US accident Factors

> About This Project

The code you've provided seems to be a data preprocessing and exploration pipeline for analyzing US accident data. Here's a breakdown of what each section of the code does:

1. **Data Loading and Preprocessing:**
   - Loads the dataset and limits it to the first 400,000 rows.
   - Handles missing values by dropping rows with missing values in certain columns.
   - Drops unnecessary columns ('End_Lat' and 'End_Lng').
2. **Data Exploration and Analysis:**
   - Performs exploratory data analysis to understand the data.
   - Visualizes correlations among numeric columns using a heatmap.
   - Focuses on data related to California ('CA').
   - Removes rows with missing values in specific columns related to weather conditions.
3. **Data Visualization:**
   - Creates visualizations to showcase insights about the data.
   - Plots the top 10 cities by the number of accidents.
   - Visualizes the relationship between 'Start_Lat' and 'Severity'.
4. **Data Cleanup and Feature Engineering:**
   - Drops unnecessary columns ('ID', 'Description', 'Street', 'City', 'Zipcode', 'Country').
   - Defines functions to extract years and months from date columns.
   - Defines a function for one-hot encoding categorical columns.
   - Applies one-hot encoding to selected categorical columns ('Side', 'County', 'State', 'Timezone', 'Airport_Code').
   - Applies binary encoding to 'Source' and other columns related to twilight conditions.
5. **Data Splitting:**
   - Prepares the target variable 'Severity' (y) and the features (x) for training.
   - Adjusts the target variable values by subtracting 1 to make them start from 0.
   - Splits the data into training and testing sets.

The code provided seems to handle various data preprocessing steps, exploratory data analysis, visualization, and feature engineering. However, it is important to note that the code does not include the model training and evaluation part, which typically involves using machine learning algorithms to build a predictive model and evaluating its performance.

If you want to proceed with model training and evaluation, you will need to add the relevant code for selecting a machine learning algorithm, training the model, making predictions, and evaluating its performance using appropriate metrics.

```
# Getting Started
```

```
import numpy as np
import pandas as pd

from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split

import tensorflow as tf
```

```
data = pd.read_csv('/kaggle/input/us-accidents/US_Accidents_March23.csv', nrows=400000)
```

```
data
```

	ID	Source	Severity	Start_Time	End_Time	Start_Lat	Start_Lng	End_Lat	End_Lng	Dista
0	A-1	Source2	3	2016-02-08 05:46:00	2016-02-08 11:00:00	39.865147	-84.058723	NaN	NaN	
1	A-2	Source2	2	2016-02-08 06:07:59	2016-02-08 06:37:59	39.928059	-82.831184	NaN	NaN	
2	A-3	Source2	2	2016-02-08 06:49:27	2016-02-08 07:19:27	39.063148	-84.032608	NaN	NaN	

```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 400000 entries, 0 to 399999
Data columns (total 46 columns):
 #   Column                 Non-Null Count   Dtype  
---  ------                 --------------   -----  
 0   ID                     400000 non-null  object 
 1   Source                 400000 non-null  object 
 2   Severity               400000 non-null  int64  
 3   Start_Time             400000 non-null  object 
 4   End_Time               400000 non-null  object 
 5   Start_Lat              400000 non-null  float64
 6   Start_Lng              400000 non-null  float64
 7   End_Lat                0 non-null       float64
 8   End_Lng                0 non-null       float64
 9   Distance(mi)           400000 non-null  float64
 10  Description            400000 non-null  object 
 11  Street                 400000 non-null  object 
 12  City                   399981 non-null  object 
 13  County                 400000 non-null  object 
 14  State                  400000 non-null  object 
 15  Zipcode                399957 non-null  object 
 16  Country                400000 non-null  object 
 17  Timezone               399957 non-null  object 
 18  Airport_Code           399956 non-null  object 
 19  Weather_Timestamp      396791 non-null  object 
 20  Temperature(F)         394085 non-null  float64
 21  Wind_Chill(F)          59095 non-null   float64
 22  Humidity(%)            393491 non-null  float64
 23  Pressure(in)           395353 non-null  float64
 24  Visibility(mi)         391221 non-null  float64
 25  Wind_Direction         396770 non-null  object 
 26  Wind_Speed(mph)        325829 non-null  float64
 27  Precipitation(in)      42045 non-null   float64
 28  Weather_Condition      391792 non-null  object 
 29  Amenity                400000 non-null  bool   
 30  Bump                   400000 non-null  bool   
 31  Crossing               400000 non-null  bool   
 32  Give_Way               400000 non-null  bool   
 33  Junction               400000 non-null  bool   
 34  No_Exit                400000 non-null  bool  
 35  Railway                400000 non-null  bool  
 36  Roundabout             400000 non-null  bool  
 37  Station                400000 non-null  bool  
 38  Stop                   400000 non-null  bool  
 39  Traffic_Calming        400000 non-null  bool  
 40  Traffic_Signal         400000 non-null  bool  
 41  Turning_Loop           400000 non-null  bool  
 42  Sunrise_Sunset         399981 non-null  object
 43  Civil_Twilight         399981 non-null  object
 44  Nautical_Twilight      399981 non-null  object
 45  Astronomical_Twilight  399981 non-null  object
dtypes: bool(13), float64(12), int64(1), object(20)
memory usage: 105.7+ MB
```

