Sprint 3_Graphic display of a dataset

July 8, 2022

1 IT Academy - Data Science

1.1 S03 T01: Graphic display of a dataset

1.1.1 *Exercise 1 : Visualize the dataset DelayedFlights.csv graphically.*

1.1.2 *Exercise 2 : Export graphics as images or as html.*

1.1.3 *Exercise 3 : Integrate the graphical visualizations of task 5, Sprint 2.*

[1]:
```
#import requested library
import pandas as pd
import numpy as np
import re
import matplotlib.pyplot as plt
import seaborn as sns
import joypy

import warnings
warnings.filterwarnings('ignore')

import os
os.chdir("/Users/giorgiatrupia/Dropbox (Personal)/CODING/Python/DATASETS")
```

Download date set 'Airlines Delay: Airline on-time statistics and delay causes' and upload it to a pandas Dataframe.

[2]:
```
#import data on airline flights statistics
df = pd.read_csv('DelayedFlights.csv', sep=',', encoding='utf8', index_col=0,␣
↪nrows=None)
```

[3]:
```
#data set is very large, show small subset of rows to display (=3)
df.head(3)
```

[3]:

	Year	Month	DayofMonth	DayOfWeek	DepTime	CRSDepTime	ArrTime	\
0	2008	1	3	4	2003.0	1955	2211.0	
1	2008	1	3	4	754.0	735	1002.0	
2	2008	1	3	4	628.0	620	804.0	

```
   CRSArrTime UniqueCarrier  FlightNum  … TaxiIn  TaxiOut  Cancelled  \
0        2225            WN        335  …    4.0      8.0          0
1        1000            WN       3231  …    5.0     10.0          0
2         750            WN        448  …    3.0     17.0          0

   CancellationCode  Diverted  CarrierDelay WeatherDelay NASDelay  \
0                 N         0           NaN          NaN      NaN
1                 N         0           NaN          NaN      NaN
2                 N         0           NaN          NaN      NaN

   SecurityDelay  LateAircraftDelay
0            NaN                NaN
1            NaN                NaN
2            NaN                NaN

[3 rows x 29 columns]
```

Clean data

[4]:
```
#Explore the data it contains, and keep only the columns that you consider␣
 ↪relevant.
df.drop(['CRSArrTime', 'CRSElapsedTime','FlightNum','TailNum',␣
 ↪'CRSElapsedTime','TaxiIn', 'TaxiOut','CarrierDelay', 'WeatherDelay',␣
 ↪'NASDelay', 'SecurityDelay','LateAircraftDelay' ], axis = 1, inplace=True)

#remove all duplicates
df.drop_duplicates(inplace = True)

##Find missing data per column
df.isnull().sum()

#return a new Data Frame with no empty cells
df = df.dropna()

df.sample(3)
```

[4]:
```
         Year  Month  DayofMonth  DayOfWeek  DepTime  CRSDepTime  ArrTime  \
3704053  2008      7           9          3    902.0         845   1108.0
47123    2008      1          17          4   1649.0        1615   2036.0
2654957  2008      5           8          4   1740.0        1710   1940.0

        UniqueCarrier  ActualElapsedTime  AirTime  ArrDelay  DepDelay Origin  \
3704053            XE              126.0    109.0      14.0      17.0    TUS
47123              WN              167.0    135.0      46.0      34.0    MDW
2654957            US              120.0    100.0      32.0      30.0    PHX

        Dest  Distance  Cancelled CancellationCode  Diverted
```

```
3704053  SMF        752           0                 N          0
47123    TPA        997           0                 N          0
2654957  OAK        646           0                 N          0
```

Map unique carrier code to carrier company name from file carrier.csv

[5]:
```
#import the carrier file as a series
carriers = pd.read_csv('carriers.csv', sep=',', encoding='utf8', index_col=0,␣
 ↪squeeze=True)

#create new column Carrier companies in dataframe using map() function
df["Carrier"] = df["UniqueCarrier"].map(carriers)
del carriers

# remove superfluous text from carriers label using RegEx module
pattern = r'\(.+\)|\s\-.+'
df["Carrier"] = df["Carrier"].apply(lambda x: re.sub(pattern, '', x))

df.sample(3)
```

