Open Research Day

9 April 2025

14:20-15:30

A108: Postdoc project Session

Chair: Pawel Herman, Digital Futures Associate Director Strategic Research

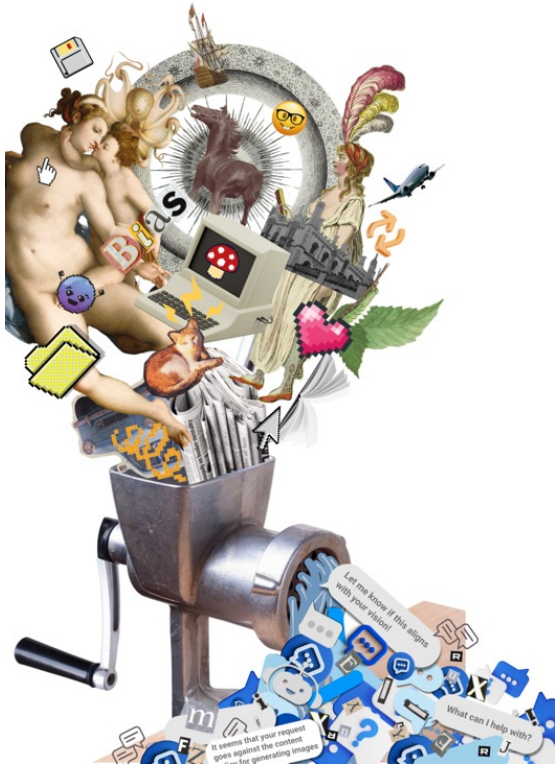
Postdocs lightning talk – 1 min

1. **Design and Policy Considerations for (Inter)Personal Data**
2. **Designing Interaction-Aware Heterogeneous Multi-Robot Systems**
3. **Distributed Optimal Control Strategies for Networked Multiagent Systems**
4. **Dynamic In-Transit Cyber Defence through AI-assisted Network Monitoring (name change: Comprehensive Network Insight for Resilient Infrastructures)**
5. **Environmental Monitoring with Autonomous Underwater Vehicles (Risk Aware Planning and Control for Autonomous Underwater Vehicles)**
6. **Explainable Machine Learning for Development of Early Warning Systems Emergency**
7. **Extraction of Parkinson's disease related temporal feature of brain activity**
8. **Fairness and Bias of Artificial Intelligence (AI) Technologies in Education: Challenges and Future Directions**
9. **Felt Connections: Creating Rich Physical Interactions for Children through Shape-Changing Textiles**
10. **Lego Inspired accessible and automated design framework for demanding Edge AI Systems**
11. **Partner Postdoc Fellow Project: Environmental impacts of digitalization based on life-cycle assessment**
12. **Rapid space-based Detection, Dimensions, and Drivers of forest fires within the context of forest-based climate solutions (3DFire)**
13. **Sensory-based hierarchical control of intelligent multi-vehicle systems**
14. **SMART- Smart Predictive Maintenance for the Pharmaceutical Industry**
15. **Technology Mediated Collective Caring through Menstrual and Reproductive Journeys**
16. **Theory and Methods for Privacy-Preserving Network Localization**
17. **Towards Smart Cities: Collaborative Spatial Perception for Digital Twinning**

1. Design and Policy Considerations for (Inter)Personal Data

Alejandra Gómez Ortega

(Inter)Personal Data and Design



Data and their algorithmic derivatives are **(inter)personal;** they capture, contain, and reveal information about a person and other people in their lives and environments.

How should this shape the way we interact with connected products and services? What implications does this have for policies surrounding personal data?

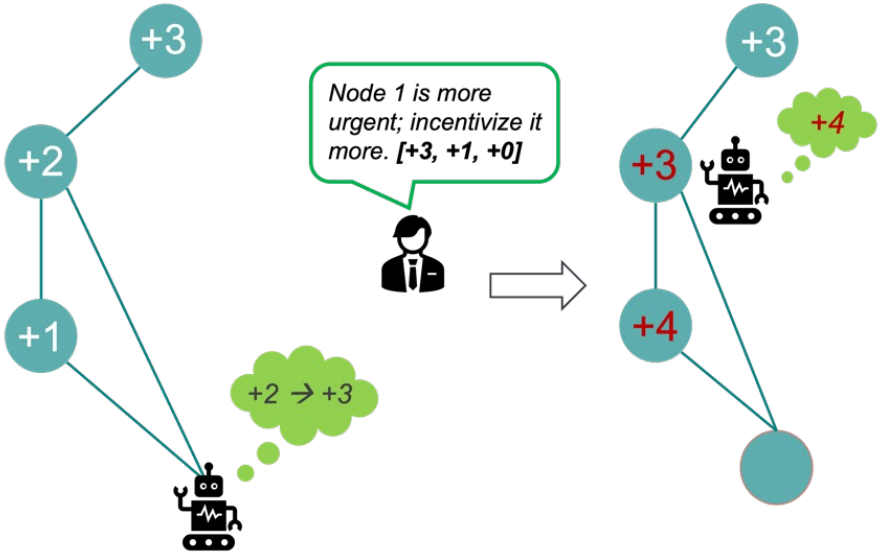
To address these questions, I design artifacts and experiences that invite people to encounter their data and algorithmic derivatives.

2. Designing Interaction-Aware Heterogeneous Multi-Robot Systems

Malintha Fernando

Improving Social-Welfare in Task-Allocation Games on Graphs

- Robots choose tasks on a graph maximizing their local utilities
- A *"manager"* influences their decisions by providing incentives based on the *social-welfare* of the system
- We approximate a *Markov potential game*, and obtain Nash policies with Multi-Agent Reinforcement Learning



3. Distributed Optimal Control Strategies for Networked Multiagent Systems

Panpan Zhou

Modelling and Control for Robots

The security of autonomous systems is becoming increasingly critical, as their rapid deployment has been accompanied by a rising number of safety-related incidents.

This project aims to model the chasing and hunting behaviors of animals, and design control strategies for robots.

