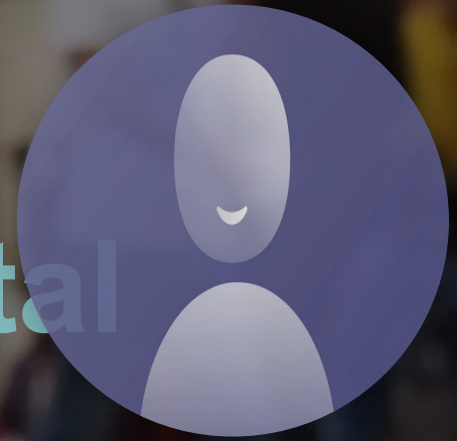# An LLM-powered Social Digital Twinning Platform

RED Seminar Series

**Önder GÜRCAN**

NORCE

27.03.2025

# Understanding the Complexity of Social Issues through Simulations

- Social issues are complex.
  - Numerous interacting variables,
    - including human behaviour,
    - cultural norms, economic factors,
    - and political dynamics
  - Constantly changing over time
- Traditional studies cannot capture
  - dynamic, non-linear interactions
  - and emergent phenomena.
- Advantages of simulations
  - Analyse and predict outcomes,
  - Controlled, replicable analysis

- Social digital twinning:
  - Collect as much as real-world data possible,
  - Recreate real-world social conditions through simulation,
  - Recreate people's actions and thoughts through simulation,
  - Run simulations using various (what-if) scenarios,
  - Test policy changes,
  - Forecast trends by calculating indicators, e.g. $CO_2$ emission by area,

