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Development of Prediction Models of Day-Ahead Hourly Building Electricity Consumption and Peak Power Demand Using the Machine Learning Method

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Abstract : To encourage building owners to purchase electricity at the wholesale market and reduce building peak demand, this study aims to develop models that predict day-ahead hourly electricity consumption and demand using artificial neural network (ANN) and support vector machine (SVM). All prediction models are built in Python, with tool Scikit-learn and Pybrain. The input data for both consumption and demand prediction are time stamp, outdoor dry bulb temperature, relative humidity, air handling unit (AHU), supply air temperature and solar radiation. Solar radiation, which is unavailable a day-ahead, is predicted at first, and then this estimation is used as an input to predict consumption and demand. Models to predict consumption and demand are trained in both SVM and ANN, and depend on cooling or heating, weekdays or weekends. The results show that ANN is the better option for both consumption and demand prediction. It can achieve 15.50% to 20.03% coefficient of variance of root mean square error (CVRMSE) for consumption prediction and 22.89% to 32.42% CVRMSE for demand prediction, respectively. To conclude, the presented models have potential to help building owners to purchase electricity at the wholesale market, but they are not robust when used in demand response control.

Keywords : building energy prediction, data mining, demand response, electricity market
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