project

March 28, 2025

[91]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

[31]:
```
df_original = pd.read_csv("AviationData.csv", encoding="ISO-8859-1")
```

```
C:\Users\Admin\AppData\Local\Temp\ipykernel_8828\2124772063.py:1: DtypeWarning:
Columns (6,7,28) have mixed types. Specify dtype option on import or set
low_memory=False.
  df_original = pd.read_csv("AviationData.csv", encoding="ISO-8859-1")
```

[32]:
```
# create a copy of may df_original to keep the original dataframe intact
df = df_original.copy()
```

[93]:
```
# Display the first five rows
df.head(3)
```

[93]:

	Event.Id	Investigation.Type	Accident.Number	Event.Date	Location	Country	Injury.Severity	Aircraft.damage	Registration.Number	Make	…	Engine.Type	Purpose.of.flight	Total.Fatal.Injuries	Total.Serious.Injuries	Total.Minor.Injuries
0	20001218X45444	Accident	SEA87LA080	1948-10-24	MOOSE CREEK, ID	United States	Fatal(2)	Destroyed	NC6404	Stinson	…	Reciprocating	Personal	2.0	0.000000	0.000000
1	20001218X45447	Accident	LAX94LA336	1962-07-19	BRIDGEPORT, CA	United States	Fatal(4)	Destroyed	N5069P	Piper	…	Reciprocating	Personal	4.0	0.000000	0.000000
2	20061025X01555	Accident	NYC07LA005	1974-08-30	Saltville, VA	United States	Fatal(3)	Destroyed	N5142R	Cessna	…	Reciprocating	Personal	3.0	0.279881	0.357061

```
   Total.Uninjured  Weather.Condition   Report.Status  Publication.Date  Year
0          0.00000                UNK  Probable Cause           Unknown  1948
1          0.00000                UNK  Probable Cause        19-09-1996  1962
2          5.32544                IMC  Probable Cause        26-02-2007  1974

[3 rows x 23 columns]
```

[34]:
```
df.shape
```

[34]:
```
(88889, 31)
```

[35]:
```
df.columns
```

[35]:
```
Index(['Event.Id', 'Investigation.Type', 'Accident.Number', 'Event.Date',
       'Location', 'Country', 'Latitude', 'Longitude', 'Airport.Code',
       'Airport.Name', 'Injury.Severity', 'Aircraft.damage',
       'Aircraft.Category', 'Registration.Number', 'Make', 'Model',
       'Amateur.Built', 'Number.of.Engines', 'Engine.Type', 'FAR.Description',
       'Schedule', 'Purpose.of.flight', 'Air.carrier', 'Total.Fatal.Injuries',
       'Total.Serious.Injuries', 'Total.Minor.Injuries', 'Total.Uninjured',
       'Weather.Condition', 'Broad.phase.of.flight', 'Report.Status',
       'Publication.Date'],
      dtype='object')
```

[36]:
```
df.describe()
```

[36]:
```
       Number.of.Engines  Total.Fatal.Injuries  Total.Serious.Injuries  \
count       82805.000000          77488.000000            76379.000000
mean            1.146585              0.647855                0.279881
std             0.446510              5.485960                1.544084
min             0.000000              0.000000                0.000000
25%             1.000000              0.000000                0.000000
50%             1.000000              0.000000                0.000000
75%             1.000000              0.000000                0.000000
max             8.000000            349.000000              161.000000

       Total.Minor.Injuries  Total.Uninjured
count          76956.000000     82977.000000
mean               0.357061         5.325440
std                2.235625        27.913634
min                0.000000         0.000000
25%                0.000000         0.000000
50%                0.000000         1.000000
75%                0.000000         2.000000
max              380.000000       699.000000
```

