Predicting the energy output of wind turbine based on weather conditions

Milestone1:ProjectInitializationandPlanningPhase

The "Project Initialization and Planning Phase" marks the project's outset, defining goals, scope, and stakeholders.This crucial phase establishes project parameters,identifies key teammembers, 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.

Activity1:DefineProblemStatement

ProblemStatement: Develop a predictive model to estimate the energy output (in kilowatt-hours) of a wind turbine based on current and forecasted weather conditions. The model should utilize historical data of weather parameters such as wind speed, temperature, humidity, and air pressure to predict the electricity generation capacity of the wind turbine accurately

Predicting the energy output of wind turbine ProblemStatementReport: ClickHere

Activity2:ProjectProposal(ProposedSolution)

The proposed project,The energy output of wind turbines fluctuates significantly due to variations in weather conditions such as wind speed, wind direction, temperature, air pressure, and humidity. Current methods for predicting wind turbine energy output are often limited in their accuracy and responsiveness to real-time weather changes. This unpredictability poses challenges for grid operators, wind farm managers, and energy market participants in terms of planning, scheduling, and maximizing the use of wind resources.

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Activity3:InitialProjectPlanning

As a team member, I need to gather historical weather data (wind speed, temperature, humidity) and turbine performance data from various sources (sensors, databases) to build a dataset for analysis

Predicting the energy output of wind turbine ProjectPlanningReport: ClickHere

Milestone2:DataCollectionandPreprocessing Phase

The Data Collection and Preprocessing Phase involves executing a plan to gather energy output

Application 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.

Activity1:DataCollectionPlan,RawDataSourcesIdentified,DataQuality Report

The dataset for "Predicting the energy output of wind turbine - Elevate your data strategy with the Data Collection plan and the Raw Data Sources report, ensuring meticulous data curation and integrity for informed decision-making in every analysis and decision-making endeavor.

- - The project aims to develop a predictive model for estimating wind turbine energy output based on real-time and historical weather data.

Predicting the energy output of wind turbine DataQualityReport: ClickHere

Activity2:DataQualityReport

The dataset for "SmartLender - The Data Quality Report will summarize data quality issues from the selected source, including severity levels and resolution plans. It will aid in systematically identifying and rectifying data discrepancies.

- Missing values in temperature data.

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Activity3:DataExplorationandPreprocessing

Data Exploration involves analyzing the energy output,scaling,and encoding categorical variables. These crucial steps enhance data quality, ensuring the reliability and effectiveness of subsequent analyses in the predicting the energy output project.

Predicting the energy output of wind turbine DataExplorationandPreprocessingReport: ClickHere

Milestone 3: Model Development Phase

The Model Development Phase entails crafting a predictive model for energy output. It encompasses strategicfeatureselection,evaluatingandselectingmodels(RandomForest,DecisionTree,KNN,XGB), initiating training with code, and rigorously validating and assessing model performance for informed decision-making in the lending process.

Activity1:FeatureSelectionReport

The Feature Selection Report outlines the rationale behind choosing specific features (e.g., wind speed,dirction,maxtemperature,humidity,pressure,output energy)for energy output.It evaluates relevance,importance, and impact on predictive accuracy, ensuring the inclusion of key factors influencing the model's ability.

Predicting the energy output of wind turbine FeatureSelectionReport:ClickHere

Activity2:ModelSelectionReport

In the model selection report for future deep learning and computer vision projects various architectures, such as CNNs or RNNs, will be evaluated. Factors such as performance, complexity, and computational requirements will be considered to determine the most suitable model for the task at hand.

Predicting the energy output of wind turbine ModelSelectionReport:ClickHere

Activity3:InitialModelTrainingCode,ModelValidationandEvaluation Report

The Initial Model Training Code employs selected algorithms on the loan approval dataset, settingthefoundationforpredictivemodeling.ThesubsequentModelValidationandEvaluation Reportrigorouslyassessesmodelperformance,employingmetricslikeaccuracyandprecisionto ensure reliability and effectiveness in predicting energy output.

Predicting the energy output of wind turbine ModelDevelopmentPhaseTemplate: ClickHere

Milestone4:ModelOptimizationandTuningPhase

The model optimization and tuning phase in predicting the energy output of wind turbines based on weather conditions is crucial for improving the accuracy and reliability of predictions.and involves refining neural network 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.

Activity1:HyperparameterTuningDocumentation

The GradientBoosting model was selected for its superior performance,exhibiting highaccuracy 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.

Activity2:PerformanceMetricsComparisonReport

The Performance Metrics Comparison Report contrasts the base line 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.

Activity3:FinalModelSelectionJustification

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 in predicting the energy output of wind turbine.

Predicting the energy output of wind turbine ModelOptimizationandTuningPhaseReport ClickHere

Milestone 5: Project Files Submission and Documentation
For project file submission in Github, Kindly click the link and refer to the flow. Click Here

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

Milestone 6: Project Demonstration
In the upcoming module called Project Demonstration, individuals will be required to record a video by sharing their screens. They will need to explain their project and demonstrate its execution during the presentation.