untitled0

May 1, 2024

[11]:
```
from google.colab import drive
drive.mount('/content/drive')
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call
drive.mount("/content/drive", force_remount=True).
```

[12]:
```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
import warnings
warnings.filterwarnings('ignore')
```

[13]:
```
import pandas as pd
df = pd.read_csv("//content/drive/MyDrive/Colab Notebooks/RTA Dataset.csv")
df.head()
```

[13]:

	Time	Day_of_week	Age_band_of_driver	Sex_of_driver	Educational_level	Vehicle_driver_relation	Driving_experience	Type_of_vehicle	Owner_of_vehicle	Service_year_of_vehicle	…	Vehicle_movement
0	17:02:00	Monday	18-30	Male	Above high school	Employee	1-2yr	Automobile	Owner	Above 10yr	…	Going straight
1	17:02:00	Monday	31-50	Male	Junior high school	Employee	Above 10yr	Public (> 45 seats)	Owner	5-10yrs	…	Going straight
2	17:02:00	Monday	18-30	Male	Junior high school	Employee	1-2yr	Lorry (41?100Q)	Owner	NaN	…	Going straight
3	1:06:00	Sunday	18-30	Male	Junior high school	Employee	5-10yr	Public (> 45 seats)	Governmental	NaN	…	Going straight
4	1:06:00	Sunday	18-30	Male	Junior high school	Employee	2-5yr	NaN	Owner	5-10yrs	…	Going straight

```
    Casualty_class Sex_of_casualty Age_band_of_casualty Casualty_severity  \
0               na              na                   na                na
1               na              na                   na                na
2  Driver or rider            Male                31-50                 3
3       Pedestrian          Female                18-30                 3
4               na              na                   na                na

  Work_of_casuality Fitness_of_casuality Pedestrian_movement  \
0               NaN                  NaN    Not a Pedestrian
1               NaN                  NaN    Not a Pedestrian
2            Driver                  NaN    Not a Pedestrian
3            Driver               Normal    Not a Pedestrian
4               NaN                  NaN    Not a Pedestrian

            Cause_of_accident Accident_severity
0             Moving Backward     Slight Injury
1                  Overtaking     Slight Injury
2   Changing lane to the left    Serious Injury
3  Changing lane to the right     Slight Injury
4                  Overtaking     Slight Injury

[5 rows x 32 columns]
```

[14]:
```
df.shape
```

[14]:
```
(12316, 32)
```

[15]:
```
df.describe()
```

[15]:
```
       Number_of_vehicles_involved  Number_of_casualties
count                 12316.000000          12316.000000
mean                      2.040679              1.548149
std                       0.688790              1.007179
min                       1.000000              1.000000
25%                       2.000000              1.000000
50%                       2.000000              1.000000
75%                       2.000000              2.000000
max                       7.000000              8.000000
```

[16]:
```
df.describe(include="all")
```

[16]:
```
             Time Day_of_week Age_band_of_driver Sex_of_driver  \
count       12316       12316              12316         12316
unique       1074           7                  5             3
top      15:30:00      Friday              18-30          Male
freq          120        2041               4271         11437
mean          NaN         NaN                NaN           NaN
```

```
std          NaN         NaN                NaN           NaN
min          NaN         NaN                NaN           NaN
25%          NaN         NaN                NaN           NaN
50%          NaN         NaN                NaN           NaN
75%          NaN         NaN                NaN           NaN
max          NaN         NaN                NaN           NaN

         Educational_level Vehicle_driver_relation Driving_experience  \
count                11575                  11737              11487
unique                   7                      4                  7
top     Junior high school               Employee            5-10yr
freq                  7619                   9627               3363
mean                   NaN                    NaN                NaN
std                    NaN                    NaN                NaN
min                    NaN                    NaN                NaN
25%                    NaN                    NaN                NaN
50%                    NaN                    NaN                NaN
75%                    NaN                    NaN                NaN
max                    NaN                    NaN                NaN

       Type_of_vehicle Owner_of_vehicle Service_year_of_vehicle  …  \
count            11366            11834                   8388  …
unique              17                4                      6  …
top         Automobile            Owner                Unknown  …
freq              3205            10459                   2883  …
mean               NaN              NaN                    NaN  …
std                NaN              NaN                    NaN  …
min                NaN              NaN                    NaN  …
25%                NaN              NaN                    NaN  …
50%                NaN              NaN                    NaN  …
75%                NaN              NaN                    NaN  …
max                NaN              NaN                    NaN  …

       Vehicle_movement   Casualty_class Sex_of_casualty Age_band_of_casualty  \
count             12008            12316           12316                12316
unique               13                4               3                    6
top      Going straight  Driver or rider            Male                   na
freq               8158             4944            5253                 4443
mean                NaN              NaN             NaN                  NaN
std                 NaN              NaN             NaN                  NaN
min                 NaN              NaN             NaN                  NaN
25%                 NaN              NaN             NaN                  NaN
50%                 NaN              NaN             NaN                  NaN
75%                 NaN              NaN             NaN                  NaN
max                 NaN              NaN             NaN                  NaN

       Casualty_severity Work_of_casuality Fitness_of_casuality  \
```

```
count              12316              9118                 9681
unique                 4                 7                    5
top                    3            Driver               Normal
freq                7076              5903                 9608
mean                 NaN               NaN                  NaN
std                  NaN               NaN                  NaN
min                  NaN               NaN                  NaN
25%                  NaN               NaN                  NaN
50%                  NaN               NaN                  NaN
75%                  NaN               NaN                  NaN
max                  NaN               NaN                  NaN

       Pedestrian_movement Cause_of_accident Accident_severity
count                12316             12316             12316
unique                   9                20                 3
top       Not a Pedestrian     No distancing     Slight Injury
freq                 11390              2263             10415
mean                   NaN               NaN               NaN
std                    NaN               NaN               NaN
min                    NaN               NaN               NaN
25%                    NaN               NaN               NaN
50%                    NaN               NaN               NaN
75%                    NaN               NaN               NaN
max                    NaN               NaN               NaN

[11 rows x 32 columns]
```

[17]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 12316 entries, 0 to 12315
Data columns (total 32 columns):
 #   Column                       Non-Null Count  Dtype
---  ------                       --------------  -----
 0   Time                         12316 non-null  object
 1   Day_of_week                  12316 non-null  object
 2   Age_band_of_driver           12316 non-null  object
 3   Sex_of_driver                12316 non-null  object
 4   Educational_level            11575 non-null  object
 5   Vehicle_driver_relation      11737 non-null  object
 6   Driving_experience           11487 non-null  object
 7   Type_of_vehicle              11366 non-null  object
 8   Owner_of_vehicle             11834 non-null  object
 9   Service_year_of_vehicle      8388 non-null   object
 10  Defect_of_vehicle            7889 non-null   object
 11  Area_accident_occured        12077 non-null  object
 12  Lanes_or_Medians             11931 non-null  object
```

