

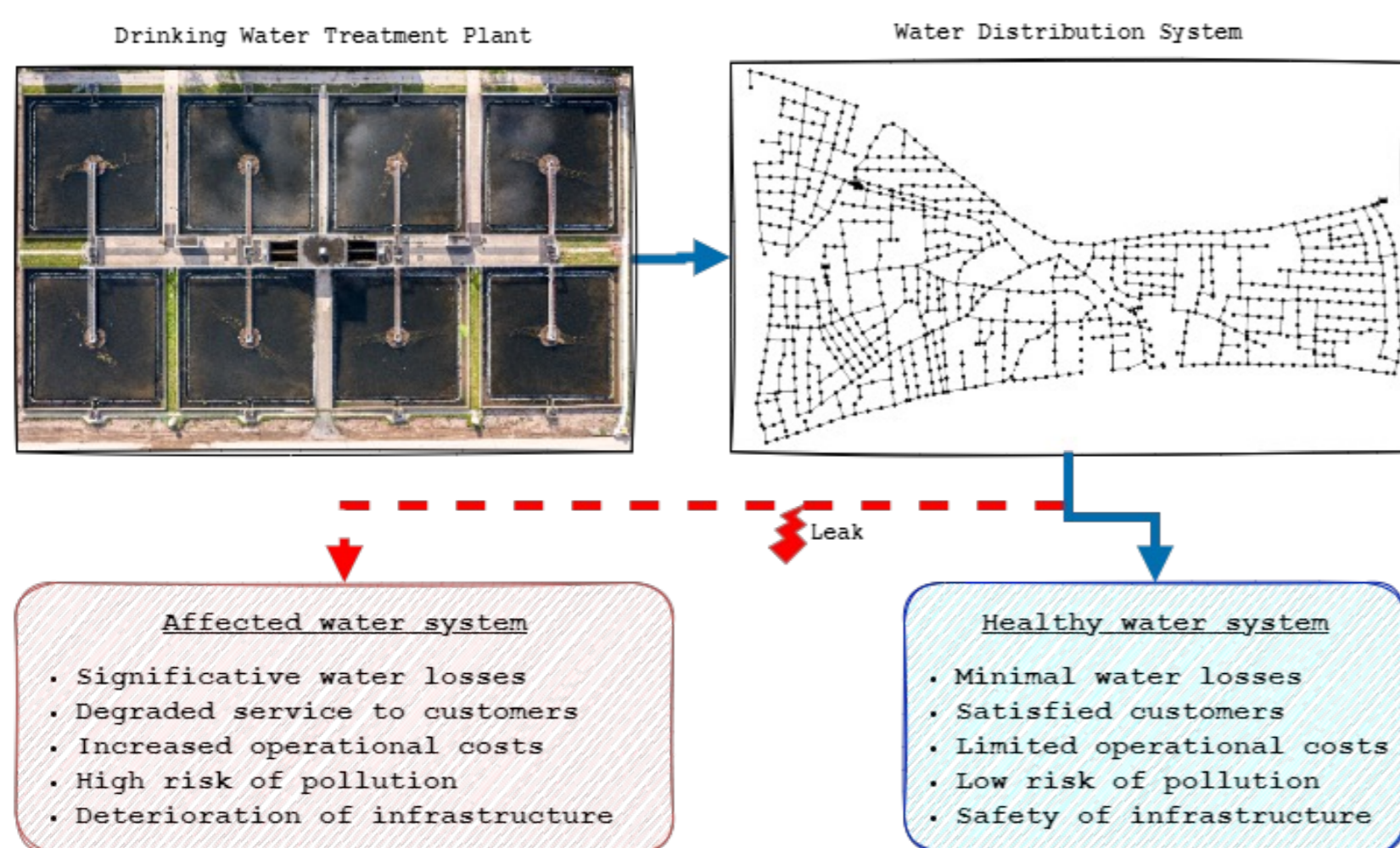
Contributions to the Real-Time Monitoring of Water Systems

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MOTIVATION

- **Leaks** in water distribution networks lead to **high economic, social, environmental and sanitary costs**.
- Water utilities may **not have access to hydraulic network models** to apply **model-based** leak management.
- **Data-driven** methods appear as a natural **solution** to this problem.



