Ammar yousuf i21-2662

Taimoor Ali Ata i21-1754

**Introduction**

In the realm of data analysis, time series forecasting is a critical area that facilitates the understanding and prediction of data trends over time. This report details a Streamlit application designed to provide users with robust tools for time series analysis, leveraging powerful statistical models including ARIMA, SARIMA, ETS, and Prophet. The application offers an interactive platform for users to upload their time series data and apply different analytical models to forecast future trends.

**Overview of the Python File**

The Python file under consideration orchestrates a Streamlit application that incorporates functionalities essential for handling data loading, user interactions, model execution, and visualization of results. It utilizes prominent libraries such as pandas for data manipulation, statsmodels and Prophet for statistical modeling, and matplotlib for plotting results. This setup ensures that users can interactively engage with the application, making it both an educational and practical tool for data analysis.

**Functional Components**

The application is structured into several key components, each designed to handle specific aspects of the time series analysis process:

**Data Loading:** Users can upload CSV files containing the time series data. The application processes this data by combining year, month, and day into a single datetime column, which is crucial for time series analysis.

**User Interface:** The interface is powered by Streamlit and includes widgets such as file uploaders, dropdown menus for model selection, and text input boxes for specifying parameters. This setup facilitates a dynamic interaction that adapts to user inputs.

**Model Execution:** Depending on the user’s choice, different models can be applied:

**ARIMA and SARIMA:** These models are suitable for understanding and predicting future points in the series.

**ETS:** This model applies exponential smoothing techniques ideal for data with trends and seasonal variations.

**Prophet:** Developed by Facebook, this model is robust against missing data and shifts in the trend, and it typically works well with daily periodicity data.

**ADF Test**: The application incorporates the Augmented Dickey-Fuller test to check the stationarity of the series, providing users with crucial diagnostic insights.

**Code Analysis**

The code is meticulously organized into functions that enhance modularity and readability. Key functionalities are encapsulated in functions like load\_data for loading the CSV files, perform\_adf\_test for performing the stationarity test, and model-specific blocks within conditional statements that execute based on user interaction.

**Usage Instructions**

1. Install Streamlit and the necessary Python packages (pandas, statsmodels, prophet, matplotlib).

2. Run the application by navigating to the directory containing the script and using the command: streamlit run your\_script\_name.py.

3. Interact with the application through the web interface that Streamlit opens, which will allow file uploading and model selection.

**Potential Enhancements**

While the application serves as a comprehensive tool for basic and intermediate time series analysis, several enhancements could be implemented to broaden its utility:

**Parameter Tuning Interface:** Allow users to dynamically adjust model parameters through the interface.

**Model Comparison Features:** Incorporate capabilities to compare results from different models side-by-side.

**Advanced Visualization Tools**: Integrate more sophisticated visualization tools to provide deeper insights into the data and model performance.

**Conclusion**

This Streamlit application stands out as a powerful analytical tool, enabling users to perform detailed time series analysis in an interactive and user-friendly environment. It effectively bridges the gap between complex statistical analysis and practical application, making it a valuable resource for students, analysts, and industry professionals alike.