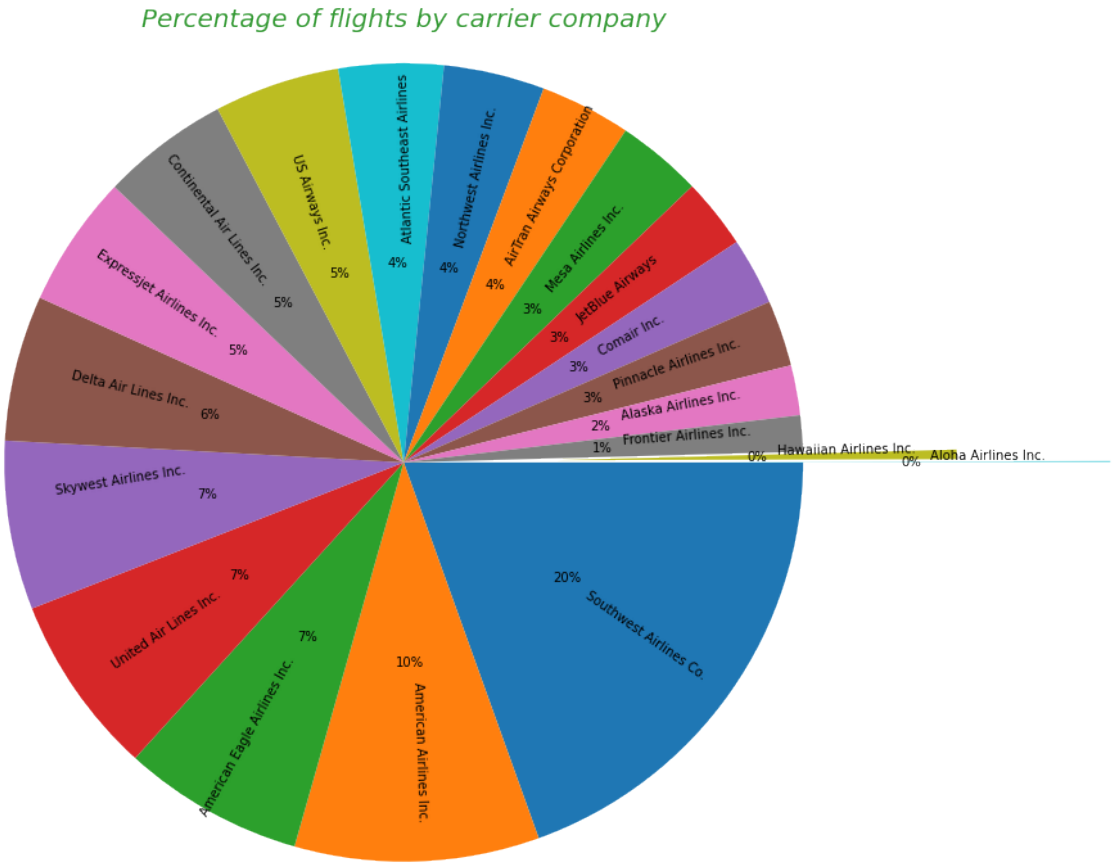
[5]:
```
         Year  Month  DayofMonth  DayOfWeek  DepTime  CRSDepTime  ArrTime  \
3940825  2008      7          27          7   1839.0        1750   2047.0
4167706  2008      7           7          1   2235.0        2120    713.0
6975026  2008     12          26          5   1903.0        1855   2222.0

        UniqueCarrier  ActualElapsedTime  AirTime  ArrDelay  DepDelay Origin  \
3940825            EV               68.0     48.0      42.0      49.0    PFN
4167706            B6              338.0    312.0      87.0      75.0    SAN
6975026            CO              139.0    117.0      12.0       8.0    IAH

        Dest  Distance  Cancelled CancellationCode  Diverted  \
3940825  MCO       290          0                N         0
4167706  BOS      2588          0                N         0
6975026  MIA       964          0                N         0

                           Carrier
3940825  Atlantic Southeast Airlines
4167706              JetBlue Airways
6975026   Continental Air Lines Inc.
```