Missing Values

```
data.isna().sum()
```

```
ID                            0
Source                        0
Severity                      0
Start_Time                    0
End_Time                      0
Start_Lat                     0
Start_Lng                     0
End_Lat                  400000
End_Lng                  400000
Distance(mi)                  0
Description                   0
Street                        0
City                         19
County                        0
State                         0
Zipcode                      43
Country                       0
Timezone                     43
Airport_Code                 44
Weather_Timestamp          3209
Temperature(F)             5915
Wind_Chill(F)            340905
Humidity(%)                6509
Pressure(in)               4647
Visibility(mi)             8779
Wind_Direction             3230
Wind_Speed(mph)           74171
Precipitation(in)        357955
Weather_Condition          8208
Amenity                       0
Bump                          0
Crossing                      0
Give_Way                      0
Junction                      0
```

```
No_Exit                       0
Railway                       0
Roundabout                    0
Station                       0
Stop                          0
Traffic_Calming               0
Traffic_Signal                0
Turning_Loop                  0
Sunrise_Sunset               19
Civil_Twilight               19
Nautical_Twilight            19
Astronomical_Twilight        19
dtype: int64
```

```
data.isna().mean()
```

```
ID                       0.000000
Source                   0.000000
Severity                 0.000000
Start_Time               0.000000
End_Time                 0.000000
Start_Lat                0.000000
Start_Lng                0.000000
End_Lat                  1.000000
End_Lng                  1.000000
Distance(mi)             0.000000
Description              0.000000
Street                   0.000000
City                     0.000048
County                   0.000000
State                    0.000000
Zipcode                  0.000107
Country                  0.000000
Timezone                 0.000107
Airport_Code             0.000110
Weather_Timestamp        0.008023
Temperature(F)           0.014788
Wind_Chill(F)            0.852263
Humidity(%)              0.016272
Pressure(in)             0.011617
Visibility(mi)           0.021948
Wind_Direction           0.008075
Wind_Speed(mph)          0.185427
Precipitation(in)        0.894887
Weather_Condition        0.020520
Amenity                  0.000000
Bump                     0.000000
Crossing                 0.000000
Give_Way                 0.000000
Junction                 0.000000
No_Exit                  0.000000
Railway                  0.000000
Roundabout               0.000000
Station                  0.000000
```

```
     Stop                     0.000000
     Traffic_Calming          0.000000
     Traffic_Signal           0.000000
     Turning_Loop             0.000000
     Sunrise_Sunset           0.000048
     Civil_Twilight           0.000048
     Nautical_Twilight        0.000048
     Astronomical_Twilight    0.000048
     dtype: float64
```

```
null_columns = ['End_Lat','End_Lng']

data = data.drop(null_columns, axis=1)
```

```
data.isna().sum()
```

```
     ID                            0
     Source                        0
     Severity                      0
     Start_Time                    0
     End_Time                      0
     Start_Lat                     0
     Start_Lng                     0
     Distance(mi)                  0
     Description                   0
     Street                        0
     City                         19
     County                        0
     State                         0
     Zipcode                      43
     Country                       0
     Timezone                     43
     Airport_Code                 44
     Weather_Timestamp          3209
     Temperature(F)             5915
     Wind_Chill(F)            340905
     Humidity(%)                6509
     Pressure(in)               4647
     Visibility(mi)             8779
     Wind_Direction             3230
     Wind_Speed(mph)           74171
     Precipitation(in)        357955
     Weather_Condition          8208
     Amenity                       0
     Bump                          0
     Crossing                      0
     Give_Way                      0
     Junction                      0
     No_Exit                       0
     Railway                       0
     Roundabout                    0
     Station                       0
     Stop                          0
```

```
Traffic_Calming                0
Traffic_Signal                 0
Turning_Loop                   0
Sunrise_Sunset                19
Civil_Twilight                19
Nautical_Twilight             19
Astronomical_Twilight         19
dtype: int64
```

```
data = data.dropna(axis=0).reset_index(drop=True)
```

```
print("Total missing values: ",data.isna().sum().sum())
```

```
Total missing values:  0
```

```
data
```