[37]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 88889 entries, 0 to 88888
Data columns (total 31 columns):
 #   Column                  Non-Null Count  Dtype
---  ------                  --------------  -----
 0   Event.Id                88889 non-null  object
 1   Investigation.Type      88889 non-null  object
 2   Accident.Number         88889 non-null  object
 3   Event.Date              88889 non-null  object
 4   Location                88837 non-null  object
 5   Country                 88663 non-null  object
 6   Latitude                34382 non-null  object
 7   Longitude               34373 non-null  object
 8   Airport.Code            50132 non-null  object
 9   Airport.Name            52704 non-null  object
 10  Injury.Severity         87889 non-null  object
 11  Aircraft.damage         85695 non-null  object
 12  Aircraft.Category       32287 non-null  object
 13  Registration.Number     87507 non-null  object
 14  Make                    88826 non-null  object
 15  Model                   88797 non-null  object
 16  Amateur.Built           88787 non-null  object
 17  Number.of.Engines       82805 non-null  float64
 18  Engine.Type             81793 non-null  object
 19  FAR.Description         32023 non-null  object
 20  Schedule                12582 non-null  object
 21  Purpose.of.flight       82697 non-null  object
 22  Air.carrier             16648 non-null  object
 23  Total.Fatal.Injuries    77488 non-null  float64
 24  Total.Serious.Injuries  76379 non-null  float64
 25  Total.Minor.Injuries    76956 non-null  float64
 26  Total.Uninjured         82977 non-null  float64
 27  Weather.Condition       84397 non-null  object
 28  Broad.phase.of.flight   61724 non-null  object
 29  Report.Status           82505 non-null  object
 30  Publication.Date        75118 non-null  object
dtypes: float64(5), object(26)
memory usage: 21.0+ MB
```

[38]:
```
# Checking the number of missing values in each column
df.isna().sum()
```

[38]:
```
Event.Id                   0
Investigation.Type         0
Accident.Number            0
Event.Date                 0
Location                  52
```

```
Country                    226
Latitude                 54507
Longitude                54516
Airport.Code             38757
Airport.Name             36185
Injury.Severity           1000
Aircraft.damage           3194
Aircraft.Category        56602
Registration.Number       1382
Make                        63
Model                       92
Amateur.Built              102
Number.of.Engines         6084
Engine.Type               7096
FAR.Description          56866
Schedule                 76307
Purpose.of.flight         6192
Air.carrier              72241
Total.Fatal.Injuries     11401
Total.Serious.Injuries   12510
Total.Minor.Injuries     11933
Total.Uninjured           5912
Weather.Condition         4492
Broad.phase.of.flight    27165
Report.Status             6384
Publication.Date         13771
dtype: int64
```

[39]:
```
# Drop columns with too many missing values
columns_to_drop = ['Latitude', 'Longitude', 'Airport.Code', 'Airport.Name',␣
 ↪'Aircraft.Category', 'FAR.Description',
                   'Schedule', 'Air.carrier', 'Broad.phase.of.flight']

df = df.drop(columns=columns_to_drop)
```

[40]:
```
df.columns
```

[40]:
```
Index(['Event.Id', 'Investigation.Type', 'Accident.Number', 'Event.Date',
       'Location', 'Country', 'Injury.Severity', 'Aircraft.damage',
       'Registration.Number', 'Make', 'Model', 'Amateur.Built',
       'Number.of.Engines', 'Engine.Type', 'Purpose.of.flight',
       'Total.Fatal.Injuries', 'Total.Serious.Injuries',
       'Total.Minor.Injuries', 'Total.Uninjured', 'Weather.Condition',
       'Report.Status', 'Publication.Date'],
      dtype='object')
```

[41]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 88889 entries, 0 to 88888
Data columns (total 22 columns):
 #   Column                  Non-Null Count  Dtype
---  ------                  --------------  -----
 0   Event.Id                88889 non-null  object
 1   Investigation.Type      88889 non-null  object
 2   Accident.Number         88889 non-null  object
 3   Event.Date              88889 non-null  object
 4   Location                88837 non-null  object
 5   Country                 88663 non-null  object
 6   Injury.Severity         87889 non-null  object
 7   Aircraft.damage         85695 non-null  object
 8   Registration.Number     87507 non-null  object
 9   Make                    88826 non-null  object
 10  Model                   88797 non-null  object
 11  Amateur.Built           88787 non-null  object
 12  Number.of.Engines       82805 non-null  float64
 13  Engine.Type             81793 non-null  object
 14  Purpose.of.flight       82697 non-null  object
 15  Total.Fatal.Injuries    77488 non-null  float64
 16  Total.Serious.Injuries  76379 non-null  float64
 17  Total.Minor.Injuries    76956 non-null  float64
 18  Total.Uninjured         82977 non-null  float64
 19  Weather.Condition       84397 non-null  object
 20  Report.Status           82505 non-null  object
 21  Publication.Date        75118 non-null  object
dtypes: float64(5), object(17)
memory usage: 14.9+ MB
```