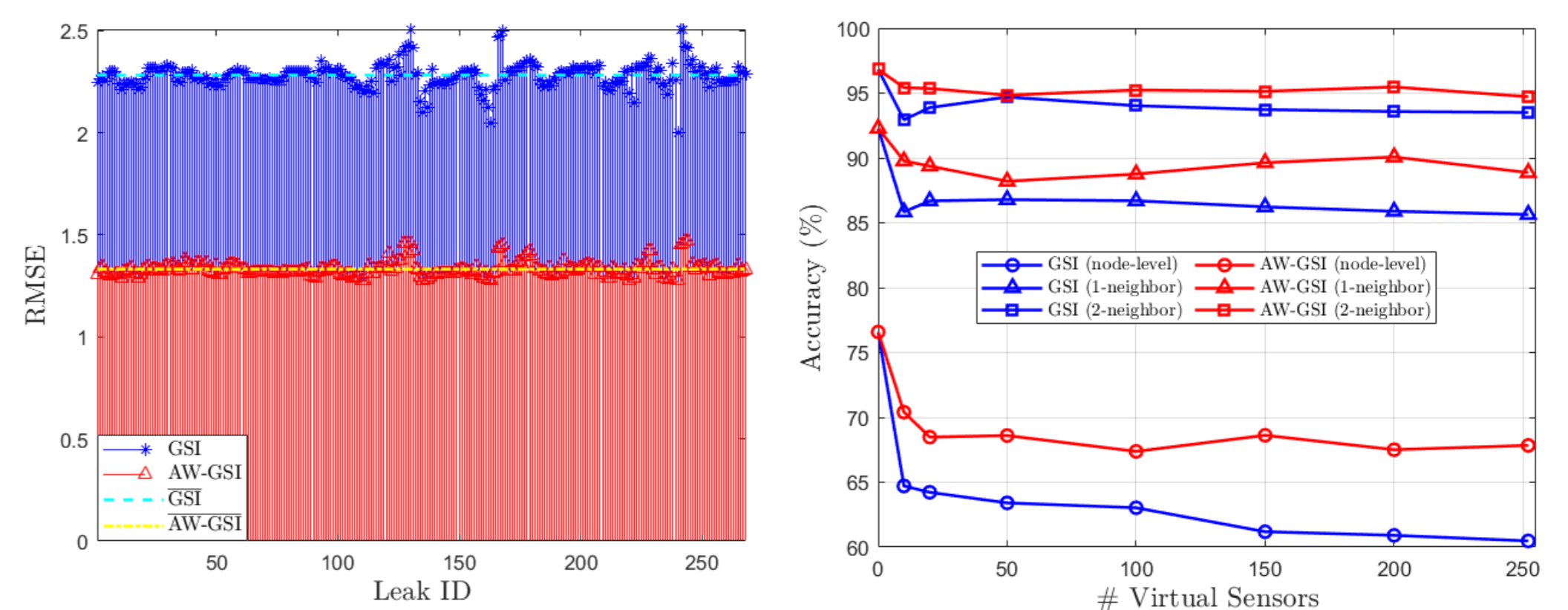
OBJECTIVES

- **Objective 1:** Design data-driven leak localization methodologies that lead to competitive performance in comparison to model-based approaches, leveraging all the available information within the water distribution network.
- **Objective 2:** Develop model-free sensor placement methodologies in order to distribute sets of sensors throughout the water distribution network, with the aim of leading to improved leak localization performance.