	ID	Source	Severity	Start_Time	End_Time	Start_Lat	Start_Lng	Distance(mi)	Description	Street	...	Rour
0	A-6	Source2	3	2016-02-08 07:44:26	2016-02-08 08:14:26	40.100590	-82.925194	0.01	Accident on I-270 Outerbelt Northbound near Ex...	Westerville Rd	...	
1	A-10	Source2	3	2016-02-08 08:10:04	2016-02-08 08:40:04	40.100590	-82.925194	0.01	Right hand shoulder blocked due to accident on...	Westerville Rd	...	
2	A-12	Source2	3	2016-02-08 08:21:27	2016-02-08 08:51:27	39.932709	-82.830910	0.01	One lane blocked due to accident on I-70 Westb...	I-70 E	...	
3	A-15	Source2	2	2016-02-08 08:39:43	2016-02-08 09:09:43	39.972038	-82.913521	0.01	Accident on OH-16 Broad St at James Rd. Expect...	E Broad St	...	
4	A-21	Source2	2	2016-02-08 10:11:15	2016-02-08	40.052509	-82.882332	0.00	Accident on Brookhill Dr at Glenhurst	Brookhill Dr	...	
...	...	...	...	...	...	...	...	...	...	...	...	
13988	A-	Source2	2	2017-04-13	13	39.253979	121.170808	0.00	Springs Rd	Springs		

Unnecessary Columns

```
df1=data[data['State']=='CA']
```

```
df1
```

	Source	Severity	Start_Lat	Start_Lng	Distance(mi)	County	State	Timezone	Airport_Code	Temperature(F)	...	Su
146	1	2	38.510437	-121.464523	0.01	Sacramento	CA	US/Pacific	KSAC	45.0	...	
147	1	2	38.676666	-121.638069	0.01	Yolo	CA	US/Pacific	KSAC	44.1	...	
13988	1	2	39.253979	-121.170898	0.00	Nevada	CA	US/Pacific	KGOO	41.0	...	

2799 rows × 41 columns

```
df1.duplicated().sum()
```

```
20
```

```
d1f=df1.dropna(subset=['Precipitation(in)'])
```

```
df1=df1.dropna(subset=['Temperature(F)','Wind_Chill(F)','Humidity(%)','Pressure(in)','Visibility(mi)','Wind_Direction', 'Wind_Speed(mph)',
                       'Weather_Condition'])
```

```
df1.shape
```

```
(2799, 41)
```

```
df1.isna().sum()/len(df1)*100
```

```
Source                0.0
Severity              0.0
Start_Lat             0.0
Start_Lng             0.0
Distance(mi)          0.0
County                0.0
State                 0.0
Timezone              0.0
Airport_Code          0.0
Temperature(F)        0.0
Wind_Chill(F)         0.0
Humidity(%)           0.0
Pressure(in)          0.0
Visibility(mi)        0.0
Wind_Direction        0.0
Wind_Speed(mph)       0.0
Precipitation(in)     0.0
Weather_Condition     0.0
Amenity               0.0
Bump                  0.0
Crossing              0.0
Give_Way              0.0
Junction              0.0
No_Exit               0.0
Railway               0.0
Roundabout            0.0
Station               0.0
Stop                  0.0
Traffic_Calming       0.0
```

```
Traffic_Signal             0.0
Turning_Loop               0.0
Sunrise_Sunset             0.0
Civil_Twilight             0.0
Nautical_Twilight          0.0
Astronomical_Twilight      0.0
Start_Time_Month           0.0
Start_Time_Year            0.0
End_Time_Month             0.0
End_Time_year              0.0
Weather_Timestamp_Month    0.0
Weather_Timestamp_Year     0.0
dtype: float64
```

```
{column:len(data[column].unique()) for column in data.columns if data.dtypes[column] == 'object'}
```

```
{'ID': 13993,
 'Source': 2,
 'Start_Time': 13947,
 'End_Time': 13927,
 'Description': 12402,
 'Street': 4789,
 'City': 1473,
 'County': 285,
 'State': 25,
 'Zipcode': 5445,
 'Country': 1,
 'Timezone': 3,
 'Airport_Code': 301,
 'Weather_Timestamp': 8554,
 'Wind_Direction': 23,
 'Weather_Condition': 53,
 'Sunrise_Sunset': 2,
 'Civil_Twilight': 2,
 'Nautical_Twilight': 2,
 'Astronomical_Twilight': 2}
```

```
df1=df1.dropna(subset=['Sunrise_Sunset',
       'Civil_Twilight', 'Nautical_Twilight', 'Astronomical_Twilight'])
```

```
df1.isna().sum()/len(df1)*100
```

```
Source                     0.0
Severity                   0.0
Start_Lat                  0.0
Start_Lng                  0.0
Distance(mi)               0.0
County                     0.0
State                      0.0
Timezone                   0.0
Airport_Code               0.0
Temperature(F)             0.0
```

```
Wind_Chill(F)              0.0
Humidity(%)                0.0
Pressure(in)               0.0
Visibility(mi)             0.0
Wind_Direction             0.0
Wind_Speed(mph)            0.0
Precipitation(in)          0.0
Weather_Condition          0.0
Amenity                    0.0
Bump                       0.0
Crossing                   0.0
Give_Way                   0.0
Junction                   0.0
No_Exit                    0.0
Railway                    0.0
Roundabout                 0.0
Station                    0.0
Stop                       0.0
Traffic_Calming            0.0
Traffic_Signal             0.0
Turning_Loop               0.0
Sunrise_Sunset             0.0
Civil_Twilight             0.0
Nautical_Twilight          0.0
Astronomical_Twilight      0.0
Start_Time_Month           0.0
Start_Time_Year            0.0
End_Time_Month             0.0
End_Time_year              0.0
Weather_Timestamp_Month    0.0
Weather_Timestamp_Year     0.0
dtype: float64
```

```
df_cat=df1.select_dtypes('object')
col_name=[]
length=[]

for i in df_cat.columns:
    col_name.append(i)
    length.append(len(df_cat[i].unique()))
df_2=pd.DataFrame(zip(col_name,length),columns=['feature','count_of_unique_values'])
df_2
```

