Heating & Cooling Energy Loads

Predicting Building Heating & Cooling Energy Loads

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Business Understanding

Goal:

Buildings consume a large amount of energy for heating and cooling.

We need a way to predict energy demand based on building design.

Why it matters:

- Supports energy-efficient architecture
- Reduces costs and environmental impact

Data understanding

Data Source: Energy Efficiency dataset (768 samples)

Features (Inputs):

- **X1–X8** → Building geometry & orientation

Targets (Outputs):

- **Y1** → Heating Load (kWh/m²)
- **Y2** → Cooling Load (kWh/m²)

Data preparation

- Removed unnecessary features
- Encoded categorical variable (Orientation → X6_3, X6_4, X6_5)
- Scaled numeric features (for Linear Regression)
- Split data (80% train / 20% test)

Models used

Supervised ML Models:

- Linear Regression
- Decision Tree
- Random Forest

MODEL RESULTS

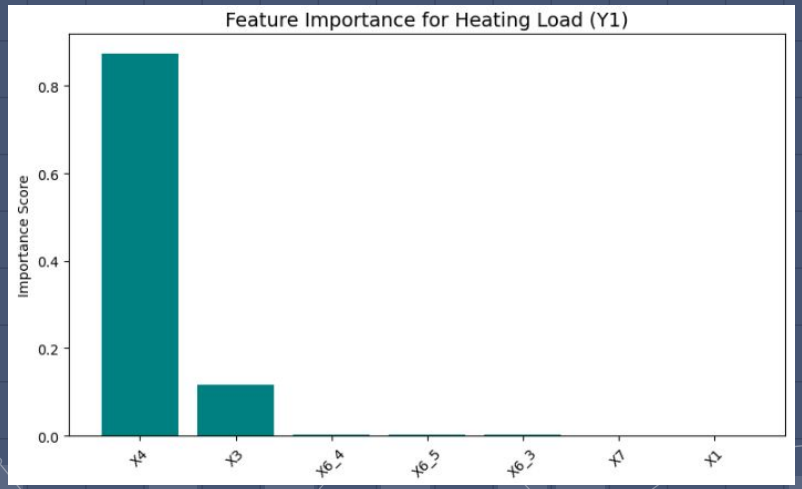
Model	Y1 (R^2)	Y2 (R^2)	MSE
Linear Regression	0.79	0.77	21.9
Decision Tree	0.89	0.90	11.3
Random Forest	089	0.91	8.7

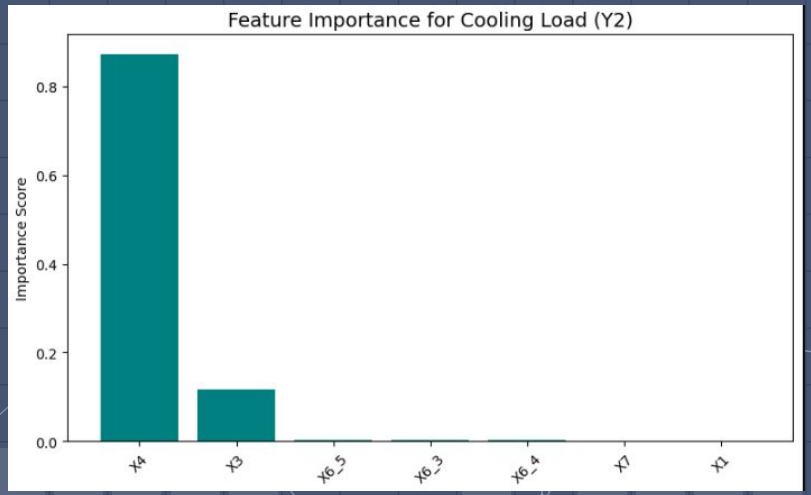
The best model is **Random Forest**

Feature importance

Top Influencing Features:

- X4 → Roof Area
- X3 → Wall Area





Conclusion & Next steps

The model can:

- Accurately predict heating and cooling needs
- Help design energy-efficient buildings
- Support sustainable architecture decisions

Future Work:

- Add more real-world data
- Test advanced models (XGBoost, Neural Nets)
- Build a web app for energy prediction

THANKS!

Any questions?

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