ETH Eidgenössische Technische Hochschule Zürich Swiss Federal Institute of Technology Zurich

TU Graz

TIK Institut für Technische Informatik und Kommunikationsnetze Computer Engineering and Networks Laboratory

Prof. Dr. Lothar Thiele

Semester / Master Thesis:

Modelling Air Pollution Transfer during Global Pandemic

Air quality changes are difficult to characterize while maintaining both interpretability and accuracy of spatial interpolations and temporal predictions. It therefore remains hard to understand the complex interactions between air pollution and other environmental, meteorological, land-use and traffic-dependent factors. A particular difficulty is to decompose the impact of local and remote air pollution sources (e.g., when pollutants are brought from remote places with the wind, also called *pollution transfer*). The COVID-19 related lockdown measures offer a unique opportunity to understand how changes in economic activity and traffic affect ambient air quality and how much pollution reduction potential can the society offer through digitalization and mobility-limiting policies.

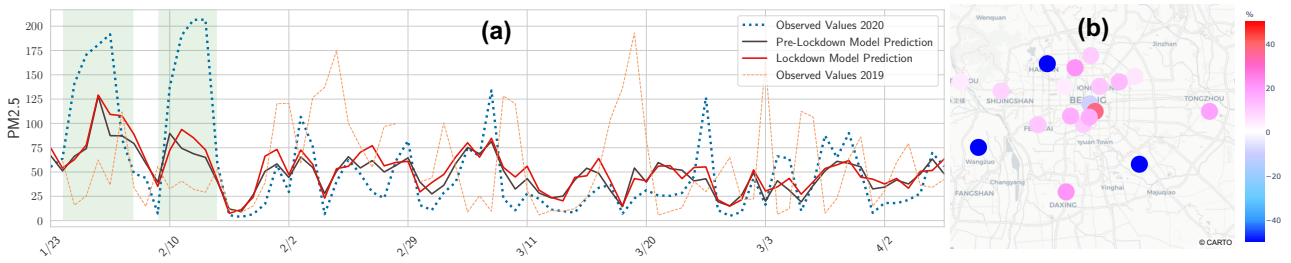

Figure 1: (a) Sample predictions for PM2.5 for Beijing, China. Green zones show the pollution transfer phenomenon, which caused unexpectedly high values in the measurements during the lockdown period in the beginning of 2020. (b) Spatial distribution of pollution reduction for PM2.5 in Beijing. Red means increasing and blue means reduction in the plot. **Yes, PM2.5 increased during lockdown!**

Tasks

In our previous work (see the figure above and read the paper: arXiv) we used Generalized Additive Models (GAMs) to model temporal air pollution changes over the lockdown in several regions. Our model is capable of generating accurate predictions, is however inaccurate when pollution transfer events takes place (see green highlighted zones in the figure). In this project, we wish to address this problem and model the contributions of local and remote air pollution sources separately. The project includes the following tasks: *(1)* Propose a concept how to separately model local and remote air pollution contributions. *(2)* Propose a method to include air pollution measurements from remote locations into an existing model (the code is online: Github). *(3)* Experiment with public data from several regions around the globe to understand the spatio-temporal air quality evolving patterns during COVID-19 lockdowns. Localize remote sources of the increased particle concentration in Beijing.

Requirements / Skills

- Basic knowledge of machine learning, or the motivation to independently learn the basic concepts;
- Curiosity to test novel methods, explore and evaluate their potential;
- Programming skills in Python.

Contacts

- Yun Cheng: chengyu@ethz.ch, ETZ G77
- Olga Saukh: saukh@tugraz.at, TU Graz / CSH Vienna