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Data Analysis

STM-WS2025

Project Assignment: Electric Power Consumption

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Dataset

The data consists of 52,416 observations of energy consumption on a 10-minute window. Every observation is described by 9 feature columns.

1. Date Time: Time window of ten minutes.
2. Temperature: Weather Temperature.
3. Humidity: Weather Humidity.
4. Wind Speed: Wind Speed.
5. General Diffuse Flows
6. Diffuse Flows
7. Zone 1 ,2 and 3 Power Consumption (7, 8, 9)

Data Overview

Time range: 2017-01-01 00:00:00 to 2017-12-30 23:50:00

Average Time Period: 0 days 00:10:00

Sampling Frequency: 0.00167

Number of records: 52,416

Number of zones: 3

Missingness: 0

datatype: float

Statistical analysis

Quantity	Mean	Median	std	Min	Max	Q1(25%)	Q3(75%)
Wind Speed	1.96	0.09	2.35	0.05	6.48	0.08	4.92
General DF	182.70	5.04	264.40	0.00	1163.00	0.06	319.60
Temperature	18.81	18.78	5.82	3.25	40.01	14.41	22.89
Diffusion Flow	75.03	4.46	124.21	0.01	936.00	0.12	101.00
Humidity	68.26	69.86	15.55	11.34	94.80	58.31	81.40

