**Air Passengers Time Series Analysis**

**Overview**

This repository contains a Jupyter Notebook for analyzing the **Air Passengers** dataset. The analysis includes time series decomposition, rolling statistics, and autocorrelation to identify patterns, trends, and seasonality in monthly air passenger numbers.

**Dataset**

The dataset used for this analysis is AirPassengers.csv. It contains monthly data of the number of passengers from 1949 to 1960.

**Dataset Columns:**

* Month: The time period in 'YYYY-MM' format.
* #Passengers: The number of passengers for each month.

**Source:**

The dataset is a well-known dataset available in the datasets package in R.

**Analysis Performed**

The notebook covers the following steps:

1. **Data Loading and Preprocessing**:
   * Load the dataset and convert the Month column to a datetime format.
   * Set the Month as the index of the DataFrame for easier time series manipulation.
2. **Exploratory Data Analysis (EDA)**:
   * Plot the original data to observe overall trends and patterns.
   * Calculate rolling mean and standard deviation to understand the trend and volatility over a 7-month window.
3. **Autocorrelation**:
   * Compute the autocorrelation with different lags to understand the persistence of trends.
4. **Time Series Decomposition**:
   * Decompose the time series into trend, seasonal, and residual components using an additive model.
5. **Visualization**:
   * Visualize the original time series, rolling statistics, autocorrelation, and decomposed components.

**Usage**

To run this analysis, follow these steps:

1. **Clone the Repository**:

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1. **Install Required Libraries**: Make sure you have the following Python libraries installed:

* pandas
* matplotlib
* statsmodels

You can install them using:



1. **Run the Jupyter Notebook**:
   1. Open the Jupyter Notebook (Time\_Series\_Air\_Passengers.ipynb) in your preferred environment.
   2. Run all cells to reproduce the analysis.
2. **Explore the Results**:
   1. Visualize and interpret the results presented in the notebook.

**Files in the Repository**

* Time\_Series\_Air\_Passengers.ipynb: The main Jupyter Notebook containing the analysis.
* AirPassengers.csv: The dataset used for the analysis.
* README.md: This file, describing the project and how to use it.

**Results**

The analysis shows:

* A clear upward trend in the number of passengers over time.
* Seasonal patterns with regular peaks and troughs each year.
* Increasing variability in passenger numbers as indicated by rolling statistics and residuals.

**Contributing**

If you would like to contribute to this project, feel free to create a pull request or submit issues for any bugs or feature requests.

**License**

This project is licensed under the MIT License.