Create one graphic for:

1. A categorical variable (using var Carrier)

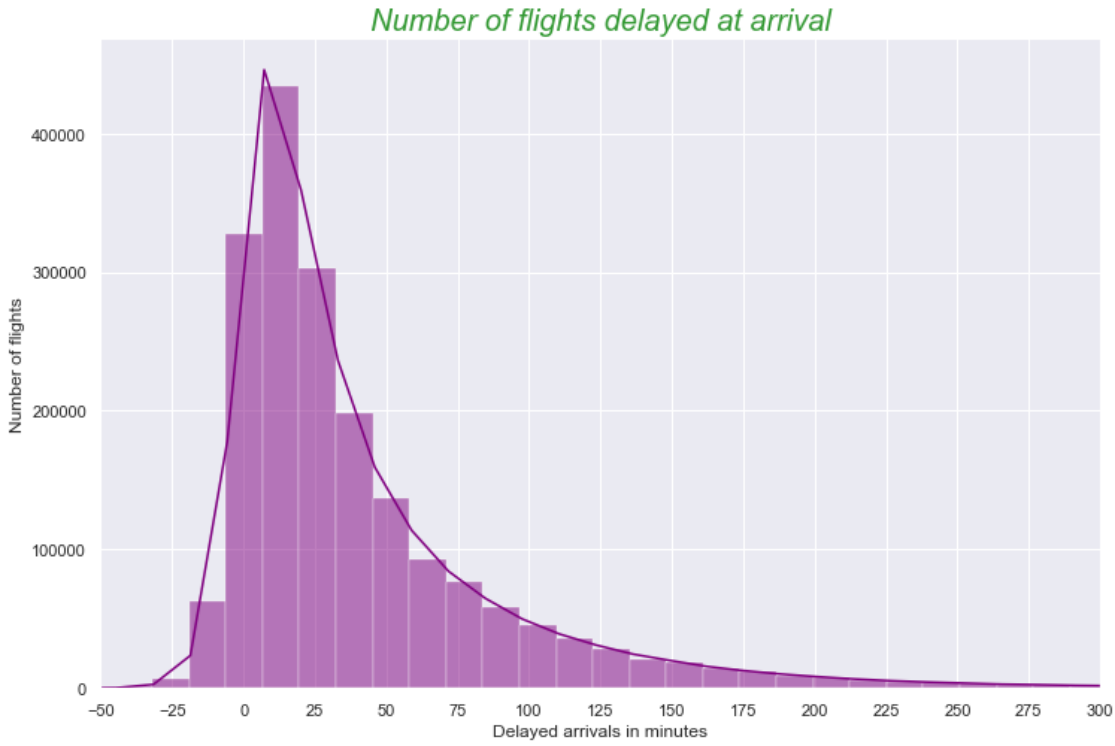
[6]:
```
# select data to analyze and index them
data1 = df['Carrier'].value_counts()
dataCarriers = data1.index
```

```
#create vector of zeros to use in explode function of pie charts
dataExplode = [0 for element in range(len(data1.index))]
#select which set of data to explode from chart
dataExplode[-2:] = [0.5, 1]

#plot pie chart to show the percentage of flights by carrier company
plt.figure(figsize =(11, 11))
plt.pie(data1.values, explode=dataExplode, labels=dataCarriers, autopct='%1.
↪0f%%',
        pctdistance=.5, labeldistance=.55, radius=1.3, counterclock=False,␣
↪center=(0.2, 0.2), rotatelabels=True, normalize=True)
plt.title("Percentage of flights by carrier company",
          fontsize=20, fontstyle='italic', color='green', alpha=0.8, pad=40)
plt.savefig('fig1.png')
plt.show()
```