Histogram View

Sensor Measurements Distributions

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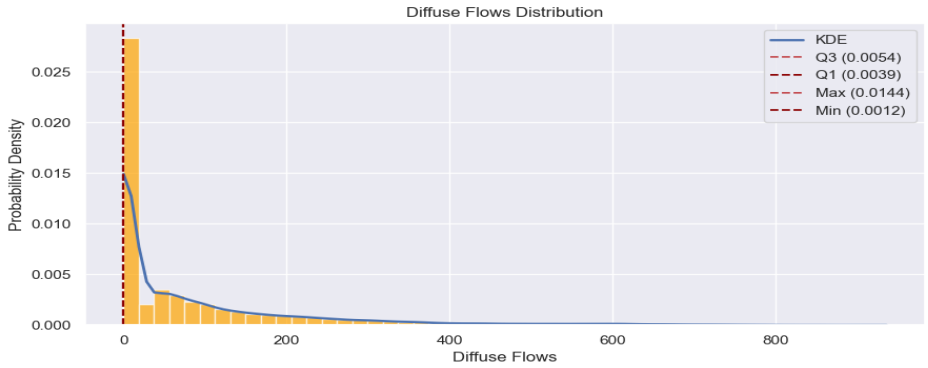
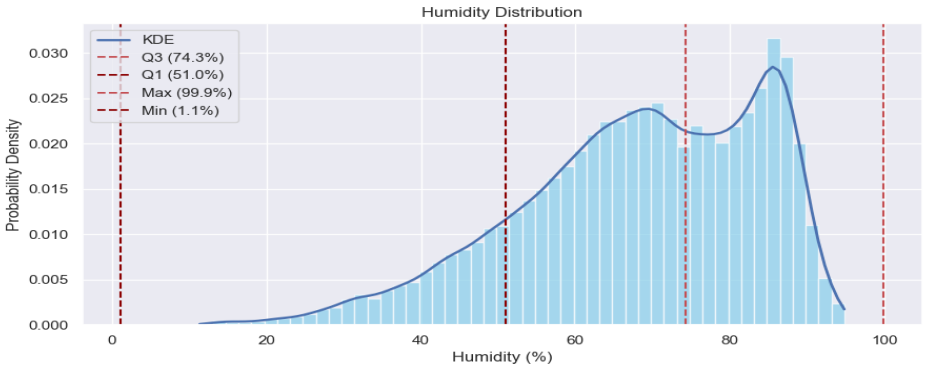
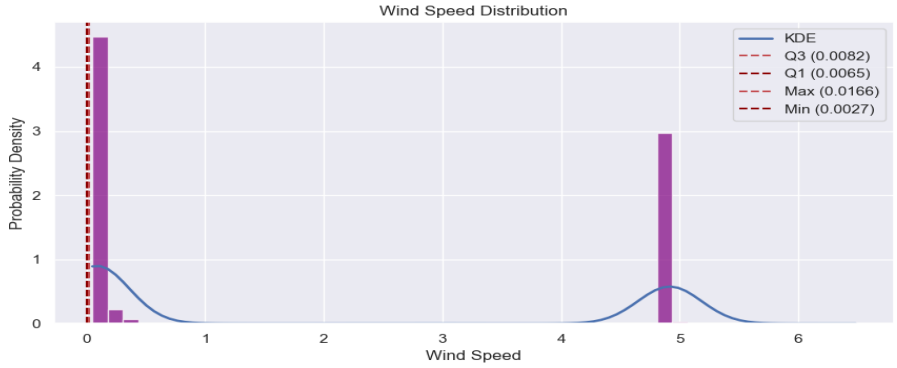
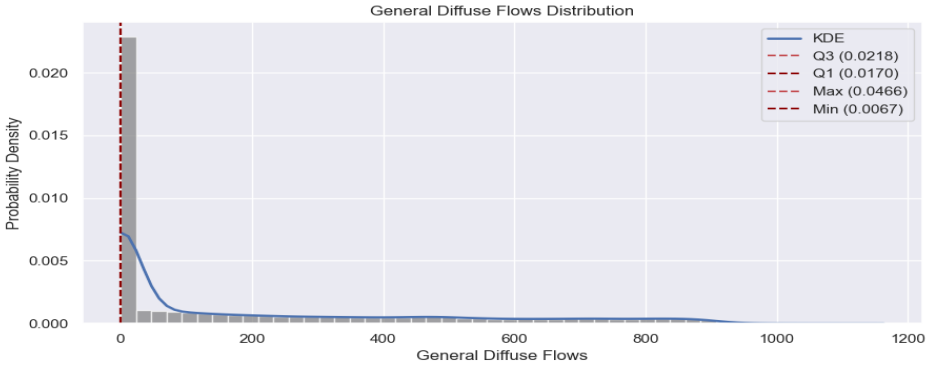
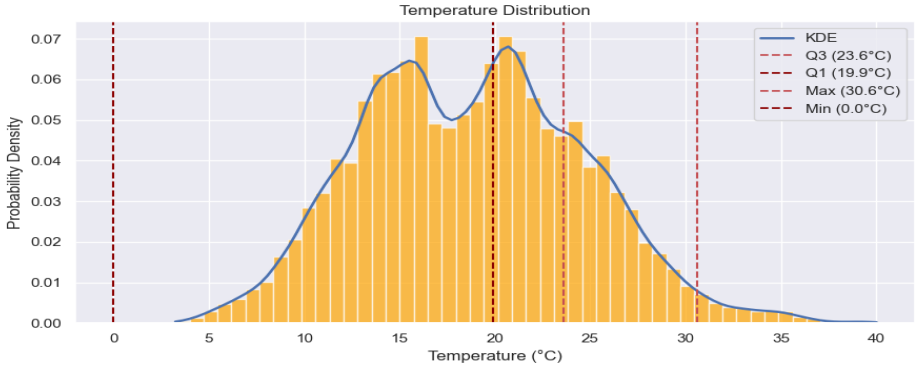


