Modelling & Leak Detection in Water Distribution Networks

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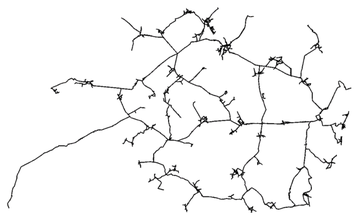
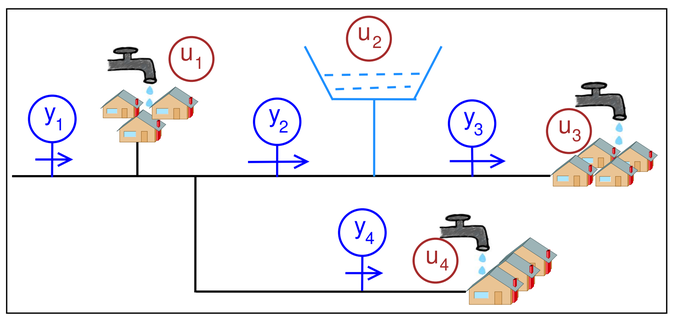
System Description

- Lorraine, France
- Two water sources
- 100+ flow sensors
- 4-year data



Modeling (Flow sensor data)



$y_1 = u_1 + u_2 + u_3 + u_4 + \text{leaks}$

u_i unknown

$y_1 = f(\text{ToD, DoW, Vacations, Temp})$

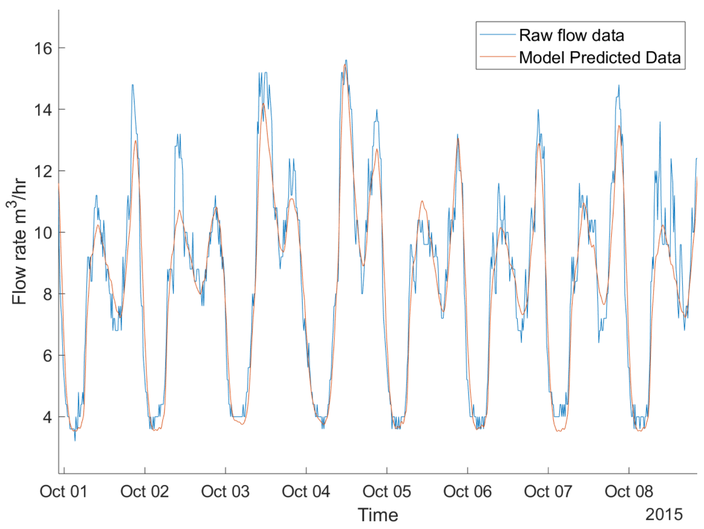
ML Modeling | sensor faults, system errors

Constrain the model set

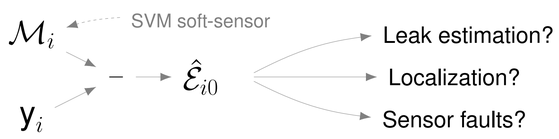
Domain knowledge

SVM/RKHS with fixed hyperparameters

Figure 1: Modelling approach [1]



Residue generation and Inference



How? Combine soft-sensors & network info:

- Generate robust residuals to localize leaks
- Use residuals to estimate sensor faults

Future works

- Complete Graph theoretic formalism (ideas?)
- Fusing the leak and sensor fault estimation to obtain a robust localized leak estimation
- Including other types of residues
- Incorporating other sensors (level, pressure)