	feature	count_of_unique_values
0	County	30
1	State	1
2	Timezone	1
3	Airport_Code	40
4	Wind_Direction	23
5	Weather_Condition	30

```
df1['Weather_Condition'].value_counts()
```

```
Fair                            1450
Partly Cloudy                    324
Cloudy                           260
Mostly Cloudy                    217
Light Rain                       211
Overcast                         113
Rain                              46
Haze                              35
Fog                               23
Clear                             20
Fair / Windy                      18
Smoke                             16
Light Snow                        10
Heavy Rain / Windy                 9
Snow                               8
Rain / Windy                       7
Light Rain / Windy                 5
Scattered Clouds                   5
Heavy Rain                         5
Showers in the Vicinity            3
Light Freezing Fog                 3
Mostly Cloudy / Windy              2
Partly Cloudy / Windy              2
Light Thunderstorms and Rain       1
Blowing Dust / Windy               1
Light Rain with Thunder            1
Light Drizzle                      1
Thunder in the Vicinity            1
T-Storm                            1
Light Rain Shower                  1
Name: Weather_Condition, dtype: int64
```

```
del df1['Airport_Code']
```

```
df_num.columns
```

```
Index(['Source', 'Severity', 'Start_Lat', 'Start_Lng', 'Distance(mi)',
       'Temperature(F)', 'Wind_Chill(F)', 'Humidity(%)', 'Pressure(in)',
       'Visibility(mi)', 'Wind_Speed(mph)', 'Precipitation(in)',
       'Sunrise_Sunset', 'Civil_Twilight', 'Nautical_Twilight',
       'Astronomical_Twilight'],
      dtype='object')
```

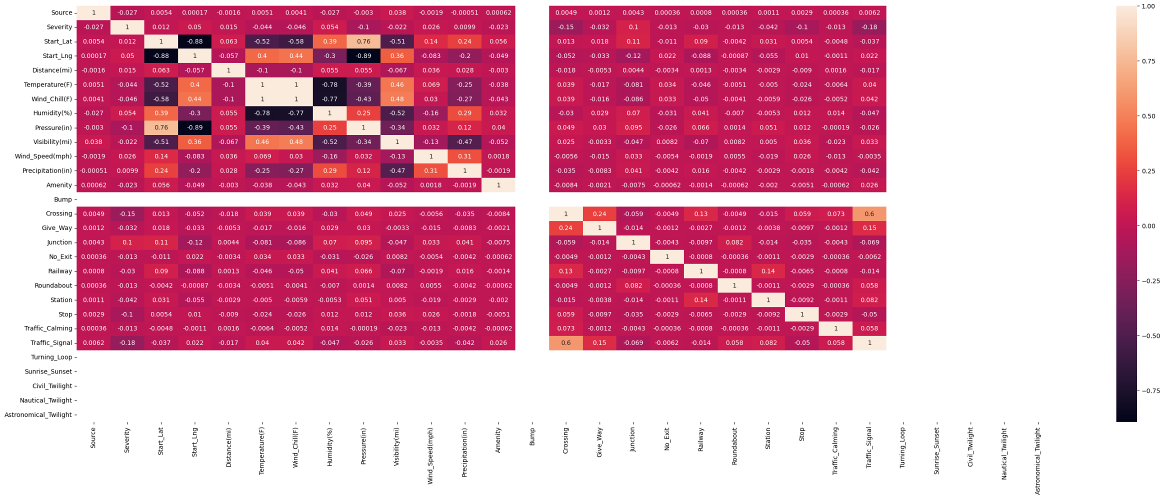
```
df_num=df1.select_dtypes(np.number)
col_name=[]
length=[]

for i in df_num.columns:
    col_name.append(i)
    length.append(len(df_num[i].unique()))
df_2=pd.DataFrame(zip(col_name,length),columns=['feature','count_of_unique_values'])
df_2
```

