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Building spatial-temporal NO2 land use regression models in complex urban environment

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Air quality and traffic-related pollutants in urban areas are major concerns especially in meg-cities. Current Air Quality Monitoring Station (AQMS) cannot sufficiently reveal these pollution conditions with limited point measurements and limited information cannot supply adequate insight on personal exposure in a complex urban environment. Land Use Regression (LUR) model provided a feasible solution for estimating outdoor personal exposure by adding multiple data sources. However, fixed-site passive monitoring still lacks enough spatial coverage or spatial flexibility to estimate pollutant distribution at the fine-scale level.

A Mobile Air Sensor Network (MASEN) project was deployed in the Hong Kong area, with electrochemical gas sensors installed on the routine buses to capture on-road NO_x pollutant measurement, the data was collected by the integrated sensor system and transfer to the database for real-time visualization. Compared with previous mobile measurements used for LUR model building which limited to 1-2 routes, this measurement covered major roads in the Hong Kong area and get an overview of pollutant distribution at various ambient. Two main variables were introduced to improve the model performance: 1) Sky View Factor (SVF) which represented pollutant dispersion status were obtained from Google street view image, a deep learning model was used for scene parsing to recognized targets in this procedure, 2) a Real-time Traffic Congestion Index (RTCI) which represented traffic pollutants emission was obtained from Google map and merged with road network. A common LUR model will be built based on a distance-decay regression selection strategy for variables selection. Meanwhile, a spatial-temporal LUR model will be built which contained both diurnal variability and day-to-day variability. Finally, a high-resolution pollution map of the urban areas will illustrate NO_2 pollutant distribution.

In this work, we aimed at estimating traffic-related pollutants in a complex city environment and identifying hotspots at both spatial and temporal aspects. Meanwhile, the novel data source which closely associated with traffic-related pollutant emission also gives a better understanding of guidance on urban planning.