, its route and schedule are determined, and the graph is immediately updated to preclude conflict with future items. Extensive experiments demonstrate that our centralized algorithm achieves higher throughput than previously proposed distributed algorithms. Moreover, it scales effectively, enabling real-time operation of large grids with thousands of cells, making it suitable for modern high-throughput sorting facilities.

Detecting Deceptive Design Patterns in Mobile Apps

By: Noam Sheena
Advised by: Prof. Eran Toch

Deceptive design patterns are user interface designs that lead users to take actions they would not otherwise choose. We encounter these patterns daily – on websites, mobile apps, and even ATMs. For example, a pop-up banner with a bold "yes" and a faint "no" option can stir users to accept offers that they may not be interested in. Such patterns often raise privacy and usability concerns, mainly in consent interfaces.

With increasing regulation around deceptive design practices, such as GDPR and the Digital Services Act, there is a growing need to detect these patterns efficiently and at scale. Manual approaches have been used but are time-consuming and difficult to scale. Automatic methods have been explored, but they often face challenges in expanding to detect new or emerging ones. Additionally, existing automated approaches primarily rely on analyzing screenshots of apps, overlooking other forms of data, such as user reviews and app metadata**.** This highlights the need for more comprehensive and scalable solutions capable of detecting a broader range of deceptive patterns and data sources.

Our approach leverages the VLM (Vision-Language Model) framework and integrates a mixture of inputs to detect deceptive patterns. It combines visual feature extraction from UI elements with NLP techniques to analyze alternative data sources, such as app reviews and metadata, enabling a more comprehensive understanding of these patterns. Additionally, it offers flexibility to adapt quickly to emerging and evolving deceptive patterns.

The Dynamic Two-Stage Order Fulfillment Problem

By: Gal Neria
Advised by: Prof. Michal Tzur

Coordinating operations across interdependent stages is a critical challenge in logistics, e-commerce, and food services. We introduce the Dynamic Two-Stage Order Fulfillment Problem (DTS-OFP), a novel class of problems that unifies logistical challenges stemming from various domains under a single framework. The DTS-OFP class involves modeling simultaneous optimization of preparation and delivery stages under dynamic stochastic conditions, addressing the limitations of approaches that treat these stages independently.

To solve this problem, we propose the Two-Stage Heuristic with Value Function Approximation (TSH-VFA), a novel solution method based on theoretical justification prioritizing second-stage optimization, where most costs arise, while ensuring first-stage feasibility through fast methods. The TSH-VFA combines several innovative components, driven by both operational research and machine learning tools. We demonstrate the DTS-OFP framework in three domains: warehousing, food delivery, and production-delivery systems. Numerical experiments using three real-world datasets reveal that TSH-VFA outperforms existing methods, significantly improving operational efficiency across diverse contexts. This work establishes a generalizable framework for dynamic two-stage logistics optimization, offering actionable insights for cost-critical operations and setting a foundation for future research in this domain.

Identifying Coordinated Groups in Social Networks via Frequency Analysis

By: Tal Buhnik
Advised by: Prof. Irad Ben-Gal

This study introduces a novel method for identifying coordinated groups on social networks, focusing on Twitter, by analyzing user activity through frequency similarity rather than traditional content-based or timing alignment approaches. The method leverages frequency analysis combined with the Kolmogorov-Smirnov (KS) distance to detect coordination while avoiding limitations of content variability and time misalignments.

To evaluate its effectiveness, three Twitter datasets containing known coordinated groups were analyzed using a custom iterative method that minimizes KS distance. Benchmarking against content-based and time analysis methods like DTW and jaccard demonstrated superior precision and recall for the frequency-based approach. Further validation was conducted by embedding real users with similar posting patterns into the datasets, confirming the robustness and accuracy of the proposed model.

This frequency-based method addresses critical challenges in traditional approaches, such as subtle or inconsistent content patterns and complex temporal misalignments. By focusing on users' posting frequencies, it provides a more reliable tool for identifying coordinated activity, significantly improving detection performance compared to existing techniques.

Simulation-Based Optimization for Enhancing Preparedness of the Israel Fire Department

By: Yaniv Leuchter
Advised by: Prof. Neta Rabin and Dr. Mor Kaspi

Effective resource allocation and emergency preparedness are vital for the Israeli Fire and Rescue Authority, particularly in the face of challenges posed by urban growth, climate change, and significant events such as the COVID-19 pandemic and the Iron Sword War. Existing tools, such as Business Intelligence (BI) systems, cannot capture dynamic interactions between fire stations and emergency incidents. This study aims to address these limitations through the development of a simulation model and optimization algorithms tailored to the unique needs of the Israeli Fire and Rescue Service.

The research employs a multi-phase methodology to improve operational efficiency and strategic planning. The first phase focuses on creating a high-fidelity simulation model of the "Coast" district, utilizing multidimensional data to replicate operational dynamics, including incident locations, response times, resource utilization, and station interactions. This model provides a robust foundation for analyzing and predicting performance under various scenarios.

