Moringa School Data Science Project: Aviation Safety Analysis

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Overview

This analysis aims to enhance aviation safety by examining historical aviation accident data. The primary objective is to uncover key patterns and insights that can inform safety improvements and risk mitigation strategies. The analysis is structured into several key phases: Business Understanding, Data Understanding, Data Preparation, Data Analysis, and Drawing Conclusions.

Business Understanding

The aviation industry constantly strives to ensure the highest levels of safety for passengers and crew.

Understanding the factors contributing to aviation accidents is critical for developing effective safety measures and protocols.

Objectives:

- Identify common factors to determine most frequent causes of aviation accidents.
- Trend analysis - This is to examine trends in accident frequency, location, and severity over time.
- Impact assessment - To evaluate the impact of different variable like weather conditions, aircraft type on acciddent severity.
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Key Business questions

What are the most common factors contributing to aviation accidents?

How do weather conditions affect the severity of aviation incidents?

Which phases of flight are most prone to severe accidents?

Data Understanding

The dataset is sourced from the National Transportation Safety Board (NTSB).

It includes detailed records of aviation accidents, covering event details, location, aircraft information, weather conditions, and injury severity.

The dataset comprises of various fields including Event.date , Location , Aircraft.damage , Weather.condition and Total.Fatal.Injuries.

It contains information on necessary to understand the circumstances and outcomes of each incident.

Data Analysis

Exploratory Data analysis

Univariate Analysis: Examined the distribution of key variables such as Injury.Severity, Aircraft.damage, Weather.Condition, and Broad.phase.of.flight.

Findings: Most incidents resulted in no injuries, but a significant number had fatalities and serious injuries. The most common injury severity category was "None".

Bivariate Analysis: Investigated relationships between variables, such as Weather.Condition and Injury.Severity, Aircraft.damage and Broad.phase.of.flight.

Findings:Incidents in Instrument Meteorological Conditions (IMC) tend to have higher fatal injuries compared to Visual Meteorological Conditions (VMC).

Substantial and destroyed aircraft damage occurred more frequently during landing and takeoff phases.

Trend Analysis: Analyzed trends over time using the Event.Date.

Findings: Fluctuations in the number of incidents over the years indicate the need for continuous monitoring and adaptation of safety protocols.

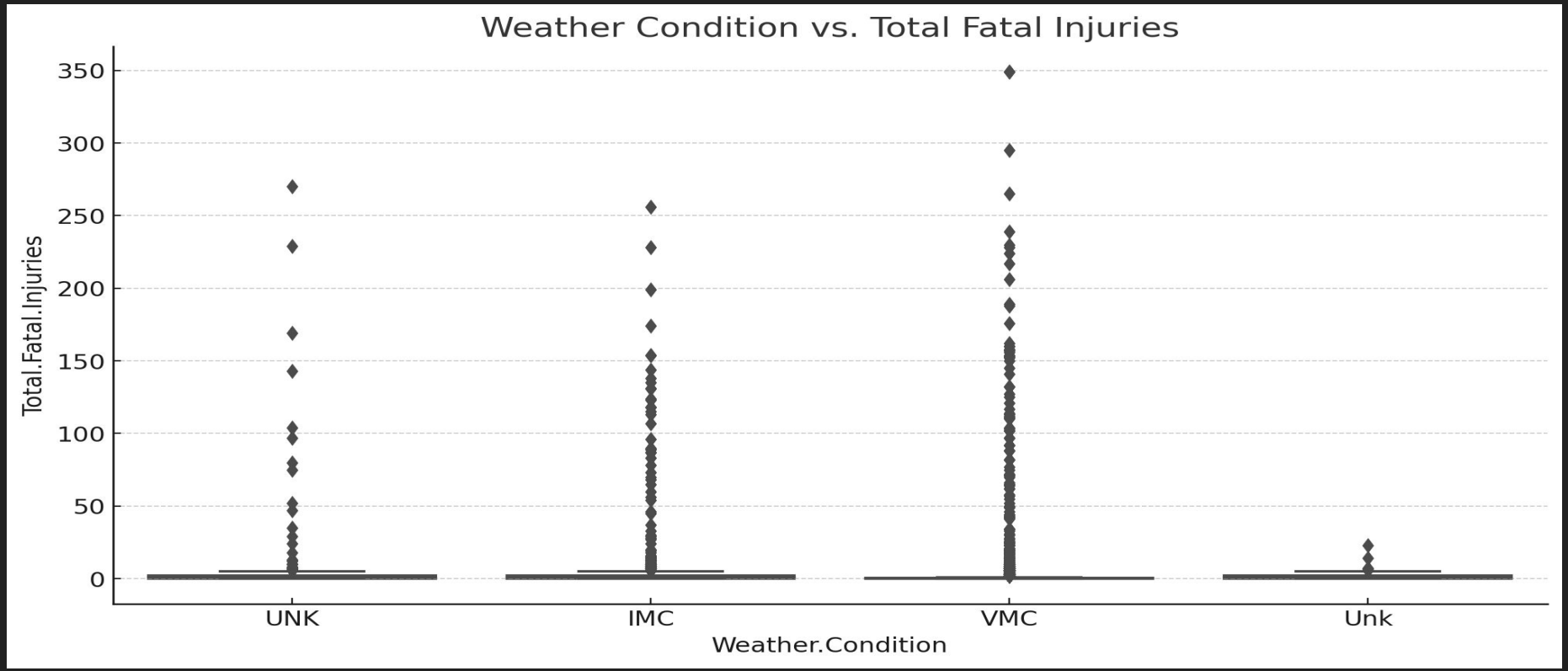
Key Visualizations.