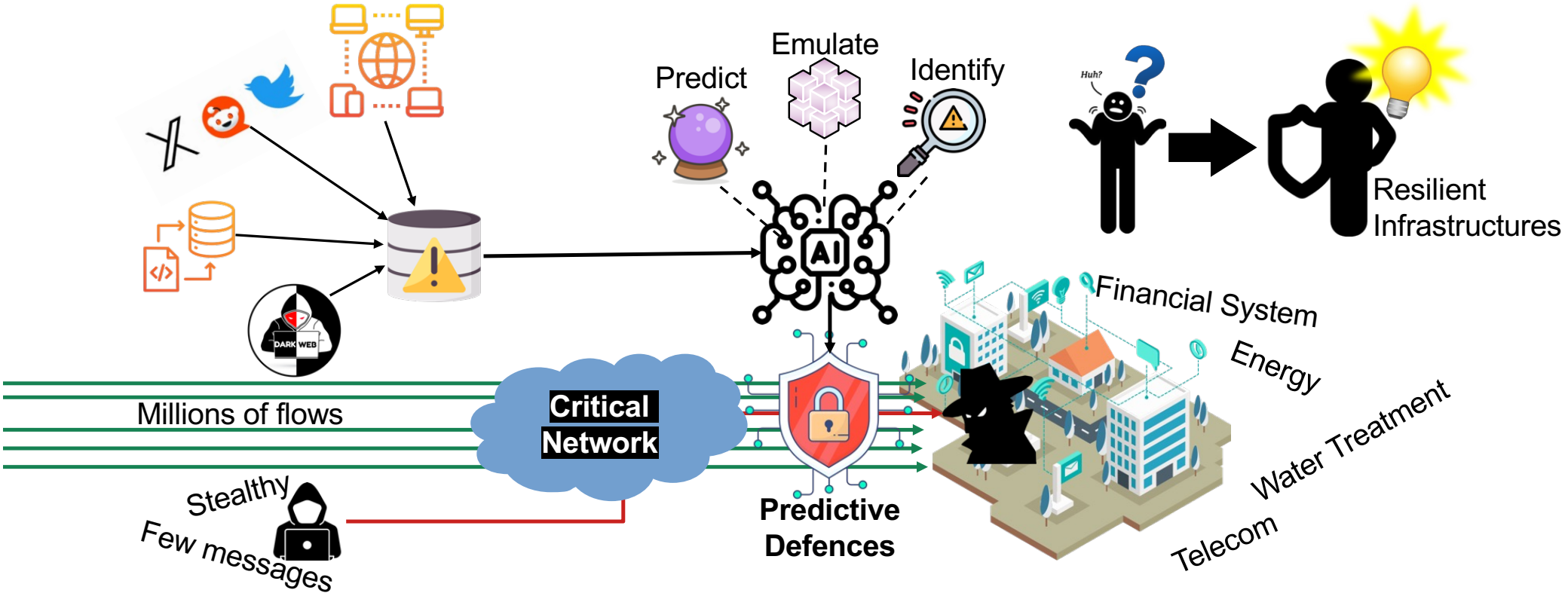
The results show that our design can replicate their behaviors and findings align with observations in nature.

4. Comprehensive Network Insight for Resilient Infrastructures

previous Dynamic In-Transit Cyber Defence through AI-assisted Network Monitoring (name change)

Jonatan Langlet

AI-Driven Network Resilience



5. Environmental Monitoring with Autonomous Underwater Vehicles (Risk Aware Planning and Control for Autonomous Underwater Vehicles)

Chelsea Sidrane

Safe Underwater Exploration

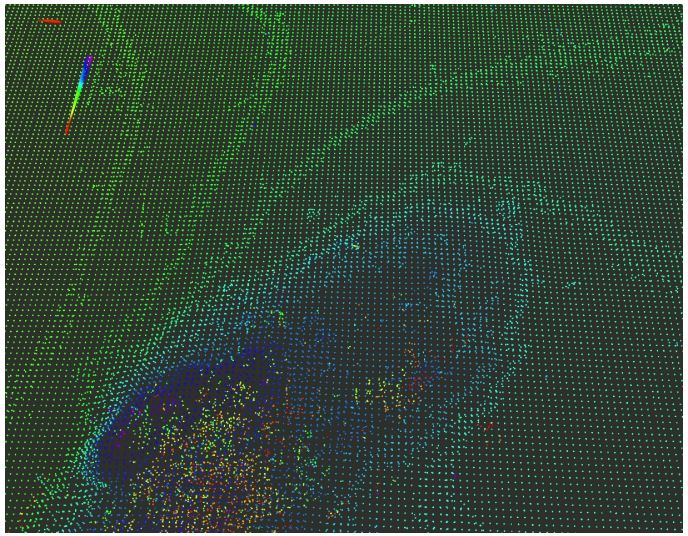
Autonomous Underwater Vehicles (AUVs) operate in dynamic, uncertain conditions

They are a good candidate for the use of machine learning methods

But machine learning can behave unpredictably

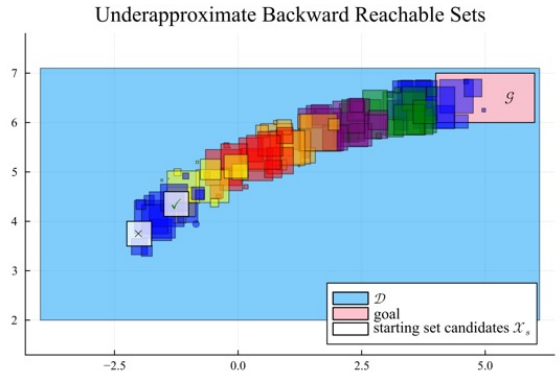
My work is focused on using formal verification to catch unpredictable behavior in *neural feedback loops*