[42]:
```
categorical_cols = ['Location', 'Country', 'Injury.Severity', 'Aircraft.damage',
                    'Make', 'Model', 'Amateur.Built', 'Engine.Type',
                    'Purpose.of.flight', 'Weather.Condition', 'Registration.
 ↪Number', 'Report.Status', 'Publication.Date']
df[categorical_cols] = df[categorical_cols].fillna('Unknown')
```

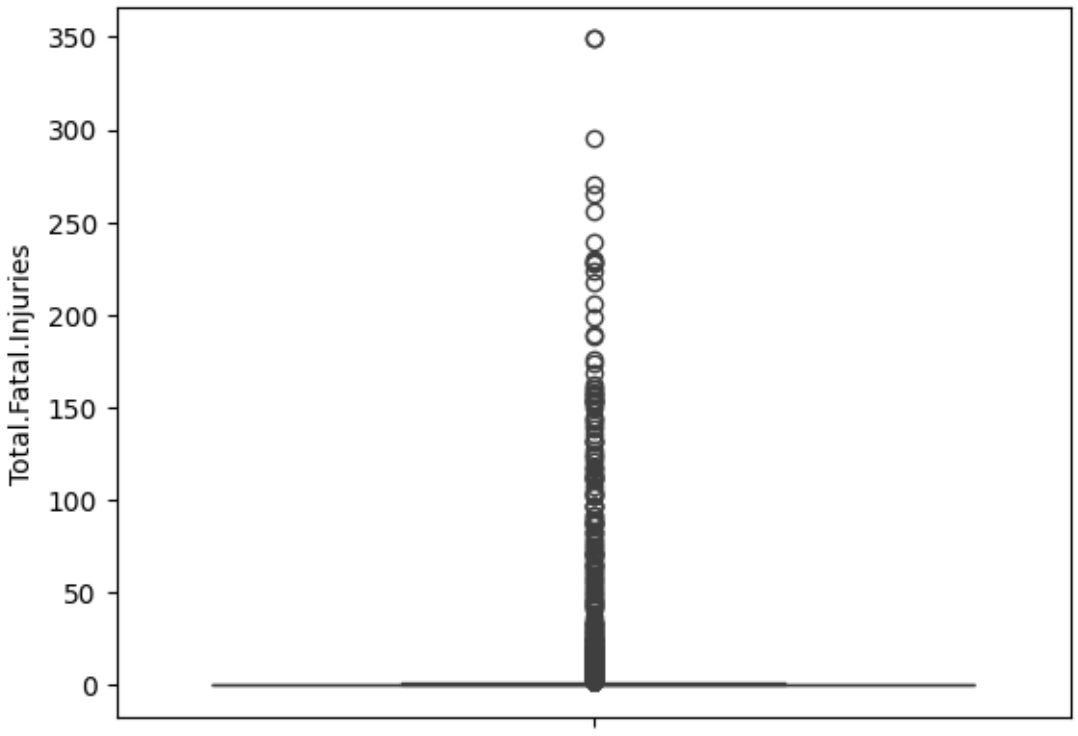
[43]:
```
numeric_cols = ['Total.Fatal.Injuries', 'Total.Serious.Injuries',
                'Total.Minor.Injuries', 'Total.Uninjured', 'Number.of.Engines']
df[numeric_cols] = df[numeric_cols].fillna(df[numeric_cols].mean())
```

