Machine Learning for Building Energy Prediction:
A Case Study of an Office Building

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Machine Learning in Energy Sector

Advantages

- Computationally efficient
- No need for a physical model
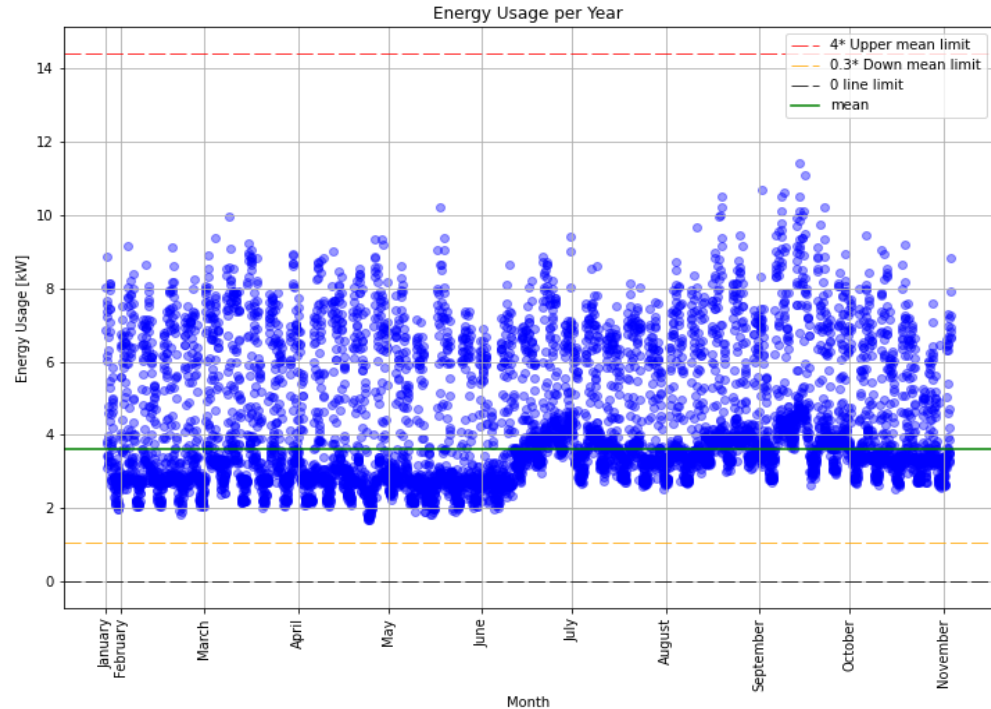- Wide range of applications

Applications in Energy

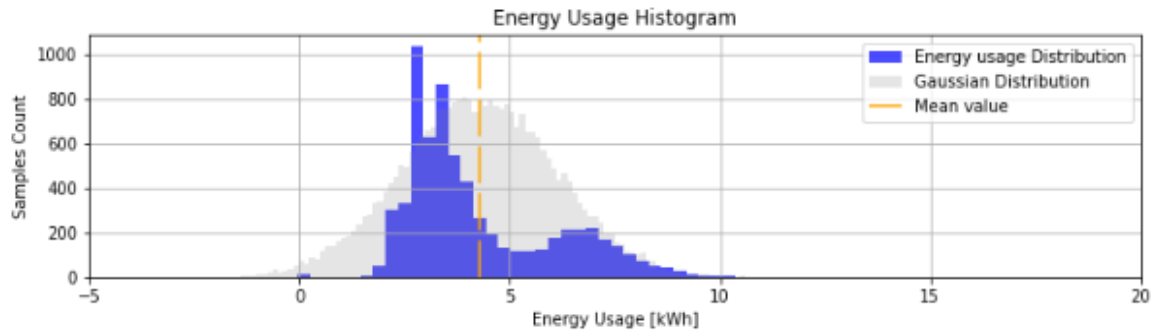- Demand side response
- Predictive maintenance
- Grid Management

Source: tugraz.at

The Dataset

- **Data**: Energy Demand (kW)
- **Source**: Office building at TU Graz
- **Timeframe**: January – November

Energy Usage per Year
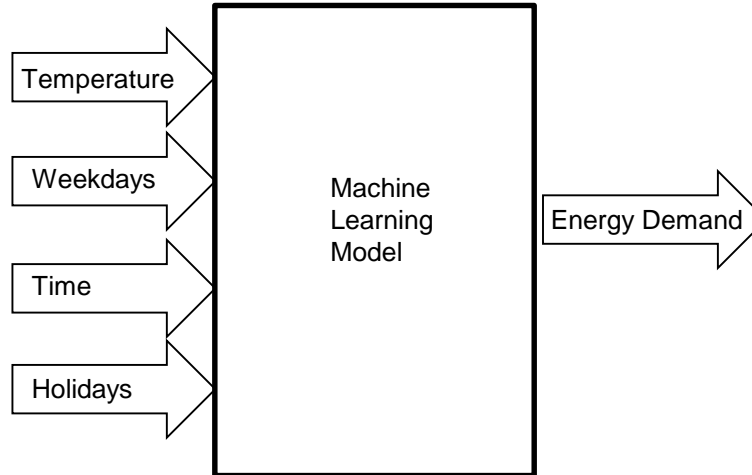
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Data Preprocessing