# Motivation

- Most research on SDT applications focuses
  - on the smart city domain.
- Most existing SDT solutions remain tightly focused on specific problems
  - rather than offering a flexible, generic platform.
- Moreover, they often require advanced programming knowledge to set up, customize, or improve,
  - which creates a significant barrier for decision-makers, researchers, or community stakeholders who lack deep technical expertise.
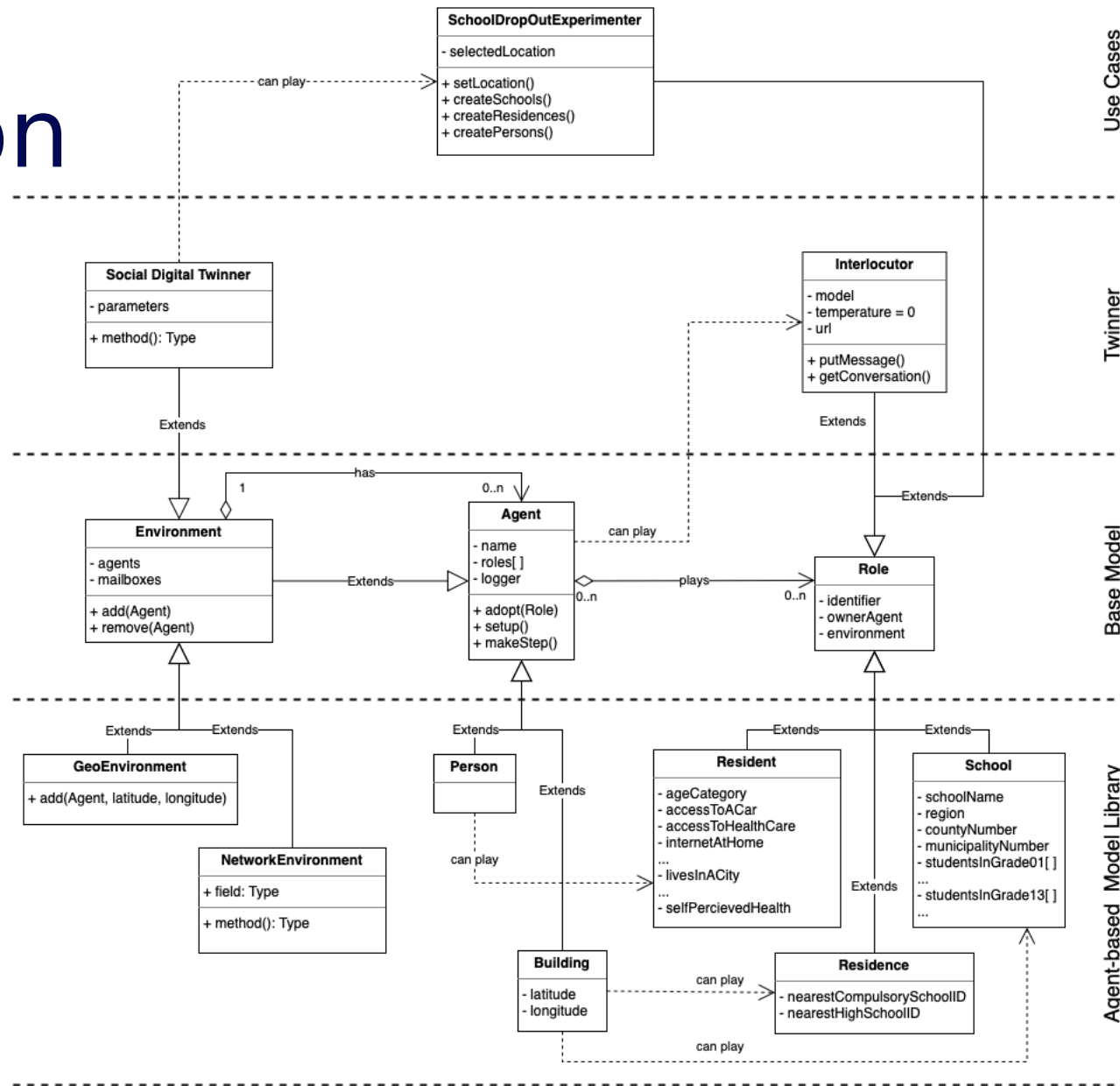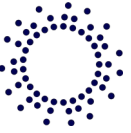
# Social Digital Twinner
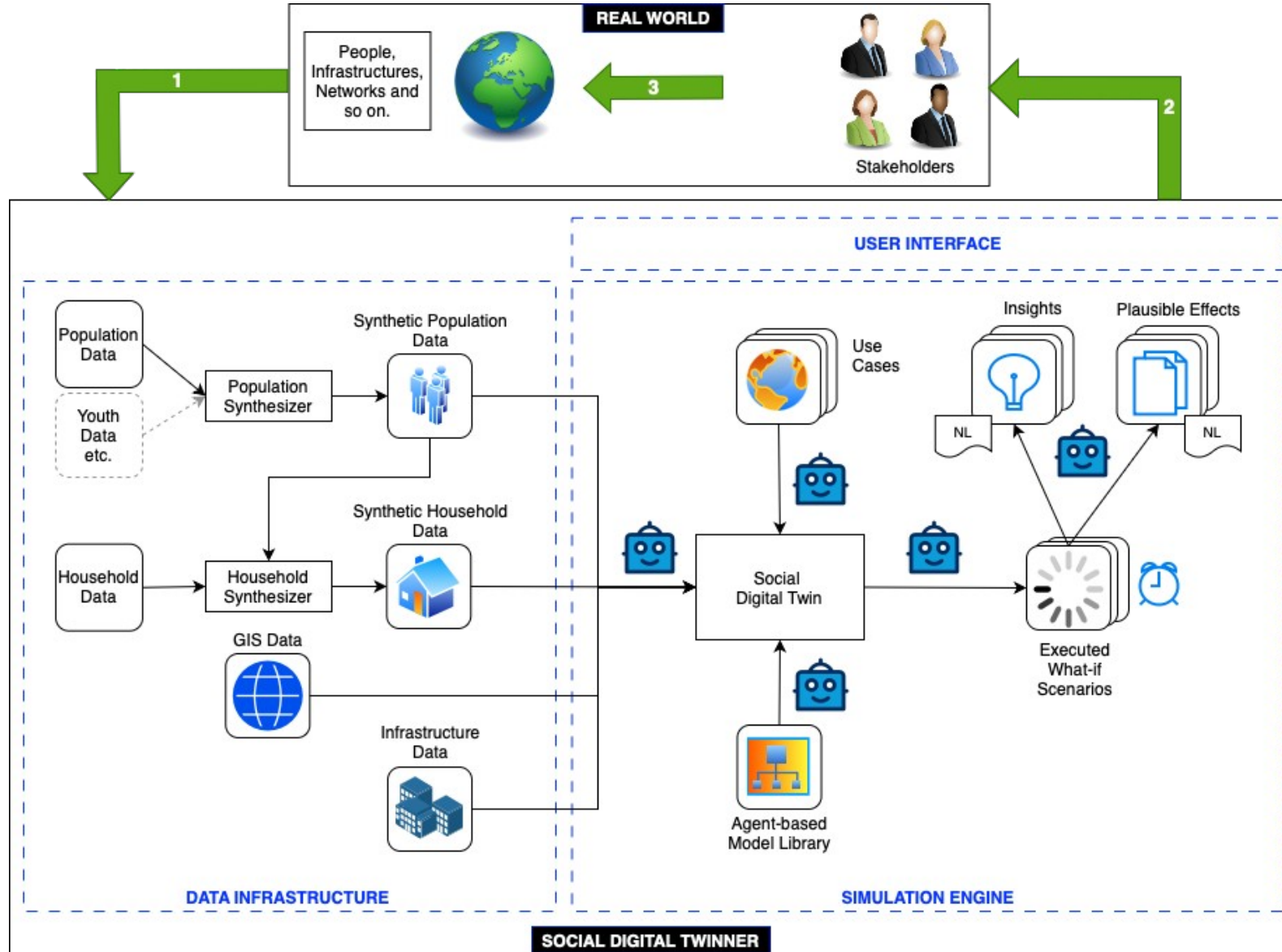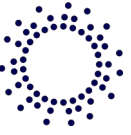
# Twinner: Data Infrastructure
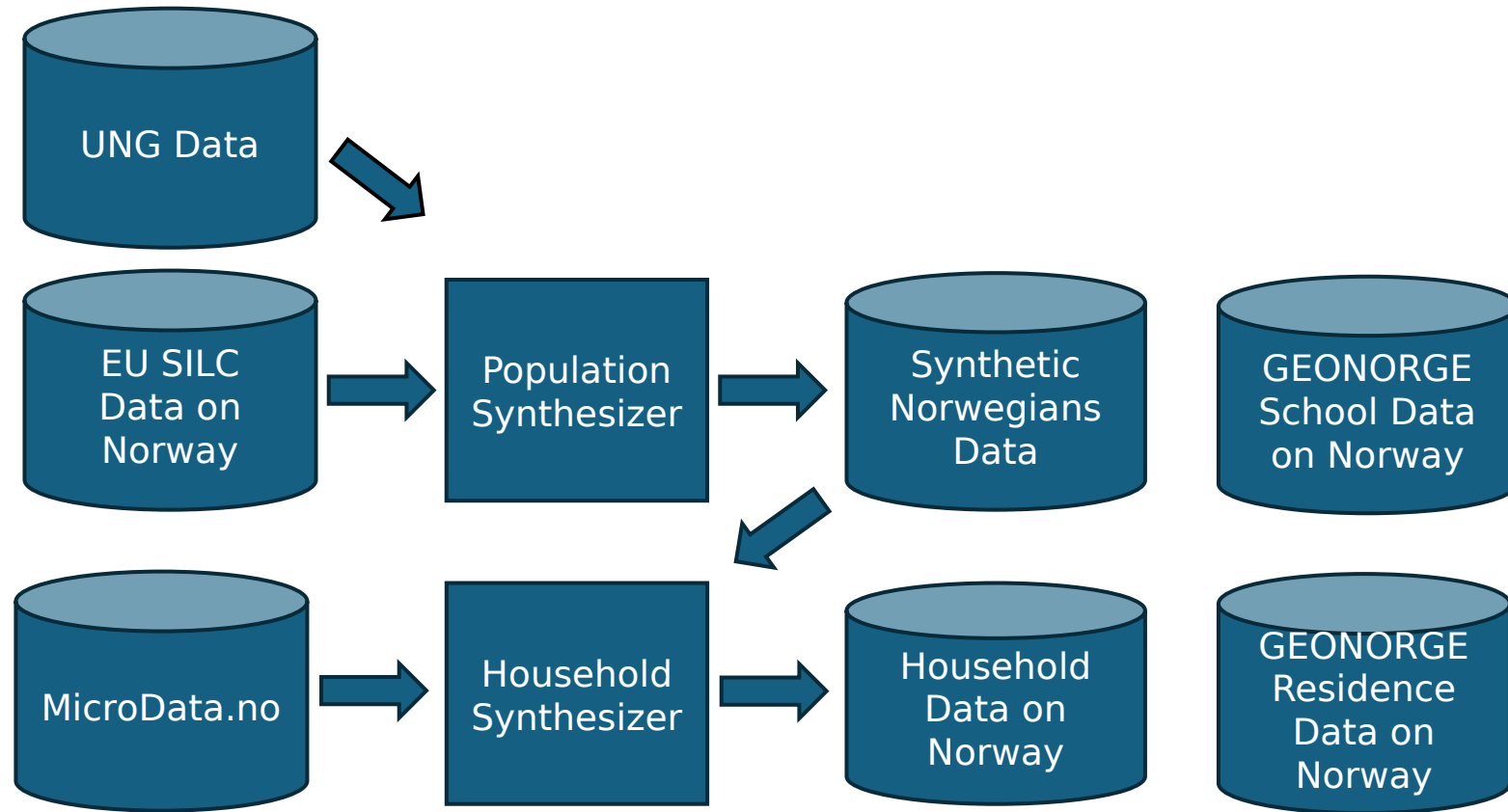
# Twinner: Simulation Engine