chelse@kth.se



Joint work with Alex Kiessling and Ignacio Torroba

2023 Tesla Crash, no major injuries

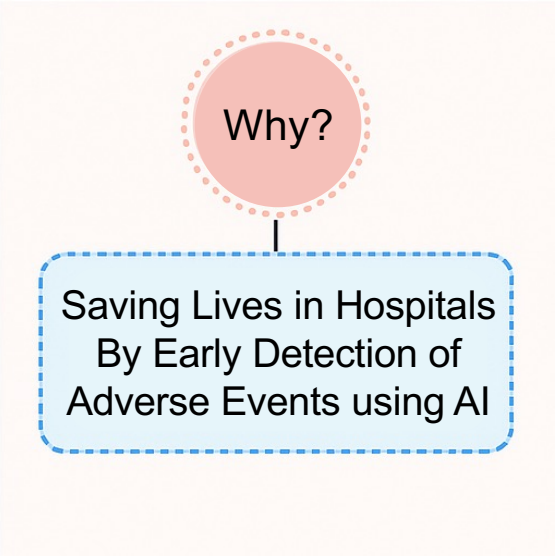


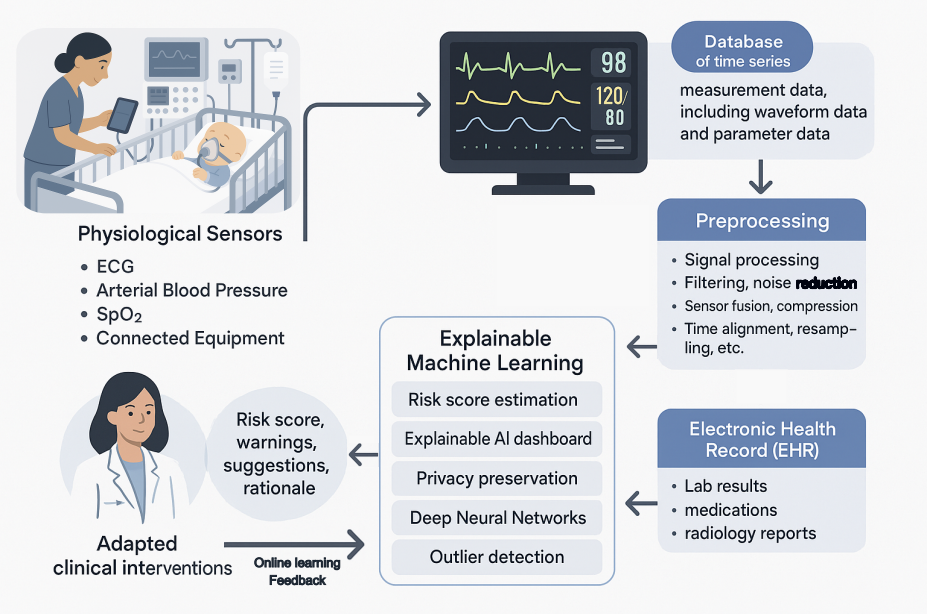
Verifying closed-loop goal-reaching

6. Explainable Machine Learning for Development of Early Warning Systems Emergency

Yogesh Todarwal

Explainable Machine Learning for Development of Early Warning Systems Emergency (EMERDENSY)





Workflow

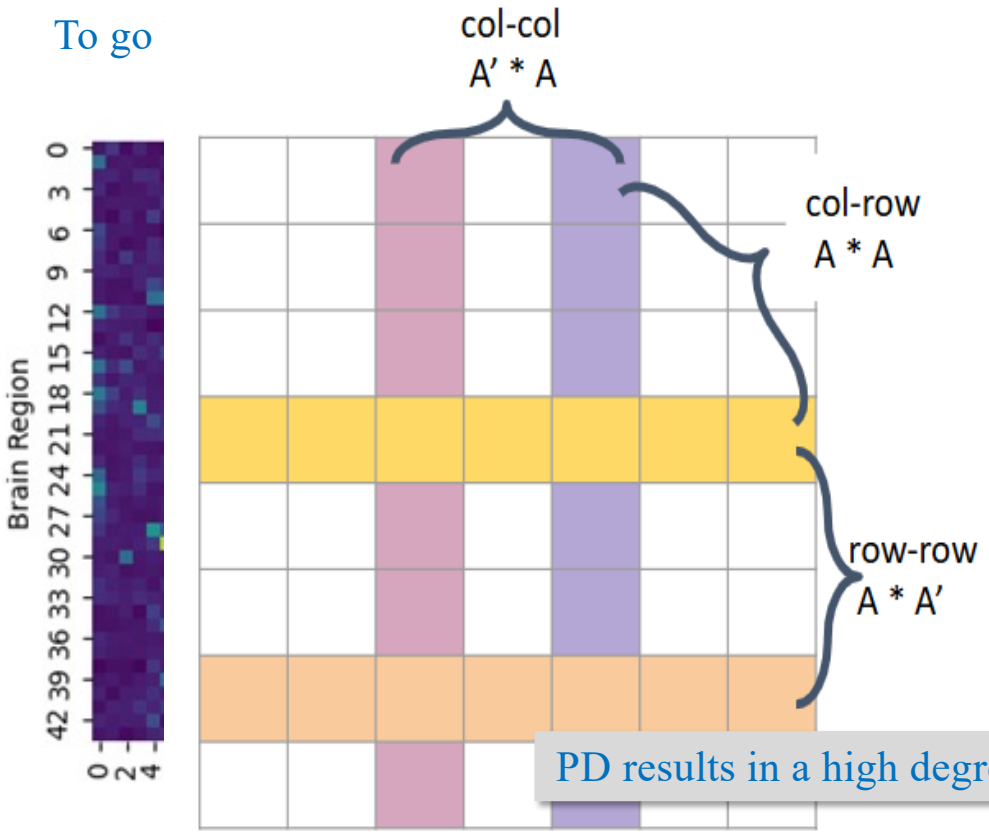
7. Extraction of Parkinson's disease related temporal feature of brain activity

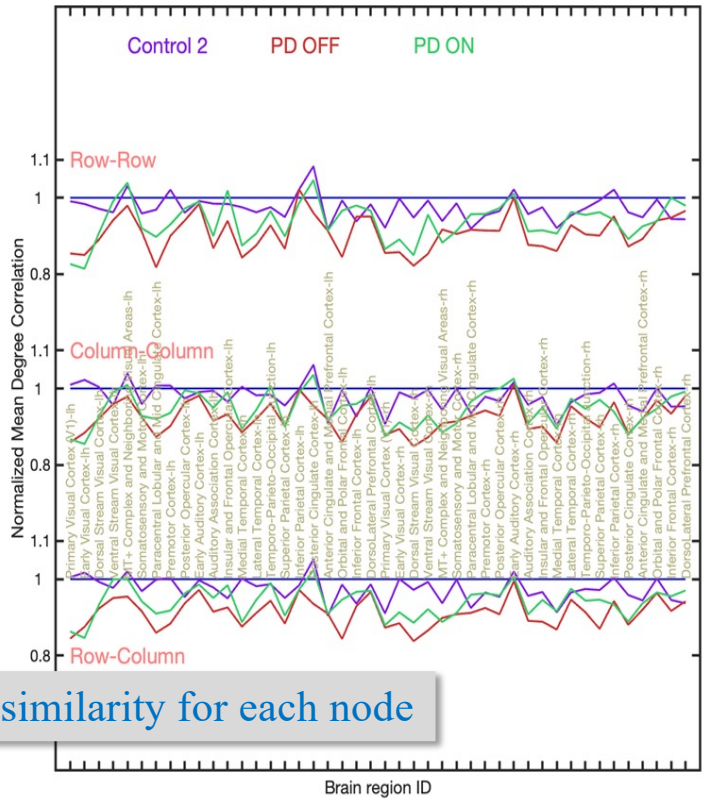
Satarupa Chakrabarti

Convergent Cross Mapping (CCM)