The second phase involves developing an optimization algorithm to address the fire department's specific challenges. The algorithm incorporates a tailored objective function aligned with goals such as minimizing response times, maximizing coverage, and optimizing resource utilization. Machine learning techniques, particularly nonlinear dimensionality reduction, will enhance the search for optimal solutions and identify key variables influencing the simulation.

The third phase centers on forecasting future demand for fire services over horizons of 5, 10, and 20 years. By analyzing historical trends and external factors such as urban development and the climate crisis, the study provides actionable insights to guide resource planning and policy decisions.

The findings will be translated into strategic recommendations for stakeholders, including the Israel Fire Commissioner. These recommendations aim to support data-driven resource acquisition and budget allocation proposals, ensuring the fire department is equipped to meet both current and future challenges effectively. This research is funded by the Ministry of Science and Technology and underscores the importance of academia-government collaboration in addressing critical emergency management challenges.

Identifying Social Media Bots and Inauthentic Users

By: Mr. Shay Matok
Advised by: Prof. Irad Ben-Gal

Social media and Online Social Networks (OSNs) have revolutionized the way we interact, share information, and understand the world around us. However, this digital landscape faces significant challenges, notably the prevalence of bots and other forms of fake users. These entities, designed to mimic real users, can distort conversations, manipulate perceptions, and undermine the authenticity of online interactions. Often, these fake users are part of larger, inauthentic coordinated networks that work together to amplify certain messages, spread misinformation, or influence social and political agendas.

To address these issues, researchers are using ML algorithms and graph analysis techniques. However, the journey to fully secure social networks is far from complete and entails numerous obstacles. This lecture will explore the current state of research focused on identifying inauthentic users and unraveling the complex networks they form, emphasizing the critical role this work plays in the broader effort to safeguard our digital societies.

Optimizing Recharging Depot Location in a Robotic Delivery Service Extended by Public Transportation

By: Yanir Zadickario
Advised by: Dr. Mor Kaspi

The rise of the on-demand economy, driven by e-commerce and fast-food delivery, has accelerated the development of innovative urban delivery concepts, including cargo bikes, robots, and lockers. One prominent solution involves Autonomous Mobile Robots (AMR) which are small, electric, wheeled robots designed to operate at pedestrian speeds. In the last-mile delivery service under consideration, a fleet of AMRs is deployed from multiple recharging depots strategically located within the service area to provide point-to-point deliveries. This research explores an innovative operational scenario where AMRs can utilize public transit vehicles to extend their service range and reduce energy consumption.

The primary focus is on solving the strategic problem of determining the optimal locations and capacities of the recharging depots. The complexity of the service design problem arises from the need to accurately represent operational performance while evaluating potential designs. Specifically, assessing the performance of a given design is challenging due to the need to account for the interactions between depots and the time-varying, stochastic nature of service request processes.

To tackle this challenge, we have developed an optimization framework consisting of three layers: a metaheuristic optimization algorithm, an approximate optimization model, and a simulation model. The metaheuristic algorithm generates system designs, which are then passed to the approximate optimization model for rapid evaluation. This iterative process continues until a convergence criterion is satisfied. Once this criterion is met, the best solution identified is forwarded to the simulation model for a more refined evaluation. The simulation's results are returned to the approximate model, prompting a fitting process to adjust the model's parameters to closely align with the simulation's evaluations. This refined model is then used to initiate another iteration of the metaheuristic optimization algorithm. The process repeats until a global convergence criterion is reached. To test this optimization framework, we have developed a case study leveraging real-world data on delivery requests and public transportation systems in Tel Aviv.

Multi-Layer Stress Assessment Using Smartwatches and Smartphones

By: Maya Reiner
Advised by: Prof. Erez Shmueli

Stress is an inherent response to the pressures of daily life, influencing people's behavior and emotions. It directly contributes to psychological and physiological disorders and diseases, affecting both mental and physical health, and ultimately diminishing quality of life. In the 21st century, stress is rapidly becoming one of the leading contributors to health decline, depression, and mental illnesses. While our bodies can manage short-term stress effectively, chronic stress can have severe impacts on various bodily systems. Therefore, it is important to assess stress levels and be vigilant when someone is experiencing long-term stress, implementing stress reduction interventions as needed.

The wearable commercial physiological sensor industry is rapidly expanding, providing real-time monitoring of various physiological and behavioral indicators such as heart rate, heart rate variability, step count, and sleep quality. However, while some market-available smartwatches do offer stress-related measurements, these measures often have a very limited correlation with individuals' perceived stress.

In this research, we propose a novel approach for assessing perceived stress using smartwatches, relying on a unique dataset of more than 1M questionnaires and 2M days of smartwatch collected from a cohort of ~5000 participants in the PerMed study. Our model employs a multi-layer approach to provide a comprehensive view of stress, incorporating smartwatch measurements (heart rate, steps, and sleep quality), demographic information, wellbeing and healthcare profiles, as well as external environmental data such as weather and other significant events. Preliminary results demonstrate promising performance, suggesting that our model can effectively capture and analyze patterns of perceived stress.