"Be as concise as possible in your answers. If you do not know the answer to a question, simply answer as 'I do not know.'."

You are {ownerAgent.name}, fulfilling the role of {role.name} in {environment}.
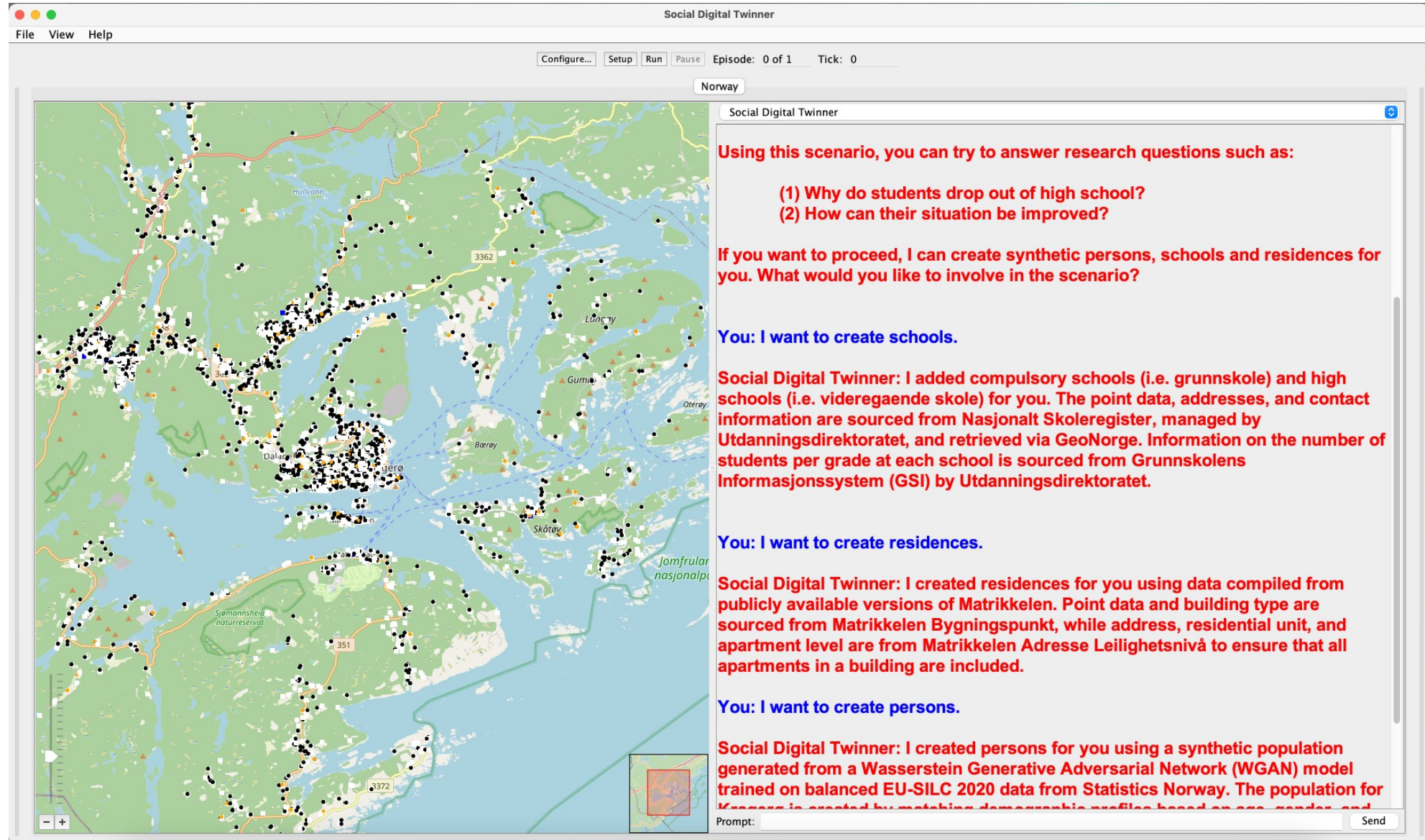
You have access to {role_specific_data}.
You are empowered to act directly as {role.name}.