```
 13  Road_allignment              12174 non-null  object
 14  Types_of_Junction            11429 non-null  object
 15  Road_surface_type            12144 non-null  object
 16  Road_surface_conditions      12316 non-null  object
 17  Light_conditions             12316 non-null  object
 18  Weather_conditions           12316 non-null  object
 19  Type_of_collision            12161 non-null  object
 20  Number_of_vehicles_involved  12316 non-null  int64
 21  Number_of_casualties         12316 non-null  int64
 22  Vehicle_movement             12008 non-null  object
 23  Casualty_class               12316 non-null  object
 24  Sex_of_casualty              12316 non-null  object
 25  Age_band_of_casualty         12316 non-null  object
 26  Casualty_severity            12316 non-null  object
 27  Work_of_casuality            9118 non-null   object
 28  Fitness_of_casuality         9681 non-null   object
 29  Pedestrian_movement          12316 non-null  object
 30  Cause_of_accident            12316 non-null  object
 31  Accident_severity            12316 non-null  object
dtypes: int64(2), object(30)
memory usage: 3.0+ MB
```

[18]:
```
df.duplicated().sum()
```

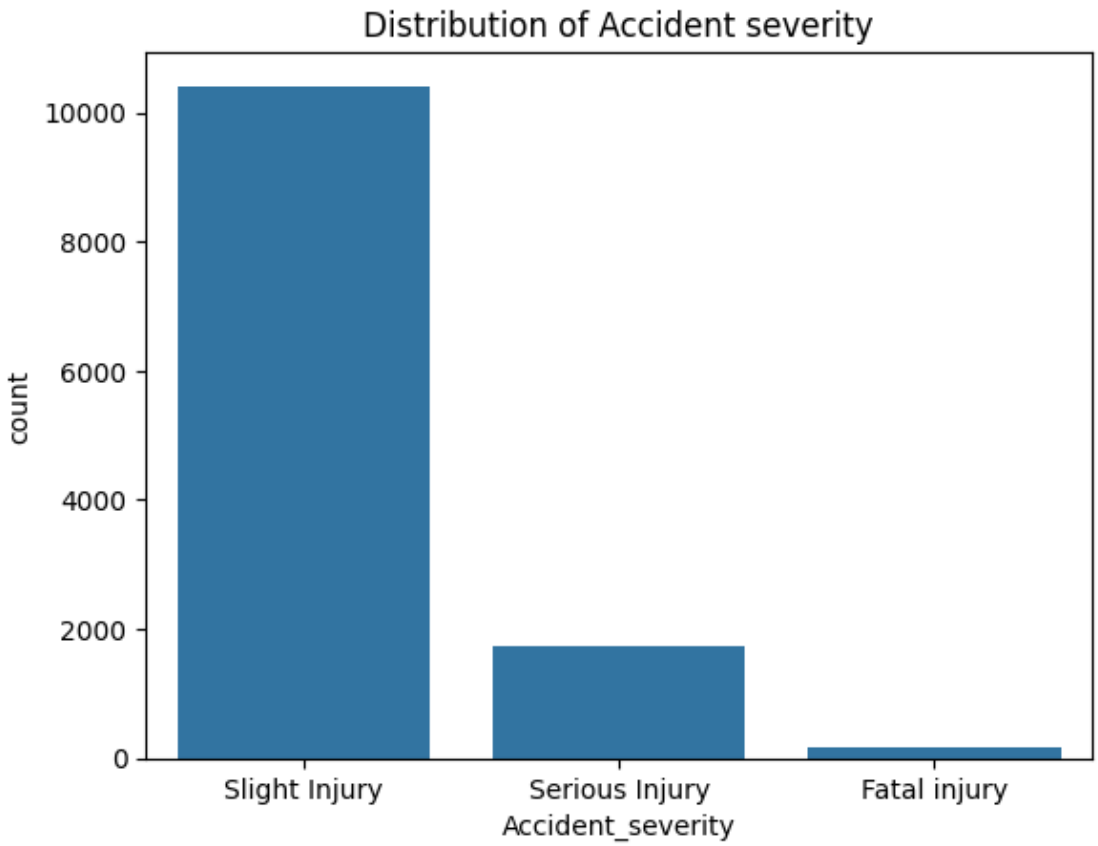
[18]:
```
0
```

[19]:
```
df['Accident_severity'].value_counts()
```

[19]:
```
Accident_severity
Slight Injury     10415
Serious Injury     1743
Fatal injury        158
Name: count, dtype: int64
```

[20]:
```
sns.countplot(x = df['Accident_severity'])
plt.title('Distribution of Accident severity')
```

[20]:
```
Text(0.5, 1.0, 'Distribution of Accident severity')
```



[21]:
```
df.isna().sum()
```

[21]:
```
Time                          0
Day_of_week                   0
Age_band_of_driver            0
Sex_of_driver                 0
Educational_level           741
Vehicle_driver_relation     579
Driving_experience          829
Type_of_vehicle             950
Owner_of_vehicle            482
Service_year_of_vehicle    3928
Defect_of_vehicle          4427
Area_accident_occured       239
Lanes_or_Medians            385
Road_allignment             142
Types_of_Junction           887
Road_surface_type           172
Road_surface_conditions       0
Light_conditions              0
```

```
Weather_conditions              0
Type_of_collision             155
Number_of_vehicles_involved     0
Number_of_casualties            0
Vehicle_movement              308
Casualty_class                  0
Sex_of_casualty                 0
Age_band_of_casualty            0
Casualty_severity               0
Work_of_casuality            3198
Fitness_of_casuality         2635
Pedestrian_movement             0
Cause_of_accident               0
Accident_severity               0
dtype: int64
```

[22]:
```
df.drop(['Service_year_of_vehicle','Defect_of_vehicle','Work_of_casuality',␣
 ↪'Fitness_of_casuality','Time'],
        axis = 1, inplace = True)
df.head()
```

[22]:

	Day_of_week	Age_band_of_driver	Sex_of_driver	Educational_level	Vehicle_driver_relation	Driving_experience	Type_of_vehicle	Owner_of_vehicle	Area_accident_occured	Lanes_or_Medians	…	Number_of_vehicles_involved	Number_of_casualties	Vehicle_movement
0	Monday	18-30	Male	Above high school	Employee	1-2yr	Automobile	Owner	Residential areas	NaN	…	2	2	Going straight
1	Monday	31-50	Male	Junior high school	Employee	Above 10yr	Public (> 45 seats)	Owner	Office areas	Undivided Two way	…	2	2	Going straight
2	Monday	18-30	Male	Junior high school	Employee	1-2yr	Lorry (41?100Q)	Owner	Recreational areas	other	…	2	2	Going straight
3	Sunday	18-30	Male	Junior high school	Employee	5-10yr	Public (> 45 seats)	Governmental	Office areas	other	…	2	2	Going straight
4	Sunday	18-30	Male	Junior high school	Employee	2-5yr	NaN	Owner	Industrial areas	other	…	2	2	Going straight

```
4                          2                   2   Going straight

    Casualty_class Sex_of_casualty Age_band_of_casualty Casualty_severity  \
0               na              na                   na                na
1               na              na                   na                na
2  Driver or rider            Male                31-50                 3
3       Pedestrian          Female                18-30                 3
4               na              na                   na                na

   Pedestrian_movement           Cause_of_accident Accident_severity
0     Not a Pedestrian             Moving Backward     Slight Injury
1     Not a Pedestrian                   Overtaking     Slight Injury
2     Not a Pedestrian   Changing lane to the left    Serious Injury
3     Not a Pedestrian  Changing lane to the right     Slight Injury
4     Not a Pedestrian                   Overtaking     Slight Injury

[5 rows x 27 columns]
```

[23]:
```
categorical=[i for i in df.columns if df[i].dtype=='O']
print('The categorical variables are',categorical)
```

