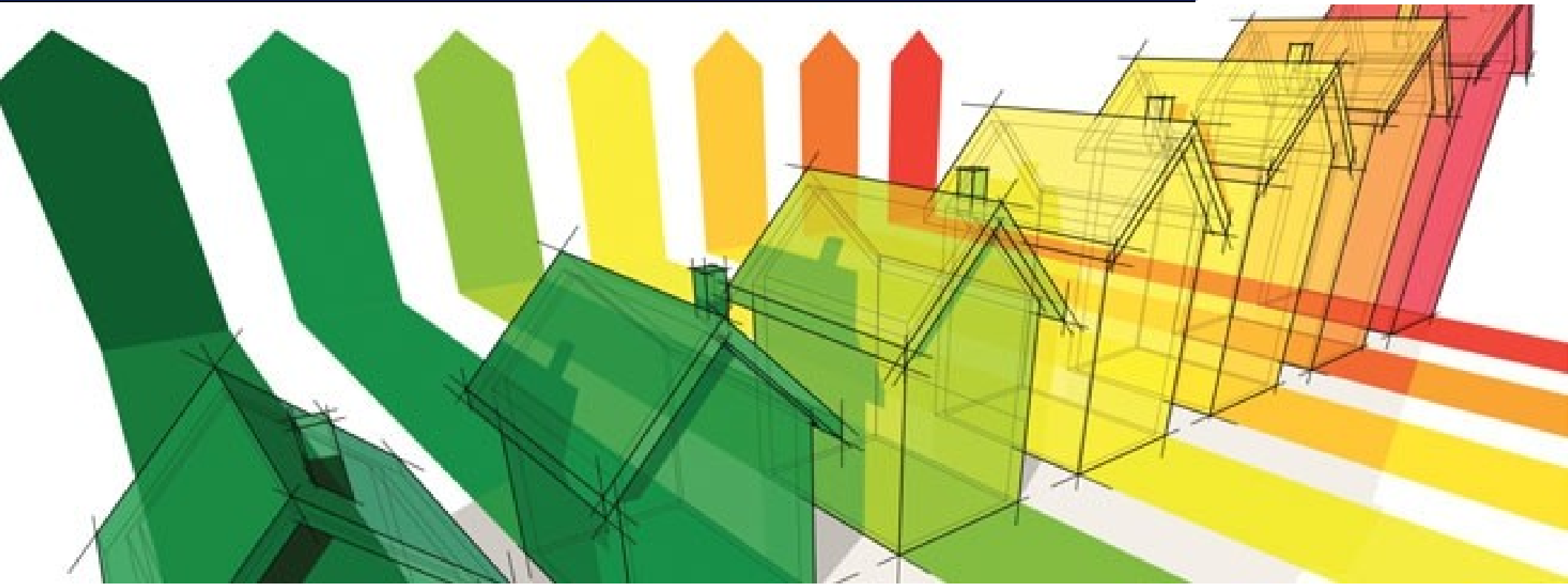
Energy Efficiency of Buildings



Presented by
Artem Ramus

Background

Abstract

Energy effectiveness of buildings is crucial for choice of HVAC system and, traditionally, it's calculated based on geometrical and thermal properties of buildings.

Source

The data set was created by Angeliki Xifara (angxifara@gmail.com, Civil/Structural Engineer) and was processed by Athanasios Tsanas (tsanasthanasis@gmail.com, Oxford Centre for Industrial and Applied Mathematics, University of Oxford, UK).