Acknowledgements

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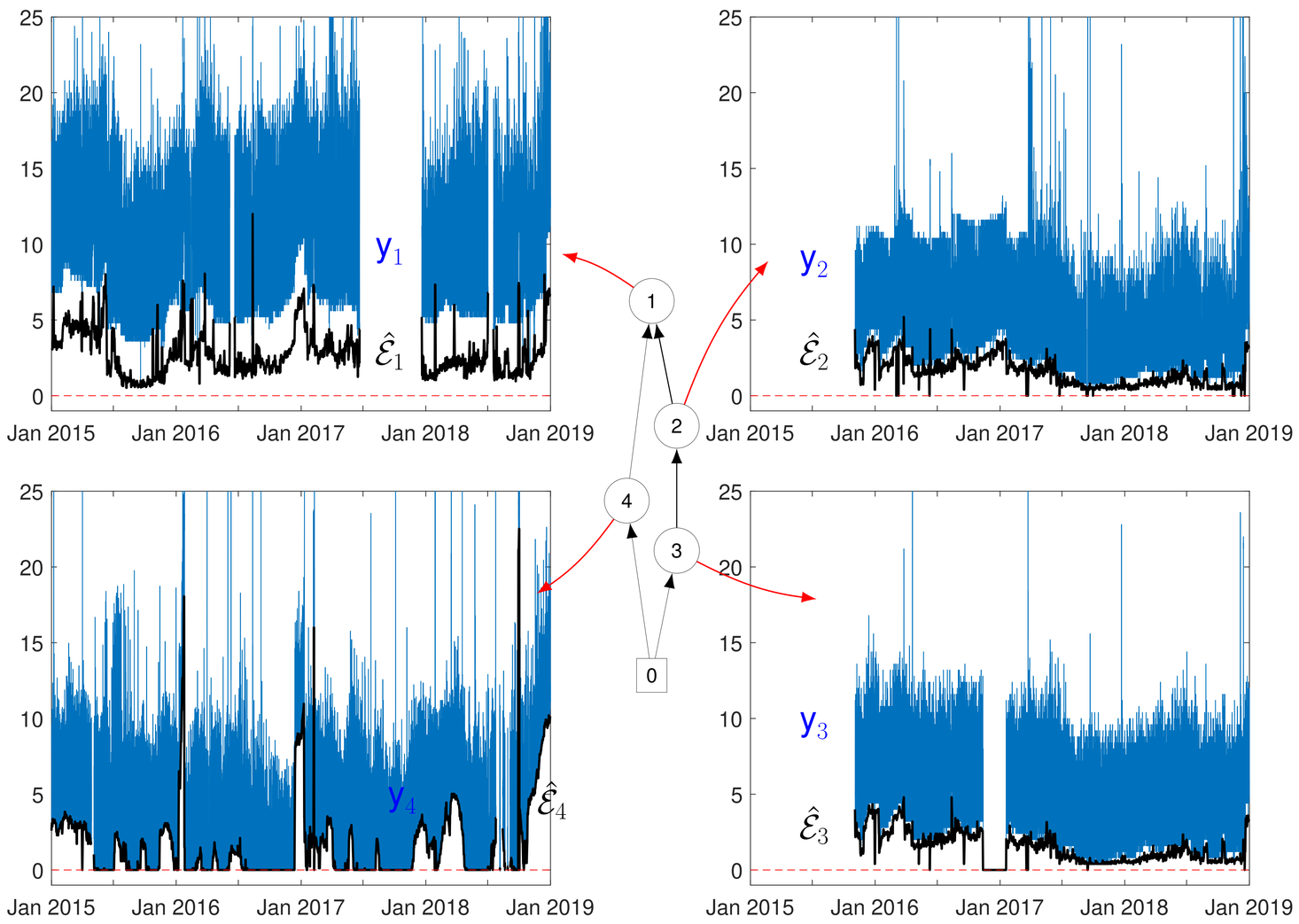
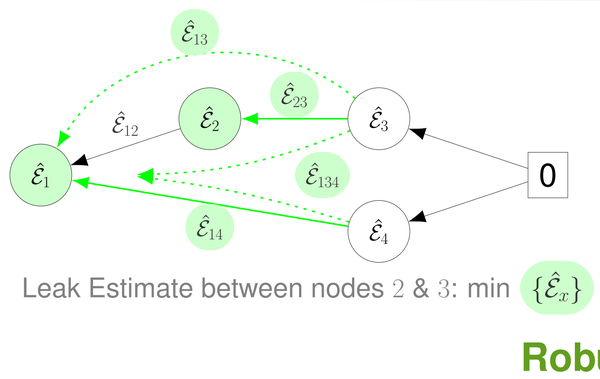
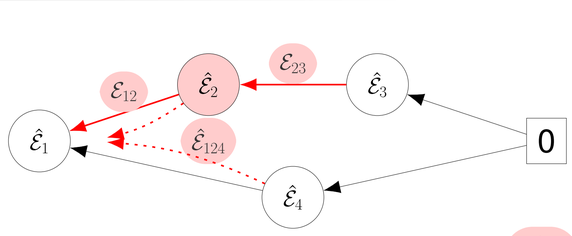
Residues (Flow)