	feature	count_of_unique_values
0	Source	2
1	Severity	3
2	Start_Lat	1330
3	Start_Lng	1343
4	Distance(mi)	6
5	Temperature(F)	98
6	Wind_Chill(F)	187
7	Humidity(%)	96
8	Pressure(in)	200
9	Visibility(mi)	21
10	Wind_Speed(mph)	46
11	Precipitation(in)	32
12	Sunrise_Sunset	1
13	Civil_Twilight	1
14	Nautical_Twilight	1
15	Astronomical_Twilight	1

```
import matplotlib.pyplot as plt
import seaborn as sns
```

```
plt.figure(figsize=(35, 12))
sns.heatmap(df1.corr(), annot=True)
```

```
/tmp/ipykernel_32/738400029.py:5: FutureWarning: The default value of numeric_only in DataFrame.corr is
  sns.heatmap(df1.corr(), annot=True)
<Axes: >
```



```
cities = df1['County'].unique()
len(cities)
```

```
30
```

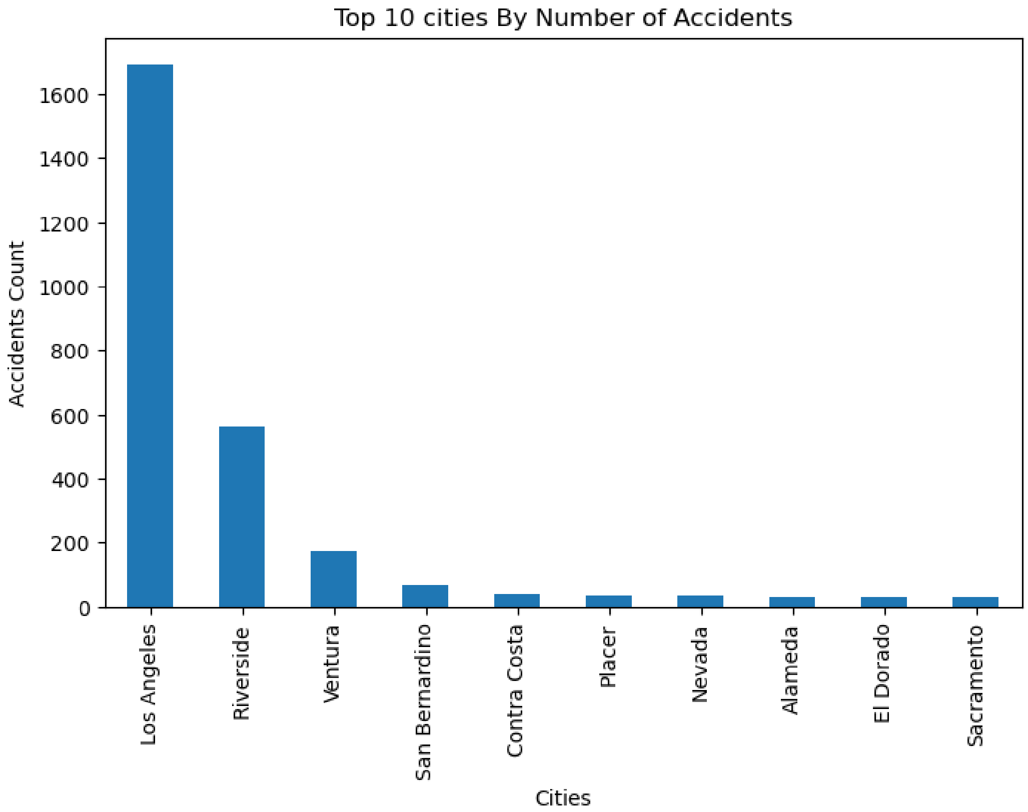
```
accidents_by_cities = df1['County'].value_counts()
accidents_by_cities
```

```
Los Angeles       1691
Riverside          561
Ventura            172
San Bernardino      66
Contra Costa        38
Placer              35
Nevada              35
Alameda             31
El Dorado           29
Sacramento          29
Sonoma              25
Santa Clara         13
Solano              13
San Joaquin         10
Calaveras            9
Lake                 6
Santa Cruz           6
San Mateo            4
Amador               4
Sierra               3
Yolo                 3
Napa                 3
Butte                3
Stanislaus           2
Mendocino            2
San Diego            2
Tuolumne             1
Monterey             1
Yuba                 1
San Francisco        1
Name: County, dtype: int64
```

```
#top 10 cities by number of accident
accidents_by_cities[:10]
```

```
Los Angeles       1691
Riverside          561
Ventura            172
San Bernardino      66
Contra Costa        38
Placer              35
Nevada              35
Alameda             31
El Dorado           29
Sacramento          29
Name: County, dtype: int64
```

```
fig, ax = plt.subplots(figsize=(8,5))
accidents_by_cities[:10].plot(kind='bar')
ax.set(title = 'Top 10 cities By Number of Accidents',
       xlabel = 'Cities',
       ylabel = 'Accidents Count')
plt.show()
```



```
accidents_severity = df1.groupby('Severity').count()
accidents_severity
```

```
            Source  Start_Lat  Start_Lng  Distance(mi)  County  State  Timezone  Temperature(F)  Wind_Chill(F)  Humidity(%)  ...  !
```

```
df1['Start_Lat'].dtypes
```

```
dtype('float64')
```