Distribution of Injury severity.

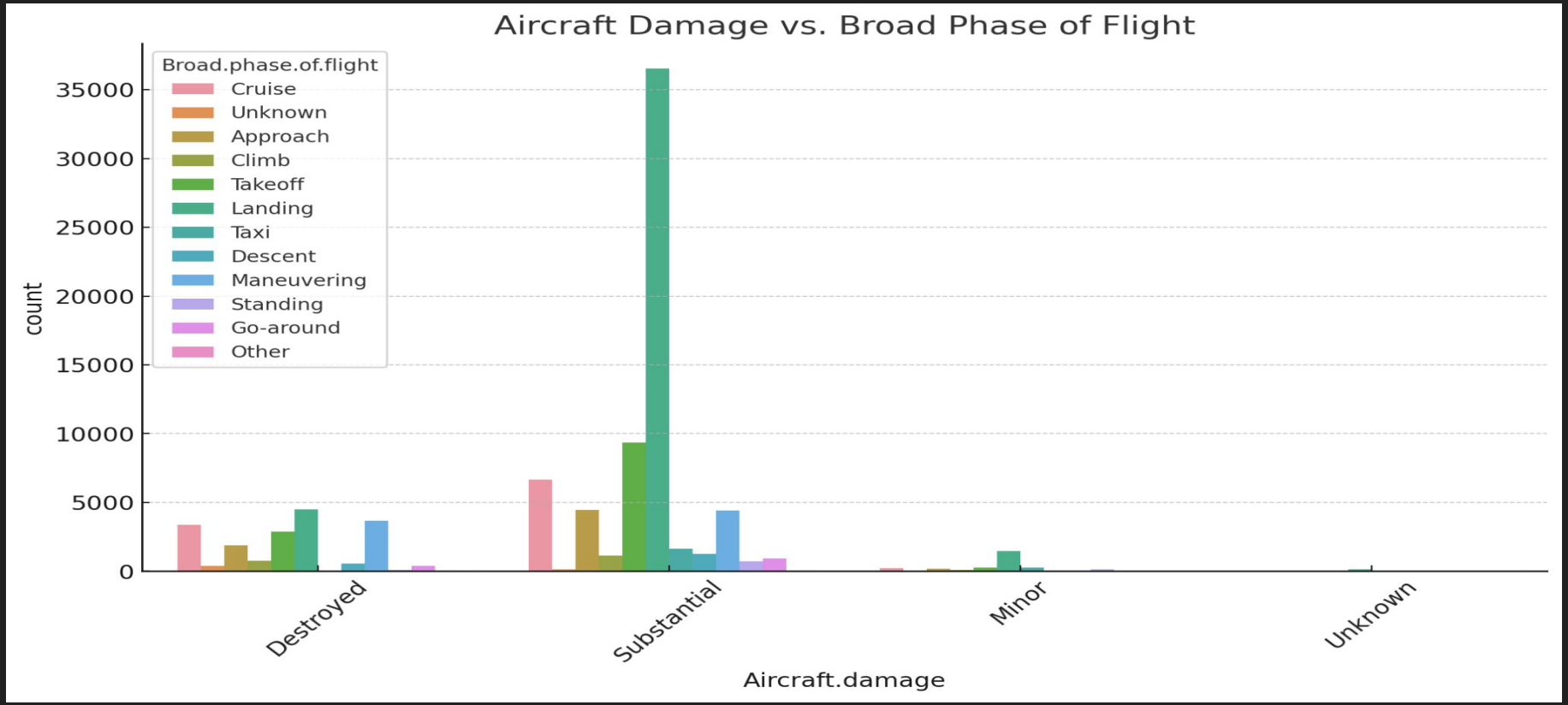
A bar chart showing the range and frequency of injury severities across incidents.

