

Safe & inclusive traffic infrastructure with data and AI

Research projects SINTIA & DAIMOND

SAFER Project Result day
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JAIL (Jönköping AI Lab) is a research centre at Jönköping University focusing on machine learning and knowledge engineering and their application in different domains, such as smart cities

Viscando is a start-up from Gothenburg. We help making traffic in cities and industry safer with 3D sensor technology, data, analytics and AI.

Traffic infrastructure - enabler for safety & sustainability goals



Ambitious goals in sustainability & traffic safety

- Protection of vulnerable road users such as children, the elderly, and disabled persons
- Safe routes to school
- Global, European, national and local environmental goals
- Social sustainability (inclusivity)

Safe & inclusive traffic infrastructure is the enabler!

- Benefit safety of vulnerable road users
- Promotes active mobility
- Focus on children, elderly and disabled

Hard to build in practice!

- Hard to achieve desired safety goals
- Many design choices – but unclear which will work
- Expensive, often cost-inefficient

Digitalization & AI – enabler for safe traffic infrastructure

A suitable task for AI

- Traffic is a complex system depending on many parameters
- Rich, accurate data on traffic behavior is becoming available

Many possibilities with AI & smart digitalization

- Optimization of traffic infrastructure and rules
- Traffic flow forecasts
- Adaptive traffic signals
- Self-driving vehicles



Jönköping municipality's AI strategy: to leverage on AI tools and competence

“AI can be used in traffic planning to improve efficiency, reduce congestion, increase road safety and optimize the use of resources”

- An integral part of advanced digitalization
- To use AI as a part of the development of administrations and municipal companies
- To create awareness on how to best use AI in Urban Development & Traffic department
- To develop required knowledge & competence network
- To build access to data for AI

Safe pedestrian crossings in Jönköping school zones

Safe environment for children walking or cycling to school

- ✓ Active mobility
- ✓ Reduced driving to school in car
- ✓ Benefits in safety, congestion, emissions & health

Two types of crossings

- Zebra-crossing
- Zebra-less crossing

Which type of crossing provides higher comfort and safety?

- ✓ Complex and context-dependent
- ✓ Outdated guidelines
- ✓ Personal experience
- ✓ Complaints from citizens



Zebra crossing ("övergångsställe")

OR



Zebra-less crossing ("övergångspassage")

Images source: Jönköpings Kommun, [länk](#)

Safe pedestrian crossings in Jönköping school zones

The leading question:

How can data and AI help choosing the right solution?

The vision:

A scientifically and empirically supported, data- and AI-based **decision-making support** for infrastructure development



Zebra crossing ("övergångsställe")

OR



Zebra-less crossing ("övergångspassage")

Images source: Jönköpings Kommun, [länk](#)

Data & AI for decision making: SINTIA & DAIMOND

SINTIA



Safe inclusive traffic infrastructure: data and AI for decision making

AI Enhanced Mobility pre-study, 2023

Goals:

- ✓ Collect state-of-the-art traffic data
- ✓ Understand its capabilities & limitations
- ✓ Propose a framework for data- and AI-based decision support tool
- ✓ Initiate a full-scale project to develop the AI tool



DAIMOND

Data and AI for decision making support in traffic infrastructure development

Financed by Vinnova through program "Start the AI journey ([link](#))", Nov. 2023-Oct. 2024, SAFER associated

Goals:

- ✓ Develop and implement a prototype of AI tool for increased understanding and decision making
- ✓ Increase expertise and understanding at Jönköping Municipality of AI and its use for urban planning
- ✓ Promote adoption of AI in and outside the organization

3D&AI based traffic safety analysis

Collection and analysis of data from 2 crossings

- Torpagatan – zebra-crossing (övergångsställe)
- Valhallavägen – zebra-less crossing (övergångspassage)
- Located on busy paths to primary schools
- As similar context as possible

Viscando 3D&AI sensor systems

- State of the art traffic data collection and analytics, GDPR compliant
- All types of road users
- Detailed movement patterns, interactions, conflicts



