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Active Localization of Gas Leaks Using Fluid Simulation

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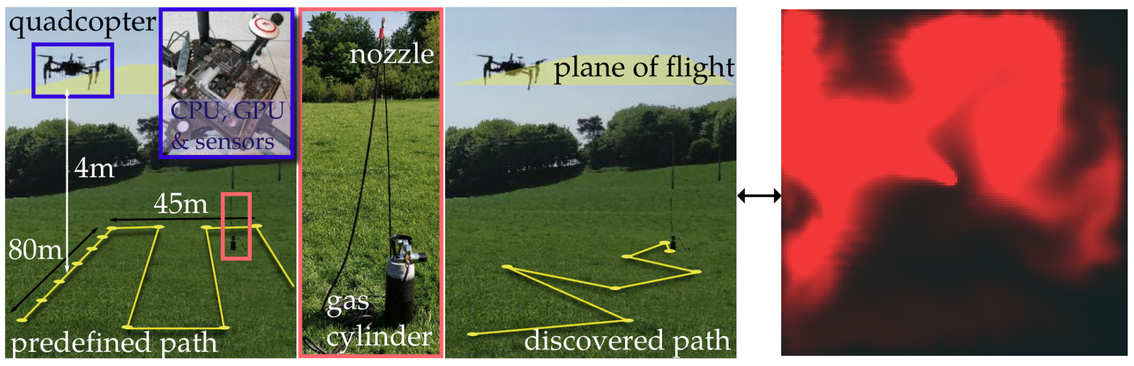
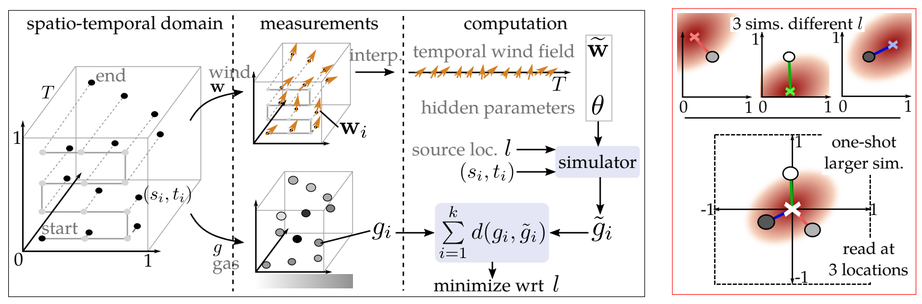
Introduction



We propose a novel **gas leakage localization** algorithm by employing a **fluid simulation as a model**.

Methodology

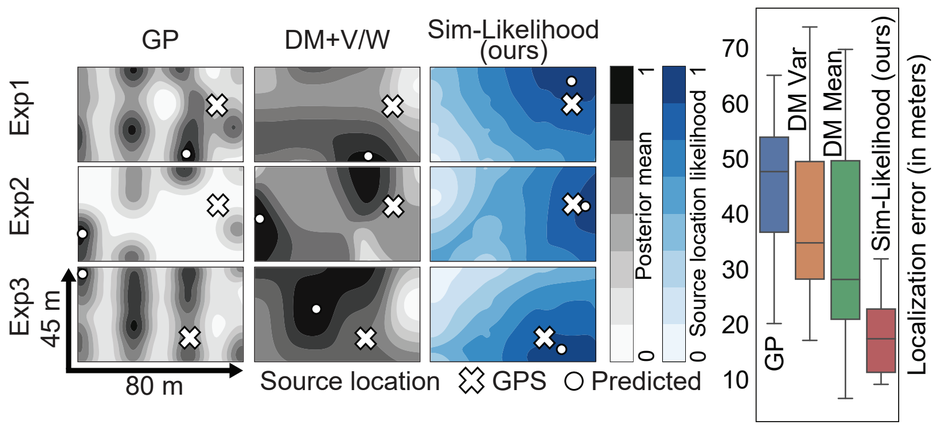


1) Wind estimations drive the simulation 2) Gas readings are compared

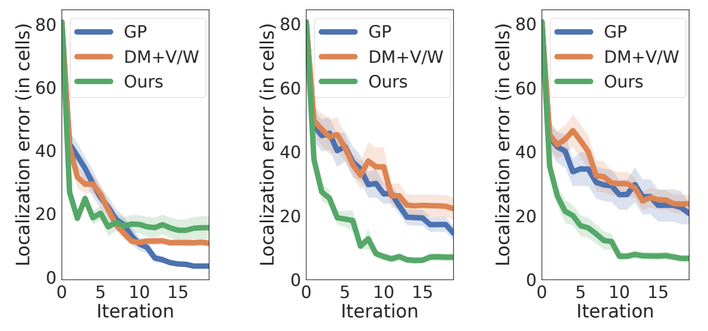
A key observation is that one simulation over a larger domain eliminates the need for multiple smaller ones, resulting in computational savings.

