**Project Planning & Management**

**Project Overview**

The Sales Forecasting and Optimization project aims to develop a predictive model that enhances sales forecasting accuracy for retail and e-commerce businesses. By leveraging historical sales data and advanced machine learning techniques, the project seeks to optimize inventory, marketing, and sales strategies, ensuring data-driven decision-making.

**Project Objectives**

* Collect, clean, and preprocess historical sales data.
* Perform exploratory data analysis (EDA) to identify trends, seasonality, and correlations.
* Develop and optimize a time-series forecasting model for accurate sales predictions.
* Deploy the model as a web-based application for real-time or batch predictions.
* Implement monitoring strategies to maintain model performance and mitigate data drift.

**Scope of Work**

**Milestone 1: Data Collection, Exploration, and Preprocessing**

* Acquire a dataset with features such as sales amount, date, promotions, and holidays.
* Conduct EDA, identifying trends, outliers, and correlations.
* Preprocess the dataset by handling missing values, engineering time-based features, and applying scaling techniques.

**Milestone 2: Data Analysis and Visualization**

* Perform advanced statistical analysis on sales correlations with factors like promotions and holidays.
* Visualize trends through interactive dashboards using Plotly or Dash.
* Prepare an analysis report summarizing key findings.

**Milestone 3: Forecasting Model Development and Optimization**

* Experiment with models such as ARIMA, SARIMA, Facebook Prophet, and XGBoost.
* Tune hyperparameters using Grid Search or Bayesian Optimization.
* Compare models using RMSE, MAE, and MAPE to select the best-performing approach.

**Milestone 4: MLOps, Deployment, and Monitoring**

* Implement model tracking with MLflow and version control with DVC.
* Deploy the model via Flask or Streamlit for real-time predictions.
* Set up monitoring systems to detect model drift and track performance.

**Milestone 5: Final Documentation and Presentation**

* Summarize findings, methodologies, and challenges in a comprehensive report.
* Develop a stakeholder presentation showcasing the model’s impact.
* Provide recommendations for future improvements and business applications.

**Team Members & Roles**

Each team member is responsible for all data science tasks, including:

* Data acquisition and preprocessing
* Exploratory data analysis and visualization
* Model development and optimization
* Deployment and monitoring (excluding managerial oversight)

**Key Performance Indicators (KPIs)**

* **Model Performance:** RMSE, MAE, and MAPE thresholds for forecast accuracy.
* **Business Impact:** Improvement in stock optimization and revenue forecasting accuracy.
* **Deployment Success**: Model uptime, response time, and API latency.
* **Adoption Rate:** Percentage of stakeholders utilizing the forecasting tool.

**Project Timeline & Deliverables**

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| **Milestone** | **Deliverables** | **Estimated Completion** |
| Data Collection & Preprocessing | Cleaned dataset, EDA report | Week 2 |
| Data Analysis & Visualization | Analysis report, interactive visualizations | Week 4 |
| Model Development & Optimization | Model evaluation report, final model | Week 6 |
| Deployment & Monitoring | Deployed model, monitoring setup | Week 8 |
| Documentation & Presentation | Final report, stakeholder presentation | Week 9 |

**Risks & Mitigation Strategies**

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| **Risk** | **Mitigation Strategy** |
| Data Quality Issues | Implement rigorous preprocessing and validation steps. |
| Model Overfitting | Use cross-validation techniques and regularization. |
| Deployment Challenges | Conduct incremental testing before full deployment. |
| Model Drift | Set up automated monitoring and retraining mechanisms. |

**Conclusion**

This project provides a structured approach to sales forecasting, integrating machine learning techniques to support business optimization. The deployed model will serve as a valuable tool for decision-makers, enhancing efficiency and strategic planning in sales and inventory management.