ABSTRACT

Indoor air quality assessment is vital for building habitability, but current protocols suit larger buildings and involve costly instruments. To address this gap, this study employ micro sensors for detailed observations. This study establish a real-time validation system, enhancing outlier detection using a sliding window with an optimal size of 240 data points (8 hours). Our analysis shows micro sensors' reliability, with an average of valid data from six sensors consistently exceeding 89%. In spatiotemporal modeling, LSTM Neural Network outperforms MLP. The temporal model, trained with individual station/node data, yields mean RMSE values of 6 $\mu g/m^3$ ($PM_{2.5}$) and 67 ppm(CO_2). However, the spatial model shows increased RMSE during cross-validation, necessitating further investigation. Results reveal $PM_{2.5}$ concentrations rising during infiltration events, signifying pollutant transport into the observed room, while CO_2 concentrations decrease and vice versa. Partitions significantly affect CO_2 concentrations, impacting predictions near '1O' node. Visualizations indicate homogeneous $PM_{2.5}$ distribution exceeding the 24-hour standard, while CO_2 consistently exceeds expectations in partitioned areas without surpassing standards. This underscores tailored indoor air quality assessments' importance, especially for smaller buildings, utilizing micro sensors for a comprehensive understanding of indoor air quality dynamics.

Keywords: Air Quality Assessment, Spatiotemporal Distribution, Machine Learning