To go

ents





PD results in a high degree similarity for each node

odel

ntrol 1
ntrol 2
Off Med
On Med

0.25
Index

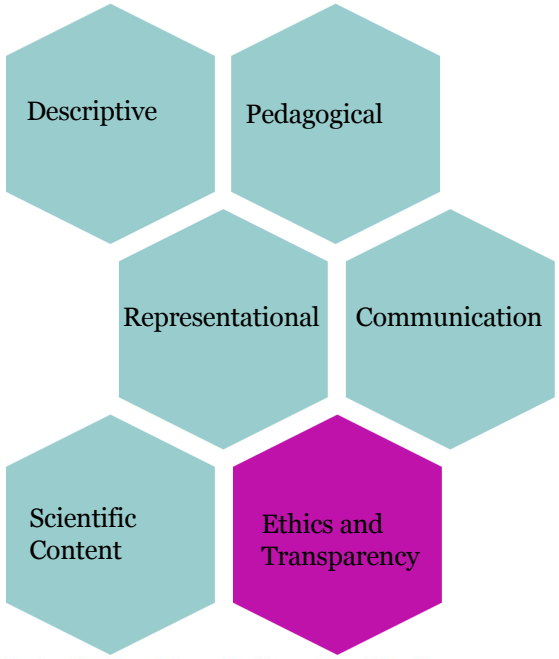
8. Fairness and Bias of Artificial Intelligence (AI) Technologies in Education: Challenges and Future Directions

Yael Feldman-Maggor

Fairness and Bias of Artificial Intelligence (AI) Technologies in Education: Challenges and Future Direction

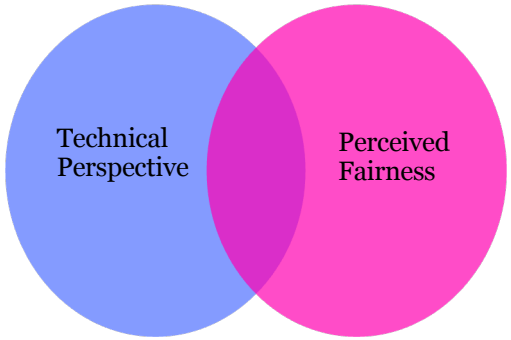
Post Doc: Yael Feldman-Maggor, Supervisors: Olga Viberg, Teresa Cerratto Pargman

While AI has the potential to enhance educational practices, it also raises concerns about fairness



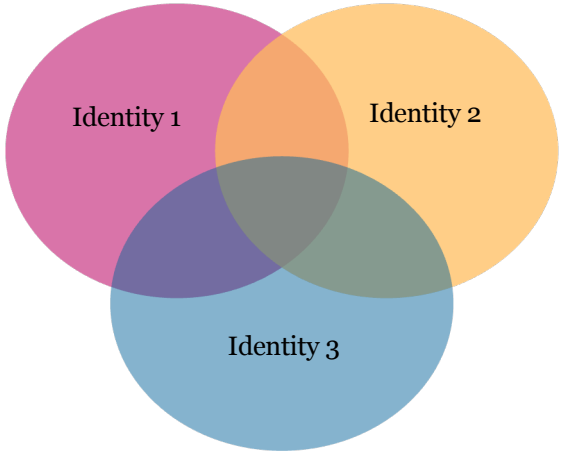
Seeing the Forest from the Trees: Unveiling the Landscape of Generative AI for Education through Six Evaluation Dimensions

Yael Feldman-Maggor[1][https://orcid.org/0000-0002-0456-6664], Teresa Cerratto-Pargman[2][https://orcid.org/0000-0001-6389-0467], Olga Viberg[3] [https://orcid.org/0000-0002-8543-3774]
1 KTH Royal Institute of Technology, Stockholm, Sweden, yaelfm@kth.se
2 Stockholm University, Stockholm, Sweden, tessy@dsv.su.se
3 KTH Royal Institute of Technology, Stockholm, Sweden, oviberg@kth.se



Technical Perspectiv, e.g. data, algorithm bias

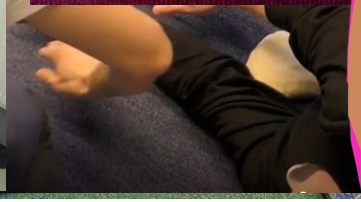
Perceived Fairness, e.g., cognitive and behavioral responses to an AI system



An intersectional perspective considers how different identities interact to influence fairness. e.g. gender, race, learnin disability

9. Felt Connections: Creating Rich Physical Interactions for Children through Shape-Changing Textiles

Alice Haynes

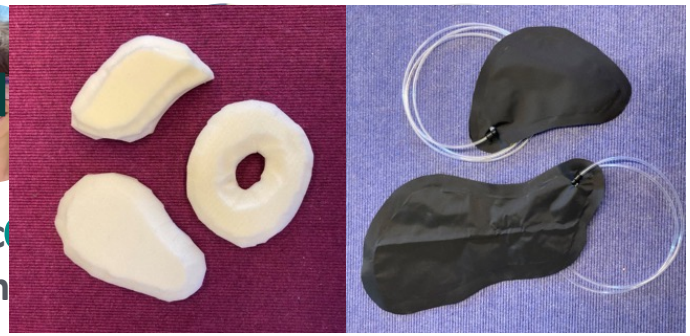


felt connections

creating novel **shape-changing textile devices** to generate rich and dynamic **body-centered interactions for children**.

year 1

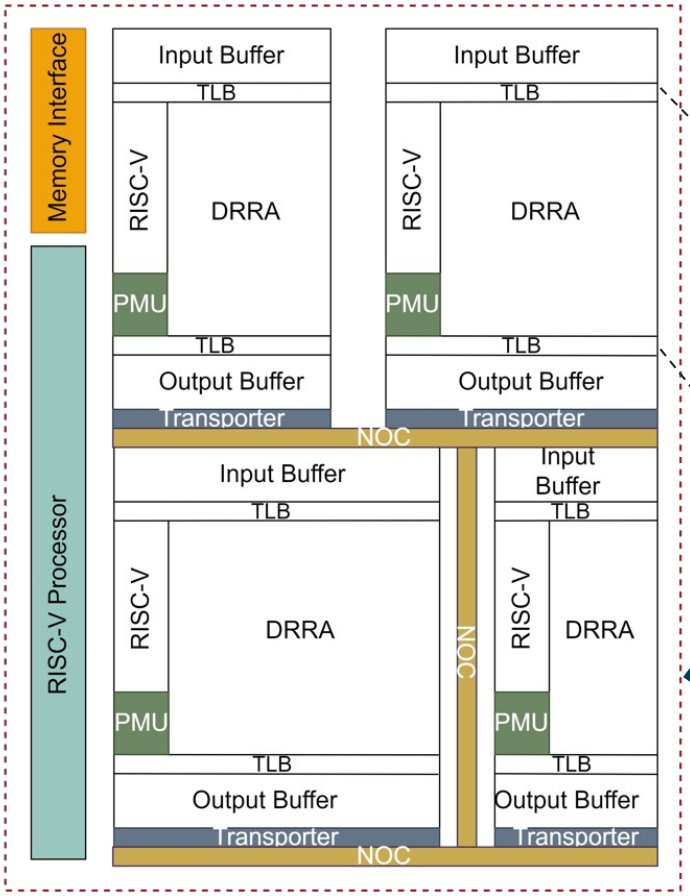
research-through-design explorations of **body symmetry** and **shape-changing materials**



