Real time Dashboard

Introduction:-

The ever-increasing availability of real-time data has revolutionized various fields by enabling proactive decision-making. Time series data, consisting of observations collected at regular intervals over time, plays a crucial role in numerous domains, from finance and economics to environmental monitoring and supply chain management. Extracting meaningful insights from such data requires not only effective forecasting techniques but also clear and interactive methods for presenting these insights to stakeholders.

This paper explores the synergy between two powerful tools:

1. **ARIMA (Autoregressive Integrated Moving Average) models:** A time series forecasting technique adept at capturing trends and seasonality within data.
2. **Real-time Dashboards built with Python:** Interactive web applications that dynamically visualize data streams, empowering users to explore trends, identify anomalies, and make informed decisions.

This paper delves into the process of developing real-time dashboards in Python that leverage ARIMA models for time series forecasting. We'll explore the key steps involved, including:

* **Time series analysis:** Techniques for understanding the characteristics of the data, such as trends, seasonality, and stationarity, to ensure it aligns with ARIMA model requirements.
* **ARIMA model integration:** Utilizing the Statsmodels library in Python to build and train ARIMA models based on the analyzed data.
* **Real-time data acquisition:** Establishing methods to acquire real-time data streams for continuous updates within the dashboard.
* **Interactive dashboard design:** Constructing a user-friendly interface using Dash, a Python framework, to visualize historical data, ARIMA forecasts, and key metrics.

By combining these elements, we aim to showcase how real-time dashboards equipped with ARIMA models can enhance decision-making across various applications. We'll explore the benefits of this approach, including improved monitoring capabilities, informed decision support, and the potential for scalability and deployment.

Literature review

This literature review examines the integration of ARIMA models for time series forecasting within real-time dashboards developed using Python. It explores the strengths of this approach and its applications across various domains.

**ARIMA Models for Time Series Forecasting**

ARIMA (Autoregressive Integrated Moving Average) models have been a cornerstone of time series forecasting for decades [1, 2]. Their popularity stems from their ability to effectively capture trends and seasonality in stationary data. The model leverages a combination of autoregressive (AR) terms that consider past observations, integrated (I) differencing to achieve stationarity, and moving average (MA) terms that account for past forecast errors [3].

Several studies have explored advancements in ARIMA modeling:

* **Automating ARIMA Order Selection:** Hyndman et al. (2018) propose automating the crucial step of selecting the optimal ARIMA order (p, d, q) by leveraging information criteria like AIC and BIC [4].
* **Enhancing Accuracy with Machine Learning:** Integration of machine learning techniques with ARIMA models is being explored to potentially improve forecasting accuracy [5].

These advancements showcase the ongoing development and refinement of ARIMA models for time series forecasting.

**Real-time Dashboards for Visualization and Decision Making**

Real-time dashboards have emerged as valuable tools for data-driven decision-making by providing interactive visualizations of data streams [6]. Ackoff (1989) and Power (2004) highlight the importance of visual representations in facilitating human understanding of complex data and enabling better decision quality [7, 8].

Python libraries like Dash offer powerful capabilities for constructing real-time dashboards. Several publications showcase the application of Dash in various domains, including finance and business intelligence [9, 10]. These studies demonstrate the effectiveness of Dash in creating interactive dashboards for real-time data exploration and analysis.

**Limited Research on Integration, High Potential**

While the literature review identifies extensive research on ARIMA models and real-time dashboards individually, there's limited research directly exploring their specific integration. However, the strengths of each technique suggest their combined potential for a powerful forecasting and visualization solution.

For instance, Santosh (2020) demonstrates the development of a web-based dashboard for real-time traffic prediction using machine learning models [11]. This concept can be adapted to integrate ARIMA forecasts within the dashboard for visualizing traffic flow and detecting anomalies.

**Applications in Various Domains**

The combination of ARIMA models and real-time dashboards holds promise for various applications:

* **Finance:** Real-time monitoring of stock prices, generation of ARIMA forecasts, and identification of trading opportunities based on visualized trends.
* **Supply Chain Management:** Forecasting demand for products, optimizing inventory levels, and preventing stockouts based on real-time data and ARIMA predictions presented within dashboards.
* **Renewable Energy Management:** Predicting wind or solar power generation using ARIMA models and visualizing the forecasts in real-time dashboards to facilitate grid balancing.
* **Environmental Monitoring:** Tracking air quality, water levels, or weather patterns in real-time with visualizations alongside ARIMA forecasts to anticipate environmental changes.

These examples showcase the potential for this integrated approach to enhance decision-making across diverse domains.

Methodology

The paper comprises of several different components that explore various aspects of

the online stores used in this study. The methodology section is broken down into

several sub-sections that follow a ‘top-down’ approach of the process that is followed

in this analysis.

This section contains detailed information about the dataset, the exact techniques

that have been used in forecasting weekly sales and the last section talks about how

this study is significant in predicting the weekly sales for online stores. It will also

discuss the success of the applied models in identifying the effect of different factors

on such weekly sales.

About dataset