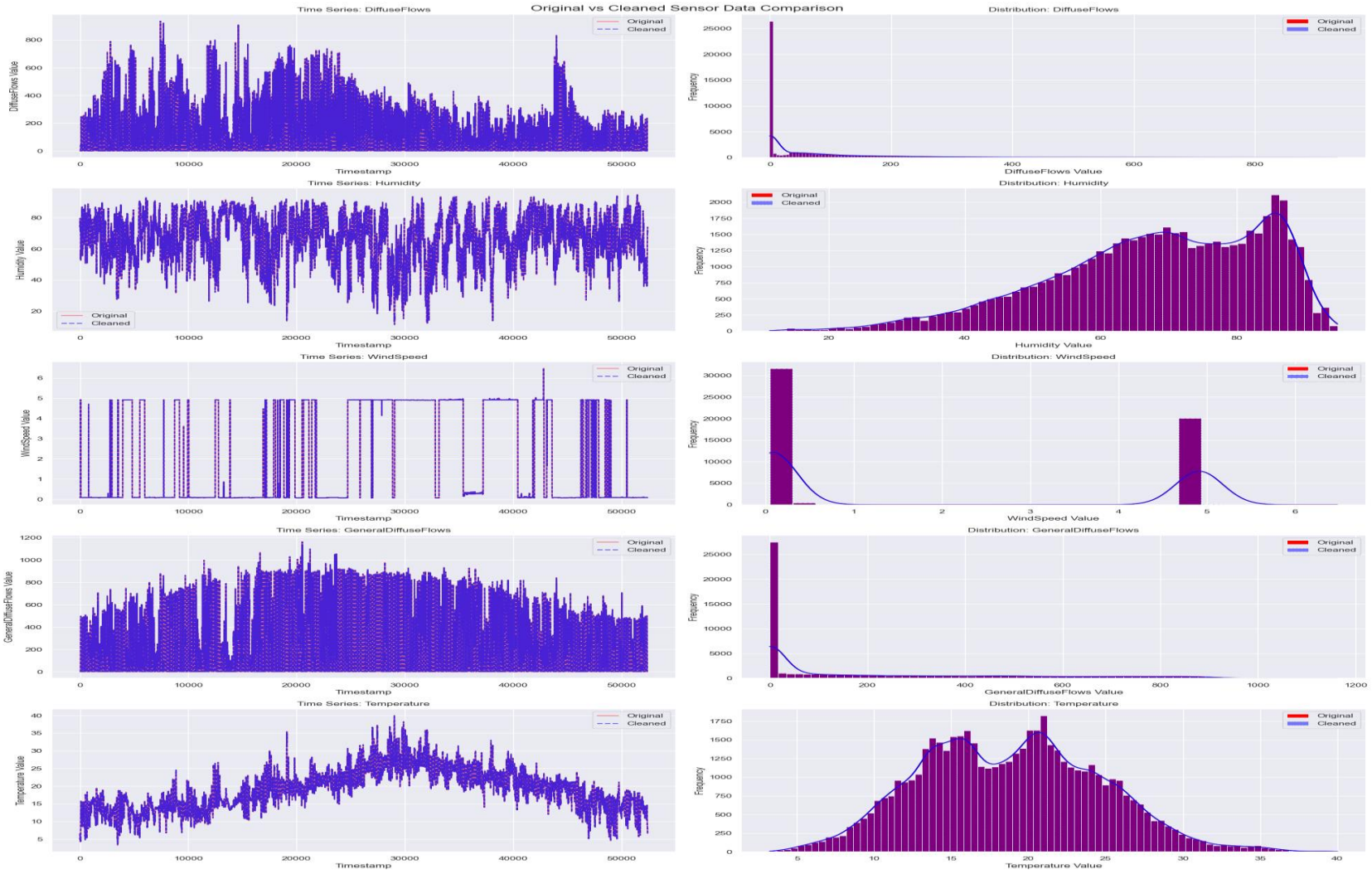








Clean Vs Original Data



