Towards a Cognitive Digital Twin of a Country with Emergency, Hydrological, and Meteorological Data

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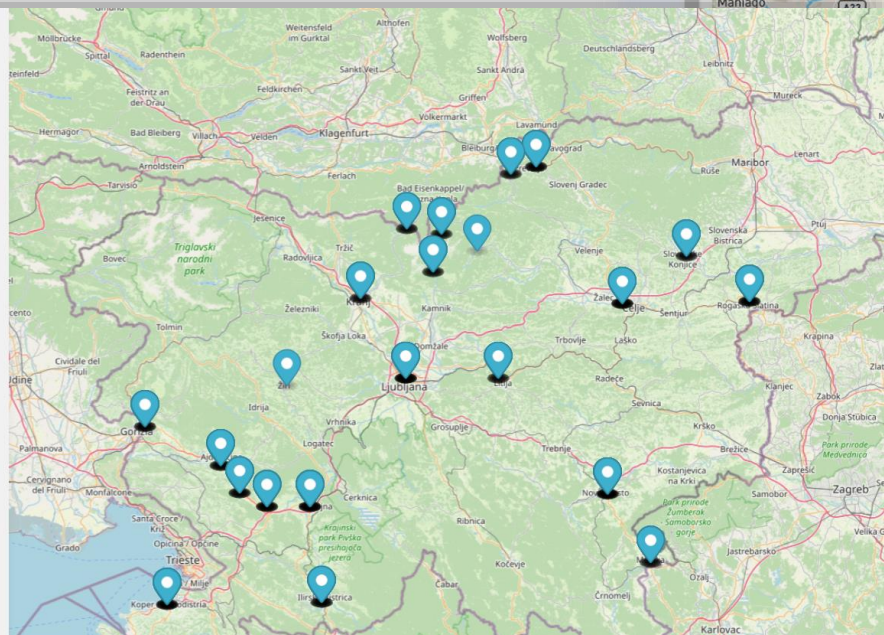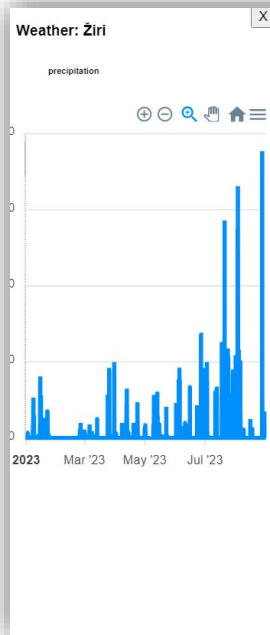
Cognitive Digital Twin of a Country

- Digital twin => replica of physical entity
- Domains of digital twins:
    - Manufacturing
    - Health
    - Smart cities
- DT of a country => Simulate, forecast social characteristics
- Digital twin of Singapore

Cognitive Digital Twin of Slovenia

- Sensors

- Media monitoring
(SLO / other countries about SLO)
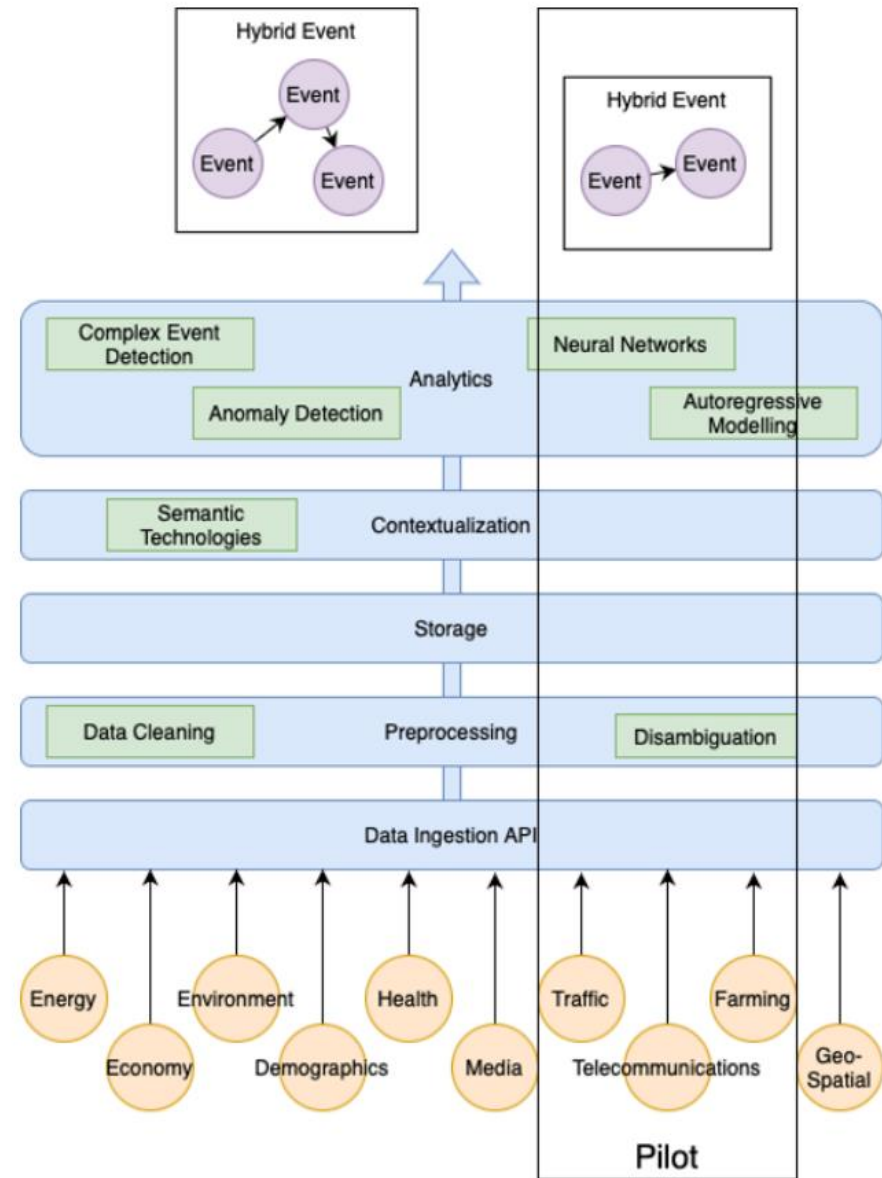
Methodology

