

Artificial Neural Network to Predict the Optimum Performance of Air Conditioners under Environmental Conditions in Saudi Arabia

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Abstract : In this study, a backpropagation artificial neural network (ANN) model has been used to predict the cooling and heating capacities of air conditioners (AC) under different conditions. Sufficiently large measurement results were obtained from the national energy-efficiency laboratories in Saudi Arabia and were used for the learning process of the ANN model. The parameters affecting the performance of the AC, including temperature, humidity level, specific heat enthalpy indoors and outdoors, and the air volume flow rate of indoor units, have been considered. These parameters were used as inputs for the ANN model, while the cooling and heating capacity values were set as the targets. A backpropagation ANN model with two hidden layers and one output layer could successfully correlate the input parameters with the targets. The characteristics of the ANN model including the input-processing, transfer, neurons-distance, topology, and training functions have been discussed. The performance of the ANN model was monitored over the training epochs and assessed using the mean squared error function. The model was then used to predict the performance of the AC under conditions that were not included in the measurement results. The optimum performance of the AC was also predicted under the different environmental conditions in Saudi Arabia. The uncertainty of the ANN model predictions has been evaluated taking into account the randomness of the data and lack of learning.

Keywords : artificial neural network, uncertainty of model predictions, efficiency of air conditioners, cooling and heating capacities

Conference Title : ICAIEERE 2024 : International Conference on Artificial Intelligence for Energy Efficiency and Renewable Energy

Conference Location : Montreal, Canada

Conference Dates : June 13-14, 2024