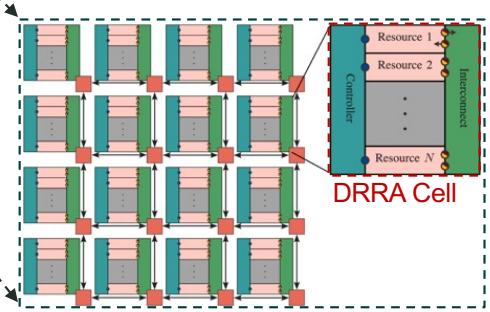
10. Lego Inspired accessible and automated design framework for demanding Edge AI Systems

Nooshin Nosrati

SiLago – A Lego-Inspired Design Framework for Edge AI Systems



Application-level Structure



DRRA: Dynamic Reconfigurable Resource Array

NN Structure

Hight throughput & Low Power Hardware

11. Partner Postdoc Fellow Project: Environmental impacts of digitalization based on life-cycle assessment

Anna Furberg

Environmental Impacts of Digitalization based on Life Cycle Assessment

Project

- Project leader: Göran Finnveden
- Postdocs: Anna Furberg and Shoaib Azizi
- Duration: 2023-2025
- Funded by: Ericsson, KTH Digital Futures, KTH Climate Action Center

Department of Sustainable Development, Environmental Science and Engineering (SEED)

Examples of questions addressed:

- What are the ***key aspects for future scenarios*** of the information and communication technology (ICT) sector's climate impact?
- Energy saving required by ***building monitoring systems*** to compensate for their ICT system climate impacts?

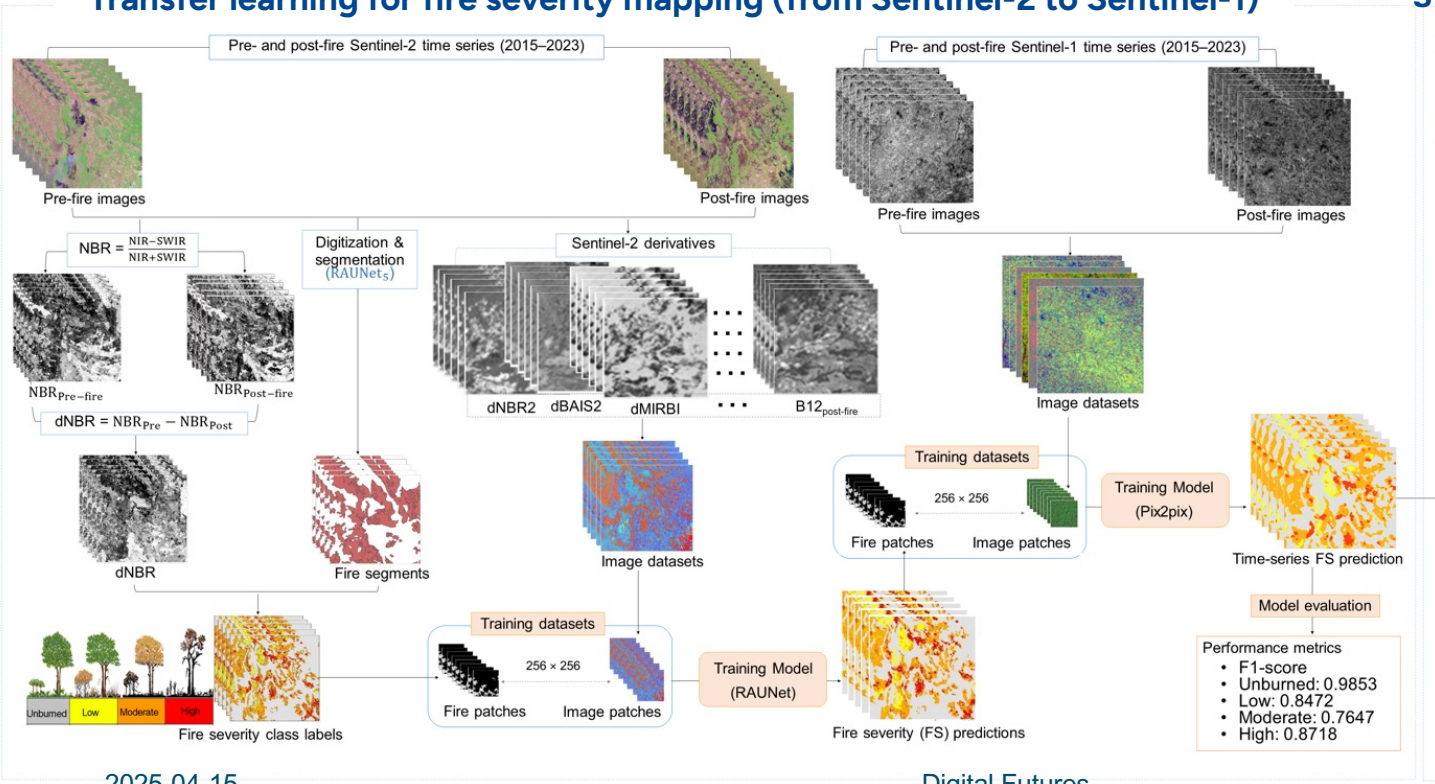
12. Rapid space-based Detection, Dimensions, and Drivers of forest fires within the context of forest-based climate solutions (3DFire)