[44]:
```
df.isnull().sum()
```

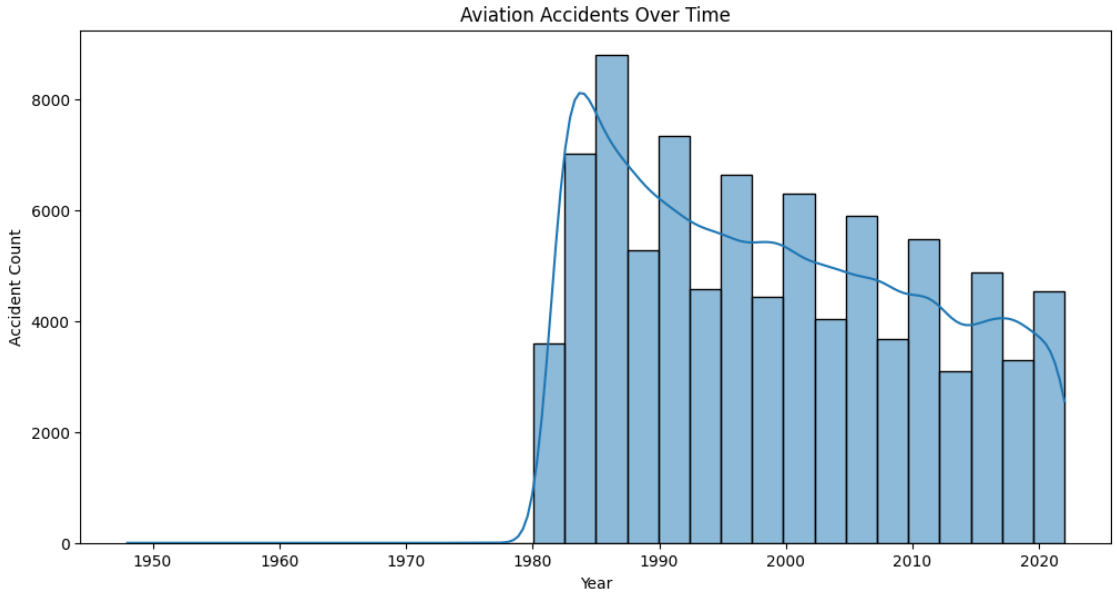
[44]:
```
Event.Id                0
Investigation.Type      0
Accident.Number         0
Event.Date              0
Location                0
```

```
Country                    0
Injury.Severity            0
Aircraft.damage            0
Registration.Number        0
Make                       0
Model                      0
Amateur.Built              0
Number.of.Engines          0
Engine.Type                0
Purpose.of.flight          0
Total.Fatal.Injuries       0
Total.Serious.Injuries     0
Total.Minor.Injuries       0
Total.Uninjured            0
Weather.Condition          0
Report.Status              0
Publication.Date           0
dtype: int64
```

[87]:
```
# detect outliers
sns.boxplot(df['Total.Fatal.Injuries'])  # Visualize outliers in fatalities
plt.show()
```



