

Challenges for the IME Visualization event

Challenge 1 — AI-driven visual analytics for industrial decision-making

Challenge 2 — Digital Twins and Immersive Visualization for Smart City Planning

Challenge 3 — Communicating Complex Data to Society: Climate, Risk & Public Engagement

Challenges and sub challenges

Challenge 1 — AI-driven visual analytics for industrial decision-making

The overall challenge: Industrial operators (energy, manufacturing, logistics) are drowning in IoT sensor data but lack tools to make it interpretable and actionable in real time. How can AI-powered visualization help human operators understand complex system states, detect anomalies, and make better decisions faster?

Sub-challenge 1.1 — Visualizations for predictive maintenance and process control

How can we visualize degradation patterns across complex machinery in ways that allow maintenance teams — not just data scientists — to anticipate failures before they happen, or provide recommendations to a human operator who needs to act immediately?

Researcher: Stand-in for Mario Romero

Connected organisations: Astra Zeneca, Siemens Energy, other related industries

Sub-challenge 1.2 – Decision-making in procurement, manufacturing and distribution supply chains – what visual support is needed?

What do we have already in terms of features in ERP-systems and business intelligence applications? Planning and scheduling – through optimization and simulation – is one side, but not always self-explanatory for decision-makers. How could visual aids support decision making in logistics processes such as material handling, inventory control, and warehousing? How to visualize the complex supply chain management context for decisionmakers to match the proper* scope for each decision?

Researchers: Martin Waldemarsson, KTS

Connected organisations: Companies within or using logistics such as Stadium, Postnord, Rusta, Martin Servera, m.fl

*proper could refer to hierarchical decision level; planning horizon; aggregated/disaggregated data; closed loop feasibility (circular economy); future compatible electrified logistics system; etc.

Challenge 2 — Digital Twins and Immersive Visualization for Smart City Planning

The overall challenge: Cities like Norrköping and Linköping are accumulating vast urban data (traffic, energy use, infrastructure wear), yet decision-makers and citizens still struggle to engage meaningfully with it. How can digital twin environments and 3D visualization support more inclusive, data-informed urban planning?

Sub-challenge 2.1 — Real-time Urban monitoring

The challenge is to define the visualization requirements for public space use. Having mobility /presence data, and models that can translate this data into insights such as attraction levels, congestion risks, and estimated demand, the key question is what stakeholders actually need to see: which KPIs matter to them, and how the outputs should be visualized to support understanding, validation, and decision-making. For example, different use cases may require different formats, such as heatmaps, flow visualizations, dashboards, alerts, or predictive warnings.

Researchers: Vangelis Angelakis KTS, Karin Ackerholm, AI Sweden

Connected partners: Linköping kommun, Visit Linköping, TheCloud, Tekniska Verken, CARER

Sub-challenge 2.2 — Urban Monitoring

The challenge is to utilize city digital twins to ingest live and historical traffic sensor data and to visualize emerging situations, such as developing congestion. By integrating data augmentation and prediction models, the goal is to enable analysis of historical events and effect from historical interventions. The session explores how visualization can help planners compare scenarios to understand impacts on flow and emissions as well as understand characteristics of different types of mobility data and models. This sub-challenge connects traffic management with long-term urban sustainability.

Researchers: Clas Rydergren and David Gundlegård, LiU/KTS

Connected partners: Norrköpings kommun, Linköpings kommun, Visual City-kommuner, Östgötatrafiken, Trafikverket

Sub-challenge 2.3 – Circular planning of masses in a smart city

Most larger cities have a planning challenge in circular material flows. We often do not have control over which materials we have available to circulate, what quality those materials are, or when we need access to them. So, the challenge is ‘How can we, with the support of visualization, balance supply and demand of circular materials in order to plan logistics flows in the development of our cities?’

Researcher: Mats Janné?

Connected organisations: Norrköpings kommun, Linköpings kommun, Trafikverket, NCC, Skanska, ...

Sub-challenge 2.4 – The future design of shelters

How can we understand, design, and support decision-making around the shelters and protected spaces of the future as an integrated part of our society – when needs, usage patterns, threat scenarios, and stakeholders are complex, dynamic, and difficult to grasp? At the same time, decisions must be made under uncertainty, across organizational boundaries, and with limited opportunities for real-world testing. Advanced visualization can enable shared understanding, explore future scenarios, and support better decisions before physical investments are made.

Researchers: Tobias Andersson Granberg, KTS, Sofie Pileman, CARER, KTS

Connected organisations: Norrköpings kommun, Linköpings kommun, Hyresbostäder, Stångåstaden, Lundbergs, ...

Challenge 3 — Communicating Complex Data to Society: Climate, Risk & Public Engagement

The overall challenge: Public institutions (SMHI, environmental agencies, public health bodies) hold critical datasets about climate risks, air quality, epidemics, and sustainability — but struggle to communicate them in ways that genuinely inform public behavior and policy and make them adjust their behavior. How can immersive and interactive visualization bridge the gap between scientific complexity and public understanding?

Sub-challenge 3.1 - Personalizing climate data for adaptation action

How can visualization support the relevance and usability of climate data on a local level - for example, to understand the impact of urban heat islands, increasing global temperature, and what actions can be taken by urban residents, planners and other stakeholders?

Researchers: Katerina Vrotsou MIT and Lotten Wiréhn Tema

Connected organisations: SMHI, Norrköpings kommun, Linköpings kommun