```
The categorical variables are ['Day_of_week', 'Age_band_of_driver',
'Sex_of_driver', 'Educational_level', 'Vehicle_driver_relation',
'Driving_experience', 'Type_of_vehicle', 'Owner_of_vehicle',
'Area_accident_occured', 'Lanes_or_Medians', 'Road_allignment',
'Types_of_Junction', 'Road_surface_type', 'Road_surface_conditions',
'Light_conditions', 'Weather_conditions', 'Type_of_collision',
'Vehicle_movement', 'Casualty_class', 'Sex_of_casualty', 'Age_band_of_casualty',
'Casualty_severity', 'Pedestrian_movement', 'Cause_of_accident',
'Accident_severity']
```

[24]:
```
for i in categorical:
    df[i].fillna(df[i].mode()[0],inplace=True)
```

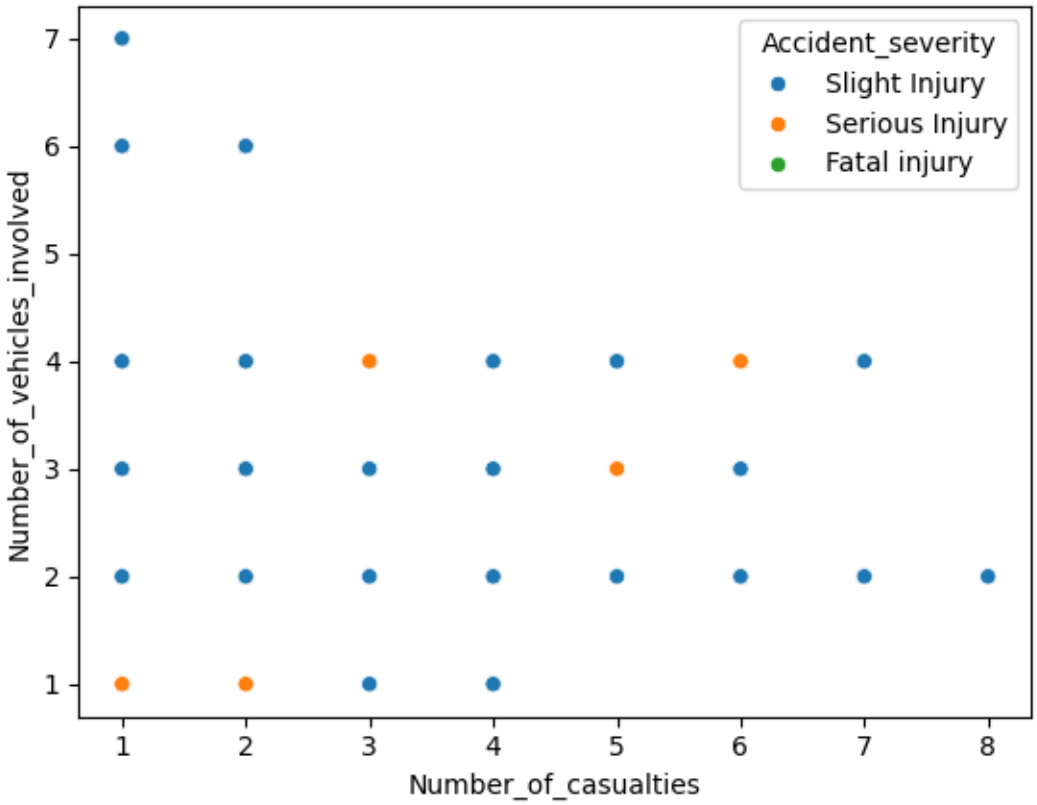
[25]:
```
df.isna().sum()
```

[25]:
```
Day_of_week                  0
Age_band_of_driver           0
Sex_of_driver                0
Educational_level            0
Vehicle_driver_relation      0
Driving_experience           0
Type_of_vehicle              0
Owner_of_vehicle             0
Area_accident_occured        0
Lanes_or_Medians             0
Road_allignment              0
```

