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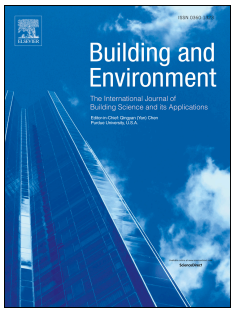

A new modeling approach for short-term predictions of occupancy presence in residential buildings

Zhaoxuan Li, Bing Dong, Ph.D

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A New Modeling Approach for Short-term Predictions of Occupancy Presence in Residential Buildings

Abstract

Occupancy models are necessary towards design and operation of smart buildings. Developing an appropriate algorithm to predict occupancy presence will allow a better control and optimization of the whole building energy consumption. However, most previous studies of development of such model only focus on commercial buildings. The occupancy model of residential houses are usually based on Time User Survey data. This study focuses on providing a unique data set of four residential houses collected from occupancy sensors. A new inhomogeneous Markov model for occupancy presence prediction is proposed and compared to commonly used models such as Probability Sampling, Artificial Neural Network, and Support Vector Regression. Training periods for the presence prediction are optimized based on change-point analysis of historical data. The study further explores and evaluates the predictive capability of the models by various temporal scenarios, including 15-min ahead, 30-min ahead, 1-hour ahead, and 24-hour ahead forecasts. The spatial-level comparison is additionally conducted by evaluating the prediction accuracy at both room-level and house-level. The final results show that the proposed Markov model outperforms the other methods in terms of an average 5% correctness with 11% maximum difference in 15-min ahead forecast of the occupancy presence. However, there is not much differences observed for 24-hour ahead forecasts.

1. Introduction