Citation Request

A. Tsanas, A. Xifara: 'Accurate quantitative estimation of energy performance of residential buildings using statistical machine learning tools', Energy and Buildings, Vol. 49, pp. 560-567, 2012 (the paper can be accessed from [Web Link])

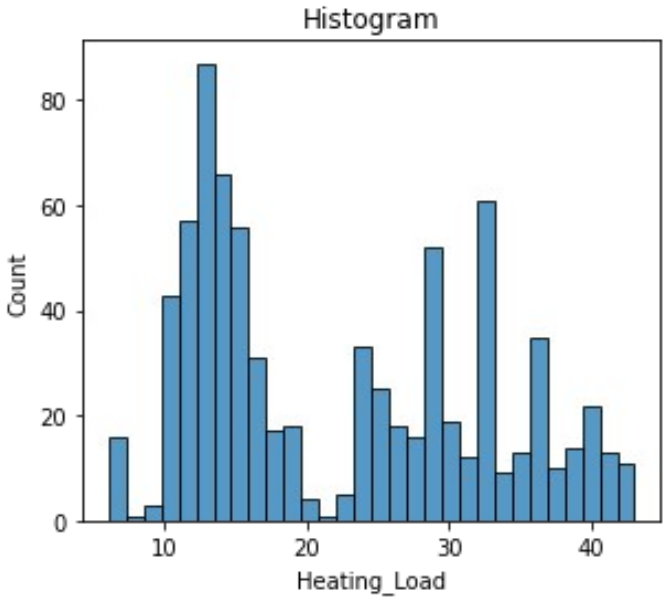
Introduction

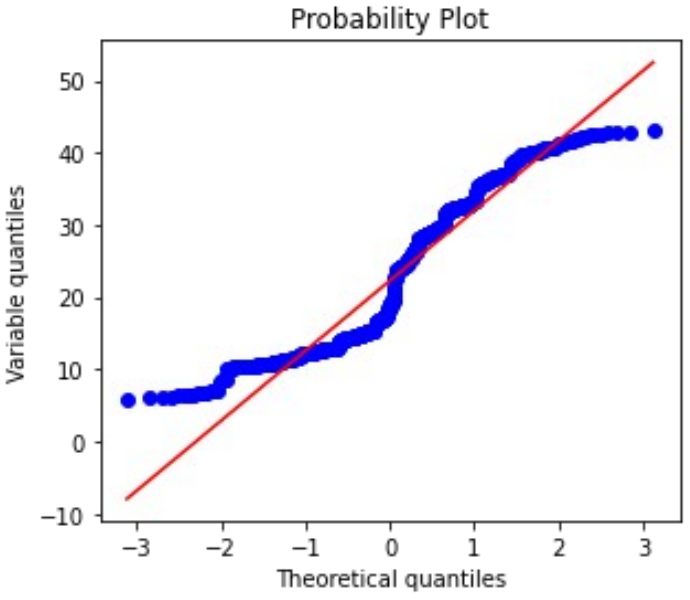
The goal of this project is to predict heating and cooling load of buildings geometrical and thermal properties of buildings.

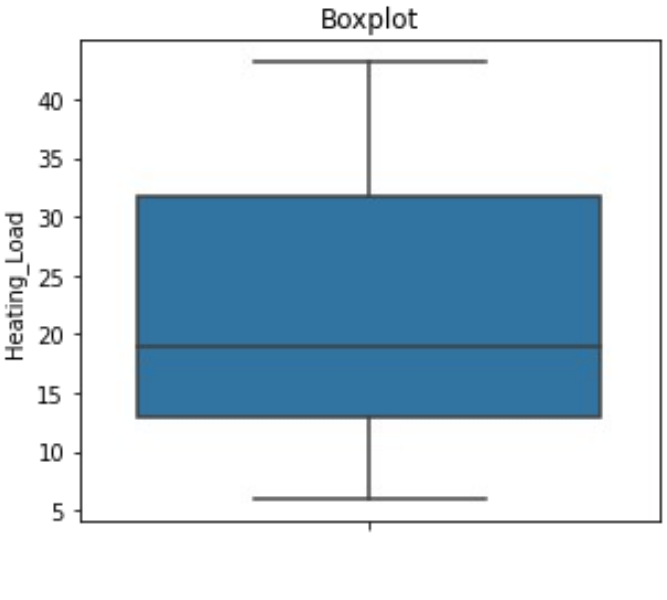
Variables

X1 Relative Compactness
X2 Surface Area - m^2
X3 Wall Area - m^2
X4 Roof Area - m^2
X5 Overall Height - m
X6 Orientation - 2:North, 3:East, 4:South, 5:West
X7 Glazing Area - 0%, 10%, 25%, 40% (of floor area)
X8 Glazing Area Distribution (Variance) - 1:Uniform, 2:North, 3:East, 4:South, 5:West
y1 Heating Load - kWh/m^2
y2 Cooling Load - kWh/m^2

