Energy Efficiency of Residual Buildings

This study aims to assess the energy efficiency of residential buildings by examining their heating and cooling load requirements. These requirements are analyzed as functions of various building parameters.

Using Ecotect software, simulate twelve distinct building shapes are simulated. These simulations vary in terms of glazing area, glazing area distribution, orientation, and other factors, resulting in a dataset of 768 simulated building shapes with 8 distinct features. This dataset is used to predict two real-valued outcomes: heating load and cooling load. The variables present in the dataset, along with their descriptions, are summarized in below Table:

Variable Name	Description
X1	Relative Compactness
X2	Surface Area
X3	Wall Area
X4	Roof Area
X5	Overall Height
X6	Orientation
X7	Glazing Area
X8	Glazing Area Distribution
Y1	Heating Load
Y2	Cooling Load

Project Tasks:

1. **Data Visualization:** In SAS JMP PRO, utilize the graph builder to visualize the data. Summarize the top five interesting observations about the dataset.
2. **Clustering:** Execute a cluster analysis on the independent variables, excluding the response variables (heating and cooling loads). Can you identify classifications of residences where each class is associated with specific ranges of heating or cooling loads (high, medium, low)? What building designs correspond to these ranges?
3. **Regression:** Develop a predictive model using multiple regression analysis to estimate the heating and cooling loads based on the building's design characteristics. Answer the following questions with your model:
    - What are the most significant factors influencing heating and cooling loads?
    - How does the glazing area affect the cooling load?
    - What impact does overall height have on the heating load?

- Identify the 20 most overestimated and 20 most underestimated instances for both heating and cooling loads.

Reference:

UC Irvine Machine Learning Repository. (n.d.). Energy efficiency. Retrieved May 12, 2024, from https://archive.ics.uci.edu/dataset/242/energy+efficiency