POWER CONSUMPTION ANALYSIS FOR HOUSEHOLDS

Milestone 1: Project Initialization and Planning Phase

The "Project Initialization and Planning Phase" marks the project's outset, defining goals, scope, and stakeholders. This crucial phase establishes project parameters, identifies key team members, allocates resources, and outlines a realistic timeline. It also involves risk assessment and mitigation planning. Successful initiation sets the foundation for a well-organized and efficiently executed machine learning project, ensuring clarity, alignment, and proactive measures for potential challenges.

Activity 1: Define Problem Statement

Problem Statement: A household concerned with energy efficiency and cost savings wants to optimize the power consumption to reduce electricity bills, posing a challenge lacking the necessary knowledge and tools to monitor and analyze energy usage effectively.

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Power consumption Analysis Problem Statement Report: Click Here

Activity 2: Project Proposal (Proposed Solution)

The proposed project, "Power Consumption Analysis for Households," aims to leverage machine learning for more accurate power consumption predictions. Using a comprehensive dataset including global active power, reactive power, global intensity, voltage, submetering readings, the project seeks to develop a predictive model for optimizing the power consumption. This initiative aligns with the Power consumption analysis objective to provide insights for energy efficiency and cost-saving measures and provides recommendations to households on how to reduce their energy consumption and save costs.

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Power consumption Analysis Proposal Report: Click Here

Activity 3: Initial Project Planning

Initial Project Planning involves outlining key objectives, defining scope, and identifying the power consumption patterns. It encompasses setting timelines, allocating resources, and determining the overall project strategy. During this phase, the team establishes a clear understanding of the dataset, formulates goals for analysis, and plans the workflow for data processing. Effective initial planning lays the foundation for a systematic and well-executed project, ensuring successful outcomes.

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Power consumption Analysis Project Planning Report: Click Here

Milestone 2: Data Collection and Preprocessing Phase

The Data Collection and Preprocessing Phase involves executing a plan to gather relevant household power consumption data from Kaggle, ensuring data quality through verification and addressing missing values. Preprocessing tasks include cleaning, encoding, and organizing the dataset for subsequent exploratory analysis and machine learning model development.

Activity 1: Data Collection Plan, Raw Data Sources Identified

The dataset for "Power Consumption Analysis for Households" is sourced from Kaggle. It includes submetering readings and global active, reactive power, global intensity, voltage. Data quality is ensured through thorough verification, addressing missing values, and maintaining adherence to ethical guidelines, establishing a reliable foundation for predictive modeling.

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Power Consumption Analysis Data Collection Report: Click Here

Activity 2: Data Quality Report

The dataset for "Power Consumption Analysis for Households" is sourced from Kaggle. It includes global active, reactive power, global intensity, voltage, submetering readings. Data quality is ensured through thorough verification, addressing missing values, and maintaining adherence to ethical guidelines, establishing a reliable foundation for predictive modeling.

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Power Consumption Analysis Data Quality Report: Click Here

Activity 3: Data Exploration and Preprocessing

Data Exploration involves analyzing the household power consumption dataset to understand patterns, distributions, and outliers. Preprocessing includes handling missing values, scaling, and encoding categorical variables. These crucial steps enhance data quality, ensuring the reliability and effectiveness of subsequent analysis.

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Power Consumption Analysis Data Exploration and Preprocessing Report: Click Here

Milestone 3: Model Development Phase

The Model Development Phase entails crafting a predictive model for power consumption analysis. It encompasses strategic feature selection, evaluating and selecting models (Linear Regression, Random

Forest, Decision Tree, XGB), initiating training with code, and rigorously validating and assessing model performance for informed decision-making in the predicting process.

Activity 1: Feature Selection Report

The Feature Selection Report outlines the rationale behind choosing specific features (e.g., Global reactive power, global intensity, submetering readings) for the power consumption prediction model. It evaluates relevance, importance, and impact on predictive accuracy, ensuring the inclusion of key factors influencing the model's ability.

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Power Consumption Analysis Feature Selection Report: Click Here

Activity 2: Model Selection Report

The Model Selection Report details the rationale behind choosing Linear Regression, Random Forest, Decision Tree, and XGB models for power consumption prediction.

It considers each model's strengths in handling complex relationships, interpretability, adaptability, and overall predictive performance, ensuring an informed choice aligned with project objectives.

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Power Consumption Analysis Model Selection Report: Click Here

Activity 3: Initial Model Training Code, Model Validation and Evaluation Report

The Initial Model Training Code employs selected algorithms on the household power consumption dataset, setting the foundation for predictive modeling. The subsequent Model Validation and Evaluation Report rigorously assesses model performance, employing metrics like mean squared error, R squared error to ensure reliability and effectiveness in predicting power consumption outcomes.

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Power Consumption Analysis Model Development Phase Template: Click Here

Milestone 4: Model Optimization and Tuning Phase

The Model Optimization and Tuning Phase involves refining machine learning models for peak performance. It includes optimized model code, fine-tuning hyperparameters, comparing performance metrics, and justifying the final model selection for enhanced predictive accuracy and efficiency.

Activity 1: Hyperparameter Tuning Documentation

The Gradient Boosting model was selected for its superior performance, exhibiting high accuracy during hyperparameter tuning. Its ability to handle complex relationships, minimize overfitting,

and optimize predictive accuracy aligns with project objectives, justifying its selection as the final model.

Activity 2: Performance Metrics Comparison Report

The Performance Metrics Comparison Report contrasts the baseline and optimized metrics for various models, specifically highlighting the enhanced performance of the Gradient Boosting model. This assessment provides a clear understanding of the refined predictive capabilities achieved through hyperparameter tuning.

Activity 3: Final Model Selection Justification

The Final Model Selection Justification articulates the rationale for choosing Gradient Boosting as the ultimate model. Its exceptional accuracy, ability to handle complexity, and successful hyperparameter tuning align with project objectives, ensuring optimal power consumption predictions.

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Power Consumption Analysis Model Optimization and Tuning Phase Report: Click Here

Milestone 5: Project Files Submission and Documentation

Project files: Click Here

For the documentation, kindly refer to the link. Click Here

Milestone 6: Project Demonstration

Demo link: Click Here