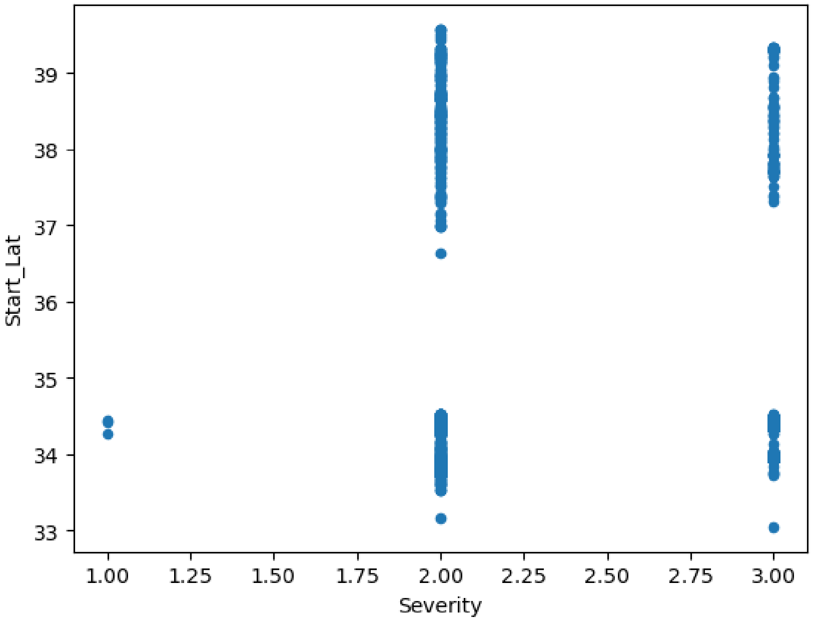
```
      2       1870       1870       1870          1870     1870    1870       1870              1870           1870       ...
```

```
df1['E'].dtypes
```

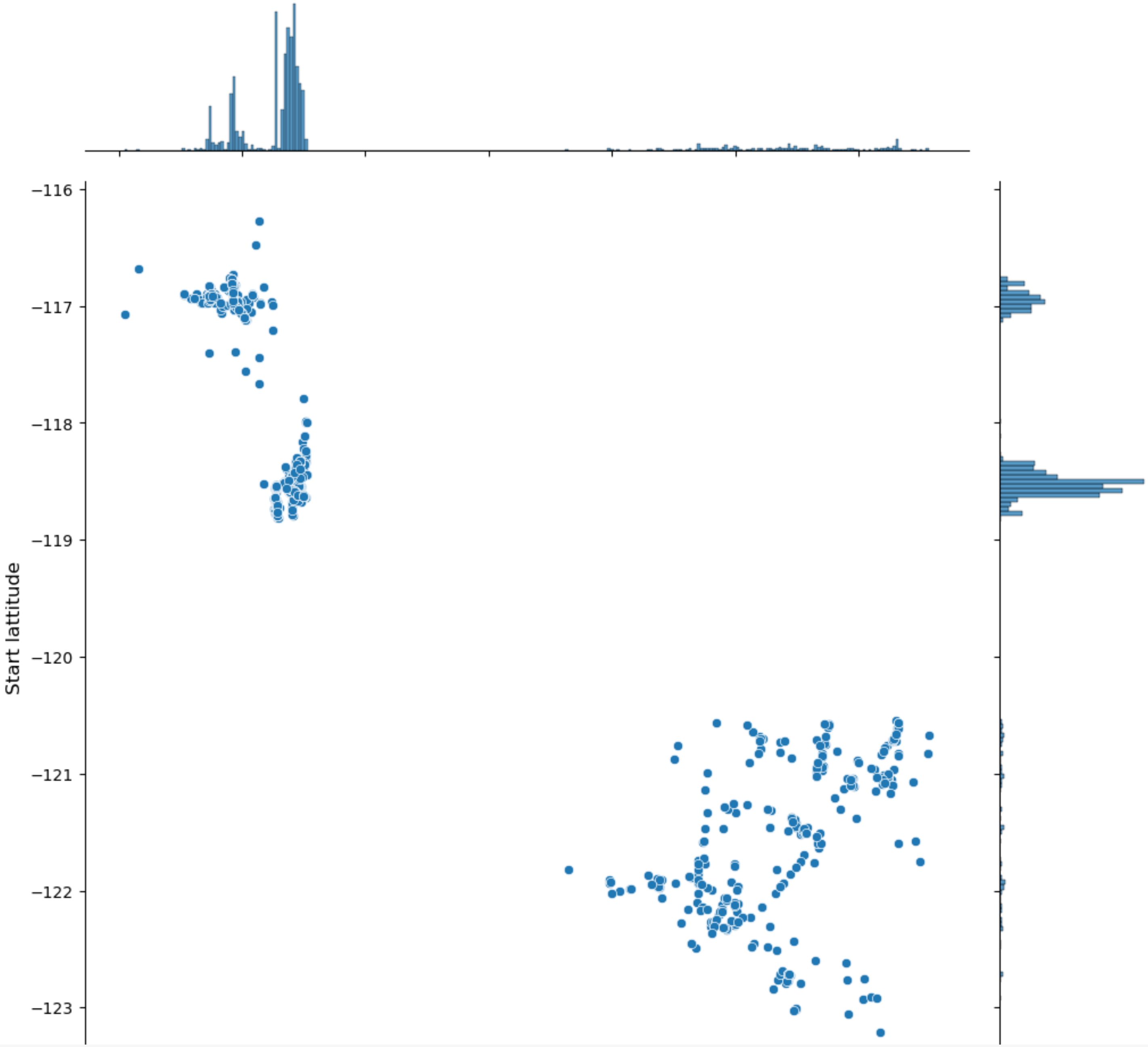
```
dtype('float64')
```

```
df_num.plot(kind='scatter', y='Start_Lat', x='Severity')
```

```
<Axes: xlabel='Severity', ylabel='Start_Lat'>
```



```
sns.jointplot(x=df_num.Start_Lat.values , y=df_num.Start_Lng.values,height=10)
plt.ylabel('Start lattitude', fontsize=12)
plt.xlabel('Start lattitude', fontsize=12)
plt.show()
```



```
len(df_num.columns)
```

```
16
```

```
Unneeded_columns = ['ID', 'Description','Street','City','Zipcode','Country']

data = data.drop(Unneeded_columns,axis=1)
```

```
data
```

