Data-driven Building Occupancy Prediction: An educational building case study

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ABSTRACT

Predicting building occupancy is crucial to design and operation of energy systems in buildings. The common method to model building occupancy is using static occupancy schedules, recommended by energy standards. Data-driven approaches are used to provide a more dynamic and accurate prediction of occupant interactions with buildings. This study built upon previously monitored data for 44 full days in a public educational building, collected via sensors on room-level occupant counts combined with indoor environmental quality data. We developed an automated machine learning framework with pipeline for pre-processing, model selection, and prediction result analysis. The framework evaluates various machine learning algorithms, including K-nearest neighbors (KNN), support vector machine (SVM), classification and regression trees (CART), and ensemble methods. Different evaluation metrics were adopted to quantify the percentage of errors. The results of these occupancy predictions were compared with the conventional static schedules in the ASHRAE Standard 90.1 through the application of dynamic energy simulation. The output of this study informs the construction sector about the advances of data analytics for occupancy schedule prediction, facility operation, and building simulation.