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# **Development of a Surrogate Model by Extracting Top Characteristic Feature Vectors for Building Energy Prediction**

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In early stage of building design, design team has to consider and simulate energy consumption for several combinations of various input parameters to analyze the building energy consumption. In a scenario considering five parameters, each with ten variations, one has to simulate hundred thousand combinations. It requires a lot of computation to simulate energy consumption for all the input combinations. This paper aims at reducing the computation required to compute the energy consumption of all the combinations. This is done by identifying appropriate training samples, computing their energy consumption using EnergyPlus and estimating energy consumption of the rest of the data using machine learning techniques. This paper presents two sampling methods along with various regression techniques to predict energy consumption of a building in the early phase. It involves usage of efficient sampling methods for identifying the training data. The key contribution of this method of surrogate modeling is saving a lot of computation by reducing the computation by ~100-fold. This method is tested for Jaipur and Hyderabad cities of India. Approximately hundred thousand simulations are performed for each location using parallel computation. By simulating approximately one percent of the input combinations, annual energy consumption for the large set of combinations are predicted using SVR and k-means clustering for Jaipur with accuracy greater than 93% for 99.8% of the input combinations. When the same model is trained for Hyderabad, it produced accuracy greater than 93% for 98% of the input combinations.

Paper link: <https://www.sciencedirect.com/science/article/pii/S2352710218306636>