

Smart Factory Energy Prediction Report

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Introduction

This report presents an approach for predicting energy consumption in a smart factory. The objective was to develop a model to predict energy usage based on sensor data from various equipment. Multiple regression models were applied, and their performance was evaluated to provide actionable insights.

Approach to the Problem

The approach involved the following steps:

- 1. Data Preprocessing:** Cleaning the data by handling missing values, encoding categorical variables, and scaling numerical features.
- 2. Model Selection:** Linear regression, Ridge regression, Gradient Boosting, and Random Forest models were chosen to predict energy consumption.
- 3. Hyperparameter Tuning:** Hyperparameters for the models were tuned using GridSearchCV to optimize their performance.
- 4. Model Evaluation:** Models were evaluated using R-squared and Mean Squared Error to determine the best performer.

Key Insights from the Data

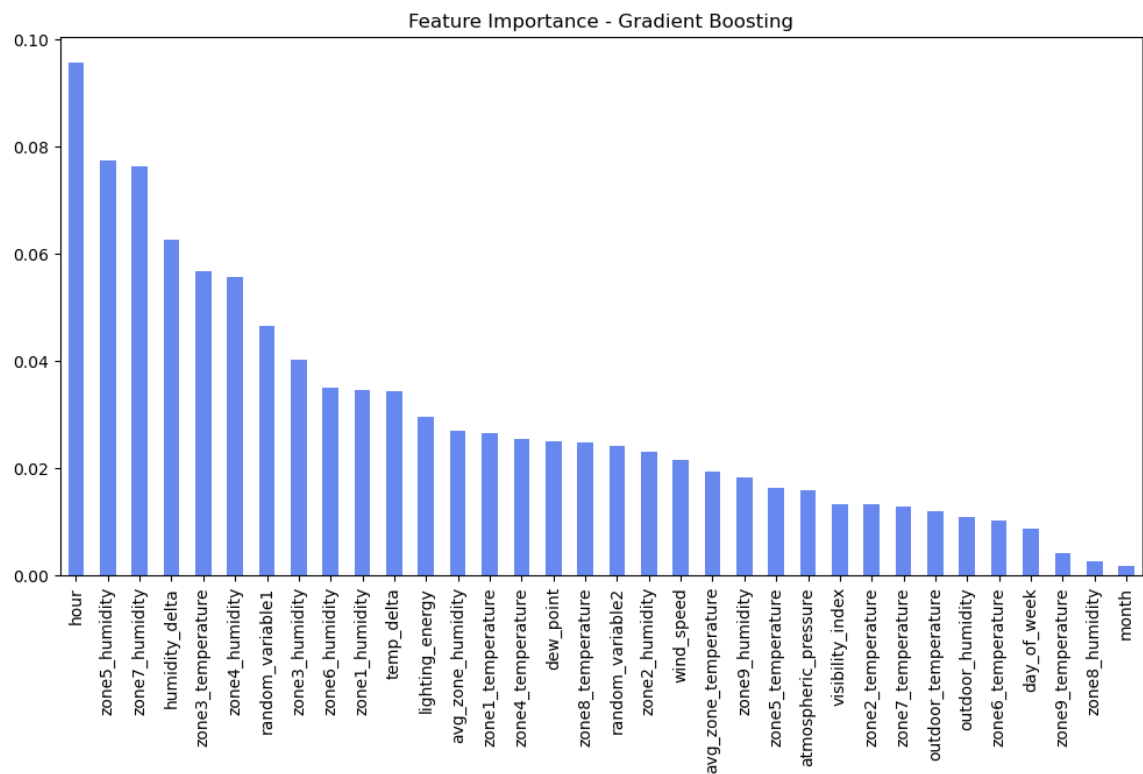
Several insights were gathered from the data, including:

1. Equipment energy consumption varies significantly across different machines and zones in the factory.
2. Features such as temperature, humidity, and operational status of machines are highly correlated with energy consumption.
3. Outliers and missing values were identified and handled appropriately to improve model accuracy.

Model Performance Evaluation

MODEL	RSME	MAE	R ²
Ridge Regression	179.59	74.20	0.01
Gradient Boosting	181.87	77.55	-0.006

Feature Importance from Gradient Boosting



Recommendations for Reducing Equipment Energy Consumption

Based on the insights and model predictions, the following recommendations can help reduce energy consumption in the factory:

- 1. Optimize Machine Operation:** Based on predictive models, schedule maintenance for equipment that shows signs of inefficiency.
- 2. Monitor Environmental Factors:** Monitor temperature and humidity closely to ensure energy usage remains within optimal ranges.
- 3. Use Energy-Efficient Equipment:** Machines with high energy consumption can be replaced with more energy-efficient models.