Experiments & Results

Predefined waypoints



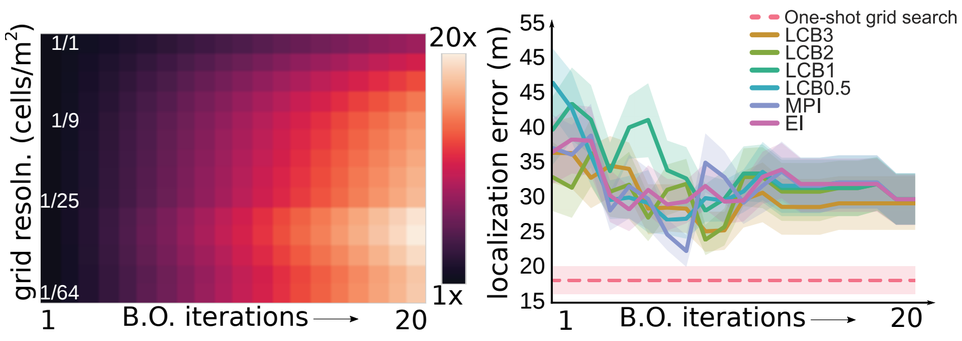
Active sensing

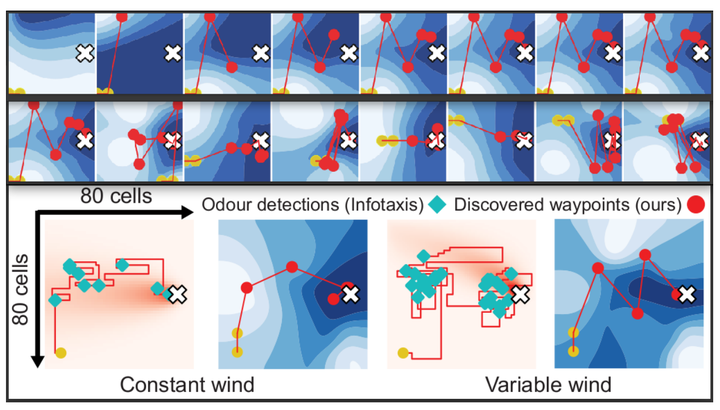


Regression Baselines

Accuracy under different wind conditions

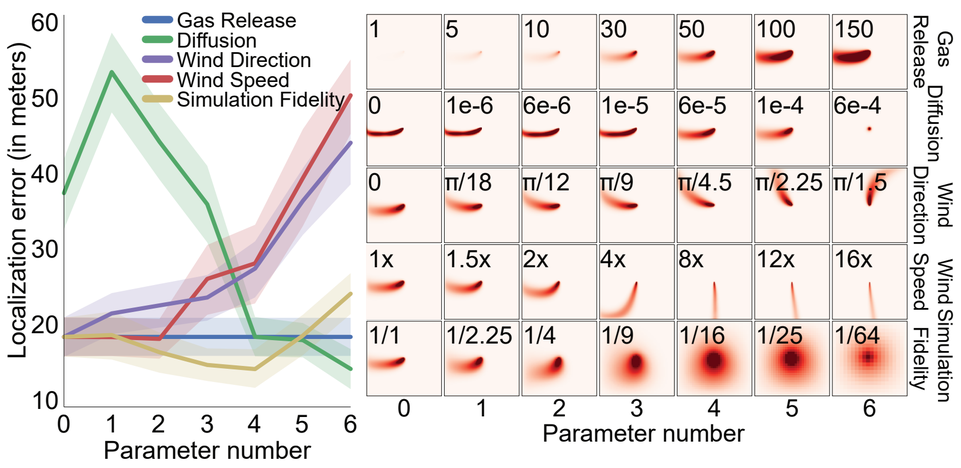
Optimizing with a simulator

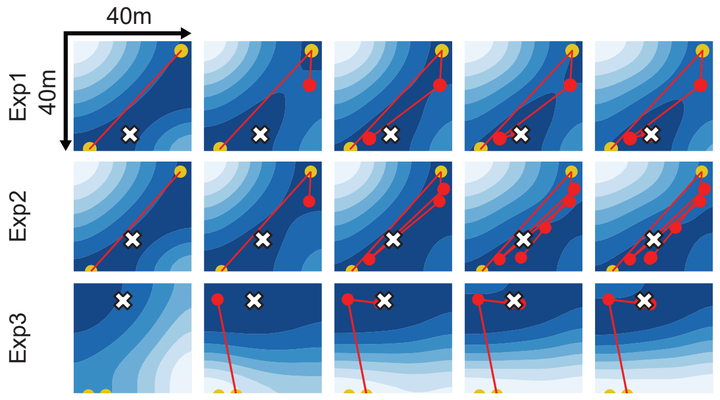




Convergence of active sensing

Sensitivity analysis





Experiments with a UAV

Conclusion

- Limited data is available -> **Fluid simulation incorporates useful dynamics knowledge**
- In online setting, running computationally expensive simulations is not feasible -> **B. O. can decrease the number of simulation calls, but it is often not enough**
- Simulation parameters need to be optimised for the task -> **Low fidelity simulations with noisy parameters still lead to accurate localization**
- When wind is not present, baselines perform better -> **When wind is present, our approach converges much faster**
- Hardware limitations, in challenging environments, make the problem hard -> **Our algorithm succeeds by optimizing with a fluid simulation in the loop**

Acknowledgements
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