Zeinab Shirvani

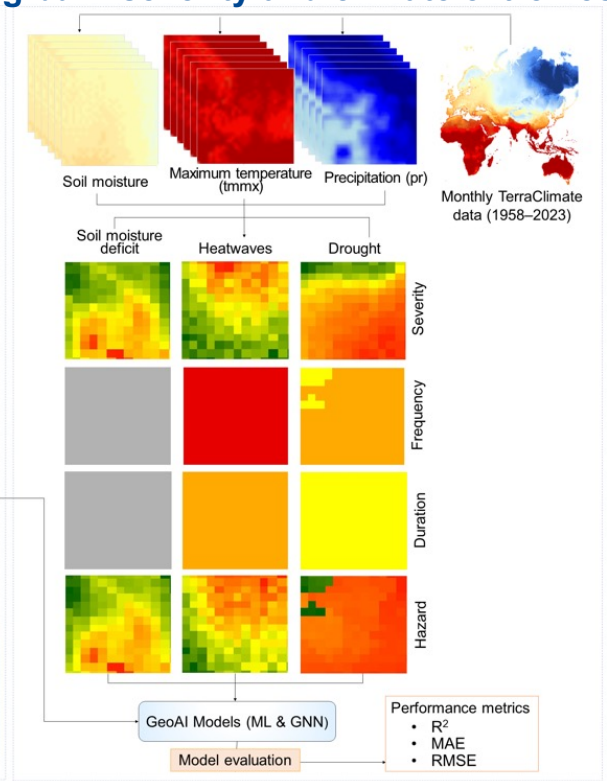
Linking Extreme Climate Hazards and Burn Severity: A GeoAI Approach

Zeinab Shirvani, Digital Futures Postdoctoral Fellow, KTH Royal Institute of Technology

Transfer learning for fire severity mapping (from Sentinel-2 to Sentinel-1)



Linking burn severity and climate extremes



13. Sensory-based hierarchical control of intelligent multi-vehicle systems

Zhiqi Tang

Sensory-based hierarchical control of intelligent multi-vehicle systems

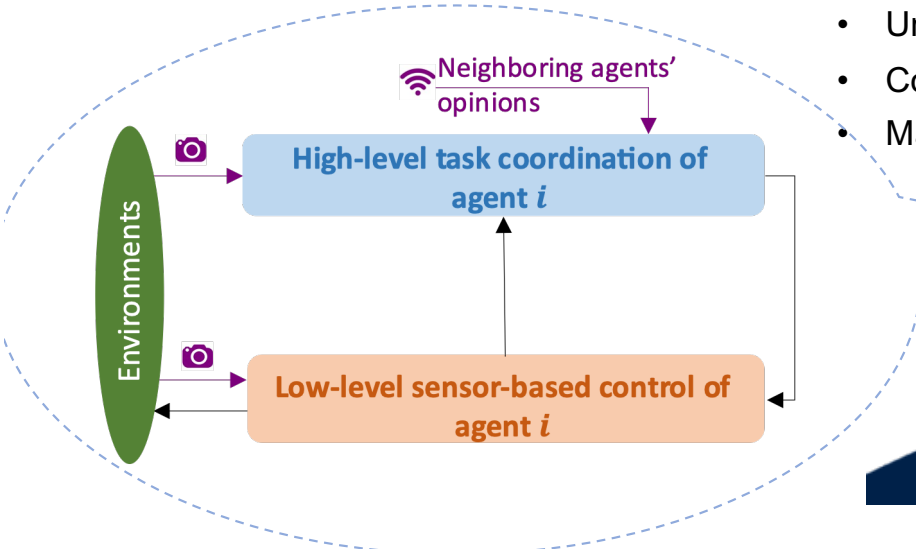
Zhiqi Tang, Jonas Mårtensson, Karl H. Johansson, Michele Simoni

Existing designs for simple mission

- Discretize state and environment
- Computational expensive
- Static/offline high-level planning

Natural swarms for complex mission

- Consider several options in parallel
- Choose options in a continuous fashion
- Reactive/proactive to dynamic changes

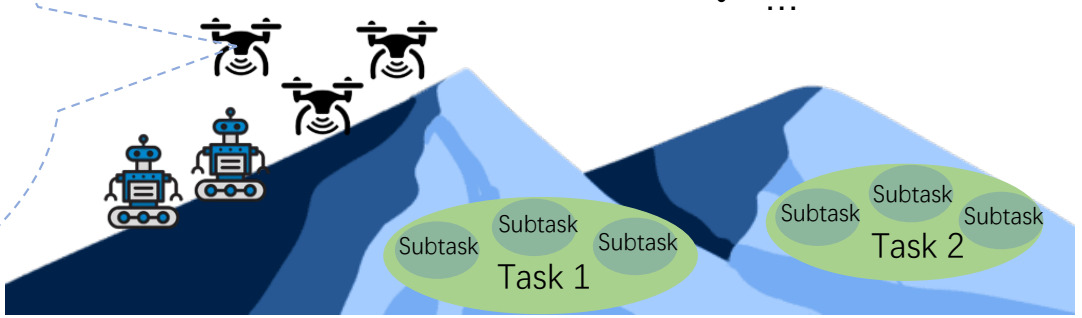


Challenges

- Multi-robot systems with complex dynamics
- Unknown and congested environment
- Collective decision-making ability
- Manage and execute complex tasks

Applications

- Environmental monitoring
- Infrastructure inspection
- Last mile delivery
- Intelligent road intersections
- …



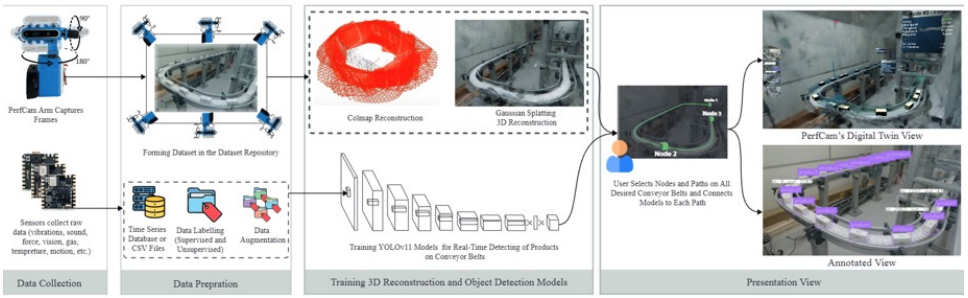
14. SMART- Smart Predictive Maintenance for the Pharmaceutical Industry

