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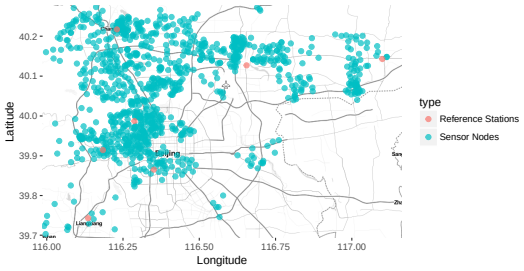
Semester Thesis:

Learning Domain-Invariant Feature Representations for Sensor Array Calibration

Recent years have witnessed a growing interest in urban air pollution monitoring, where hundreds of low-cost air quality sensors are deployed city-wide. To guarantee data accuracy and consistency, these sensors need periodic calibration after deployment. Since access to ground truth references is often limited in large-scale deployments, it is difficult to conduct city-wide post-deployment sensor calibration. In our previous work [1], we proposed a distribution matching based schema to transfer the calibration parameters of source sensors (with access to references) to target sensors (without access to references). In this project, we try to learn domain-invariant feature representations for air quality sensor calibration.



Tasks

The goal of this project is to learn domain-invariant feature representations for sensor array calibration. Instead of transferring calibration parameters from a source sensor to a target sensor [1], this work tries to learn feature representations and use those features to calibrate sensor array accurately and remove sensor shift on-the-fly. This project offers the opportunity to learn the basic ideas on sensor array calibration, calibration transfer and representation learning schema. You will get the change to test your proposed algorithm on a real deployment air quality monitoring sensor network which contains almost 1,000 sensor nodes in Beijing, China. The tasks for this project are:

- Learn domain-invariant features to calibrate air quality sensors of $PM_{2.5}$ and PM_{10}
- Build a framework in Python which contains sensor array data preprocessing, feature representation learning, sensor calibration and model evaluation.

Requirements / Skills

- Basic knowledge in machine learning, or the motivation to independently learn basic concepts
- Programming skills in Python

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References

[1] Y. Cheng, X. He, Z. Zhou, and L. Thiele. Ict: In-field calibration transfer for air quality sensor deployments. *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies*, 3(1):6, 2019.