Robust Residue generation & Inference (Example)

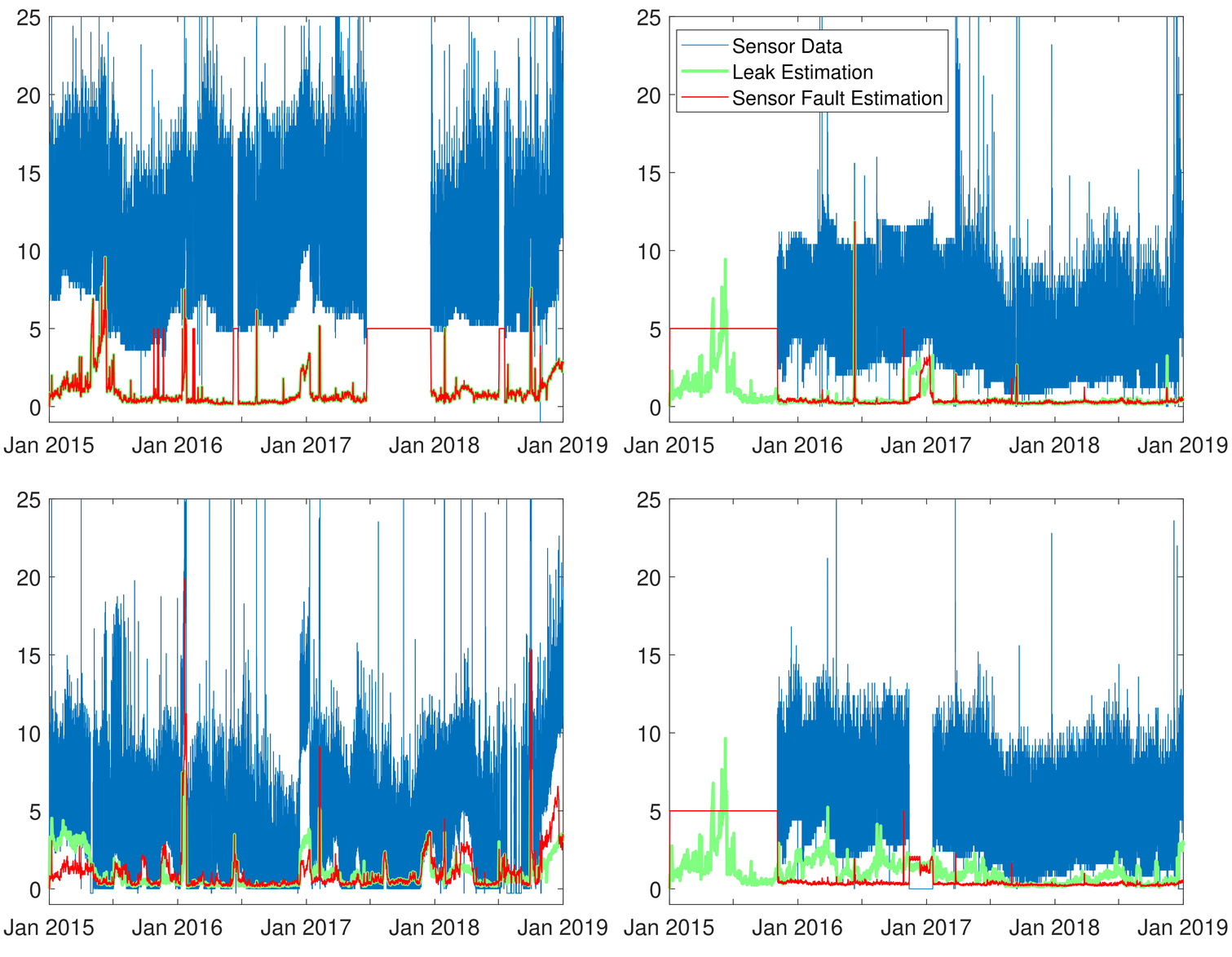


Leak Estimate between nodes 2 & 3: min $\{\hat{\mathcal{E}}_x\}$



Estimating Sensor fault at node 2: min $\{\hat{\mathcal{E}}_x\}$

Robust residues (Flow)



[1] BM Brentan, V Laurain, and S Aberkane. How to infer prior knowledge in water distribution data-driven models? In WDSA/CCWI Joint Conference Proceedings, volume 1, 2018.