2. A numerical variable (using var Arrival Delay)

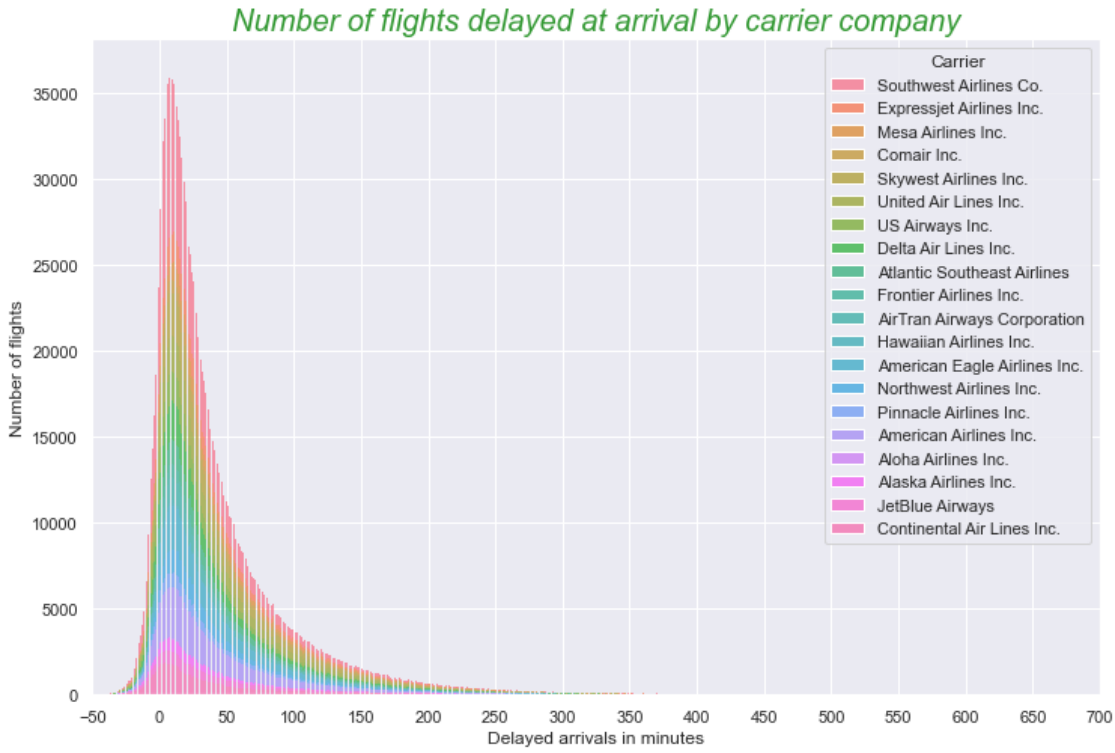
[7]:
```
#plot histogram to show the frequency of flights by delay
sns.set(style="darkgrid")
fig, ax = plt.subplots(figsize =(12, 8))
sns.histplot(data = df, x="ArrDelay", multiple="stack", bins=200,␣
 ↪color="purple",
             kde=True)
ax.set_xlim(-50,300,50)
ax.set_xticks(range(-50,301,25))

plt.title("Number of flights delayed at arrival",
          fontsize=20, fontstyle='italic', color='green', alpha=0.8)
plt.xlabel("Delayed arrivals in minutes")
plt.ylabel("Number of flights")
plt.savefig('fig2.png')
plt.show()
```