Visual shows that while most incidents resulted in no injuries, there are significant numbers of incidents with serious and fatal injuries.

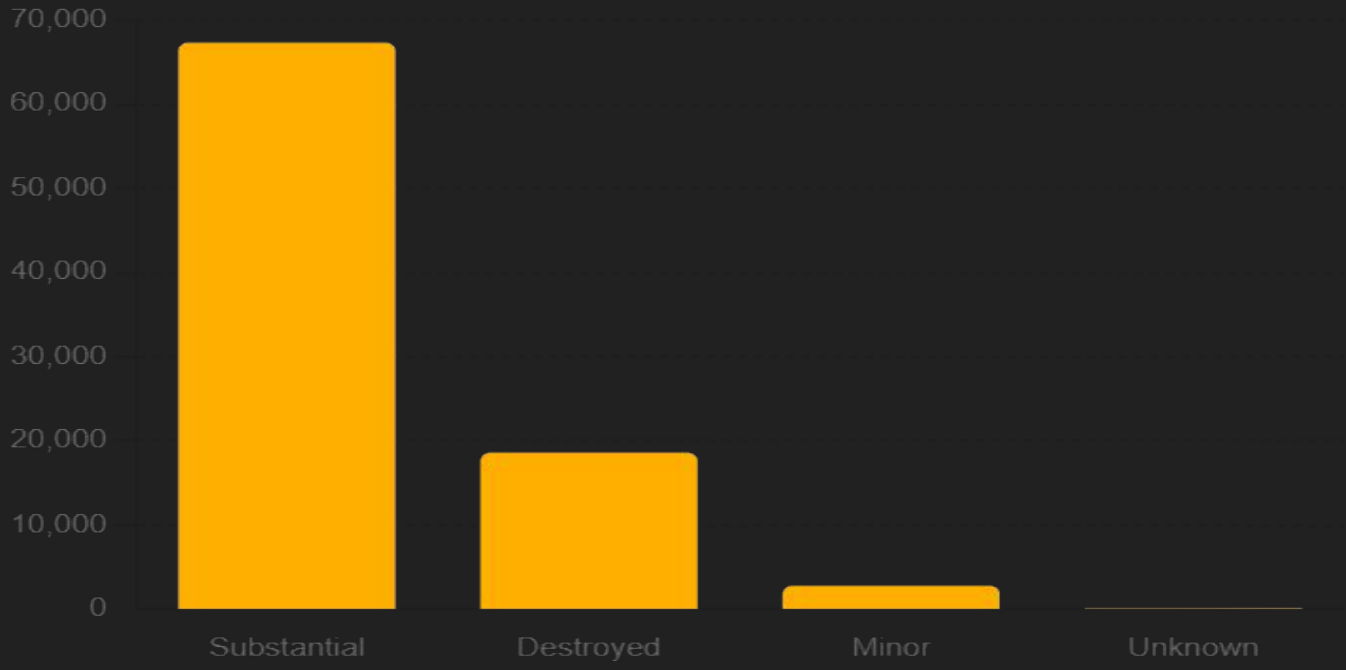
Distribution of weather Condition vs Total fatal injuries.