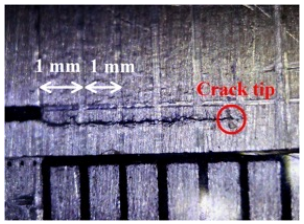
Renan Guarese

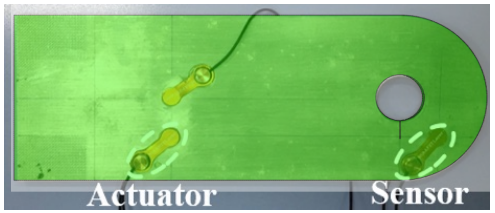
Smart Predictive Maintenance for the PhARMaceutical Industry

Integrating AI and human expertise for condition monitoring inpharmaceutical manufacturing

Tianzhi Li | Xi Vincent Wang | Benjamin Edvinsson | Anders Bergman
tianzhil@kth.se

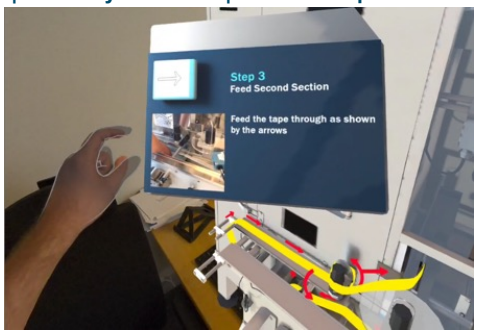


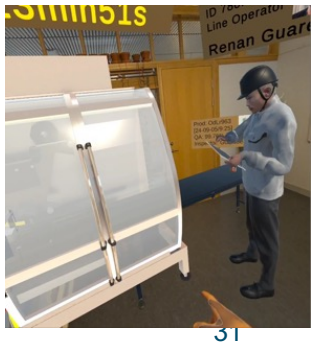




PerfCam: 3D Object Tracking and Visual Semantic SLAM for Digital Twinning and KPI Extraction in Production Lines

Michel Gokan Khan | Jérémy Vachier | Jan Kronqvist
michelgk@kth.se





Towards collaborative cross-reality and situated visualization for smart industry operators

Renan Guarese | Miruna Vasiliu | Zeinab BagheriFard | Fabian Johnson | Mario Romero
guarese@kth.se

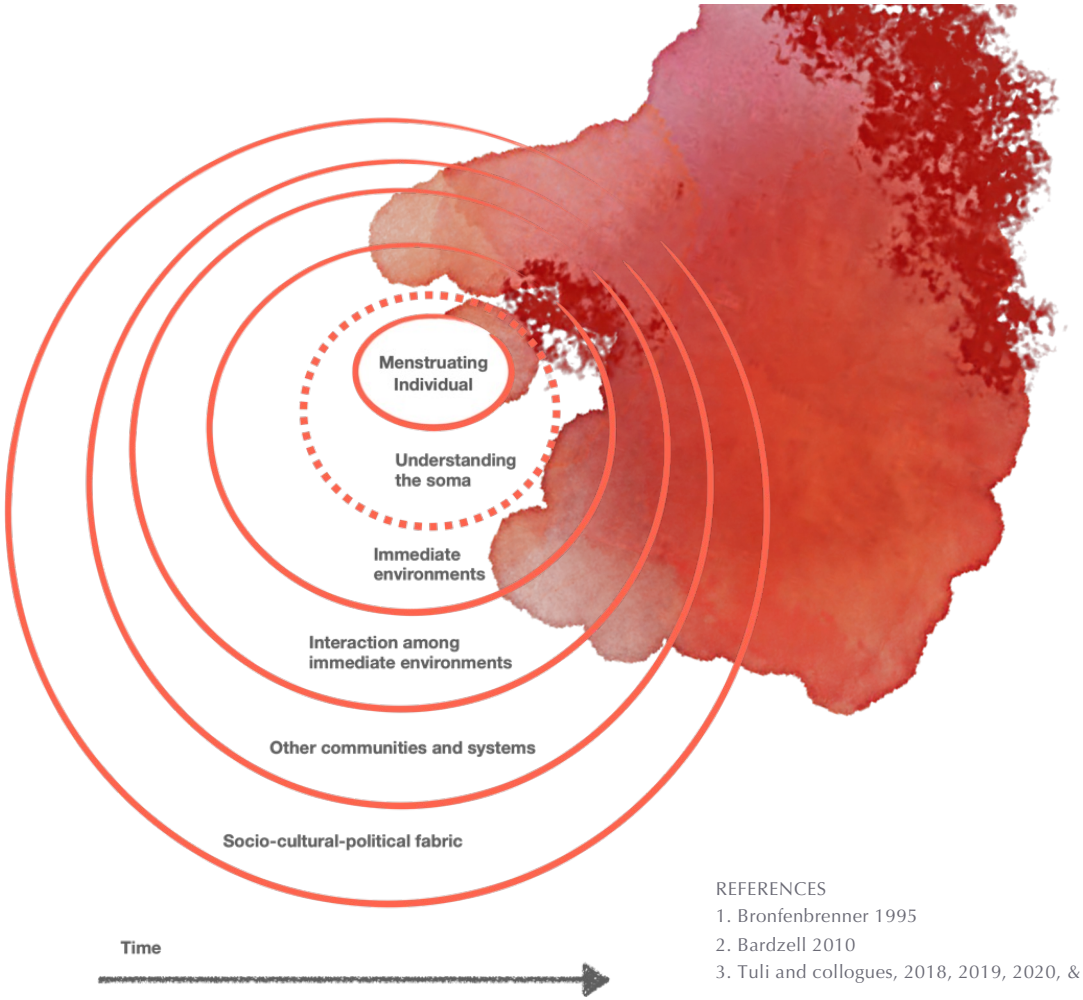
15. Technology Mediated Collective Caring through Menstrual and Reproductive Journeys

Anupriya Tuli

Technology Mediated Collective Caring through Menstrual and Reproductive Journeys

"Menstrual and Reproductive Journey is experienced by an **Individual,** shared & shaped by **Many"** [3].