3. A numeric and a categorical variable (using var Carrier and Arrival Delay)

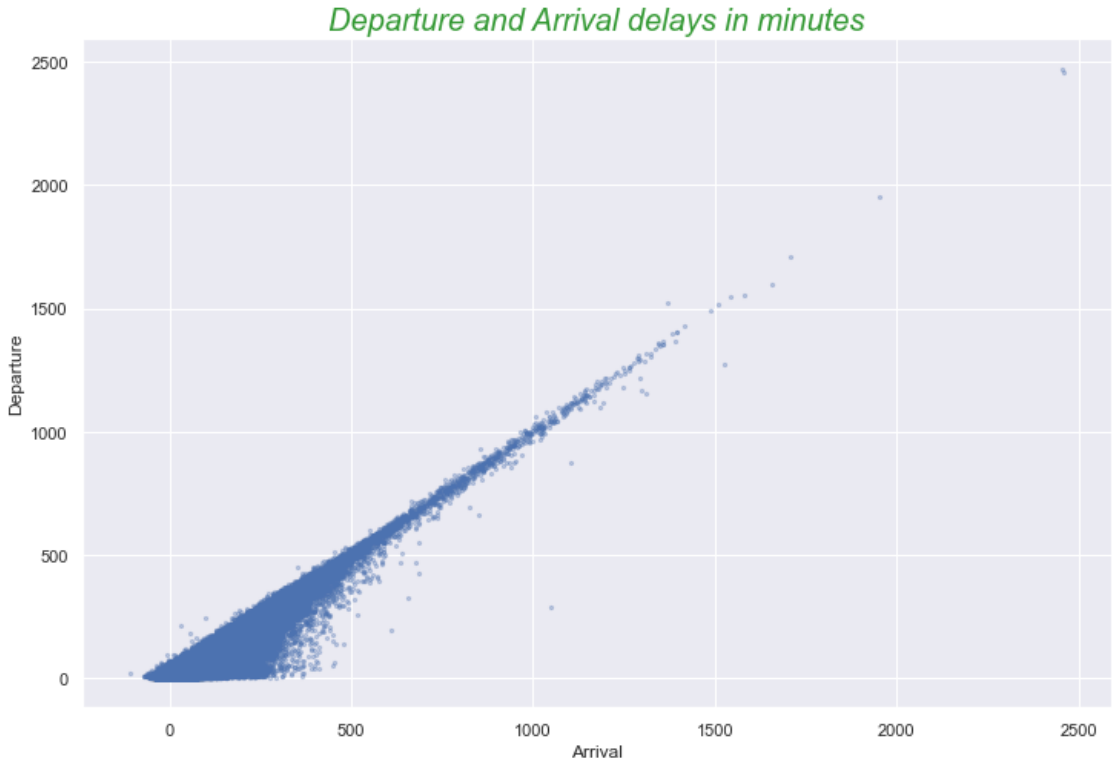
[8]:
```
#plot histogram to show the frequency of flights by delay by carrier company
fig, ax = plt.subplots(figsize =(12, 8))
sns.histplot(data = df, x="ArrDelay", hue="Carrier", multiple="stack")
ax.set_xlim(-50,700,50)
ax.set_xticks(range(-50,701,50))
```

```
plt.title("Number of flights delayed at arrival by carrier company",
          fontsize=20, fontstyle='italic', color='green', alpha=0.8)
plt.xlabel("Delayed arrivals in minutes")
plt.ylabel("Number of flights")
plt.savefig('fig3.png')
plt.show()
```