Exploratory Data Analysis

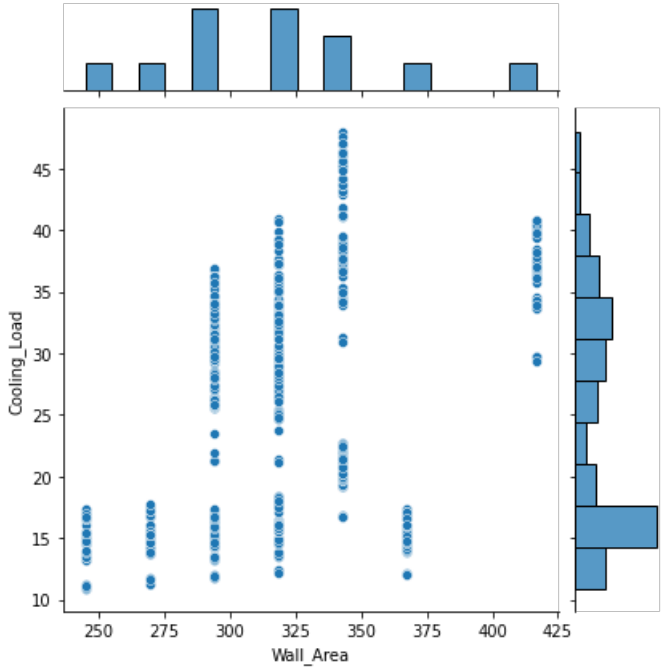


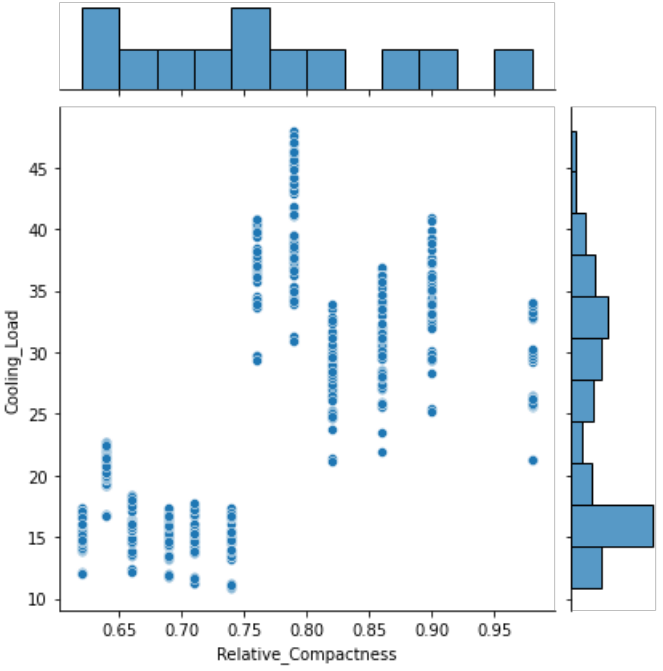




Distributions of numerical variables are reasonably close to normal.
No acute outliers.

Exploratory Data Analysis





Target variables are correlated with all the variables.

Feature Engineering and Selection

Original distribution of all the variables selected.

One hot encoding applied to categorical variables.

All the features selected for modeling.

Summary and Conclusions

Both, heating and cooling load, predicted by XGBoost regressor with R square score of 0.99. RMSE of heating load is 0.011, cooling - 0.025 kWh/m².

Evaluation Criteria	Heating Load	Cooling Load
RMSE train	0.0074	0.0107
RMSE test	0.0124	0.0252
R2 train	0.99	0.99
R2 test	0.99	0.99

The end

Thank you for your attention!