Optimizing Vehicle Data Transmission for Regional Situational Awareness

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Scope

Why use trucks for data collection?

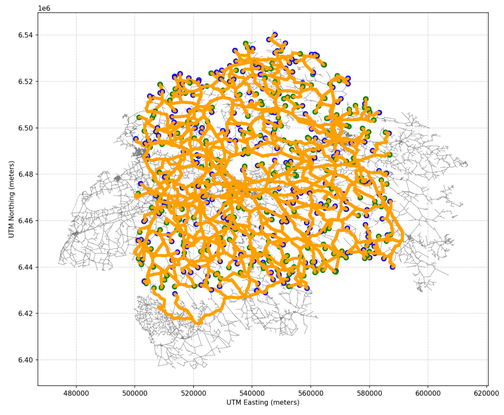
- Trucks are equipped with an abundance of sensors.
- Fleets act as mobile sensor networks across wide regions.
- Enable large-scale data for planning, monitoring, and estimation.

Challenge: Sending all raw data to a central node is inefficient.

Research Questions:

- Which data should be transmitted and when?
- What preprocessing should occur on the vehicle?
- How to maintain estimation consistency between vehicle and central node?

Vehicle Fleets an Unexplored Information Source



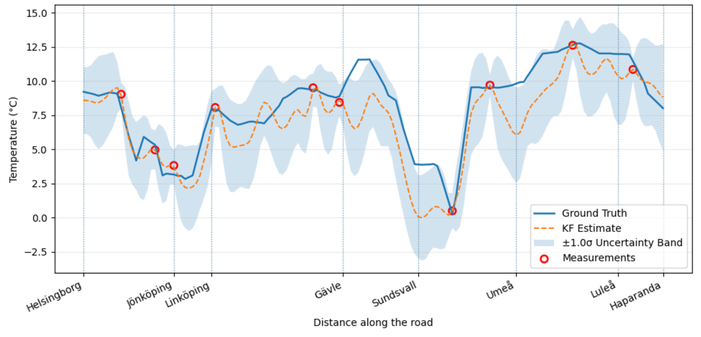
Each dot in the map represents an underutilized source of information.

First Steps

- Investigating spatial-temporal variation sampled by moving vehicles.
- Applying Kalman filter for statistical evaluation of data collection strategies.
- Starting with a centralized approach to validate concepts before addressing complexity.

Temperature Along a Road

- Studying temperature (a scalar property) along a 1D road gives results easy to visualize and interpret.
- Compare different information measures and uncertainty propagation.
- Aim to optimize sensor usage and minimize communication.



Example of temperature variations along a road, from south to north, together with estimated temperature based on information from 10 out of 100 vehicles.

Challenges

- Modeling the property of interest.
- Properly scaling the problem.
- Selecting a good case study.

Potential Applications

- Vehicle management: *optimize fleet operations.*
- Informed route planning: *reduce travel time and energy use.*
- Road condition prediction: *enhance safety and maintenance planning.*

Acknowledgements

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Contributions to SEDDIT Goals

- Reducing energy consumption through better route planning.
- Environmental monitoring through efficient usage of sensor data from vehicle fleet.

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