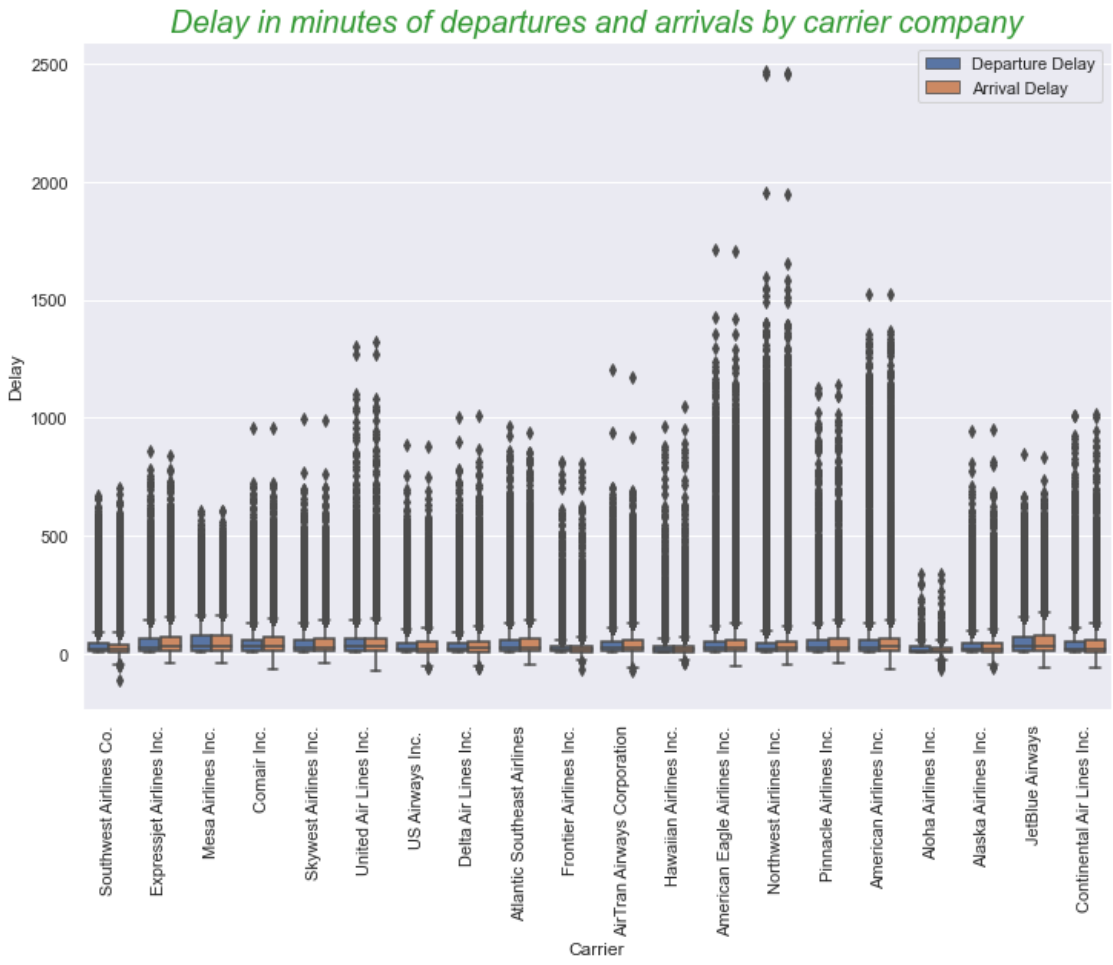
4. Two numerical variables (using var Arrival Delay and Departure Delay)

[9]:
```
plt.figure(figsize =(12, 8))
plt.scatter(df["ArrDelay"], df["DepDelay"], s=5, c='b', alpha=0.3)
plt.title("Departure and Arrival delays in minutes",
          fontsize=20, fontstyle='italic', color='green', alpha=0.8)
plt.xlabel("Arrival")
plt.ylabel("Departure")
plt.savefig('fig4.png')
plt.show()
```



