SpaceX Falcon 9 First Stage Landing Success Predictor

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

Predicting the success of Falcon 9 first stage landings is crucial for SpaceX to improve mission success rates and reduce costs. The challenge lies in accurately predicting the landing outcome based on various parameters such as payload mass, orbit type, launch site, and more.

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SpaceX Falcon 9 Problem Statement Report: Click Here

Activity 2: Project Proposal (Proposed Solution)

The project "SpaceX Falcon 9 First Stage Landing Success Predictor" aims to utilize machine learning to predict the landing success of Falcon 9 first stages. Leveraging a dataset that includes parameters like payload mass, orbit, launch site, and previous flight outcomes, the project will develop a predictive model to enhance mission planning and execution, aligning with SpaceX's objective to maximize efficiency and success rates.

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Activity 3: Initial Project Planning

This involves outlining key objectives, defining scope, and identifying stakeholders for the Falcon 9 landing success prediction system. 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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Milestone 2: Data Collection and Preprocessing Phase

The Data Collection and Preprocessing Phase involves executing a plan to gather relevant Falcon 9 launch 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, Data Quality Report

The dataset for "SpaceX Falcon 9 First Stage Landing Success Predictor" is sourced from Kaggle. It includes details of launches and landing attempts. 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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Activity 2: Data Quality Report

Ensuring the integrity of the dataset by handling missing values, removing duplicates, and validating the accuracy of recorded information. This step is critical to ensure that the machine learning models built on this data are reliable and robust.

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Activity 3: Data Exploration and Preprocessing

Analyzing the Falcon 9 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 analyses in predicting landing success.

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Milestone 3: Model Development Phase

The Model Development Phase entails crafting a predictive model for Falcon 9 landing success. It encompasses strategic feature selection, evaluating and selecting models (Logistic Regression, Decision Tree, KNN, Random Forest), initiating training with code, and rigorously validating and assessing model performance for informed decision-making.

Activity 1: Feature Selection Report

Outlining the rationale behind choosing specific features (e.g., PayloadMass, Orbit, LaunchSite,Outcome) for the landing success model. It evaluates relevance, importance, and impact on predictive accuracy, ensuring the inclusion of key factors influencing the model's ability to predict successful landings.

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Activity 2: Model Selection Report

Detailing the rationale behind choosing Logistic Regression, Decision Tree, KNN, and Random Forest models for landing success 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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Activity 3: Initial Model Training Code, Model Validation and Evaluation Report

Employing selected algorithms on the Falcon 9 landing dataset, setting the foundation for predictive modeling. The subsequent Model Validation and Evaluation Report rigorously assesses model performance, employing metrics like accuracy and precision to ensure reliability and effectiveness in predicting landing outcomes.

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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 Logistic Regression 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 Logistic Regression 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 Logistic Regression as the ultimate model. Its exceptional accuracy, ability to handle complexity, and successful hyperparameter tuning align with project objectives, landing success predictions.

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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.