Outlier Detection: Rule- based method

- Negatives values
- Zero values
- Illogical values

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Features Construction and Selection

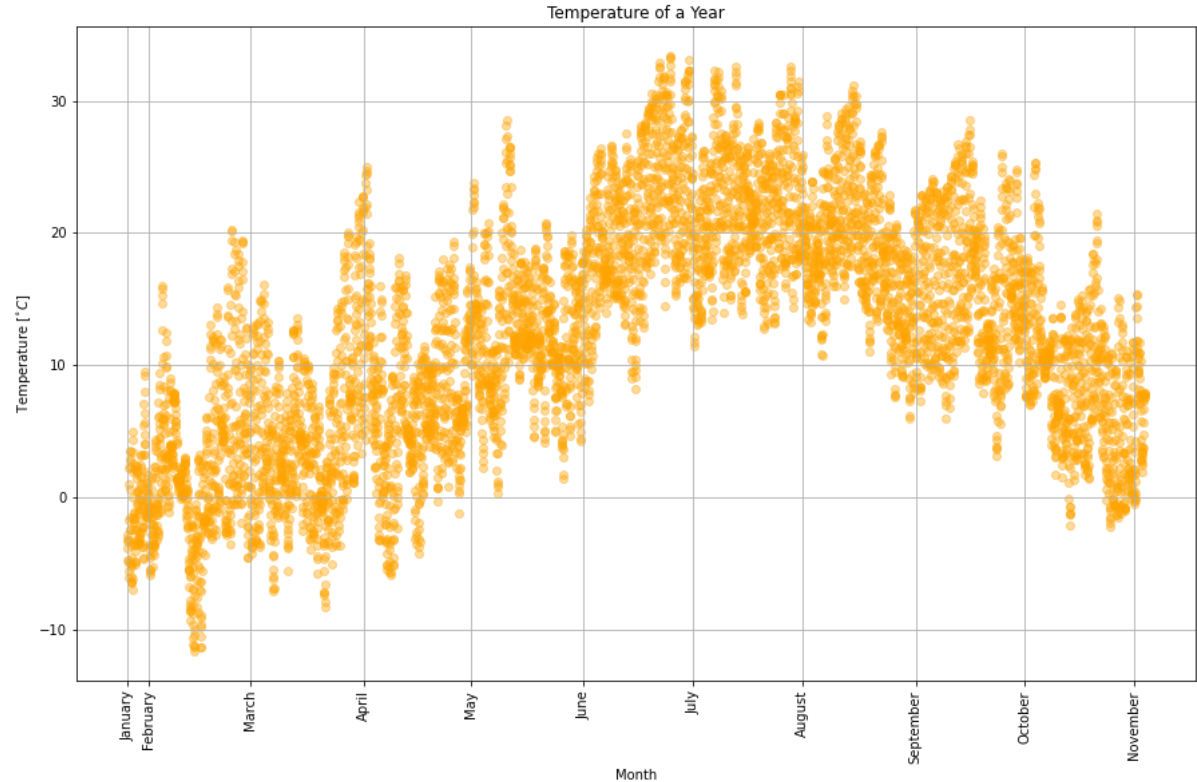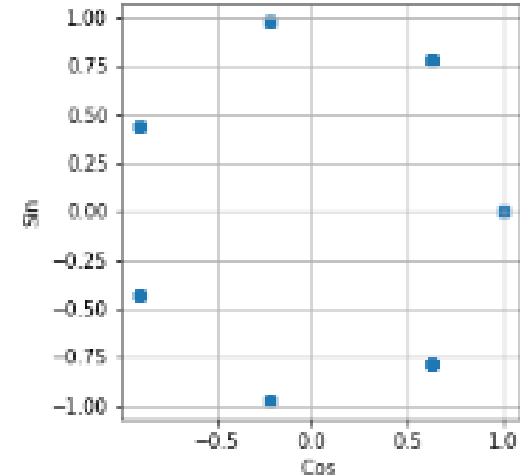# Features Construction and Selection - Timestamp matching