5. Three variables (using var Arrival Delay, Departure Delay and Carrier)

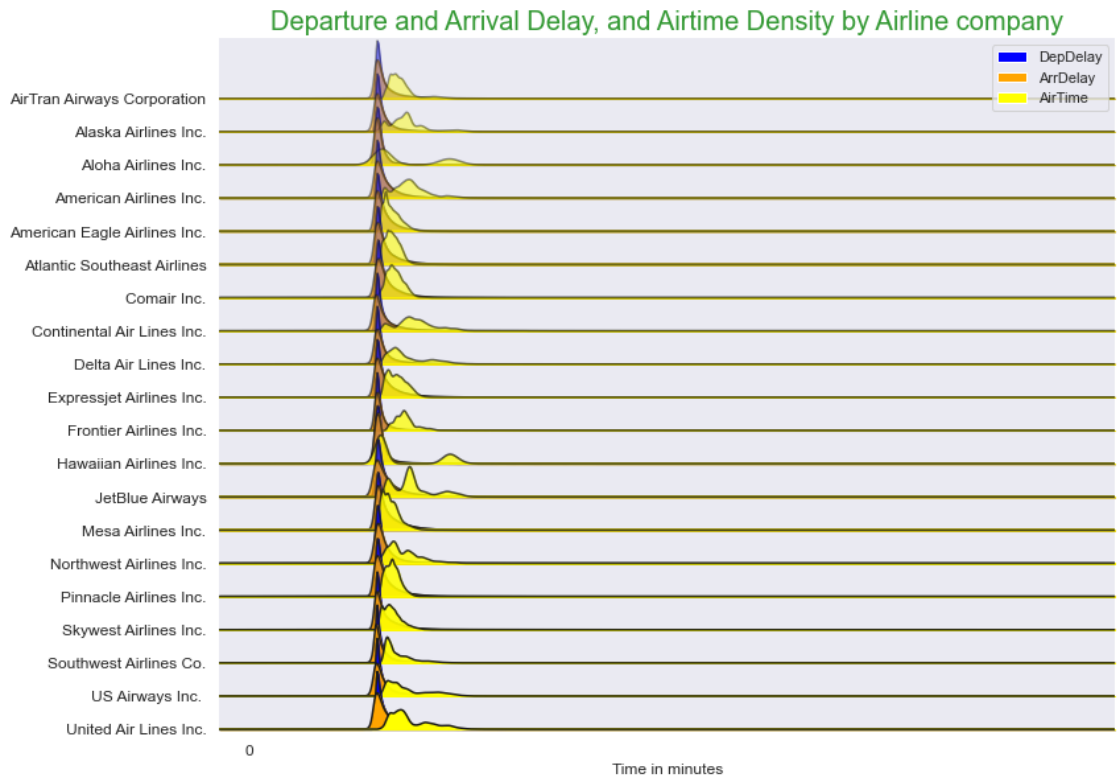
[17]:
```
dataDeparture = df[['Carrier', 'DepDelay']].copy()
dataDeparture.rename(columns={'DepDelay': 'Delay'}, inplace = True)
dataDeparture['T'] = "Departure Delay"
dataArrival = df[['Carrier', 'ArrDelay']].copy()
dataArrival.rename(columns={'ArrDelay': 'Delay'}, inplace = True)
dataArrival['T'] = "Arrival Delay"
data2 = pd.concat([dataDeparture, dataArrival])
del dataDeparture, dataArrival

fig, ax = plt.subplots(figsize =(12, 8))
sns.boxplot(x=data2["Carrier"], y=data2["Delay"], hue=data2["T"])
plt.title("Delay in minutes of departures and arrivals by carrier company",␣
 ↪fontsize=20, fontstyle='italic', color='green', alpha=0.8)
plt.xlabel("Carrier")
plt.ylabel("Delay")
plt.xticks(rotation='vertical')
plt.legend(loc='upper right')
plt.show()
ax.set_ylim(0,160,20)
plt.savefig('fig5.png')
plt.show()
```




```
<Figure size 432x288 with 0 Axes>
```

6. More than three variables (using var Arrival Delay, Departure Delay, Air Time and Carrier)

[16]:
```
data3 = df[["Carrier", "DepDelay", "ArrDelay", "AirTime"]].copy()

fig, ax = joypy.joyplot(data=data3, column=["DepDelay", "ArrDelay", "AirTime"],␣
 ↪by="Carrier", fade=True,
                         ylim='own', xlim=(-100,300), figsize=(12, 8),␣
 ↪legend=True, color=['blue', 'orange', 'yellow'], alpha=0.8)
plt.rc("font", size=12)
plt.title("Departure and Arrival Delay, and Airtime Density by Airline␣
 ↪company", fontsize=20, color='green', alpha=0.8)
plt.xlabel("Time in minutes",  fontsize=12)
ax[-1].set_xlim(-10,300,20)
plt.savefig('fig6.png')
plt.show()
```



1.1.4 Pairwise graphic to summarize task 5 of Sprint 2

[18]:
```
plt.figure(figsize =(15, 12))
axis = sns.pairplot(data3)
plt.title("Pairwise relationship between Departure and Arrival Delay, and␣
 ↪Airtime", fontsize=15, fontstyle='italic', color='green', alpha=0.8,␣
 ↪loc='right', pad=330)
plt.savefig('fig7.png')
plt.show()
```

```
<Figure size 1080x864 with 0 Axes>
```


Pairwise relationship between Departure and Arrival Delay, and Airtime
DepDelay
ArrDelay
AirTime
0
500
1000
1500
2000
2500
0
200
400
600
800
1000
0
1000
2000
0
500
1000