```
Types_of_Junction              0
Road_surface_type              0
Road_surface_conditions        0
Light_conditions               0
Weather_conditions             0
Type_of_collision              0
Number_of_vehicles_involved    0
Number_of_casualties           0
Vehicle_movement               0
Casualty_class                 0
Sex_of_casualty                0
Age_band_of_casualty           0
Casualty_severity              0
Pedestrian_movement            0
Cause_of_accident              0
Accident_severity              0
dtype: int64
```

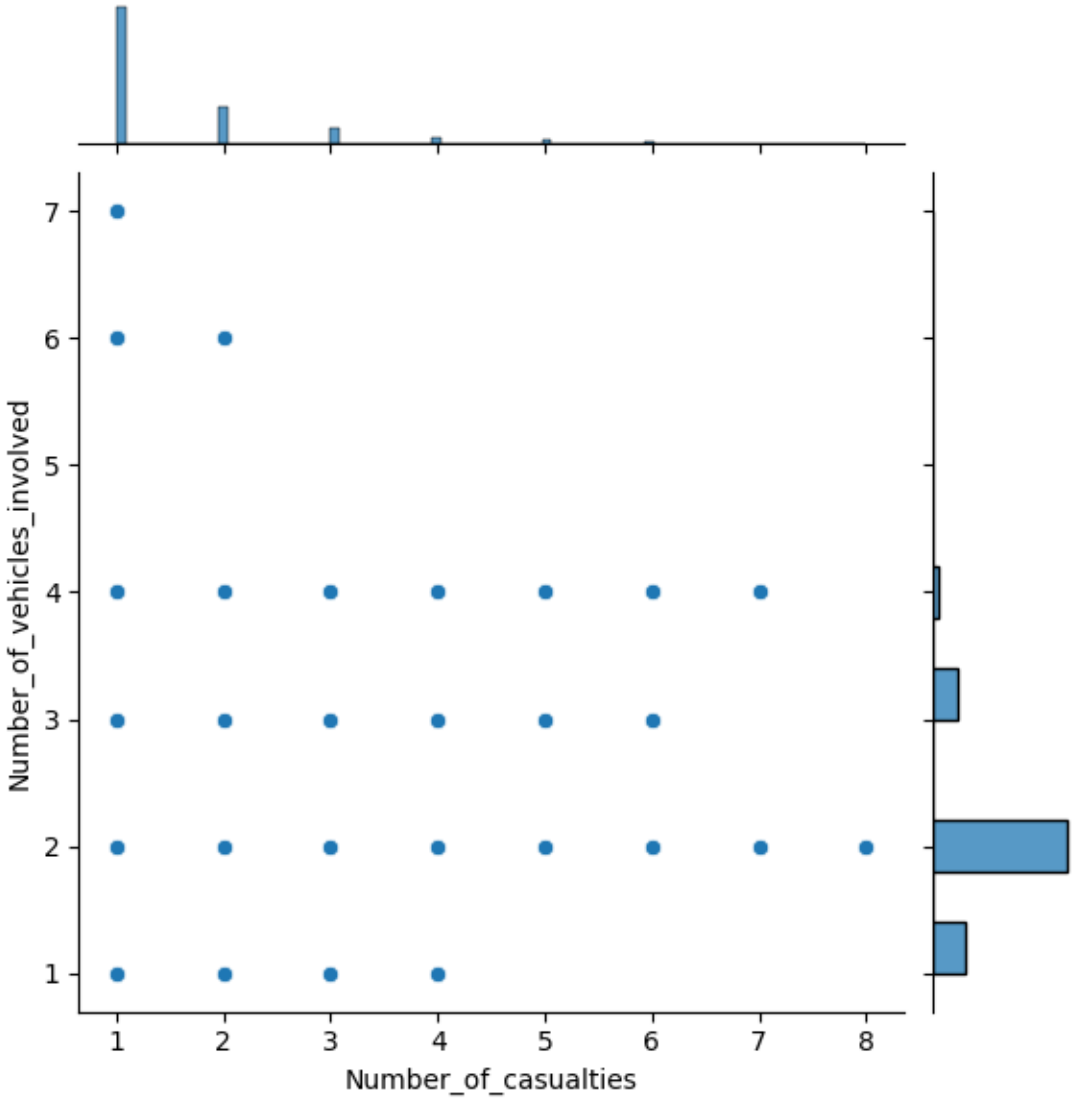
[26]:
```
sns.scatterplot(x=df['Number_of_casualties'],␣
↪y=df['Number_of_vehicles_involved'], hue=df['Accident_severity'])
```

[26]:
```
<Axes: xlabel='Number_of_casualties', ylabel='Number_of_vehicles_involved'>
```



[27]:
```
sns.jointplot(x='Number_of_casualties',y='Number_of_vehicles_involved',data=df)
```

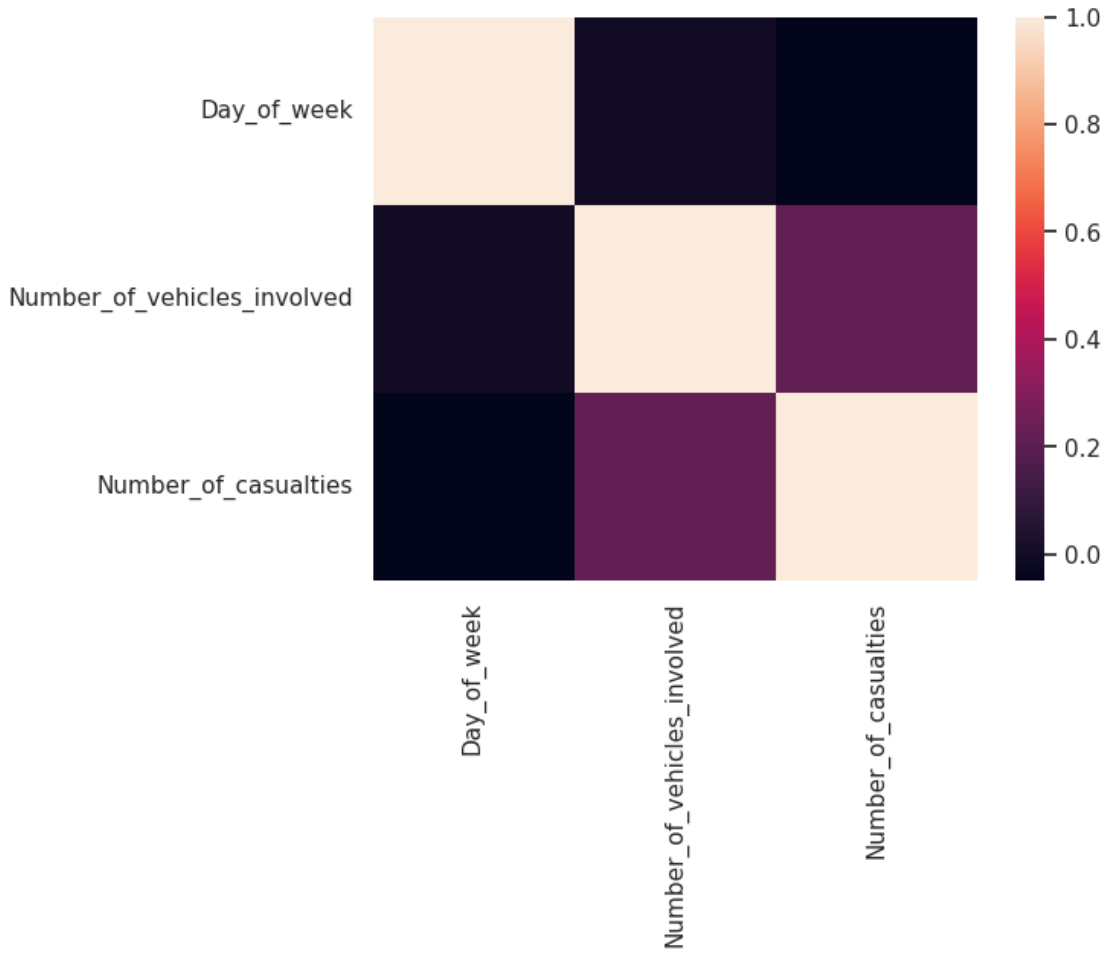
[27]: <seaborn.axisgrid.JointGrid at 0x7d203d6b06a0>



[74]:
```
df_numerical = df.select_dtypes(include=['number'])
correlation_matrix = df_numerical.corr()
```

[73]:
```
df_numeric = df.select_dtypes(include=["number"])
sns.heatmap(df_numeric.corr())
```

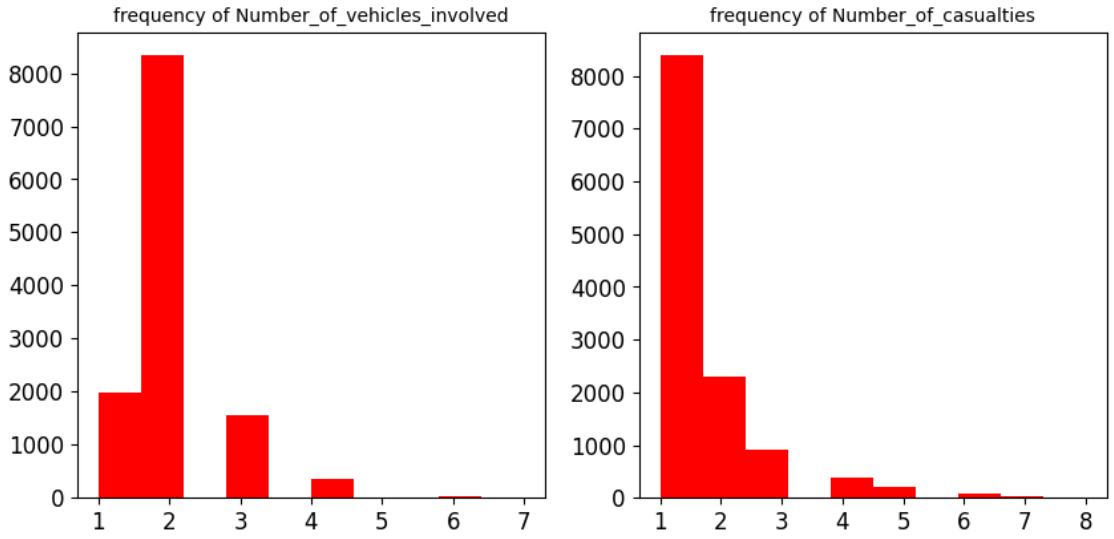
[73]: <Axes: >



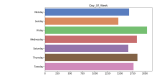
[30]:
```
numerical=[i for i in df.columns if df[i].dtype!='O']
print('The numerica variables are',numerical)
```

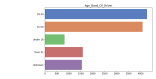
```
The numerica variables are ['Number_of_vehicles_involved',
'Number_of_casualties']
```

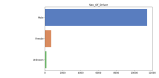
[31]:
```
plt.figure(figsize=(10,10))
plotnumber = 1
for i in numerical:
    if plotnumber <= df.shape[1]:
        ax1 = plt.subplot(2,2,plotnumber)
        plt.hist(df[i],color='red')
        plt.xticks(fontsize=12)
        plt.yticks(fontsize=12)
        plt.title('frequency of '+i, fontsize=10)
    plotnumber +=1
```

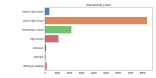


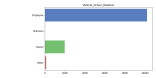
[32]:
```
plt.figure(figsize=(10,200))
plotnumber = 1