Image source: Eniro, © Lantmäteriet/Infotrader i Ronneby AB

Insights & gaps

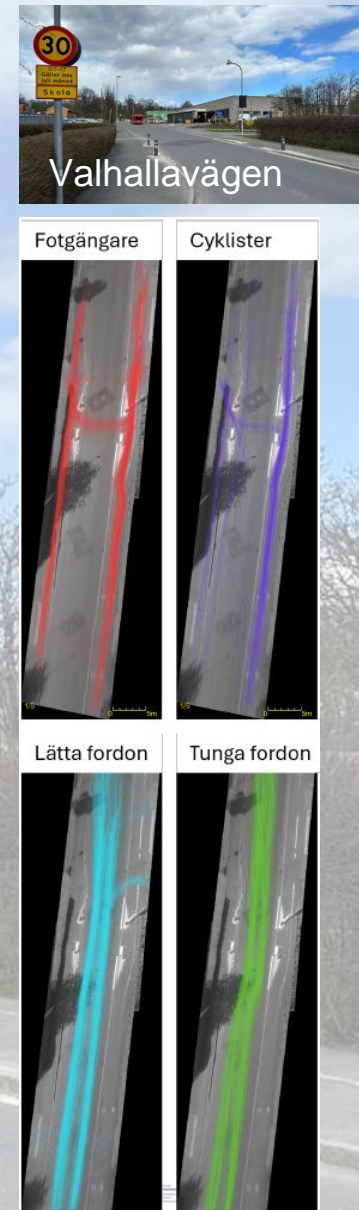
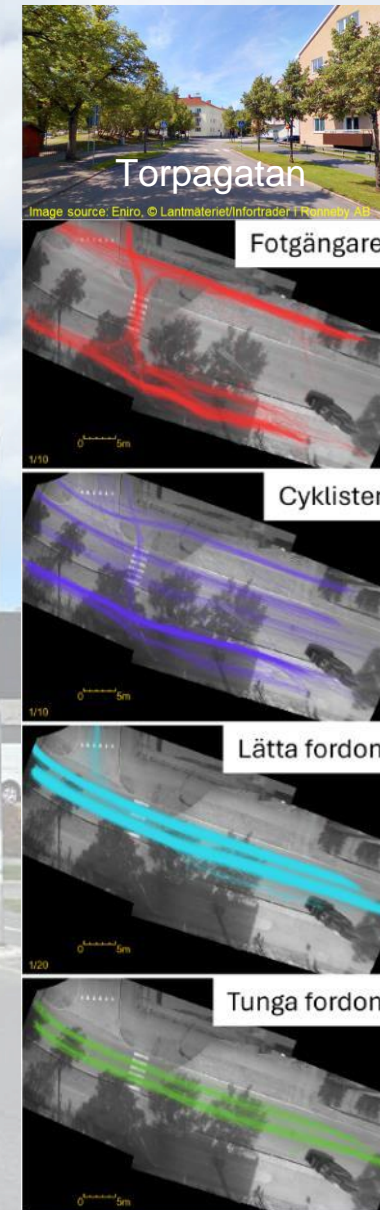
3D&AI measurements provide important insights for specific crossings

- Speed compliance is inadequate – even in interactions
- Fewer traffic conflicts than expected
- Conflicts between pedestrians and cyclists
- Drivers fail to give pedestrians priority
- Only 40% of car drivers yield to pedestrians

What more do we need to know?

- **Distinguish** children from other road users
- **Understand** how traffic conditions & infrastructure influence pedestrian behaviors and interactions
- **Predict** traffic effects of new locations & crossing designs

Solution: More data + AI!



Spatial-Temporal Representation

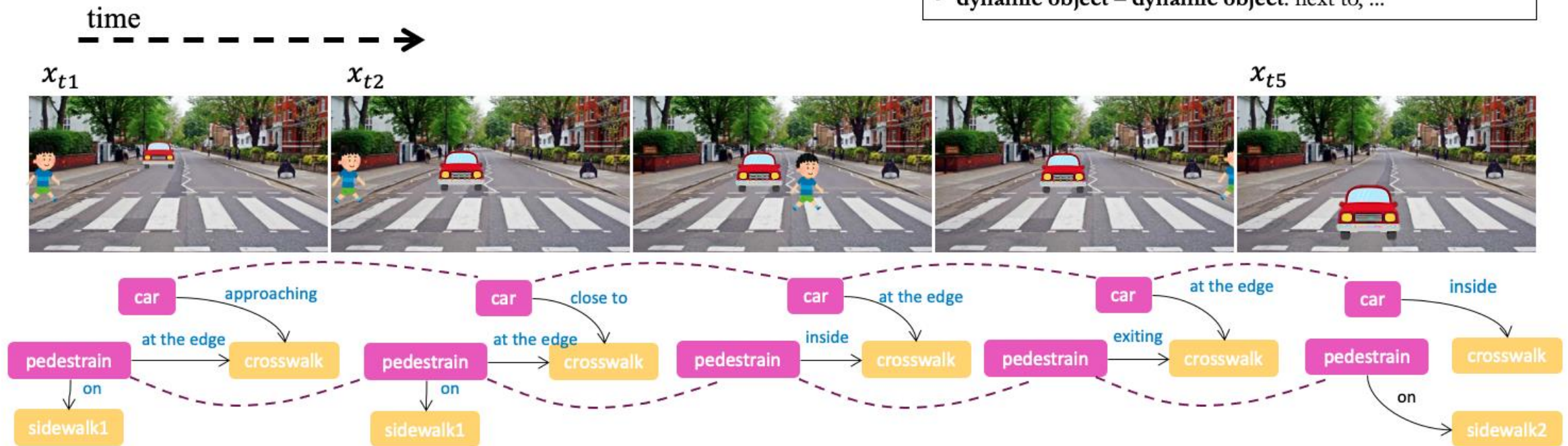
Crossing Street Behavior

Dynamic Object: pedestrian (child/adult, individual/groups), bicycle, car, bus, etc.

