

A methodology based on Hidden Markov Models for occupancy detection and a case study in a low energy residential building

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ABSTRACT

This paper presents and evaluates a simple methodology based on Hidden Markov models for the problem of unsupervised occupancy detection using the open source program R. The models were created using different environmental parameters such as temperature, humidity, humidity ratio, CO₂ and light time series data and were evaluated against ground truth occupancy from a public data set. The accuracies of the models are reported. Also, as a case study, the developed methodology is applied for humidity ratio data calculated from temperature and humidity measured in different rooms (kitchen, living room, office, parents' room, teenager's room, laundry room, ironing room and bathroom) in a low energy residential building to infer daily and hourly average occupancy schedules for which there is no ground truth data. The estimated occupancy schedules are commented on by one of the house occupants and discussed. Inferred schedules found with this method could be useful for understanding average occupancy schedules, for detecting regular activities or actions and as an input for residential building energy simulations.