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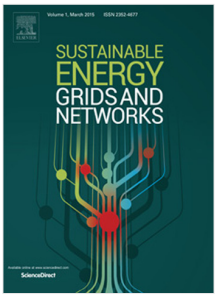

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Intra ELM Variants Ensemble Based Model to Predict Energy Performance in Residential Buildings

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Abstract

Optimisation of energy performance of the buildings has been a great interest of research. Energy performance monitoring and maintenance depend on the several parameters such as temperature, humidity, sunlight, roof area, wall area and mostly on heating ventilation and air conditioning(HVAC). Each building has its own patterns and settings obtained through monitoring which depends on many parameters such as users activities, environmental related attributes and building design structural parameters etc. In this respect, an estimation of energy load of the building in real-time efficiently for optimisation becomes an important task for cost-effective energy management. The paper proposes an Intra ensemble model based on variants of emerging machine learning approach which includes extreme learning machine(ELM), Online Sequential ELM(OSELM) and Bidirectional ELM(B-ELM). The energy performance estimation requires the model to be real-time and efficient. This asks for use of highly correlated parameters and a very efficient model.For this, OSELM based model for real-time prediction of energy performance has been used. ELM variants are used because of their fast computation and efficiency of prediction over conventional machine learning models. The proposed model has been compared with few state of art methods on accuracy and efficiency criteria and proposed models outperformed existing methods.

Keywords: B-ELM, Cooling load, Energy performance prediction, ELM, Heating load, OSELM, Intra ensemble model.

1. Introduction

Across the world, buildings consume a major part of the energy for performing certain processes to make the life and working conditions conducive. Building sector consumes 40 present of the energy in the form of electricity[1] [2]. Researchers have shown that the process of heating, ventilation and air conditioning (HVAC) consumes energy up to 50 percent of the total energy need of the building in the tropical region[3]. According to one study in Spain, the Spanish households energy consumption is 30 percent of total energy expenditure of the country[4]. Several studies have stated HVAC systems are responsible for the major consumption of energy[5] [6] [7]. Energy performance basically depends on parameters such as the environmental and structural parameters. Environmental parameters include such as indoor temperature, humidity, solar irradiance etc. The structural parameters are relative compactness(RC), surface area(SA), wall area(WA), roof area(RA), overall height(OH), orientation(O), glazing area(GA) and glazing area distribution(GAD)

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