Static Object: crosswalk, sidewalk, bus stop, parking slot, etc.

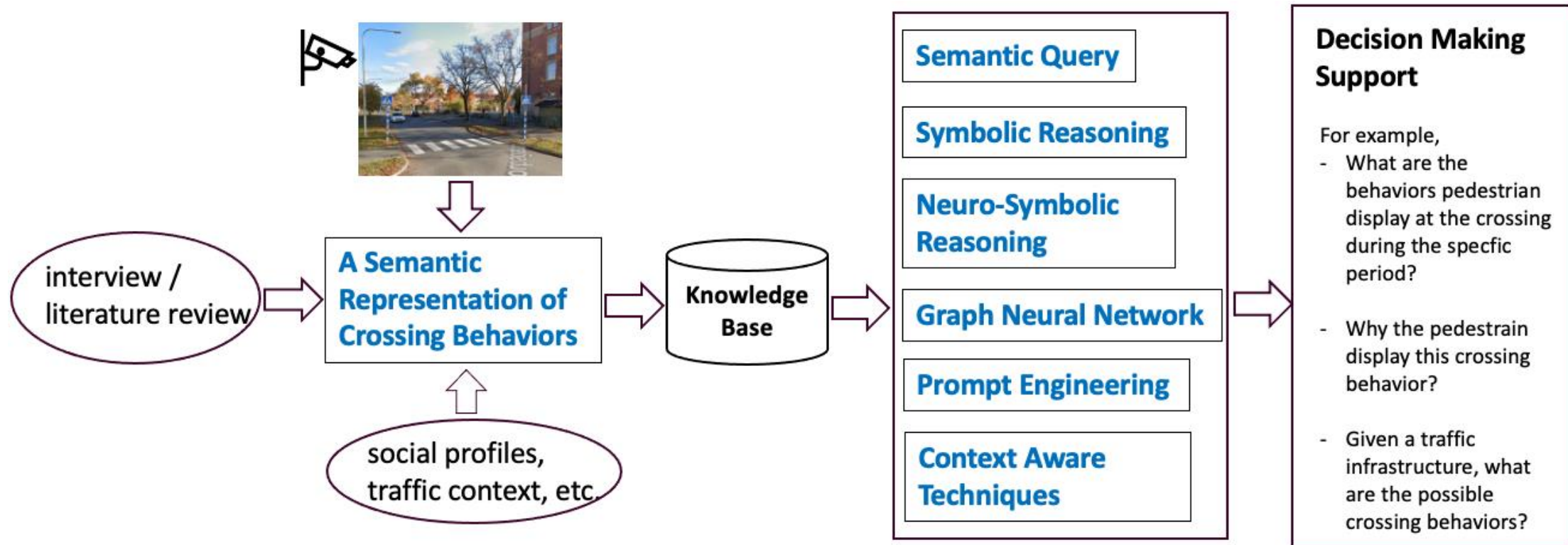
Spatial relationships (interactions):

- dynamic object – static object: on, close-to, approaching, at the edge, inside, exiting
- dynamic object – dynamic object: next to, ...



H. Tan and F. Westphal, "A semantic representation of pedestrian crossing behavior," submitted to *Semantic Methods for Events and Stories (SEMMES) workshop at ESWC 2024*.

The AI-based Decision-Making Support Framework



H. Tan, F. Westphal and J. Oetsch. "AI for Decision Making Support in Development of Safe and Inclusive Road Infrastructure", will submit to SCAI'24 - *The 14th Scandinavian Conference on AI*.

Conclusions and Next Steps

The outcomes of SINTIA and DAIMOND projects

- Build up the cooperation between JK, JU and Viscando
- Perform the traffic measurement
- Propose and develop the AI based solutions

Next steps

- Continue the cooperation and build a bigger consortium
- Further refine and develop the AI solutions
- Perform more traffic measurement to support the development of AI solutions
- Identify more use cases of AI tool, as the ambition of JK for AI advanced digitalization
- Apply for fundings from the agencies, such as Vinnova, Formas, etc.

Get in touch with the project team!

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