	Source	Severity	Start_Time	End_Time	Start_Lat	Start_Lng	Distance(mi)	County	State	Timezone	...	Roundabout
0	Source2	3	2016-02-08 07:44:26	2016-02-08 08:14:26	40.100590	-82.925194	0.01	Franklin	OH	US/Eastern	...	False
1	Source2	3	2016-02-08 08:10:04	2016-02-08 08:40:04	40.100590	-82.925194	0.01	Franklin	OH	US/Eastern	...	False
2	Source2	3	2016-02-08 08:21:27	2016-02-08 08:51:27	39.932709	-82.830910	0.01	Franklin	OH	US/Eastern	...	False
3	Source2	2	2016-02-08 08:39:43	2016-02-08 09:09:43	39.972038	-82.913521	0.01	Franklin	OH	US/Eastern	...	False
4	Source2	2	2016-02-08 10:11:15	2016-02-08 10:41:15	40.052509	-82.882332	0.00	Franklin	OH	US/Eastern	...	False
...	...	...	...	...	...	...	...	...	...	...	...	...
13988	Source2	2	2017-04-13 19:12:02	2017-04-13 19:41:50	39.253979	-121.170898	0.00	Nevada	CA	US/Pacific	...	False
13989	Source2	3	2017-04-13 21:04:44	2017-04-13 21:34:27	39.320442	-120.560776	0.01	Nevada	CA	US/Pacific	...	False
13990	Source2	3	2017-04-17 09:18:08	2017-04-17 09:47:33	39.303341	-120.657280	0.01	Placer	CA	US/Pacific	...	False
13991	Source2	2	2017-04-17 16:09:52	2017-04-17 16:39:18	39.187840	-120.833069	0.00	Placer	CA	US/Pacific	...	False
13992	Source2	3	2017-04-17 21:35:48	2017-04-17 22:05:28	39.202686	-120.809448	0.01	Placer	CA	US/Pacific	...	False

13993 rows × 38 columns

```
def get_years(df, column):
    return df[column].apply(lambda date: date[0:4])

def get_months(df, column):
    return df[column].apply(lambda date: date[5:7])
```

```
data
```

