**Interactive Visualization of Flight Delays in the United States**

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1. Stacked Bar Chart: "Comparison of Carrier Delay Performance"

**图表, 条形图

描述已自动生成**

Bars:

* Each bar represents the average carrier delay across airlines.
* The bar is divided into stacked colored segments, with each color corresponding to a specific cause of delay.

X-Axis:

* Displays the airline codes (e.g., DL for Delta Airlines).

Y-Axis:

* Indicates the average delay time in minutes, broken down by delay causes.

1. Pie Chart: "Proportions of Delay Causes"

图表, 饼图

描述已自动生成

Colored Slices (Segments):

* Each colored segment represents a specific cause of flight delays.

Size of Segments:

* Proportional to the total contribution of each delay cause to the overall delay times.

Labels:

* Display the delay cause and its percentage contribution.

1. Interactive Map: "Geographic Distribution of Flight Delays"

地图

描述已自动生成Markers (Points):

* Represent the locations of major U.S. cities involved in flight operations.
* Each marker corresponds to a city as a flight origin.

Colors:

* Green: Delays < 20 minutes.
* Yellow: Delays between 20–50 minutes.
* Red: Delays > 50 minutes.

Marker Size:

* Uniform across all markers for visual consistency.

Popups:

* Display detailed information consisted of city name and average delay time and major delay cause.

1. Findings Highlights
2. **Bar chart** and **pie chart** summary:

* The analysis shows significant variability in delays among different carriers:
* Late Aircraft Delays account for a substantial portion of the overall delay times, indicating potential issues in scheduling and maintenance. In contrast, NAS delays and weather-related delays represent relatively small proportions, while security delays are extremely low.
* Some carriers(such as DL) have significantly higher CARRIER\_DELAY compared to other carriers, indicating potential operational inefficiencies that need to be addressed.

1. Key Insights from Map:

Cities with red markers highlight delay hotspots. Green-dominated cities indicate efficient flight performance.

1. Data and Methods
2. Data:

* Flight delay data was sourced from a CSV file containing carrier, origin, destination, and delay details. (from https://transtats.bts.gov/Fields.asp?gnoyr\_VQ=FGK)
* U.S. city geographical coordinates were extracted from a GeoJSON file. (from https://github.com/codeforgermany/click\_that\_hood/tree/main/public/data)

1. Methods:

* Calculated average delay for each flight, aggregating delays from different causes.
* Used Folium for map visualization and Matplotlib for bar and pie charts.
* Color-coded markers to represent varying delay durations.
* Interactive popups for detailed flight information.

1. Significance Statement

* Flight delays are a significant source of frustration for passengers and a critical operational challenge for airlines. This visualization bridges the gap between raw data and actionable insights by presenting delay patterns in an intuitive and interactive manner.
* From a passenger's perspective, the map helps individuals identify which cities or airlines are more prone to delays, enabling more informed travel planning. For instance, a traveler might avoid carriers or routes frequently associated with long delays based on this analysis.
* From an industry perspective, the visualization highlights delay hotspots and key contributors, such as late aircraft or operational inefficiencies in specific carriers. Airlines can use these insights to target improvements in scheduling, maintenance, and overall efficiency, potentially reducing delays and enhancing customer satisfaction.
* By integrating data on causes, carriers, and geography, this tool serves as a powerful resource for both personal decision-making and industry optimization, ultimately contributing to a more reliable and efficient air travel experience.