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Data driven prediction models of energy use of appliances in a low-energy house

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Highlights

- The appliances energy consumption prediction in a low energy house has been studied.
- Weather data from a nearby station was found to improve the prediction.
- Pressure, air temperature and wind speed are important parameters in the prediction.
- Data from a WSN that measures temperature and humidity increase the pred. accuracy.
- From the WSN, the kitchen, laundry and living room data ranked high in importance.

Abstract

This paper presents and discusses data-driven predictive models for the energy use of appliances. Data used include measurements of temperature and humidity sensors from a wireless network, weather from a nearby airport station and recorded energy use of lighting

fixtures. The paper discusses data filtering to remove non-predictive parameters and feature ranking. Four statistical models were trained with repeated cross validation and evaluated in a testing set: (a) multiple linear regression, (b) support vector machine with radial kernel, (c) random forest and (d) gradient boosting machines (GBM). The best model (GBM) was able to explain 97% of the variance (R^2) in the training set and with 57% in the testing set when using all the predictors. From the wireless network, the data from the kitchen, laundry and living room were ranked the highest in importance for the energy prediction. The prediction models with only the weather data, selected the atmospheric pressure (which is correlated to wind speed) as the most relevant weather data variable in the prediction. Therefore, atmospheric pressure may be important to include in energy prediction models and for building performance modeling.

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Keywords

Appliances; Energy; Prediction; Wireless sensor network; Statistical learning models; Data mining; Data sets available

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