**National Crash Data Analysis**

Leveraging National Highway Traffic Safety Administration (NHTSA) data, this project analyzes motor vehicle crash trends and contributing factors from 2019 to 2023. The analysis, which incorporates variables like weather, driver age, and intersection type, aims to deliver actionable insights for transportation authorities. The objective is to support data-driven policy decisions, inform risk identification, and ultimately improve public safety by reducing the frequency of roadways.

**Objectives**

* **Crash Trend Analysis**  
  Analyze crash data from 2019 to 2023 to understand the frequency and severity of motor vehicle crashes across the U.S.
* **Contributing Factors Study**  
  Examine how factors such as weather, driver age, lighting conditions, intersection types, and alcohol involvement influence crash outcomes.
* **High-Risk Scenario Identification**  
  Identify combinations of conditions that are strongly associated with serious or fatal crashes.
* **Public Safety Awareness**  
  Provide insights to support educational campaigns aimed at reducing risky driving behaviors.
* **Region-Level Comparison**  
  Compare crash patterns across regions to uncover regional risks and guide localized safety strategies.

**Dataset**

* **Source:**  [https://www.nhtsa.gov/file-downloads?p=nhtsa](https://www.nhtsa.gov/file-downloads?p=nhtsa.csv)
* **Years of Data Covered**: 2019–2023
* **Format**: CSV
* **Metrics Tracked**: Number of Accidents, Age Group, Injury Severity, Gender, Alcohol-Impaired Driving, Weekday, Intersection Type

**Tools & Technologies**

* **Python/Pandas** - For exploration, normalizing and aggregation of the dataset, matplotlib, seaborn
* **Notebook Environment**: Jupyter Notebook
* **Power BI** – For creating Interactive dashboard.
* **Git** – For version control

**Visualizations in Power BI**

* **Stacked Bar Chart**Visualizes trends in crash frequency and severity from 2019 to 2023. Users can filter by year, region, or intersection type to explore specific patterns.
* **Tree Map**Displays total crash counts categorized by weather conditions or injury severity. Interactive filters allow users to drill down by region or time period.
* **Column Charts**Compare crash rates across weekdays and highlight different types of collisions, alcohol test types, or lighting conditions.
* **Donut and Funnel Charts**Show demographic breakdowns based on gender, lighting conditions, area type (urban/rural), and alcohol involvement. Users can toggle between categories for deeper insights.
* **Maps**Illustrate the geographic distribution of crashes across the U.S., identifying regional hotspots. Zoom and hover features reveal crash density and severity by location.
* **Button Slicer**Allows users to filter data by age group or blood alcohol concentration (BAC) range for targeted analysis.

**Key Takeaways**

* The highest number of accidents occurred during **daylight**, in **clear weather**, and most frequently on **Fridays**.
* **Southern regions** of the U.S. reported more crashes compared to other areas.
* Crashes involving **male drivers** were more common than those involving female drivers.
* The number of crashes caused by **young drivers** has been decreasing since **2022**, likely due to the implementation of **hands-free laws** in more states.
* Most accidents involving young drivers **did not involve alcohol** and resulted in **no reported injuries**.
* The most common **collision type** among young drivers was **front-to-rear impact**.
* **Alcohol-impaired crashes** peaked in **2020**, showing a notable increase compared to other years.

**Conclusion**

The analysis provides a clear understanding of how mandatory Automatic Emergency Braking (AEB) in all new passenger vehicles could contribute to a meaningful reduction in crash incidents. It also highlights the importance of investing in public education campaigns aimed at reducing distracted driving, which could enhance overall road safety. Together, these insights underscore the value of combining technological solutions with targeted awareness efforts to foster safer driving environments.

**Future Research**

* Add data for years beyond 2023 to extend the current 2019–2023 dataset
* Analysis focuses on modeling crash patterns caused by driver distraction.
* Develop a system to categorize crash data at the state level using police jurisdiction and regional information.
* Focusing analysis on the evolving nature of crashes as advanced driver-assistance systems (ADAS) become standard.