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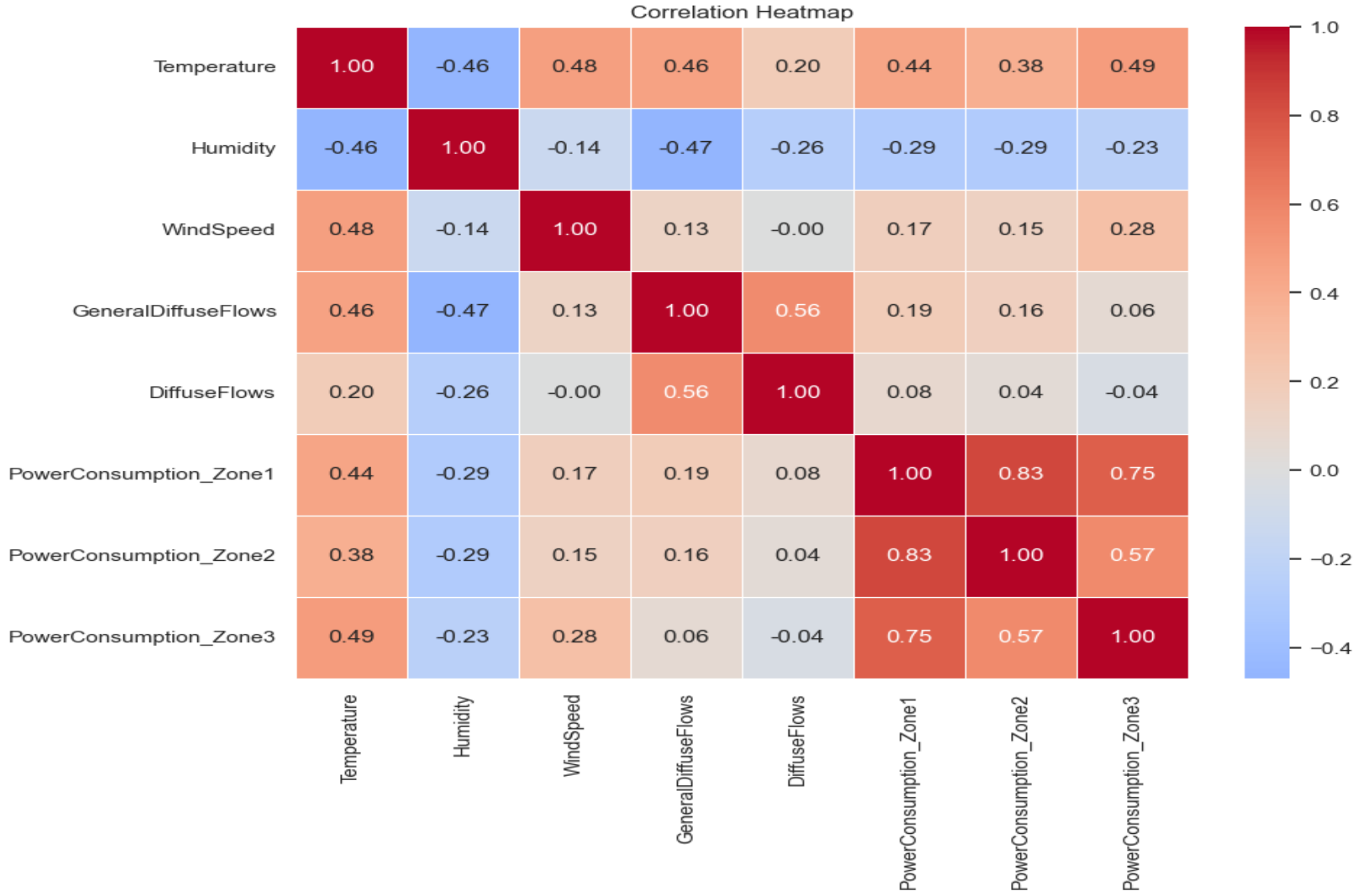