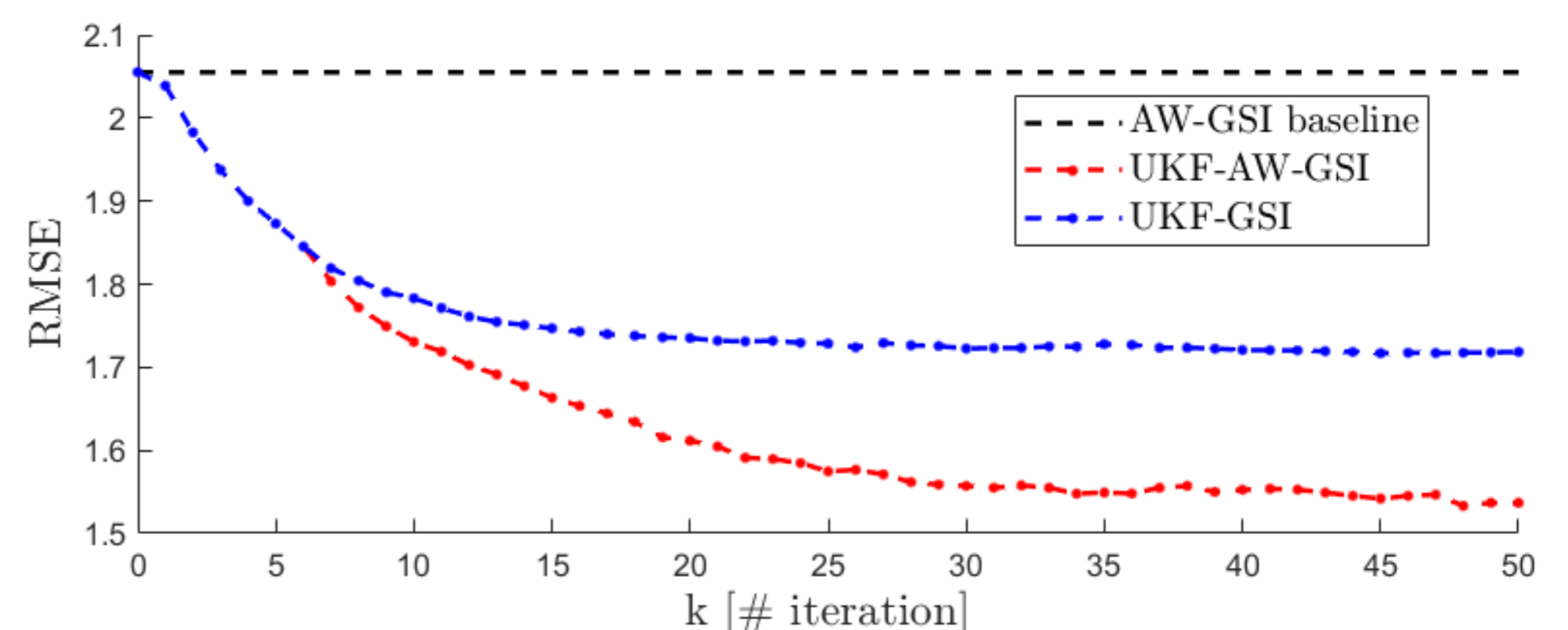
LATEST RESULTS

Leak localization in WDS: Graph-based State Interpolation

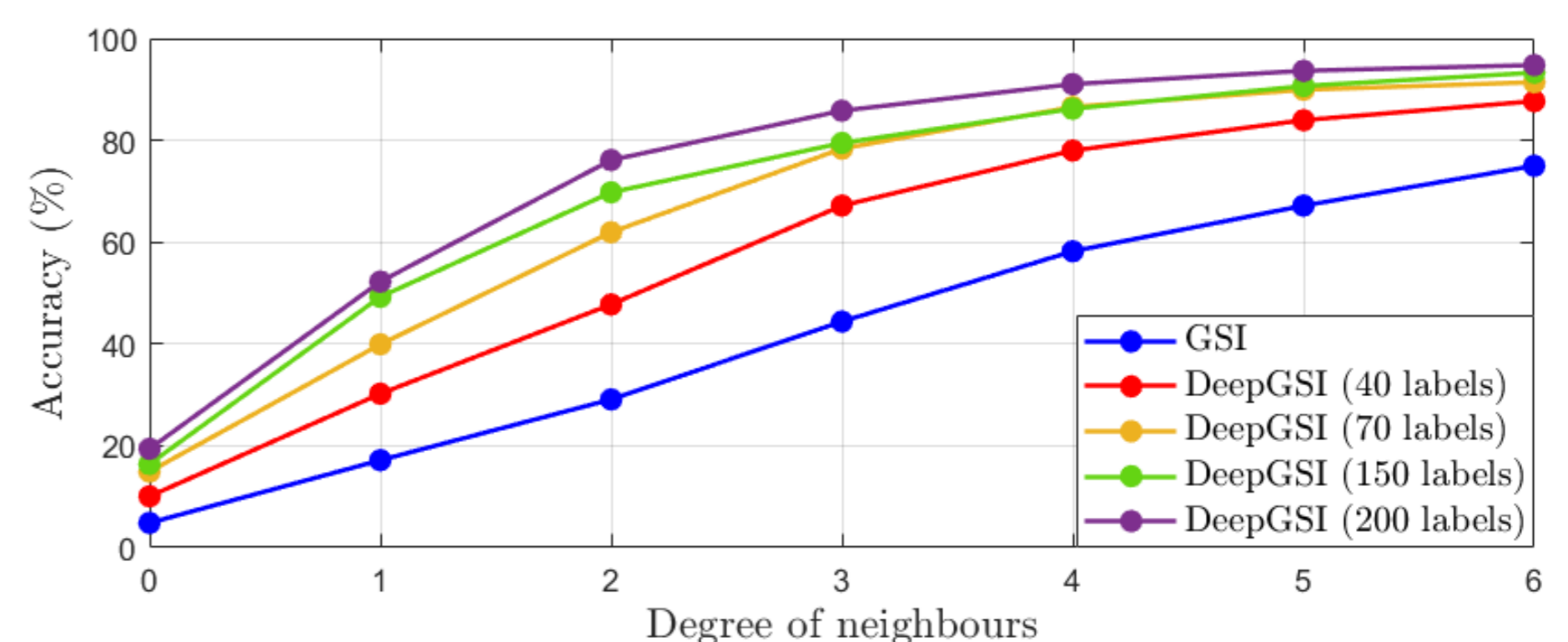
- **Integration of learning and analytical weighting:**



- **State estimation with sensor fusion (UKF) and analytical weighting:**



- **Leak localization through DeepGSI:**



Start date: March 2022
Research Plan defense: July 2022



Research collaborations and research stays

- Participation in the European project **LIFE-RUBIES** (LIFE20 ENV/FR/000179).
- Technology transfer contract **NODELAB**



Funding

Spanish Research Project **L-BEST**: Supervision and fault-tolerant control of smart infrastructures based on advanced learning and optimization (PID2020-115905RB-C21)



Publications

- [1] L. Romero-Ben, D. Alves, J. Blesa, G. Cembrano, V. Puig and E. Duviella. (2023). **Leak detection and localization in water distribution networks: Review and perspective**. Annual Reviews in Control, 55(4), 392-419.
- [2] P. Irofti, L. Romero-Ben, F. Stoican, V. Puig. (2024). **Learning Dictionaries From Physical-Based Interpolation for Water Network Leak Localization**. IEEE Transactions on Control Systems Technology, 32(3), 755-766.
- [3] L. Romero-Ben, P. Irofti, F. Stoican, V. Puig. (2024). **Nodal hydraulic head estimation through Unscented Kalman Filter for data-driven leak localization in water networks**. IFAC Safeprocess 2024, Ferrara, Italy.