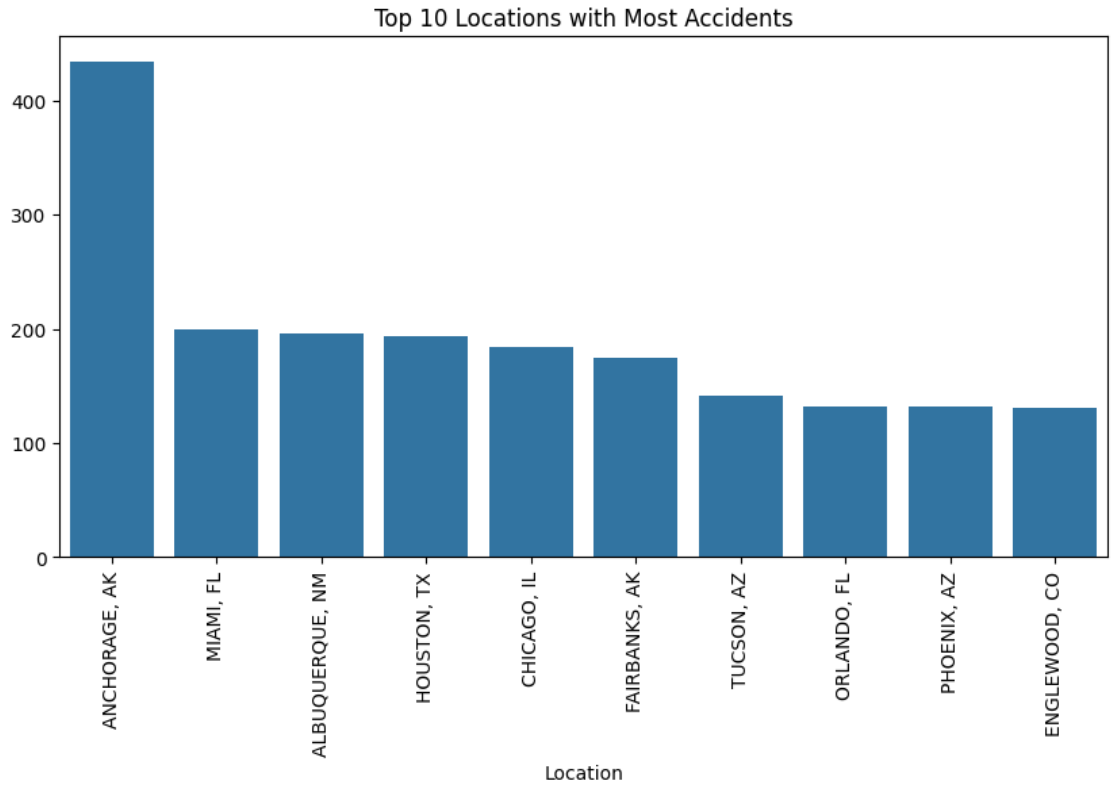
[46]:
```
import matplotlib.pyplot as plt
import seaborn as sns

df['Event.Date'] = pd.to_datetime(df['Event.Date'])  # Convert to datetime
df['Year'] = df['Event.Date'].dt.year  # Extract the year

plt.figure(figsize=(12,6))
sns.histplot(df['Year'], bins=30, kde=True)
plt.title("Aviation Accidents Over Time")
plt.xlabel("Year")
plt.ylabel("Accident Count")
plt.show()
```



0.0.1 Accident trends over time

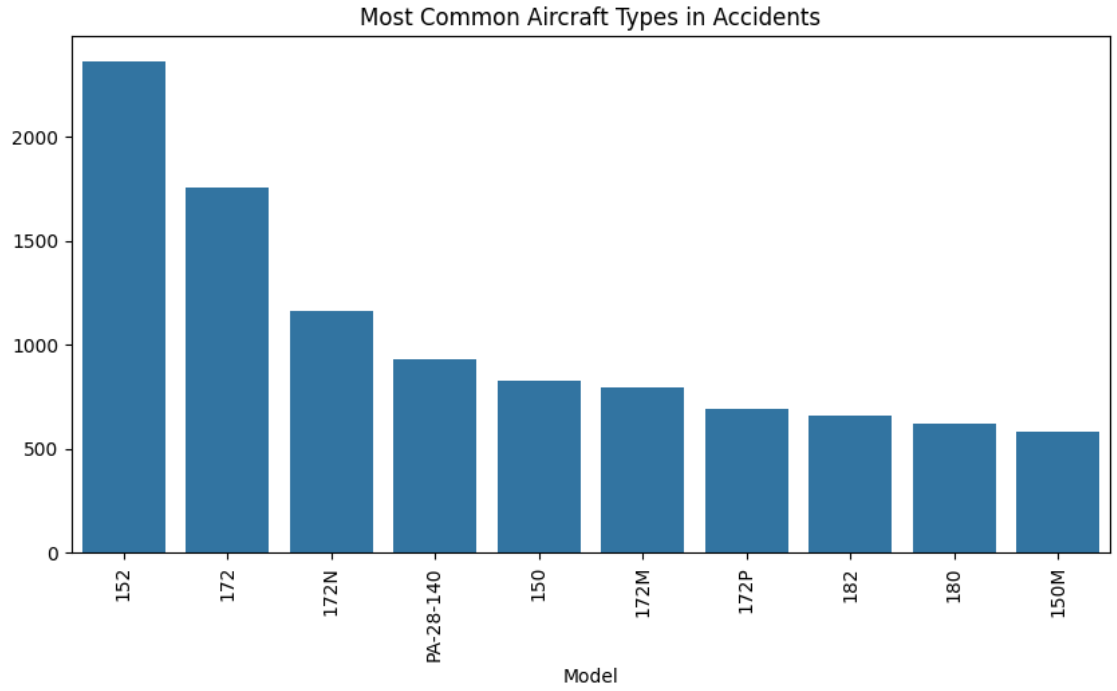
0.0.2 Geographical distribution of accidents