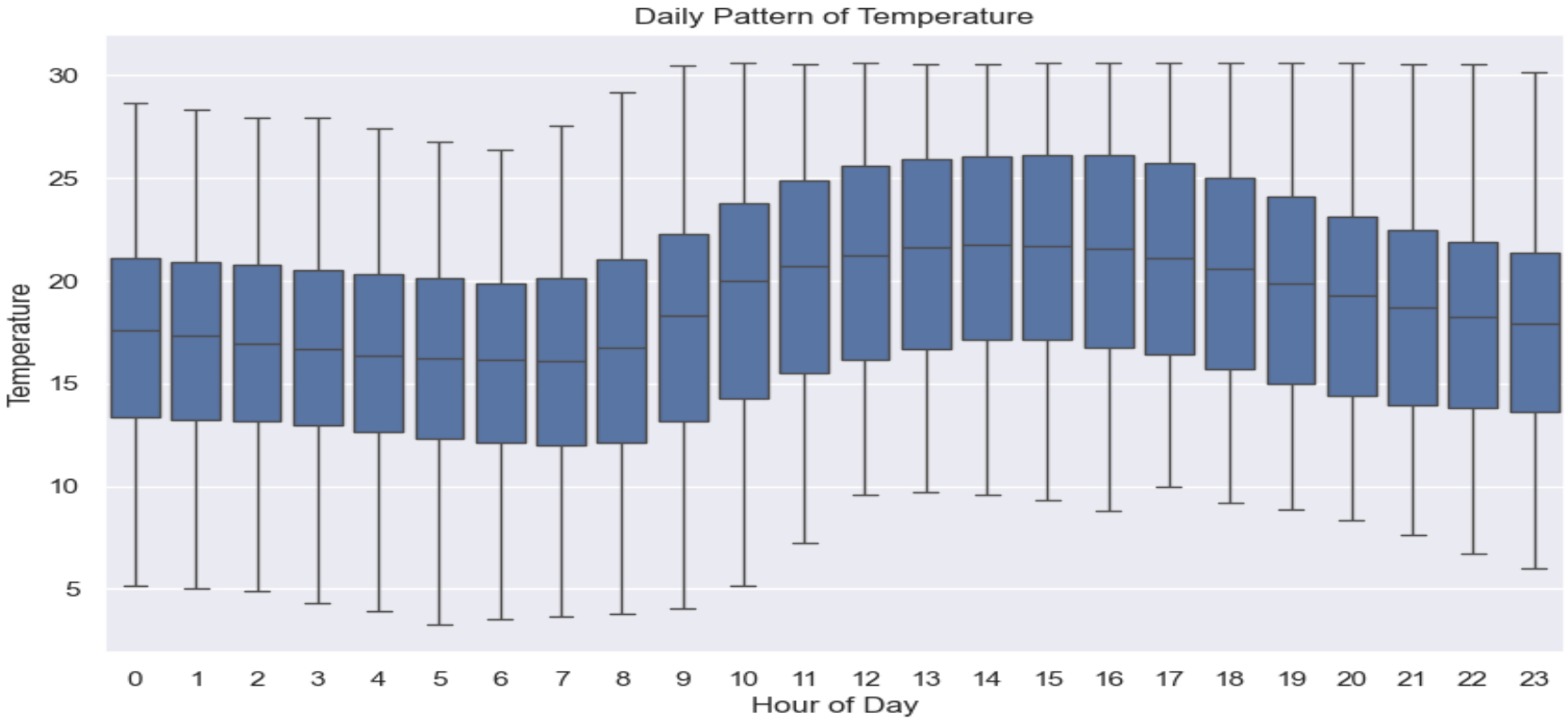
Correlation Analysis