Multi-Session Appointment Scheduling Using Reinforcement Learning

By: Noam Prinz
Advised by: Dr. Reut Noham

The Multi-Session Appointment Scheduling (MSAS) problem involves scheduling patients for long-term clinical and paramedical treatments of varying durations. The scheduling process is challenging due to its dynamic nature, requiring decisions that consider patient time preferences, treatment durations, and the current state of the schedule. These decisions are made with only probabilistic knowledge of future patient requests.

In this work, we model the MSAS as a Markov Decision Process (MDP) and examine two perspectives: the client-dominant case, which seeks to minimize rejections or maximize the acceptance rate, and the provider-dominant case, which focuses on maximizing provider utilization and revenue. Minimizing rejections is essential, as rejections can delay the start of treatment, reduce the match quality between patients and providers, and prolong processes, potentially leading to worse health outcomes. Conversely, maximizing provider revenue emphasizes efficiency and financial performance. While these goals might appear aligned, we demonstrate that, under certain realistic cost structures, they can conflict.

Despite the compact formulation of the problem as an MDP, the exponential growth of the state space makes finding the MDP's optimal solution computationally infeasible for large schedules or extended treatment durations. Consequently, effective solution methods must be developed. To address these challenges, our research applies Reinforcement Learning (RL) to effectively manage the state space complexity.

We begin by framing the problem as an RL environment - defining states, actions, and rewards - while striving to minimize the state space's dimensionality. Various RL algorithms are then tested to develop an optimal scheduling policy for request acceptance or rejection. Finally, we evaluate the results and aim to uncover the policy characteristics. We present preliminary results comparing RL approaches to simple benchmark policies and previously developed heuristics, highlighting the relative effectiveness and potential of the RL methods

הכירו את המחלקה ◄◄◄

מועמדים ומועמדות יקרים,
בעמוד הבא תמצאו את רשימת חברי וחברות סגל המחלקה. אתם מוזמנים ומוזמנות לפנות אליהם לקבל מידע נוסף על המחקרים שלהם ואיפה ניתן להצטרף למחקר.

פרופ' ארז שמואלי

למידת מכונה, היבטים חישוביים של מדעי החברה, בינה מלאכותית ברפואה

פרופ' גורן גורדון

רובוטים חברתיים, מודלים והערכה של סקרנות של ילדים

פרופ' דן ימין

רפואה מותאמת אישית, ביג דאטה בבריאות ורפואה, בריאות דיגיטלית, מודלים של מחלות מידבקות

פרופ׳ טל רביב

תחבורה ולוגיסטיקה, אופטימיזציה, חקר ביצועים

פרופ׳ יבגני חמלינצקי

ניתוח מערכות דינאמיות, בקרה אופטימלית, תכנון ובקרת תהליכי ייצור ושירות, שיבוץ ותזמון

פרופ׳ יואכים מאייר

אינטראקציה עם AI ואוטומציה מתקדמת, מידול החלטות הנעזרות במערכות תומכות החלטה

פרופ׳ יוסי בוקצ׳ין

לוגיסטיקה פנים ארגונית, אופטימיזציה של מערכות בריאות, תעשייה 4.0

ד״ר מור כספי

תחבורה ולוגיסטיקה עירונית, חקר ביצועים, אופטימיזציה קומבינטורית

פרופ׳ מיכל צור

בעיות תחבורה בזמן אמת, למידת מכונה משולבת אופטימיזציה, לוגיסטיקה הומניטרית

פרופ' נטע רבין

ניתוח סדרות עתיות, למידת מכונה

ד״ר נעם קניגשטיין

למידה עמוקה, מערכות המלצה

ד״ר עמיחי פיינסקי

למידה סטטיסטית, הסקה מעל א"ב גדול, סטטיסטיקה במימדים גבוהים

פרופ׳ עירד בן גל

יישומים בינה מלאכותית, בקרה וניסויים סטטיסטים, יישומי תורת האינפורמציה

ד"ר עילי ביסטריץ

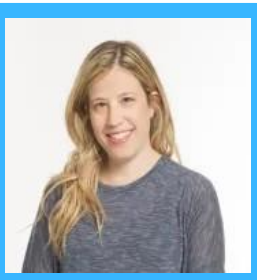
למידה מרובת סוכנים ותורת המשחקים

פרופ׳ ערן חנני

תורת ההחלטות, תורת המשחקים, חקר ביצועים, תיאוריה כלכלית

פרופ' ערן טוך

הנדסת פרטיות, אינטראקציית אדם-AI, וניתוח התנהגות אנושית רחבת היקף



ד"ר רעות נוחם

תפעול מערכות בריאות וניהול שרשראות אספקה הומניטאריות