Anupriya Tuli, PhD | anupriya@kth.se
IxD, MID, KTH Royal Institute of Technology



REFERENCES
1. Bronfenbrenner 1995
2. Bardzell 2010
3. Tuli and collogues, 2018, 2019, 2020, & 2022

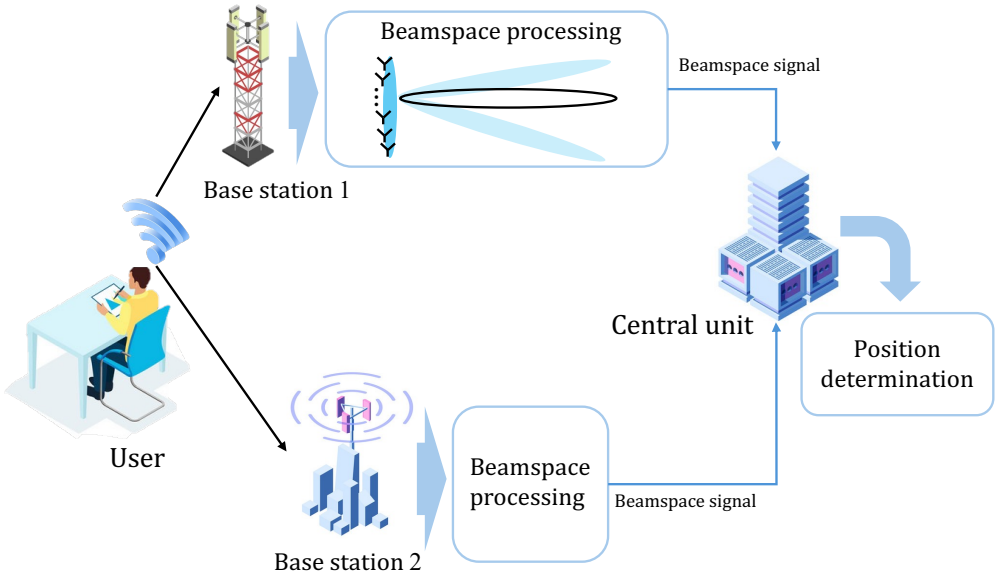
16. Theory and Methods for Privacy-Preserving Network Localization

Hanying Zhao

Theory and Methods for Privacy-Preserving Localization in Wireless Networks

Hanying Zhao (hanying@kth.se) Supervisor: Prof. Tobias Oechtering and Prof. Mats Bengtsson

- Future wireless networks will provide wireless localization service
  - User privacy becomes a challenge
- Beamspace localization with reduced communication load
  - Subspace reduction step inherently enhances privacy!
- Small revision of algorithm provides **privacy guarantee for free!**



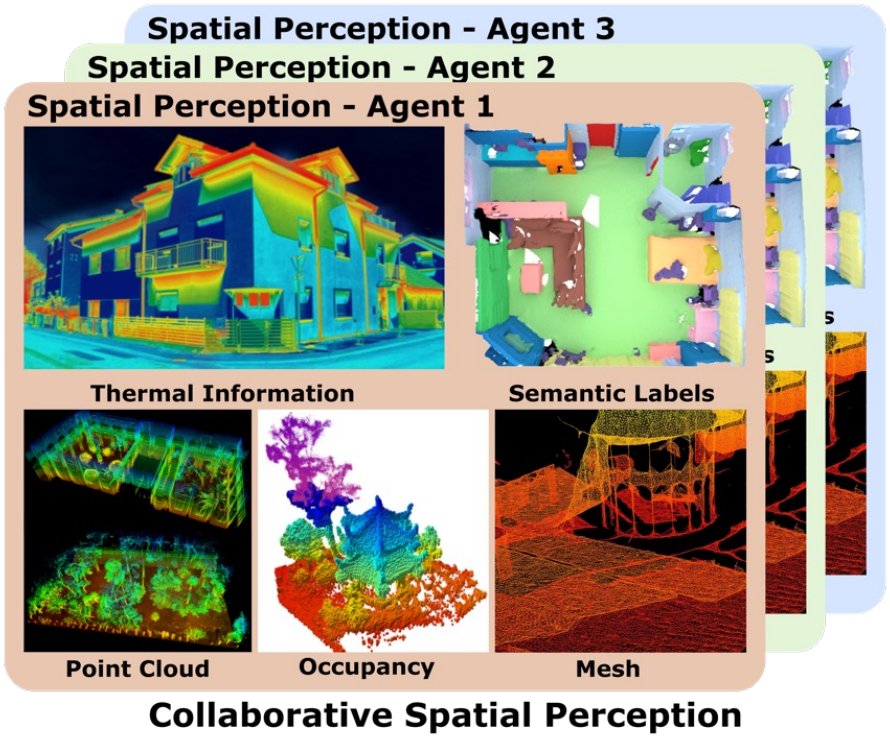
Privacy-preserving wireless localization through beamspace technology

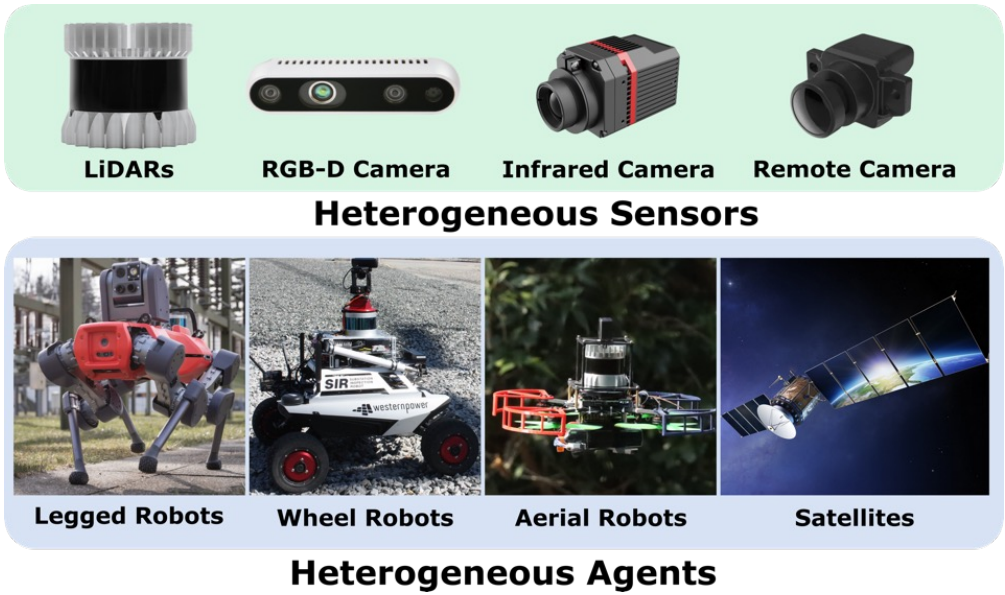
H. Zhao, M. Bengtsson, T.J. Oechtering, "A Privacy-Preserving Beamspace for Wireless Localization", submitted to SPAWC 2025

17. Towards Smart Cities: Collaborative Spatial Perception for Digital Twinning

Yixi Cai

Towards Smart Cities: Collaborative Spatial Perception for Digital Twinning





More Robust, Efficient, Comprehensive, and More Intelligent!

Thank you

digital futures

PARTNERS

KTH VETENSKAP OCH KONST

RI. SE

Stockholm University