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Fault diagnostic network for subway indoor air quality sensors using domain adaptation-driven transfer component analysis

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Indoor air quality (IAQ) sensors in subway stations are crucial in maintaining correct ventilation management whilst preserving safety conditions for the commuters. These sensors tend to fail due to hostile conditions of the confined environment; thus, an early diagnostic system is of key importance for sustaining the quality and reliability of the sensors in this type of space. Generally, machine learning (ML) models focused on fault diagnosis (FD) tasks need to be trained on the same data distribution to be considered valid. This study considers different sensors locations based on the measurements in stations: Dongdaemun, City hall, Euljiro-3, and Euljiro-4. Therefore, a general FD model to address the multiple sensor locations can be achieved by domain adaptation (DA) techniques that discover a feature representation across different domains reducing the discrepancy among data distributions. In this context, transfer components analysis (TCA) computes the transfer components across domains in a reproducing Kernel Hilbert Space (RKHS) using maximum minimum discrepancy (MMD), resulting in a subspace where data distributions of different domains are close to each other; then, a classification model for the FD task is trained. This method is validated in the subway IAQ network composed by four stations with five different failure modes, achieving an accuracy improvement of approximately 17% - 56%, with respect to state-of-art classifiers as decision trees (DT), and logistic regressors.

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참고문헌

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