for col in categorical:
    if plotnumber <= df.shape[1] and col!='Pedestrian_movement':
        ax1 = plt.subplot(28,1,plotnumber)
        sns.countplot(data=df, y=col, palette='muted')
        plt.xticks(fontsize=12)
        plt.yticks(fontsize=12)
        plt.title(col.title(), fontsize=14)
        plt.xlabel('')
        plt.ylabel('')
    plotnumber +=1
```

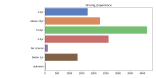

Day_Of_Week
Monday
Sunday
Friday
Wednesday
Saturday
Thursday
Tuesday
0
200
400
600
800
1000
1200
1400

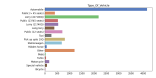

Age_Band_Of_Driver
31-50
Over
Under 18
Data
Unknown
0
500
1000
1500
2000
2500
3000
3500
4000

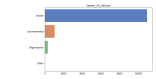

Sex_Of_Driver
Male
Female
Unknown
0
2000
4000
6000
8000
10000
12000

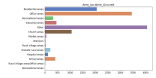

Educational_Level
Above high school
Junior high school
Elementary school
High school
Unknown
Illiterate
Writing
0
1000
2000
3000
4000
5000
6000
7000
8000

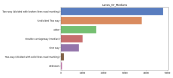

Vehicle_Driver_Relation
Employee
Unknown
Owner
Other
0
2000
4000
6000
8000
10000

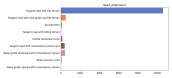

Driving_Experience
1-2yr
Above 10yr
5-10yr
No Licence
Below 1yr
Unknown
0
500
1000
1500
2000
2500
3000
3500
4000
4500

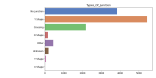

Type_Of_Vehicle
Automobile
Public (> 45 seats)
Public (13-45 seats)
Lorry (41-100Q)
Pick up upto 10Q
Stationwagen
Lorry (11-40Q)
Public (12 seats)
Ridden
Other
Bajaj
Turbo
Motorcycle
Special vehicle
Bicycle
0
500
1000
1500
2000
2500
3000
3500
4000

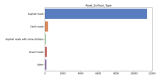

Owner_Of_Vehicle
Owner
Government
Organization
Other
0
1000
2000
3000
4000
5000
6000

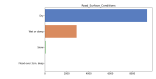

Area_Accident_Occured
Residential area
Office areas
Recreational areas
Industrial areas
Church areas
Market areas
Rural village areas
Hospital areas
School areas
Other Private Service Providers' area
Unknown
0
500
1000
1500
2000
2500
3000
3500
4000

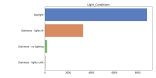

Lanes_Or_Medians
Two-way (divided with solid fence type barrier or heavy traffic median)
Undivided Two Way
One
Undivided Two Way (divided with broken or solid line median)
Other
Two-way (divided with solid line road marking only)
Unknown
0
1000
2000
3000
4000
5000

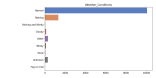

Road_Allignment
Straight road with flat terrain
Straight road with mild grade and flat terrain
Escarpment
Tangent road with rolling terrain
Gentle horizontal curve
Tangent road with horizontal and vertical alignment
Steep grade downward with horizontal curve
Steep reverse curve
Other
0
2000
4000
6000
8000
10000

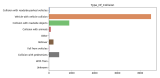

Types_Of_Junction
No Junction
Crossing
Roundabout
Other
Y Shape
Unknown
T Shape
0
1000
2000
3000
4000
5000

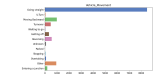

Road_Surface_Type
Asphalt roads
Earth roads
Asphalt roads with some distress
Gravel roads
Other
0
500
1000
1500
2000
2500
3000

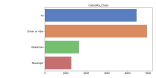

Road_Surface_Conditions
Dry
Wet or damp
Snow
Flood over 3cm. deep
0
1000
2000
3000
4000
5000
6000

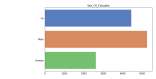

Light_Conditions
Daylight
Darkness - lights lit
Darkness - no lighting
Darkness - lights unlit
0
1000
2000
3000
4000
5000
6000

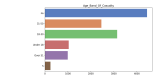

Weather_Conditions
Normal
Raining
Raining and Windy
Cloudy
Other
Windy
Snow
Unknown
Fog or mist
0
1000
2000
3000
4000
5000
6000
7000

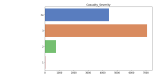

Types_Of_Collision
Collision with roadside-parked vehicle
Vehicle with vehicle collision
Collision with roadside objects
Collision with animals
Other
Rollover
Fall from vehicles
Collision with pedestrians
With Train
Unknown
0
1000
2000
3000
4000
5000
6000

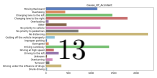

Vehicle_Movement
Going straight
U-Turn
Moving Backward
Turning
Waiting to go
Parked
Reversing
Unknown
Stopping
Overtaking
Turning left
Changing lane to left
0
1000
2000
3000
4000
5000
6000
7000

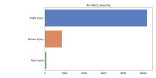

Casualty_Class
Pedestrian
Driver or rider
Unknown
Passenger
0
1000
2000
3000
4000
5000
6000


Sex_Of_Casualty
Male
Female
Unknown
0
2000
4000
6000
8000
10000


Age_Band_Of_Casualty
31-50
Over
Under 18
Data
Unknown
0
1000
2000
3000
4000
5000


Casualty_Severity
3
2
1
0
1000
2000
3000
4000
5000
6000
7000


Hazard_Of_Accident
Driving carelessly
Changing lane to the left
Changing lane to the right
Overloading
Other
No distance between vehicles
No faulty
Driving off the road
Driving under the influence of drugs
Driving to the left
Driving to the right
Unknown
Driving under the influence of alcohol
Driving carelessly
0
500
1000
1500
2000
2500


Accident_Severity
Slight Injury
Serious Injury
Fatal injury
0
2000
4000
6000
8000
10000

Handling Categorical Values

[33]:
```
df.dtypes
```

[33]:
```
Day_of_week                   object
Age_band_of_driver            object
Sex_of_driver                 object
Educational_level             object
Vehicle_driver_relation       object
Driving_experience            object
Type_of_vehicle               object
Owner_of_vehicle              object
Area_accident_occured         object
Lanes_or_Medians              object
Road_allignment               object
Types_of_Junction             object
Road_surface_type             object
Road_surface_conditions       object
Light_conditions              object
Weather_conditions            object
Type_of_collision             object
Number_of_vehicles_involved    int64
Number_of_casualties           int64
Vehicle_movement              object
Casualty_class                object
Sex_of_casualty               object
Age_band_of_casualty          object
Casualty_severity             object
Pedestrian_movement           object
Cause_of_accident             object
Accident_severity             object
dtype: object
```

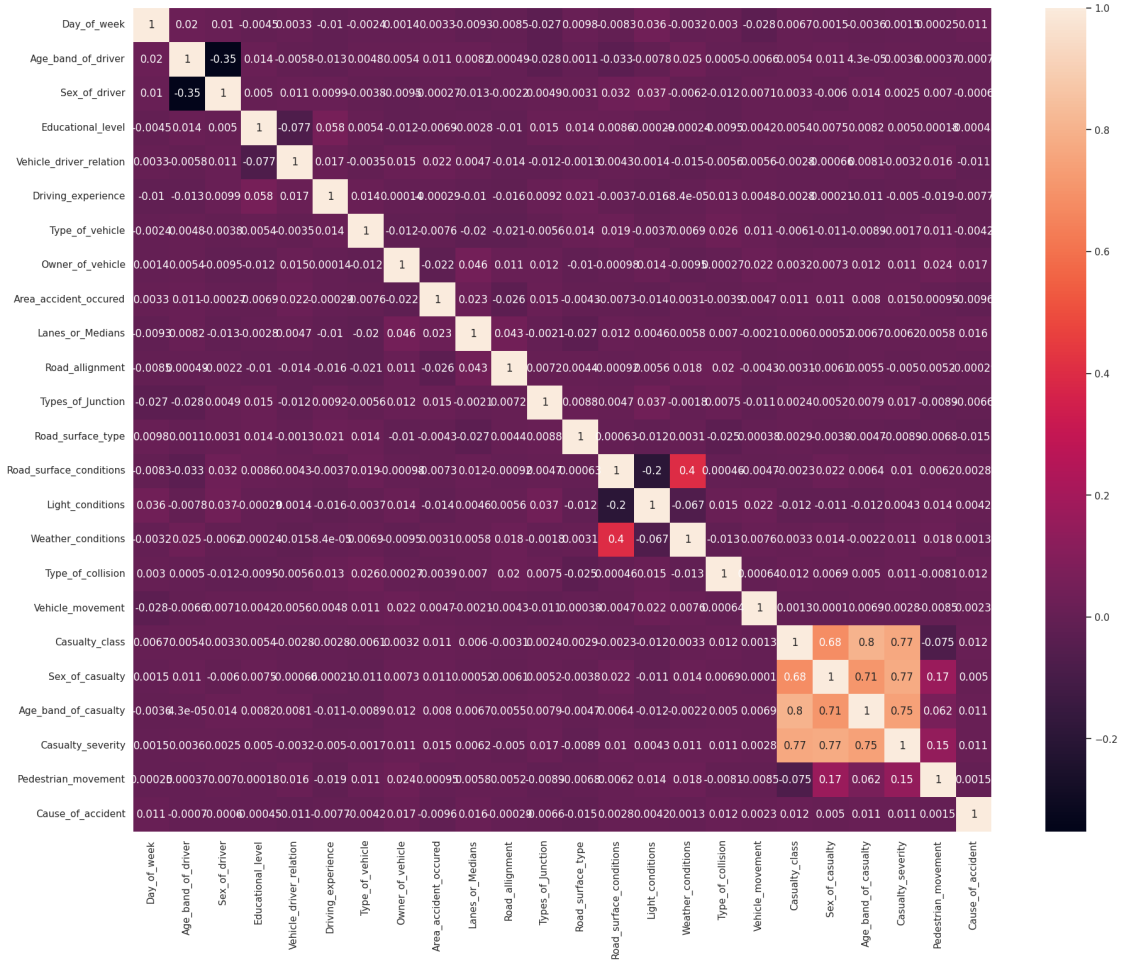
[34]:
```
from sklearn.preprocessing import LabelEncoder
le=LabelEncoder()