	Source	Severity	Start_Lat	Start_Lng	Distance(mi)	County	State	Timezone	Airport_Code	Temperature(F)	...	Sunr
0	Source2	3	40.100590	-82.925194	0.01	Franklin	OH	US/Eastern	KCMH	37.9	...	
1	Source2	3	40.100590	-82.925194	0.01	Franklin	OH	US/Eastern	KCMH	37.4	...	
2	Source2	3	39.932709	-82.830910	0.01	Franklin	OH	US/Eastern	KCMH	37.4	...	
3	Source2	2	39.972038	-82.913521	0.01	Franklin	OH	US/Eastern	KCMH	37.4	...	
4	Source2	2	40.052509	-82.882332	0.00	Franklin	OH	US/Eastern	KCMH	33.8	...	
...	...	...	...	...	...	...	...	...	...	...	...	
13988	Source2	2	39.253979	-121.170898	0.00	Nevada	CA	US/Pacific	KGOO	41.0	...	
13989	Source2	3	39.320442	-120.560776	0.01	Nevada	CA	US/Pacific	KBLU	30.0	...	
13990	Source2	3	39.303341	-120.657280	0.01	Placer	CA	US/Pacific	KBLU	42.1	...	
13991	Source2	2	39.187840	-120.833069	0.00	Placer	CA	US/Pacific	KBLU	44.1	...	
13992	Source2	3	39.202686	-120.809448	0.01	Placer	CA	US/Pacific	KBLU	41.0	...	

13993 rows × 41 columns

```
def onehot_encode(df,columns,prefixes):
    df = df.copy()
    for column,prefix in zip(columns,prefixes):
        dummies = pd.get_dummies(df[columns],prefix=prefix)
        df = pd.concat([df,dummies],axis=1)
        df = df.drop(columns,axis=1)
    return df
```

```
{column:len(data[column].unique()) for column in data.columns if data.dtypes[column] == 'object'}
```

```
{'Source': 2,
 'County': 285,
 'State': 25,
 'Timezone': 3,
 'Airport_Code': 301,
 'Wind_Direction': 23,
 'Weather_Condition': 53,
 'Sunrise_Sunset': 2,
 'Civil_Twilight': 2,
 'Nautical_Twilight': 2,
 'Astronomical_Twilight': 2,
 'Start_Time_Month': 12,
 'Start_Time_Year': 2,
 'End_Time_Month': 12,
 'End_Time_year': 2,
 'Weather_Timestamp_Month': 12,
 'Weather_Timestamp_Year': 2}
```

```
data = onehot_encode(
        data,
    columns=['Side','County','State','Timezone','Airport_Code']
    prefixes=['SI','CO','ST','TZ','AC']
)
```

```
data
```

```
        Source  Severity  Start_Lat   Start_Lng  Distance(mi)  County  State   Timezone  Airport_Code  Temperature(F)  ...  Sunr
    0  Source2         3  40.100590  -82.925194          0.01  Franklin   OH  US/Eastern        KCMH            37.9  ...
    1  Source2         3  40.100590  -82.925194          0.01  Franklin   OH  US/Eastern        KCMH            37.4  ...
    2  Source2         3  39.932709  -82.830910          0.01  Franklin   OH  US/Eastern        KCMH            37.4  ...
    3  Source2         2  39.972038  -82.913521          0.01  Franklin   OH  US/Eastern        KCMH            37.4  ...
    4  Source2         2  40.052509  -82.882332          0.00  Franklin   OH  US/Eastern        KCMH            33.8  ...
  ...      ...       ...        ...         ...           ...       ...  ...         ...         ...             ...  ...
13988  Source2         2  39.253979 -121.170898          0.00    Nevada   CA  US/Pacific        KGOO            41.0  ...
13989  Source2         3  39.320442 -120.560776          0.01    Nevada   CA  US/Pacific        KBLU            30.0  ...
13990  Source2         3  39.303341 -120.657280          0.01    Placer   CA  US/Pacific        KBLU            42.1  ...
13991  Source2         2  39.187840 -120.833069          0.00    Placer   CA  US/Pacific        KBLU            44.1  ...
13992  Source2         3  39.202686 -120.809448          0.01    Placer   CA  US/Pacific        KBLU            41.0  ...

13993 rows × 41 columns
```

```
data['Source'].unique()
```

```
array(['Source2', 'Source3'], dtype=object)
```

```
def get_binary_column(df, column):
    if column == 'Source':
        return df[column].apply(lambda x: 1 if x == 'Source2' else 0)
    else :
        return df[column].apply(lambda x: 1 if x == 'Source2' else 0)
```

```
data['Source'] = get_binary_column(data,'Source')


data['Sunrise_Sunset'] = get_binary_column(data,'Sunrise_Sunset')
data['Civil_Twilight'] = get_binary_column(data,'Civil_Twilight')
data['Nautical_Twilight'] = get_binary_column(data,'Nautical_Twilight')
data['Astronomical_Twilight'] = get_binary_column(data,'Astronomical_Twilight')
```

```
y = data['Severity'].copy()
x = data.drop('Severity',axis=1).copy()
```

```
y.unique()
```

```
array([3, 2, 1, 4])
```

```
y=y-1
```

```
x.shape
```

```
(13993, 40)
```