

Shervin Azadi



Urban Digital Twin

By 2050, over 70% of the world's population will live in cities. Urban environments are diverse, complex, and constantly evolving. Domains like housing, mobility, and energy work too independently, making it extremely difficult to collaboratively build a city. We need a new way of working. A digital way.

The Urban Development Initiative (UDI) has established an ecosystem to fundamentally reshape how we plan, design, build, research, and govern cities. At the heart of this transition is Urban Digital Twinning: creating digital versions of the city that integrate various domains, and represent their interdependencies, so humans and AI can collaboratively shape the future of our cities.

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Robbert Reijnen

Understandable and Generalizable AI Hybridizations

We study the hybridizations of two optimization domains: metaheuristics and deep reinforcement learning (DRL). The basic target is aimed at providing high-quality solutions, that improve productivity in many areas. While the high quality of solutions is necessary, there are two properties to be studied to more extent: generalizability and understandability.

By hybridizing Metaheuristics with DRL, we target solutions that more generalizable, as the tuning step could be automatized by DRL. Understandability, understood as lack of complexity, can decrease time to deployment, and improve robustness and trust in systems. We plan to allow the metaheuristics to alter the definition of solutions, such that complexity can be reduced.

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Vahideh Reshadat

Knowledge Acquisition from Textual documents

A case study for Special Cargo Transportation Domain

The airfreight industry of shipping goods with special handling needs, also known as special cargo, deals with nontransparent data and outdated technology, resulting in significant inefficiency. Exploiting special cargo ontology is a means to extract, structure, and store domain knowledge and represent the domain concepts and relationship between them in a machine-readable format. We developed and populated this special cargo ontology that can be used as the base of semantic data retrieval in many artificial intelligence applications, such as planning for special cargo shipments.

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Dirk Aarts



Aristotle Cognitive Training

Using personalized and specialized evidence-backed cognitive tasks, our software tool supports, challenges, and engages its users to train their cognitive abilities (e.g., anticipation, working memory, and inhibitory control) to improve their performance, social participation, and quality of life.

The Aristotle Cognitive Training tool is implemented in the youth academy of the PSV football organization, helping football players improve their cognitive performance under high stress, pressure, and uncertainty.

Next to sports, the product is validated in the healthcare and education segments.

Aristotle Cognitive Training

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Lasitha Chamari Rathnayaka

Data Integration for Smart Demand Side Management Operations

Building Management System and Internet of Things (IoT) devices in a building produce a large volume of time-series data. Another invaluable source of information is the Building Information Model, which has geometry, spatial location, and metadata about the building objects. Usually, these remain as data silos and there is little to no integration. This research is aimed at integrating the above data silos to improve Demand Side Management (DSM) strategies. Based on above data, a combination of statistical AI methods and symbolic AI methods are used for improving DSM operations.

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Ya Song

Improving heuristic algorithms with machine learning for sequential decision-making problems

The project focuses on the Train Unit Shunting Problem, a complex sequential decision-making problem Dutch Railways faced. This problem involves allocating arrival train units to shunting yards and then assigning them to scheduled train services so that the resulting operations are without conflicts. When a heuristic algorithm is applied to solve this problem, it is hard to tell whether and why it will fail to provide a feasible solution and how to select a more appropriate heuristic algorithm. This research will mainly focus on applying machine learning methods to analyze the instance difficulty and guide the heuristic algorithms design.

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Graph Generating Dependencies for Data Quality

Constraints play a key role in data management research, e.g., in the study of data quality, data integration and exchange, and query optimization. As graph-structured datasets proliferate in domains such as social networks, biological networks and knowledge graphs, the study of graph dependencies is also of increasing practical interest. Given this scenario, we propose a new class of dependencies named Graph Generating Dependencies (GGDs). Informally, a GGD expresses a constraint between two (possibly) different graph patterns enforcing relationships between potential similarity of property values and topological structure. Some applications of the GGDs include entity resolution, data integration and data cleaning.

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Intelligent Bridge Infrastructure Maintenance

The project aims at integrating AI systems into inspection and maintenance strategies of bridge infrastructures to reduce the cost of ownership of the infrastructure and prolong its life. Digital image recognition will be applied to detect fatigue cracks in bridge infrastructures, providing the basis for automated inspections of bridges. Existing inspection data of bridges are used as a basis, but also images of fatigue cracks in laboratory tests can be used. Computer vision algorithms can improve the reliability of the inspection method as compared to standard visual inspections. The accuracy of the method will be translated into “probability of detection curves”, allowing comparison with ordinary inspection techniques.

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Steel Structures

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Reza Refaei Afshar

Machine Learning for Ad Publishers in Real Time Bidding

Display advertising is a form of online advertising in which advertisement (ad) slots are located on the web pages of the publishers to show ads.

Recently, Real-Time Bidding (RTB) is introduced to use computer programs for connecting publishers and advertisers. In RTB, real-time auctions are performed to sell the ad slots. From the publishers' perspective, the main objective is to increase the revenue obtained from advertising, and several decisions can be optimally made to reach this objective. In this research, we use machine learning methods, including supervised learning, and Reinforcement Learning to develop decision support systems for the publishers in display advertising.

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Extending human senses with AI

At HART, we are extending human senses by enabling people to interpret haptic feedback patterns subconsciously. It's like interpreting the smartphone vibrations but then much more complex. To develop this technology, we need to transform information into vibrational patterns, which requires extensive research in the intersection of AI and various other fascinating fields.

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Debargha (Dave) Dey

Human Factors of Automated Vehicles: Communication between self-driving cars and other road users

In self-driving cars, human drivers can no longer take the responsibility for communication with other road users. Driver-centric communication methods such as eye contact or gestures will be missing in such cars. But automated vehicles will still need to cooperate with pedestrians, cyclists, and other road users to act as a social entity in traffic. In our research, we explore and investigate communication paradigms and interfaces that facilitate interactions between self-driving cars and other road users.

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