df1=pd.DataFrame()


for i in categorical:
    if i!= 'Accident_severity':
        df1[i]=le.fit_transform(df[i])
```

[35]:
```
df1.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 12316 entries, 0 to 12315
Data columns (total 24 columns):
 #   Column                    Non-Null Count  Dtype
---  ------                    --------------  -----
 0   Day_of_week               12316 non-null  int64
 1   Age_band_of_driver        12316 non-null  int64
 2   Sex_of_driver             12316 non-null  int64
 3   Educational_level         12316 non-null  int64
 4   Vehicle_driver_relation   12316 non-null  int64
 5   Driving_experience        12316 non-null  int64
 6   Type_of_vehicle           12316 non-null  int64
 7   Owner_of_vehicle          12316 non-null  int64
 8   Area_accident_occured     12316 non-null  int64
 9   Lanes_or_Medians          12316 non-null  int64
 10  Road_allignment           12316 non-null  int64
 11  Types_of_Junction         12316 non-null  int64
 12  Road_surface_type         12316 non-null  int64
 13  Road_surface_conditions   12316 non-null  int64
 14  Light_conditions          12316 non-null  int64
 15  Weather_conditions        12316 non-null  int64
 16  Type_of_collision         12316 non-null  int64
 17  Vehicle_movement          12316 non-null  int64
 18  Casualty_class            12316 non-null  int64
 19  Sex_of_casualty           12316 non-null  int64
 20  Age_band_of_casualty      12316 non-null  int64
 21  Casualty_severity         12316 non-null  int64
 22  Pedestrian_movement       12316 non-null  int64
 23  Cause_of_accident         12316 non-null  int64
dtypes: int64(24)
memory usage: 2.3 MB
```

[36]:
```
plt.figure(figsize=(22,17))
sns.set(font_scale=1)
sns.heatmap(df1.corr(), annot=True)
```

[36]: <Axes: >



[37]:
```
df1.head()
```

[37]:

	Day_of_week	Age_band_of_driver	Sex_of_driver	Educational_level	\
0	1	0	1	0	
1	1	1	1	4	
2	1	0	1	4	
3	3	0	1	4	
4	3	0	1	4	

	Vehicle_driver_relation	Driving_experience	Type_of_vehicle	\
0	0	0	0	
1	0	3	11	
2	0	0	5	
3	0	2	11	
4	0	1	0	

	Owner_of_vehicle	Area_accident_occured	Lanes_or_Medians	…	\

```
0                3                    9                2  …
1                3                    6                4  …
2                3                    1                6  …
3                0                    6                6  …
4                3                    4                6  …

   Light_conditions  Weather_conditions  Type_of_collision  Vehicle_movement  \
0                 3                   2                  3                 2
1                 3                   2                  8                 2
2                 3                   2                  2                 2
3                 0                   2                  8                 2
4                 0                   2                  8                 2

   Casualty_class  Sex_of_casualty  Age_band_of_casualty  Casualty_severity  \
0               3                2                     5                  3
1               3                2                     5                  3
2               0                1                     1                  2
3               2                0                     0                  2
4               3                2                     5                  3

   Pedestrian_movement  Cause_of_accident
0                    5                  9
1                    5                 16
2                    5                  0
3                    5                  1
4                    5                 16

[5 rows x 24 columns]
```

[38]:
```
from sklearn.feature_selection import chi2
f_p_values=chi2(df1,df['Accident_severity'])
```

[39]:
```
f_p_values
```

[39]:
```
(array([ 0.15822071,  8.91539214,  0.1431894 ,  0.17458477,  5.34534549,
         4.49967858,  1.07767124,  1.10426215,  3.61654037,  3.28161464,
         0.1319306 ,  3.08648691,  6.99480557,  0.61510308, 16.08282359,
         1.14934538, 10.09632283,  2.20071197,  3.2168602 ,  0.12594479,
        13.77841337,  0.20273788,  0.39747982,  3.19366551]),
 array([9.23937958e-01, 1.15890328e-02, 9.30908116e-01, 9.16409114e-01,
        6.90673790e-02, 1.05416165e-01, 5.83427189e-01, 5.75721597e-01,
        1.63937473e-01, 1.93823502e-01, 9.36163348e-01, 2.13686893e-01,
        3.02759144e-02, 7.35244973e-01, 3.21854237e-04, 5.62889079e-01,
        6.42112839e-03, 3.32752607e-01, 2.00201664e-01, 9.38969394e-01,
        1.01872169e-03, 9.03599597e-01, 8.19763078e-01, 2.02536988e-01]))
```

[40]:
```
f_p_values1=pd.DataFrame({'features':df1.columns, 'Fscore': f_p_values[0],␣
↪'Pvalues':f_p_values[1]})
f_p_values1
```

[40]:

	features	Fscore	Pvalues
0	Day_of_week	0.158221	0.923938
1	Age_band_of_driver	8.915392	0.011589
2	Sex_of_driver	0.143189	0.930908
3	Educational_level	0.174585	0.916409
4	Vehicle_driver_relation	5.345345	0.069067
5	Driving_experience	4.499679	0.105416
6	Type_of_vehicle	1.077671	0.583427
7	Owner_of_vehicle	1.104262	0.575722
8	Area_accident_occured	3.616540	0.163937
9	Lanes_or_Medians	3.281615	0.193824
10	Road_allignment	0.131931	0.936163
11	Types_of_Junction	3.086487	0.213687
12	Road_surface_type	6.994806	0.030276
13	Road_surface_conditions	0.615103	0.735245
14	Light_conditions	16.082824	0.000322
15	Weather_conditions	1.149345	0.562889
16	Type_of_collision	10.096323	0.006421
17	Vehicle_movement	2.200712	0.332753
18	Casualty_class	3.216860	0.200202
19	Sex_of_casualty	0.125945	0.938969
20	Age_band_of_casualty	13.778413	0.001019
21	Casualty_severity	0.202738	0.903600
22	Pedestrian_movement	0.397480	0.819763
23	Cause_of_accident	3.193666	0.202537

[42]:
```
f_p_values1.sort_values(by='Pvalues',ascending=True)
```

[42]:

	features	Fscore	Pvalues
14	Light_conditions	16.082824	0.000322
20	Age_band_of_casualty	13.778413	0.001019
16	Type_of_collision	10.096323	0.006421
1	Age_band_of_driver	8.915392	0.011589
12	Road_surface_type	6.994806	0.030276
4	Vehicle_driver_relation	5.345345	0.069067
5	Driving_experience	4.499679	0.105416
8	Area_accident_occured	3.616540	0.163937
9	Lanes_or_Medians	3.281615	0.193824
18	Casualty_class	3.216860	0.200202
23	Cause_of_accident	3.193666	0.202537
11	Types_of_Junction	3.086487	0.213687
17	Vehicle_movement	2.200712	0.332753
15	Weather_conditions	1.149345	0.562889