Analyze the user's question or request, leverage your knowledge and the provided data, and generate the best possible answer or solution.

If you need additional reasoning steps, please outline them clearly.

Then, finalize your response as {role.name}.

# Twinner: User Interface

# Digital NEETs in Norway (DN2) Pilot

- **DN2 Pilot** is the first pilot case study of **Social Digital Twinner**
  - based on the phenomenon of NEET (Not in Education, Employment, or Training).
- In this pilot, we study the school drop out of NEETs.
  - Location: Kragerø, Norway
  - Scenario
    - Students from rural and urban areas attend secondary schools, and high-schools.
    - If there is no high-school in a rural area, a student may attend to a school in closest urban area.
  - Questions
    - Why do students who live in rural areas drop out of high school?
    - How can this situation be improved?

# Demo

- [https://drive.google.com/file/d/1Ju6vZHXk7djYxszjHkag6VqWpAufObXn/view?usp=share_link](https://drive.google.com/file/d/1Ju6vZHXk7djYxszjHkag6VqWpAufObXn/view?usp=share_link)

# Discussion

- Privacy
  - The privacy of personal data was considered when retrieving georeferenced data.
  - The synthetic population is anonymised based on training anonymised and restricted-use data from EU SILC.
  - The synthetic population is allocated randomly to residences and schools.

- Security
  - The data is securely accessed mitigating the risk of unauthorized breaches.

- Democratisation
  - On-demand, interactive social digital twins via natural language interfaces.
    - The platform lowers technical barriers, empowering non-specialists to simulate complex use cases.

# Conclusions

- We present the Social Digital Twinner,
  - an advanced and democratized platform
  - designed to build on-demand social digital twins
  - for delivering deep insights into societal challenges at various scales,
  - enhancing decision-making and policy development.

- Twinner achieves greater realism, flexibility, and scalability thanks to the combination of cutting technologies like ABM, ML and LLMs.

- We implemented of PoC for studying the school drop-out in Kragerø.

- The techniques and methodologies employed in Twinner have not been formally evaluated yet.

# Thank you.

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