Linear interpolation
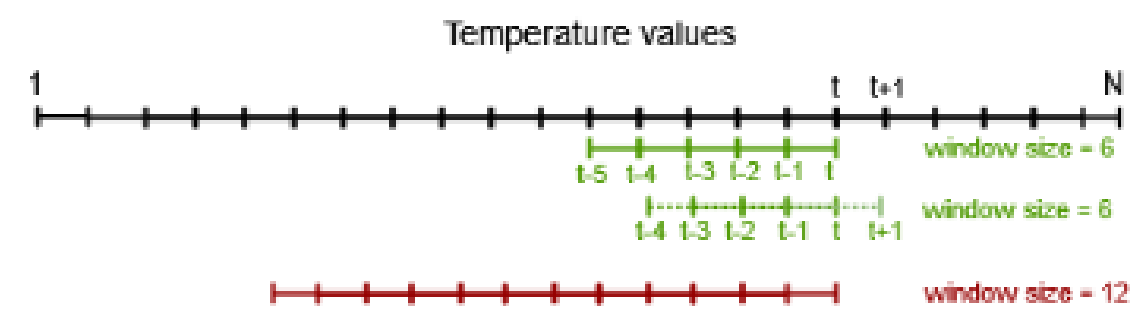
Fill missing values -
Timestamp matching

Temperature of a Year

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Features Construction and Selection - Cyclical variables

Weekdays →⟶ **Sin and cosine combination**

Features Construction and Selection – Rolling Windows

Rolling windows method

Training and validation

GRID SEARCH
Hyperparameters

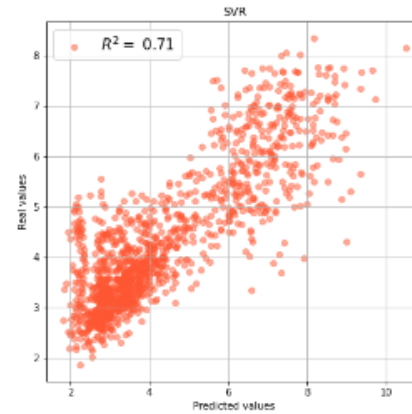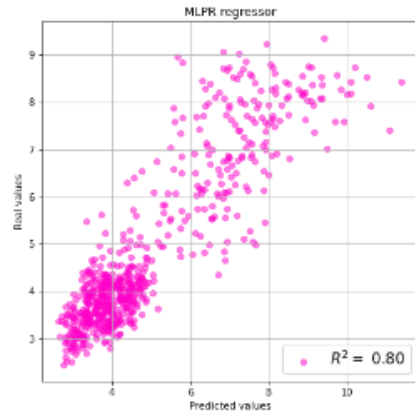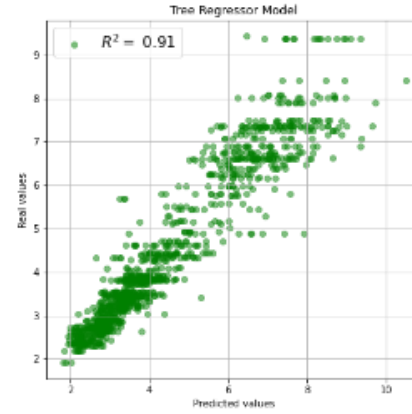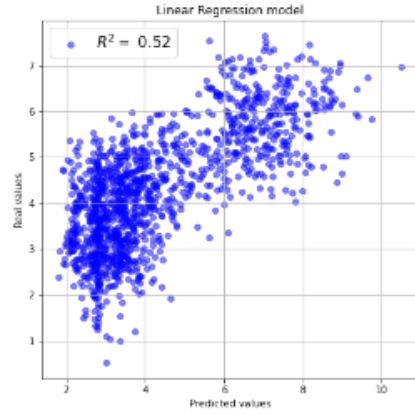| Model	Parameters
Linear Regression	Default
Decision Tree Regression	criterion = mean-square-error (mse)
	minimum number of splits (min_num_of_split) = 60
Support Vector Regression	gamma = 0.01
Multi-Layer Perceptron	hidden_layer_sizes = (400,20)
	activation function = Tanh
	alpha = 0.001
	learning rate = constant value with the initial equals to 0.001

Results

Model	Linear Regression			Decision Tree			SVR			MLP		
	0 Steps	6 Steps	12 Steps	0 Steps	6 Steps	12 Steps	0 Steps	6 Steps	12 Steps	0 Steps	6 Steps	12 Steps
R2	0.30	0.48	0.52	0.91	0.91	0.91	0.72	0.64	0.62	0.78	0.80	0.80
RMSE	1.51	1.32	1.25	0.55	0.56	0.55	0.96	1.10	1.12	0.83	0.80	0.73
MAE	1.19	1.05	1.00	0.36	0.38	0.37	0.68	0.76	0.73	0.58	0.55	0.57

Results

Results

Models' Perfomance

Conclusion