```
7          Owner_of_vehicle   1.104262  0.575722
6           Type_of_vehicle   1.077671  0.583427
13  Road_surface_conditions   0.615103  0.735245
22      Pedestrian_movement   0.397480  0.819763
21        Casualty_severity   0.202738  0.903600
3         Educational_level   0.174585  0.916409
0               Day_of_week   0.158221  0.923938
2             Sex_of_driver   0.143189  0.930908
10          Road_allignment   0.131931  0.936163
19          Sex_of_casualty   0.125945  0.938969
```

[43]:
```
df2=df.drop(['Owner_of_vehicle', 'Type_of_vehicle', 'Road_surface_conditions',␣
↪'Pedestrian_movement',
       ␣
↪'Casualty_severity','Educational_level','Day_of_week','Sex_of_driver','Road_allignment',
        'Sex_of_casualty'],axis=1)
df2.head()
```

[43]:
```
  Age_band_of_driver Vehicle_driver_relation Driving_experience  \
0              18-30                Employee             1-2yr
1              31-50                Employee         Above 10yr
2              18-30                Employee             1-2yr
3              18-30                Employee            5-10yr
4              18-30                Employee             2-5yr

  Area_accident_occured                                    Lanes_or_Medians  \
0     Residential areas  Two-way (divided with broken lines road marking)
1          Office areas                                 Undivided Two way
2    Recreational areas                                             other
3          Office areas                                             other
4      Industrial areas                                             other

  Types_of_Junction Road_surface_type       Light_conditions  \
0       No junction     Asphalt roads               Daylight
1       No junction     Asphalt roads               Daylight
2       No junction     Asphalt roads               Daylight
3           Y Shape       Earth roads  Darkness - lights lit
4           Y Shape     Asphalt roads  Darkness - lights lit

  Weather_conditions                         Type_of_collision  \
0             Normal  Collision with roadside-parked vehicles
1             Normal           Vehicle with vehicle collision
2             Normal          Collision with roadside objects
3             Normal           Vehicle with vehicle collision
4             Normal           Vehicle with vehicle collision

   Number_of_vehicles_involved  Number_of_casualties Vehicle_movement  \
```

```
0                          2                    2   Going straight
1                          2                    2   Going straight
2                          2                    2   Going straight
3                          2                    2   Going straight
4                          2                    2   Going straight

    Casualty_class Age_band_of_casualty           Cause_of_accident  \
0               na                    na             Moving Backward
1               na                    na                   Overtaking
2  Driver or rider                 31-50   Changing lane to the left
3       Pedestrian                 18-30  Changing lane to the right
4               na                    na                   Overtaking

  Accident_severity
0     Slight Injury
1     Slight Injury
2    Serious Injury
3     Slight Injury
4     Slight Injury
```

[44]:
```
df2.shape
```

[44]:
```
(12316, 17)
```

[45]:
```
df2.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 12316 entries, 0 to 12315
Data columns (total 17 columns):
 #   Column                       Non-Null Count  Dtype
---  ------                       --------------  -----
 0   Age_band_of_driver           12316 non-null  object
 1   Vehicle_driver_relation      12316 non-null  object
 2   Driving_experience           12316 non-null  object
 3   Area_accident_occured        12316 non-null  object
 4   Lanes_or_Medians             12316 non-null  object
 5   Types_of_Junction            12316 non-null  object
 6   Road_surface_type            12316 non-null  object
 7   Light_conditions             12316 non-null  object
 8   Weather_conditions           12316 non-null  object
 9   Type_of_collision            12316 non-null  object
 10  Number_of_vehicles_involved  12316 non-null  int64
 11  Number_of_casualties         12316 non-null  int64
 12  Vehicle_movement             12316 non-null  object
 13  Casualty_class               12316 non-null  object
 14  Age_band_of_casualty         12316 non-null  object
 15  Cause_of_accident            12316 non-null  object
```

```
 16  Accident_severity           12316 non-null  object
dtypes: int64(2), object(15)
memory usage: 1.6+ MB
```

[46]:
```
categorical_new=[i for i in df2.columns if df2[i].dtype=='O']
print(categorical_new)
```

```
['Age_band_of_driver', 'Vehicle_driver_relation', 'Driving_experience',
'Area_accident_occured', 'Lanes_or_Medians', 'Types_of_Junction',
'Road_surface_type', 'Light_conditions', 'Weather_conditions',
'Type_of_collision', 'Vehicle_movement', 'Casualty_class',
'Age_band_of_casualty', 'Cause_of_accident', 'Accident_severity']
```

[47]:
```
for i in categorical_new:
    print(df2[i].value_counts())
```

```
Age_band_of_driver
18-30       4271
31-50       4087
Over 51     1585
Unknown     1548
Under 18     825
Name: count, dtype: int64
Vehicle_driver_relation
Employee    10206
Owner        1973
Other         123
Unknown        14
Name: count, dtype: int64
Driving_experience
5-10yr        4192
2-5yr         2613
Above 10yr    2262
1-2yr         1756
Below 1yr     1342
No Licence     118
unknown         33
Name: count, dtype: int64
Area_accident_occured
Other                          4058
Office areas                   3451
Residential areas              2060
 Church areas                  1060
 Industrial areas               456
School areas                    415
  Recreational areas            327
 Outside rural areas            218
 Hospital areas                 121
```

```
  Market areas                        63
Rural village areas                   44
Unknown                               22
Rural village areasOffice areas       20
Recreational areas                     1
Name: count, dtype: int64
Lanes_or_Medians
Two-way (divided with broken lines road marking)    4796
Undivided Two way                                   3796
other                                               1660
Double carriageway (median)                         1020
One way                                              845
Two-way (divided with solid lines road marking)      142
Unknown                                               57
Name: count, dtype: int64
Types_of_Junction
Y Shape        5430
No junction    3837
Crossing       2177
Other           445
Unknown         191
O Shape         164
T Shape          60
X Shape          12
Name: count, dtype: int64
Road_surface_type
Asphalt roads                       11468
Earth roads                           358
Gravel roads                          242
Other                                 167
Asphalt roads with some distress       81
Name: count, dtype: int64
Light_conditions
Daylight                   8798
Darkness - lights lit      3286
Darkness - no lighting      192
Darkness - lights unlit      40
Name: count, dtype: int64
Weather_conditions
Normal               10063
Raining               1331
Other                  296
Unknown                292
Cloudy                 125
Windy                   98
Snow                    61
Raining and Windy       40
Fog or mist             10
```

