



Empowering Healthcare Data Analytics: Streamlit for Streamlined Application Development and Visualization

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ABSTRACT

This paper discusses how Streamlit can improve healthcare data analytics by simplifying application development and enhancing data visualization. Streamlit is an open-source Python framework that allows quick creation of interactive web applications without complex front-end programming. In healthcare, it helps analyze large datasets, create real-time visualizations, and provide valuable insights for medical professionals, researchers, and decision-makers. By connecting healthcare data with Streamlit's easy-to-use interface, the system enables users to visualize patient trends, track health outcomes, and make better decisions. The paper explains how Streamlit can simplify the development of customized tools for healthcare providers, improving patient care and efficiency. It also shows how real-time data updates, interactive dashboards, and machine learning models can support better decision-making in healthcare. This study demonstrates how Streamlit can turn raw healthcare data into useful insights, offering a user-friendly platform for better decision support and collaboration.

Keywords: Streamlit, Healthcare Data Analytics, Data Visualization, Machine Learning

1. Introduction

The healthcare industry generates vast amounts of data daily, ranging from patient records and clinical trials to medical imaging and administrative details. This data holds significant potential for improving patient care, streamlining operations, and advancing research. However, harnessing the power of this data is often a complex and time-consuming process due to the challenges of data integration, analysis, and visualization. Healthcare professionals and researchers require tools that allow them to quickly analyze and interpret large datasets to make informed decisions.

In recent years, Streamlit, an open-source Python framework, has emerged as a powerful tool for simplifying the development of interactive web applications. Its ease of use and focus on rapid prototyping have made it particularly suitable for data-driven applications in fields like healthcare. Streamlit allows users to create custom applications with interactive visualizations, helping to transform raw healthcare data into actionable insights.

This paper explores the potential of Streamlit in healthcare data analytics, focusing on how it can streamline the development of applications for analyzing healthcare data and visualizing key trends. By eliminating the need for complex front-end development, Streamlit empowers healthcare professionals and data scientists to rapidly build and deploy applications that support decision-making. Furthermore, the integration of real-time data updates, machine learning models, and user-friendly interfaces makes Streamlit a promising tool for enhancing the accessibility and usability of healthcare data. This paper aims to demonstrate how Streamlit can simplify the creation of custom applications that improve patient outcomes, operational efficiency, and research capabilities in the healthcare sector.

Related Works

The article [1] demonstrates how Streamlit simplifies the creation of interactive dashboards and visual analytics, with applications in healthcare and beyond. The paper [2] discusses the use of advanced analytics and visualization in healthcare, emphasizing the need for accessible tools like Streamlit. Demonstrates the use of Streamlit to develop a real-time COVID-19 dashboard for healthcare analytics was demonstrated [3]. How machine learning and visualization tools can improve healthcare insights and decision-making was explored [4].

The research work in [5] analyzes frameworks like Streamlit and their roles in enabling streamlined healthcare analytics applications. Work in [6] reviews the impact of interactive visualization tools in healthcare management and decision support systems. [7] Official documentation providing practical insights into building healthcare-focused analytics and visualization applications using Streamlit. These related works highlight how Streamlit and similar technologies can empower healthcare data analytics, improving visualization, usability, and decision-making processes.

2. Proposed Methodology

The user interface available at present is functional but simplistic, with minimal visual enhancements. Basic filters allow for data exploration, and users can view testing data and time series trends. However, the overall design lacks visual depth and interactivity, limiting the user experience.

The proposed system significantly upgrades the user interface by introducing vibrant gradient backgrounds, enhancing visual appeal and user engagement. Advanced analytical features are added, such as the ability to group data by medical conditions and perform detailed age-group based analysis, providing deeper insights into the data. The system also improves user experience by offering colorful, dynamic visualizations, making data exploration more intuitive and visually engaging. These enhancements make the dashboard more interactive, informative, and suitable for users seeking a comprehensive data analysis in health care.

The system introduces interactive features like tooltips and hover effects for contextual data insights. It also offers customizable options, allowing users to personalize visualizations. These enhancements enhance user engagement and comprehension, making data exploration more meaningful.

Streamlit Data Framework

Streamlit is a Python-based, open-source framework designed to build interactive web applications quickly. It is particularly useful for data scientists and developers who want to create dashboards, data apps, and prototypes without needing expertise in web development.

3. Key Features:

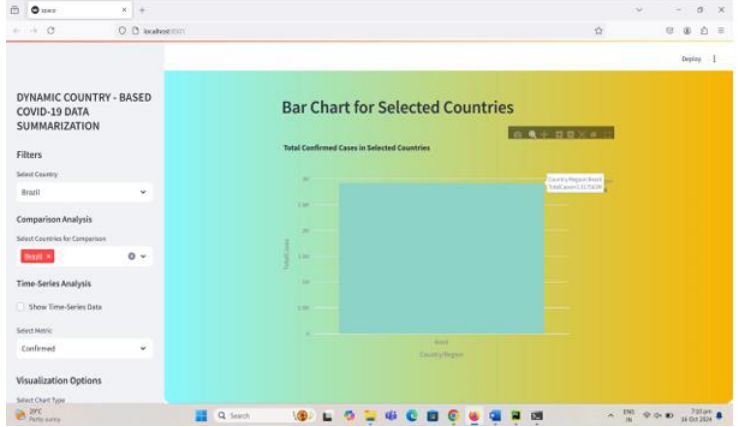
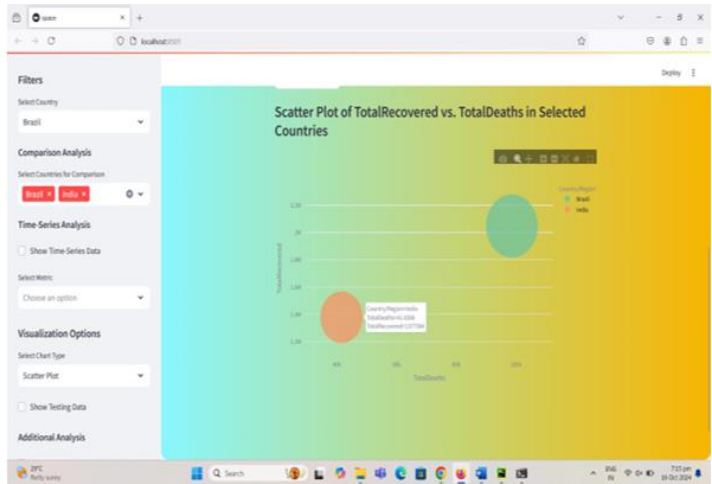
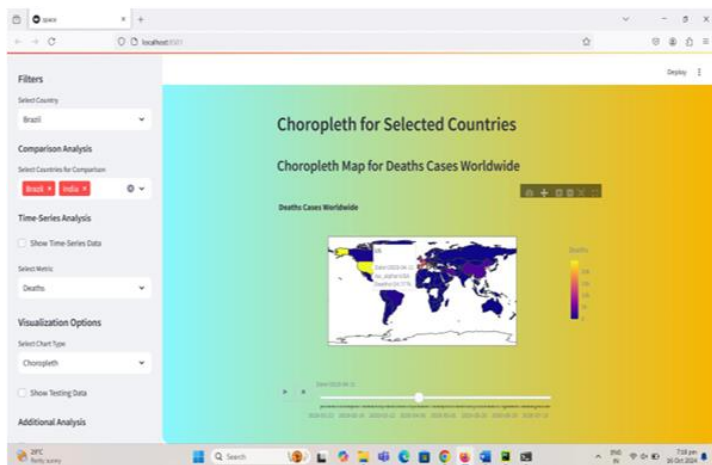
- ❖ **Ease of Use:** Write Python code and Streamlit automatically turns it into an interactive web app.
- ❖ **Real-Time Updates:** Any changes to code or data are instantly reflected in the web app.
- ❖ **Data Visualizations:** Seamless integration with popular libraries like Plotly, Matplotlib, and Altair.


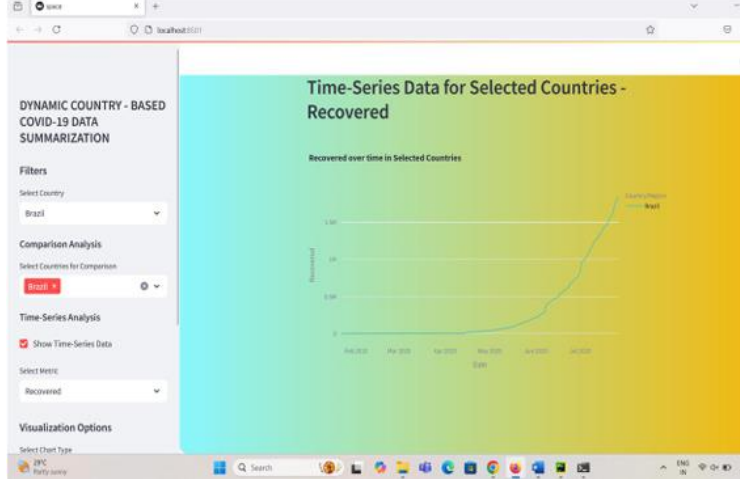
Streamlit's Visualization Features

Streamlit excels in offering user-friendly and interactive visualization tools, making it a powerful platform for presenting complex datasets in an easily understandable format. Key visualization is carried out on the publicly available COVID – 19 dataset [8] and the visualization features, such as bar chart, scatter plot, choropleth map, pie chart and real-time rendering are shown in figure 1.