Daily Pattern



Threshold Probability

Humidity Statistics:

Mean: 68.2897

Standard Deviation: 15.4585

Threshold: 70

Probability of Humidity exceeding 70 is approximately 0.4560

Threshold-Based Probability Estimations:

Threshold: 50.0 -> Probability of exceeding: 0.8816

Threshold: 60.0 -> Probability of exceeding: 0.7041

Threshold: 70.0 -> Probability of exceeding: 0.4560

Threshold: 80.0 -> Probability of exceeding: 0.2244

Key Observations

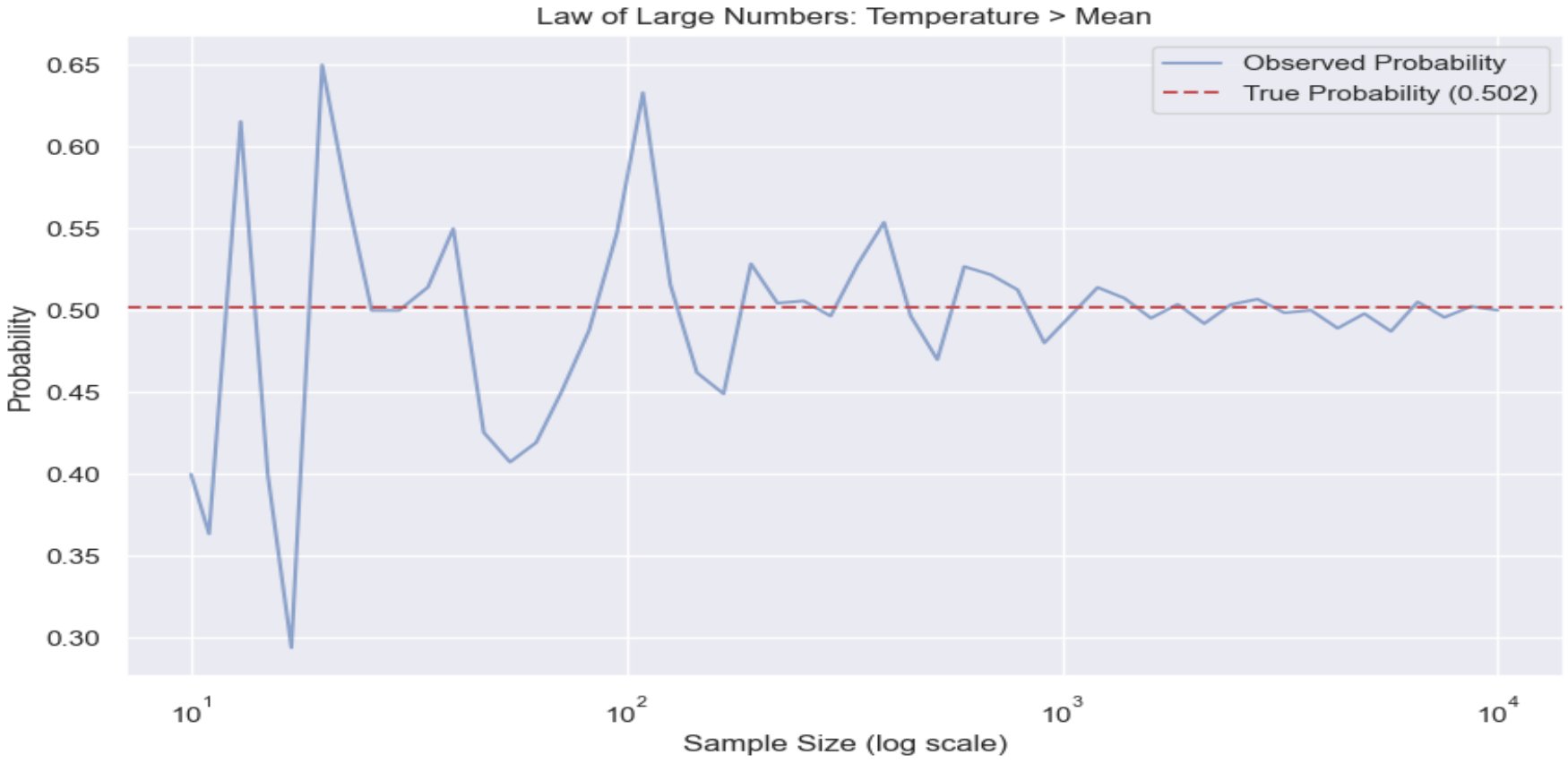
Threshold-based probability

- High Thresholds ➔ Low probability (away from mean)
- Low Thresholds ➔ High probability (close to mean)

Conditional Probability:

- P(High Humidity | Medium Temperature) ➔ 0.366688
- P(Medium Humidity | Low Temperature) ➔ 0.126603
- P(Very High Temperature | High Humidity) ➔ 0.146209

Law of Large Numbers demonstration



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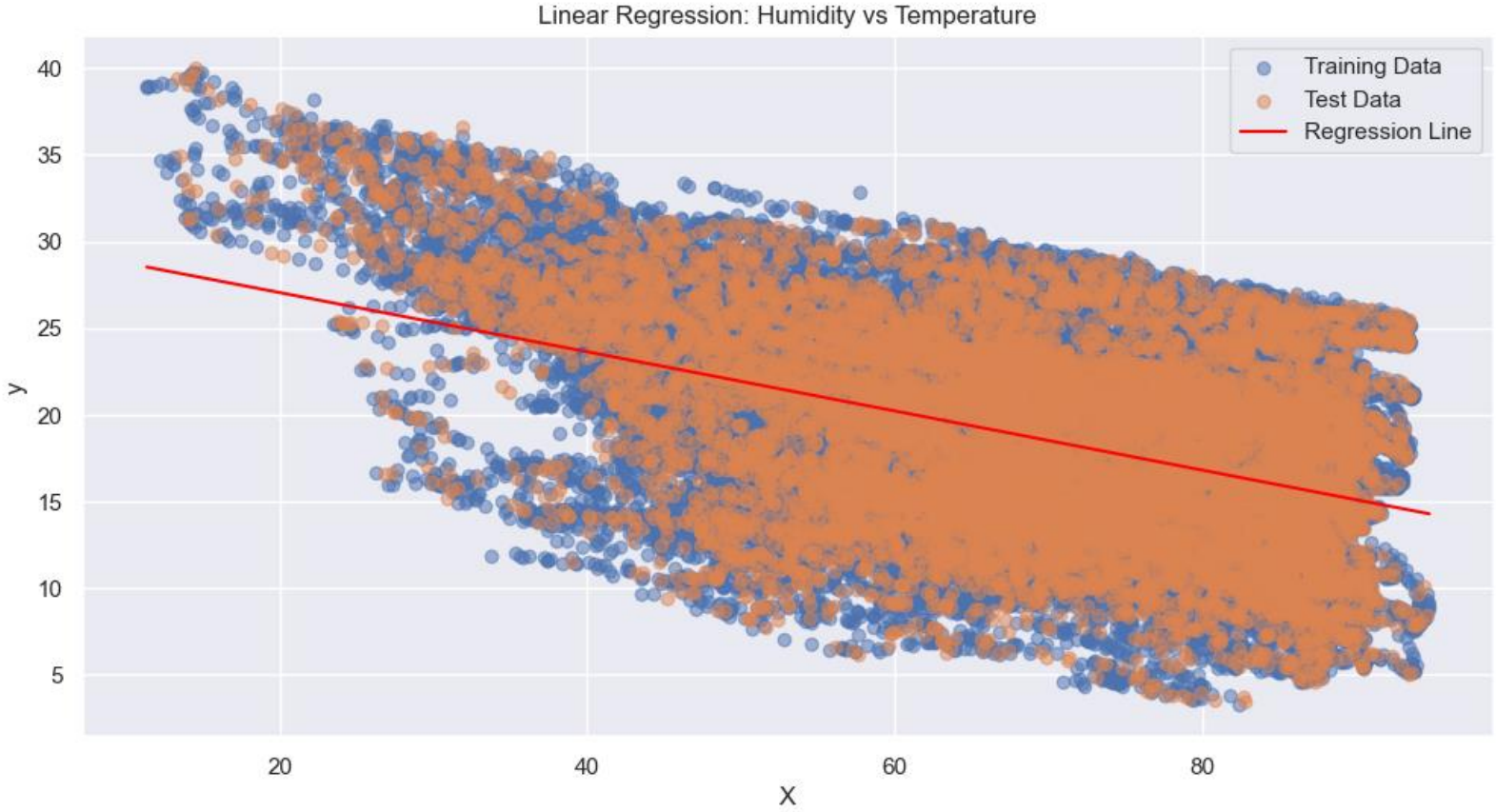
Linear Regression Model



- **R^2 (Train): 0.209**
- **R^2 (Test): 0.222**
- **RMSE (Train): 5.153**
- **RMSE (Test): 5.201**

Observations

R^2 And $RMSE$:

- Degree 1 to Degree 2: R^2(0.212➔ 0.243), RMSE = 5.163
- Degree 2 to Degree 3: R^2(0.243➔ 0.245) , RMSE = 5.058
- Degree 3 to Degree 4: R^2(0.245) unchanged, RMSE = 5.052

Thank You