

# Data Analysis and Green Computing: Profiling HPC Power and Tracking CO<sub>2</sub> Emissions

Green Team Report



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### **Abstract**

The following report includes the observations related to our work, the goal of which is profiling the HPC (High Performance Computing) power consumption and CO2 emissions in the scope of Laboratory of Big Data course.

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# 1 Introduction

introduce background info, general information about the project; the schematic representation of the computer, where and how the racks are located

## 2 Tools

Tools - tools that were used and what techniques/libraries were used to prepare dataset etc; 2.1. preparation of dataset: the interpolation, sorting etc; 2.2. Meta Prophet? 2.3. STL

To start, a brief introduction to the tools and methods employed for data analysis is provided.

### 2.1 STL (Seasonal-Trend Decomposition)

STL (Seasonal-Trend Decomposition) is a technique used in time series analysis to break down a dataset into three main components: trend, seasonality, and remainder.

1. **Trend:** This component captures the long-term direction or progression of the data, indicating whether it is increasing, decreasing, or staying constant over time.
2. **Seasonality:** Seasonality refers to the periodic patterns or fluctuations that occur at regular intervals within the data, such as daily, weekly, or yearly cycles.
3. **Remainder:** The remainder component represents the variability in the data that cannot be explained by the trend or seasonality. It captures the random fluctuations or noise present in the data.

By decomposing the time series data into these components, STL allows to understand the underlying patterns and structures, making it easier to analyze and model the data effectively.

### 2.2 Meta's Prophet

Prophet is a forecasting tool developed by Facebook, designed to handle time series data with seasonal patterns and uncertainty. Its key points are:

1. **Automatic Seasonality Detection:** Prophet automatically detects seasonal patterns in the data, making it suitable for datasets with irregular or changing seasonalities.
2. **Trend Flexibility:** Users can specify various components of the time series, including holidays and special events, which are incorporated into the forecasting model.
3. **Uncertainty Estimation:** Prophet provides uncertainty intervals around the forecasted values, helping users understand the range of possible outcomes.
4. **Scalability:** It's designed to be scalable and can efficiently handle large datasets.

In summary, Prophet simplifies the time series forecasting process with an intuitive interface and powerful forecasting capabilities, making it suitable for both beginners and experienced analysts.

Prophet automates seasonal modeling for forecasting, while STL offers manual control for detailed trend analysis. Choose based on data complexity and desired level of control.

### 3 Power and Energy Consumption

3. Power/Energy+Temperature 3.1. the outputs of preparing, approximating and plotting of the power dataset 3.2. discussion - what trends have been noticed (or not?) if yes, what is the outcome and also temperature considerations

## 4 Carbon Intensity & Operational Carbon Footprint

4. Carbon Intensity 4.1. the outputs of raw data + plots? 4.2. COP - ? 4.2. trying to predict the carbon intensity? 4.2. discussion - what was observed?

## 5 Conclusion?

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