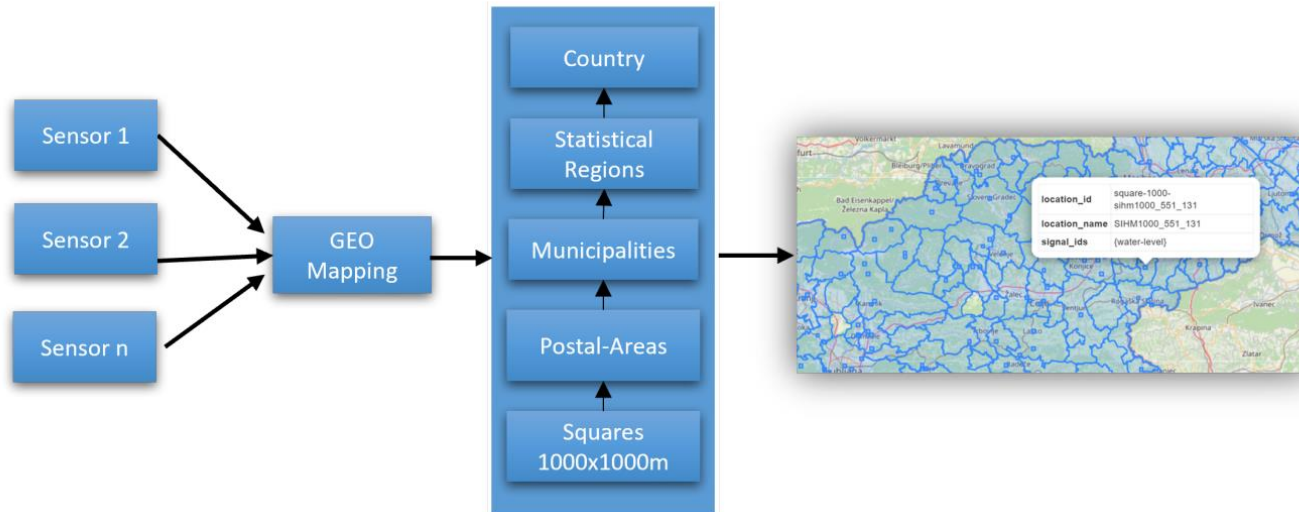# Conceptual Design

- Data
  - ARSO weather
  - ARSO surface waters
  - SOS interventions
- Data clients (scrape, ingest)
- ETL (extract, transform, load)

Data Aggregation

- By time
- By geospatial location

Experiments

Predicting Floods in Area of Poljane Valley

- Preliminary experiments
- Dataset: Feb. 2015 – Aug 2023
- Data split:
  - Training: Feb. 2015 – Dec. 2021
  - Validation: Jan. 2022 – Dec. 2022
  - Testing: Jan. 2023 – Aug 2023
- Initial columns:
  - Precipitation
  - Temperature
  - Humidity
  - Wind speed / direction
  - Number of emergency events
- Resampled 12H
- Feature engineering
  - Highest correlations around ~ 0.37
  - Interactions between columns
  - Non linear transformations

Results

	Logistic Regression	Random Forest	XGBoost
Precision	0.05	0.40	0.54
Recall	0.33	0.66	0.67
F1 score	0.08	0.50	0.60

Future Work

- Feature engineering
- Knowledge graph
- Modelling of multiple locations