[48]:
```
accident_counts = df['Location'].value_counts().head(10)  # Adjust based on␣
↪dataset
plt.figure(figsize=(10,5))
sns.barplot(x=accident_counts.index, y=accident_counts.values)
plt.xticks(rotation=90)
plt.title("Top 10 Locations with Most Accidents")
plt.show()
```



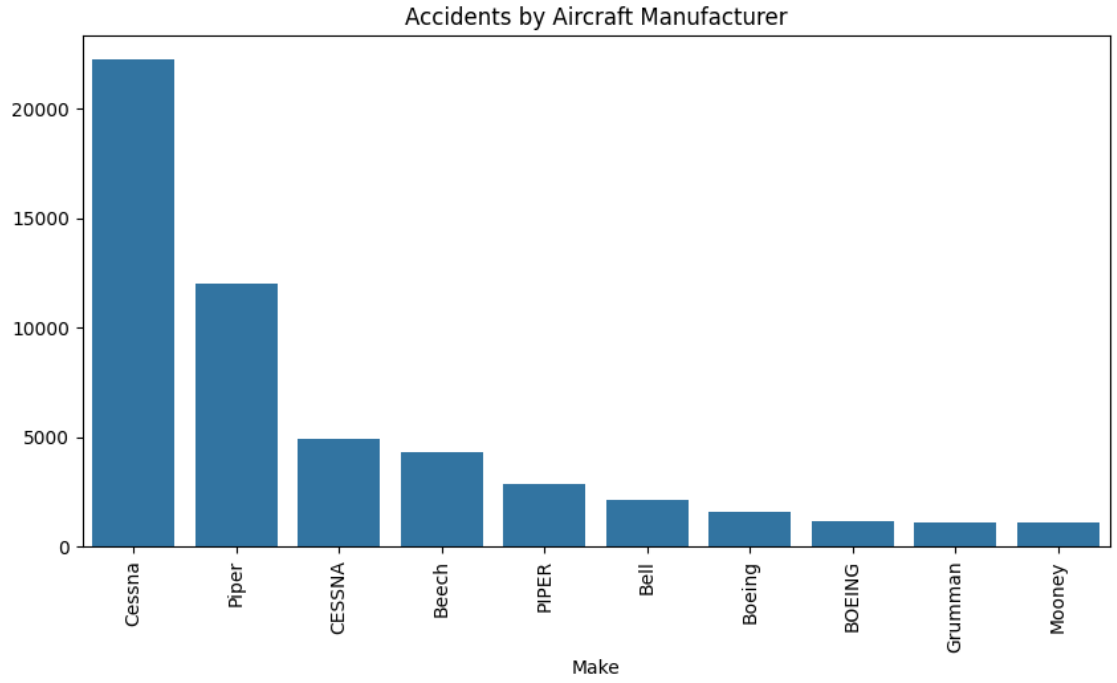
0.0.3 Aircraft types involved

[50]:
```
aircraft_counts = df['Model'].value_counts().head(10)
plt.figure(figsize=(10,5))
sns.barplot(x=aircraft_counts.index, y=aircraft_counts.values)
plt.xticks(rotation=90)
plt.title("Most Common Aircraft Types in Accidents")
plt.show()
```



0.0.4 manufacture analysis

[81]:
```
manufacturer_counts = df['Make'].value_counts().head(10)
plt.figure(figsize=(10,5))
sns.barplot(x=manufacturer_counts.index, y=manufacturer_counts.values)
plt.xticks(rotation=90)
plt.title("Accidents by Aircraft Manufacturer")
plt.show()
```



[95]:
```
df.to_csv("aviation_data.csv", index=False)
```

[ ]:

[ ]: