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Shiny App R Script

Introduction:

In this analysis, we delve into a comprehensive dataset documenting tornado occurrences since 1950, aiming to uncover insights and patterns in the dynamic landscape of these weather events. Each record provides a snapshot of a tornado event, including informative variables such as date, state, magnitude, fatalities, and more. This data was derived from a dataset produced by the National Oceanic and Atmospheric Administration (NOAA) Storm Prediction Center.
This shiny application visualizes tornado trends throughout each state since 1950. The visualization seeks to answer and understand questions such as:

1. Where are tornadoes most prevalent and what patterns emerge?
2. How have tornado prevalence and seasonality trends changed over time?
3. How do climatic factors influence the temporal distribution? Are there noticeable cyclic patterns or anomalies?

Interesting Findings:

In many states, March through July have seen far higher rates of tornadoes throughout more recent years, demonstrating a possible shift in known tornado season. This, along with other noticeable changes in similar meteorological events, could likely be tied to our changing climate. Furthermore, for most states where tornadoes are more common, the trends over the last 30 years have been highly fluctuating while the first 30 years of this dataset (1950s-1980s) appeared to have much more steady and lower rates of tornado frequency. Surprisingly, not only has the prevalence of tornadoes heightened over the last 30 years, but the location of tornadoes is shifting east. In exploring the trends of tornadoes in states such as Kentucky, Louisiana, Arkansas, and Tennessee, states that are not widely known for traditionally having many tornadoes and east of "tornado alley," it becomes apparent that especially since the early 2000s, tornadoes are moving east across the United States.

Interface Creation:

The data preparation for this application included ensuring that the tornado dataset was effectively summarized for the visualization. This included extracting the month and year from the date column and grouping the data by that variable. Only then could I summarize the tornadoes to a count column, counting every tornado in each state by the month and year it happened. The style of the interface seeks to enhance user experience and facilitate meaningful insights. The ggplot2 library was used to create a line plot, providing a simple and visually appealing representation of the summarized tornado data. Further, an interactive data table enhances overall user engagement and understanding of specific tornado events.

The layout of the interface was designed for a clear and accessible user experience. On the sidebar, a slider component allows users to select a desired range of years for analysis. This can simplify an overwhelming visual or assist in dissecting trends over specific periods throughout the data. The state input selection feature enables users to choose one or multiple states of interest, tailoring the analysis to specific regions. This filter defaults to Texas, a state with historically the most tornadoes, inviting users to draw comparisons within the data. The interactive visualization acts as a focal point for users to observe patterns and variations in tornado occurrences. Finally, a dynamic data table below the graph provides a comprehensive overview of what the user is viewing in the visualization. This invites the user to gain deeper insights into the characteristics of each tornado event. Through these design choices and the integration of visualization tools, the interface was crafted to be intuitive, informative, and engaging for all users exploring tornado data.

Reactive Graph Structure:

The reactive structure of the application contains a slider to filter years, a dropdown element for filtering states, and a brush object to more effectively "zoom in" to a select part of the line chart. Such reactive expressions can simply filter the tornado data based on the selected year range and states to extract necessary information. These elements are efficient in adding interactivity to the application while assisting the user to draw conclusions and explore the tornado dataset in detail. Furthermore, the line plot uses plotly to provide sufficient detail about each point with a label on hover. The interactive data table displays detailed information about tornado events and updates as the filters change. The reactive graph ensures that changes in the inputs (year range and selected states) trigger the necessary computations, updating both the line plot and the data table accordingly. With a variety of filters and information at their fingertips, users can explicitly explore NOAA tornado data throughout states over time.