Fig. 1. Streamlit's Visualization Features

Streamlit's Visualization Features	Explanation	Interactive Visualization Output
Bar Chart	Displays comparisons of	

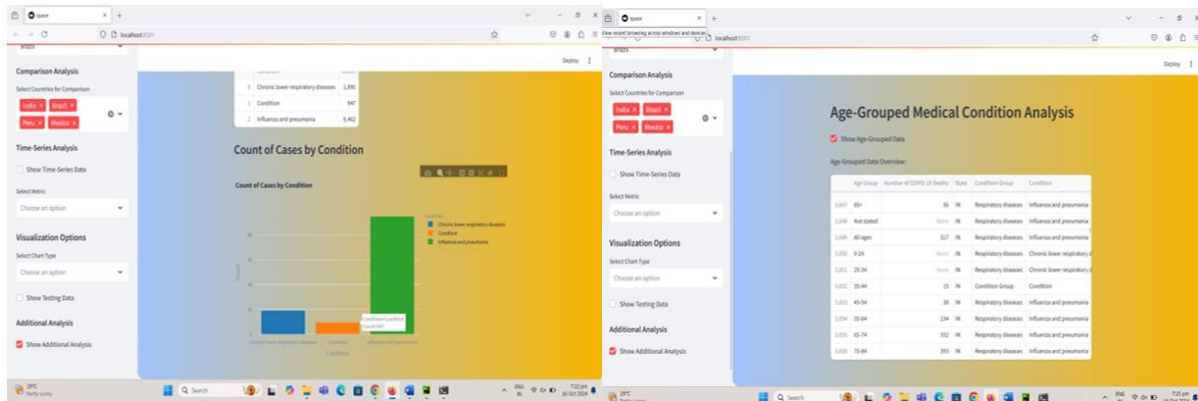
	<p>metrics, such as confirmed COVID-19 cases or deaths, across different countries. Ideal for identifying trends and contrasts in data.</p>	
<p>Scatter Plot</p>	<p>Visualizes relationships between two variables, such as total cases vs. total deaths. Useful for uncovering patterns and correlations in data for deeper analytical insights</p>	
<p>Choropleth Map</p>	<p>Presents geographic data visually, showcasing distributions of cases worldwide by country. Effective for spotting regional trends and global patterns in data.</p>	

Pie Chart	<p>Illustrates proportions of specific metrics, such as the distribution of confirmed cases among selected countries.</p> <p>Helps provide a clear breakdown of how data is segmented.</p>	
Real-time Rendering	<p>Real-time rendering ensures that any updates or changes to the dataset are reflected instantly in the visualizations.</p>	

Customization and Interactivity

Streamlit allows users to tailor visualizations by selecting chart types, adjusting parameters, and focusing on specific data subsets. Its real-time rendering ensures that any updates or changes to the dataset are reflected instantly in the visualizations.

By offering diverse and interactive visualization options, Streamlit empowers users to explore data dynamically, communicate insights effectively, and facilitate informed decision-making. Additionally, it allows for conditional analysis which is evident in figure 2.

Fig. 2. Additional Condition Analysis

While Streamlit is a powerful tool for rapid development and visualization in healthcare data analytics, understanding its limitations is crucial for making informed decisions. The key limitations include limited customization, performance issues, scalability limits, integration challenges, single threaded nature and limited community and ecosystem. Balancing these constraints with its strengths can help in effectively leveraging Streamlit for application specific needs.

4. Conclusion

The integration of Streamlit into healthcare data analytics represents a transformative approach to simplifying application development and enhancing data visualization. By leveraging Streamlit's intuitive interface and interactive capabilities, healthcare professionals and researchers can efficiently analyze and interpret complex datasets, making data-driven decision-making more accessible. This paper highlighted how Streamlit empowers the development of custom analytics tools, enabling real-time insights and fostering collaboration across multidisciplinary teams. Furthermore, the framework's ability to handle diverse healthcare scenarios, from patient monitoring to predictive modeling, demonstrates its potential to improve outcomes while reducing development time and costs. As the healthcare sector continues to generate vast amounts of data, tools like Streamlit provide a pathway toward streamlined analytics, bridging the gap between raw data and actionable intelligence. Future work could explore integrating advanced AI models and ensuring compliance with data privacy regulations, with actionable steps like identifying key use cases, conducting feasibility studies and by developing prototypes to evaluate its performance and accuracy, conducting data privacy audits, using a secure data infrastructure to protect sensitive health care information, paving the way for further innovation in healthcare analytics.

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