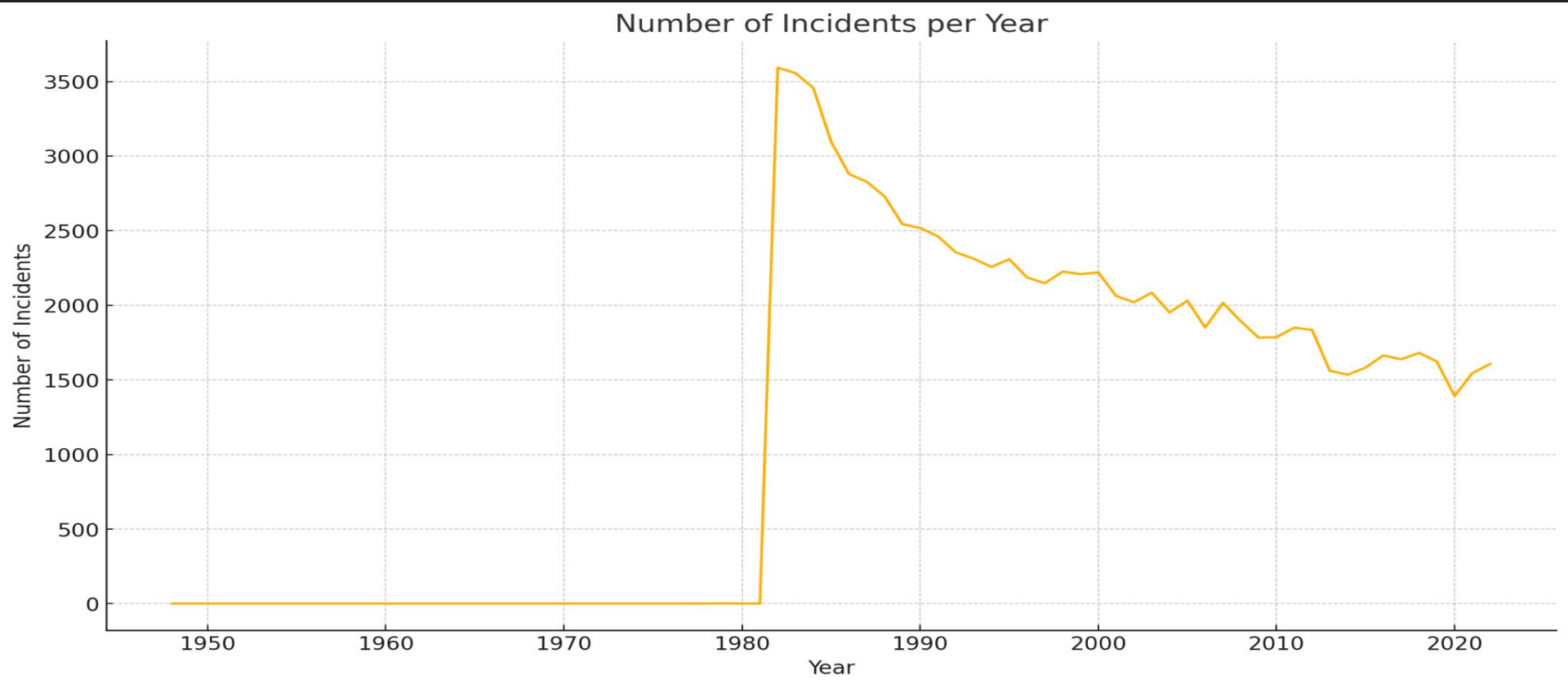
Aircraft Damage vs Broad Phase of flight



Distribution of Aircraft damage



Number of incidents per year



Recommendations

Enhance Safety Protocols

Implement stricter safety measures and checks during landing and takeoff phases.

Develop and enforce protocols for better management during critical flight phases.

Increase ground and air traffic control measures to ensure safety during landing and takeoff.

Improve Training

Provide comprehensive training for pilots to handle adverse weather conditions, particularly IMC.

Enhance simulator training to include various adverse weather scenarios.

Regularly update training programs to include the latest safety practices and technological advancements.

Continuous Monitoring

Establish continuous monitoring systems to track aviation incidents in real-time.

Use data analytics to identify emerging trends and potential safety issues.

Implement predictive maintenance systems to detect and address potential aircraft issues before they lead to accidents.

Next Steps

Data Validation and Further Analysis

Validate the findings with additional datasets and perform further analysis to confirm the identified trends and factors.

Collaborate with other aviation safety organizations to cross-verify data.

Conduct longitudinal studies to observe trends over extended periods.

Implement Recommendations

Collaborate with stakeholders to implement the recommended safety protocols and training programs.

Engage with regulatory bodies to update and enforce new safety standards.

Work with training institutions to revise and enhance pilot training curricula.

Develop Predictive Models

Utilize the insights gained from the analysis to develop predictive models that can assess the risk of accidents.

Create machine learning models to predict potential safety risks based on historical data.

Integrate predictive models into aviation safety management systems for real-time risk assessment.

Continuous Improvement

Establish a framework for continuous monitoring and improvement of aviation safety protocols.

Thank you !!

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