```
Name: count, dtype: int64
Type_of_collision
Vehicle with vehicle collision             8929
Collision with roadside objects            1786
Collision with pedestrians                  896
Rollover                                    397
Collision with animals                      171
Collision with roadside-parked vehicles      54
Fall from vehicles                           34
Other                                        26
Unknown                                      14
With Train                                    9
Name: count, dtype: int64
Vehicle_movement
Going straight         8466
Moving Backward         985
Other                   937
Reversing               563
Turnover                489
Getting off             339
Entering a junction     193
Overtaking               96
Unknown                  88
Stopping                 61
U-Turn                   50
Waiting to go            39
Parked                   10
Name: count, dtype: int64
Casualty_class
Driver or rider    4944
na                 4443
Pedestrian         1649
Passenger          1280
Name: count, dtype: int64
Age_band_of_casualty
na          4443
18-30       3145
31-50       2455
Under 18    1035
Over 51      994
5            244
Name: count, dtype: int64
Cause_of_accident
No distancing                          2263
Changing lane to the right             1808
Changing lane to the left              1473
Driving carelessly                     1402
No priority to vehicle                 1207
```

```
Moving Backward                          1137
No priority to pedestrian                 721
Other                                     456
Overtaking                                430
Driving under the influence of drugs      340
Driving to the left                       284
Getting off the vehicle improperly        197
Driving at high speed                     174
Overturning                               149
Turnover                                   78
Overspeed                                  61
Overloading                                59
Drunk driving                              27
Unknown                                    25
Improper parking                           25
Name: count, dtype: int64
Accident_severity
Slight Injury     10415
Serious Injury     1743
Fatal injury        158
Name: count, dtype: int64
```

[48]:
```
dummy=pd.get_dummies(df2[['Age_band_of_driver', 'Vehicle_driver_relation',␣
↪'Driving_experience',
                          'Area_accident_occured', 'Lanes_or_Medians',␣
↪'Types_of_Junction', 'Road_surface_type',
                          'Light_conditions', 'Weather_conditions',␣
↪'Type_of_collision', 'Vehicle_movement',
                          'Casualty_class', 'Age_band_of_casualty',␣
↪'Cause_of_accident']],drop_first=True)
dummy.head()
```

[48]:
```
   Age_band_of_driver_31-50  Age_band_of_driver_Over 51  \
0                     False                       False
1                      True                       False
2                     False                       False
3                     False                       False
4                     False                       False

   Age_band_of_driver_Under 18  Age_band_of_driver_Unknown  \
0                        False                       False
1                        False                       False
2                        False                       False
3                        False                       False
4                        False                       False

   Vehicle_driver_relation_Other  Vehicle_driver_relation_Owner  \
```

```
0                          False                           False
1                          False                           False
2                          False                           False
3                          False                           False
4                          False                           False

   Vehicle_driver_relation_Unknown  Driving_experience_2-5yr  \
0                            False                     False
1                            False                     False
2                            False                     False
3                            False                     False
4                            False                      True

   Driving_experience_5-10yr  Driving_experience_Above 10yr  …  \
0                      False                          False  …
1                      False                           True  …
2                      False                          False  …
3                       True                          False  …
4                      False                          False  …

   Cause_of_accident_No distancing  \
0                            False
1                            False
2                            False
3                            False
4                            False

   Cause_of_accident_No priority to pedestrian  \
0                                        False
1                                        False
2                                        False
3                                        False
4                                        False

   Cause_of_accident_No priority to vehicle  Cause_of_accident_Other  \
0                                     False                    False
1                                     False                    False
2                                     False                    False
3                                     False                    False
4                                     False                    False

   Cause_of_accident_Overloading  Cause_of_accident_Overspeed  \
0                          False                        False
1                          False                        False
2                          False                        False
3                          False                        False
4                          False                        False
```

```
   Cause_of_accident_Overtaking  Cause_of_accident_Overturning  \
0                         False                          False
1                          True                          False
2                         False                          False
3                         False                          False
4                          True                          False

   Cause_of_accident_Turnover  Cause_of_accident_Unknown
0                       False                      False
1                       False                      False
2                       False                      False
3                       False                      False
4                       False                      False

[5 rows x 102 columns]
```

[49]:
```
df3=pd.concat([df2,dummy],axis=1)
df3.head()
```

[49]:
```
  Age_band_of_driver Vehicle_driver_relation Driving_experience  \
0              18-30               Employee              1-2yr
1              31-50               Employee         Above 10yr
2              18-30               Employee              1-2yr
3              18-30               Employee             5-10yr
4              18-30               Employee              2-5yr

  Area_accident_occured                                    Lanes_or_Medians  \
0     Residential areas  Two-way (divided with broken lines road marking)
1          Office areas                                 Undivided Two way
2    Recreational areas                                             other
3          Office areas                                             other
4      Industrial areas                                             other

  Types_of_Junction Road_surface_type       Light_conditions  \
0       No junction     Asphalt roads               Daylight
1       No junction     Asphalt roads               Daylight
2       No junction     Asphalt roads               Daylight
3           Y Shape       Earth roads  Darkness - lights lit
4           Y Shape     Asphalt roads  Darkness - lights lit

  Weather_conditions                       Type_of_collision  …  \
0             Normal  Collision with roadside-parked vehicles  …
1             Normal           Vehicle with vehicle collision  …
2             Normal          Collision with roadside objects  …
3             Normal           Vehicle with vehicle collision  …
4             Normal           Vehicle with vehicle collision  …
```

```
   Cause_of_accident_No distancing  \
0                            False
1                            False
2                            False
3                            False
4                            False

   Cause_of_accident_No priority to pedestrian  \
0                                        False
1                                        False
2                                        False
3                                        False
4                                        False

  Cause_of_accident_No priority to vehicle Cause_of_accident_Other  \
0                                    False                   False
1                                    False                   False
2                                    False                   False
3                                    False                   False
4                                    False                   False

  Cause_of_accident_Overloading Cause_of_accident_Overspeed  \
0                         False                        False
1                         False                        False
2                         False                        False
3                         False                        False
4                         False                        False

  Cause_of_accident_Overtaking  Cause_of_accident_Overturning  \
0                        False                          False
1                         True                          False
2                        False                          False
3                        False                          False
4                         True                          False

   Cause_of_accident_Turnover  Cause_of_accident_Unknown
0                       False                     False
1                       False                     False
2                       False                     False
3                       False                     False
4                       False                     False

[5 rows x 119 columns]
```

[50]:
```
df3.drop(['Age_band_of_driver', 'Vehicle_driver_relation',␣
 ↪'Driving_experience', 'Area_accident_occured', 'Lanes_or_Medians',
```

```
        'Types_of_Junction', 'Road_surface_type', 'Light_conditions',␣
↪'Weather_conditions', 'Type_of_collision',
        'Vehicle_movement','Casualty_class', 'Age_band_of_casualty',␣
↪'Cause_of_accident'],axis=1,inplace=True)
df3.head()
```

[50]:

	Number_of_vehicles_involved	Number_of_casualties	Accident_severity	Age_band_of_driver_31-50	Age_band_of_driver_Over 51	Age_band_of_driver_Under 18	Age_band_of_driver_Unknown	Vehicle_driver_relation_Other	Vehicle_driver_relation_Owner	Vehicle_driver_relation_Unknown	…	Cause_of_accident_No distancing	Cause_of_accident_No priority to pedestrian
0	2	2	Slight Injury	False	False	False	False	False	False	False	…	False	False
1	2	2	Slight Injury	True	False	False	False	False	False	False	…	False	False
2	2	2	Serious Injury	False	False	False	False	False	False	False	…	False	False
3	2	2	Slight Injury	False	False	False	False	False	False	False	…	False	False
4	2	2	Slight Injury	False	False	False	False	False	False	False	…	False	False

```
   Cause_of_accident_No priority to vehicle  Cause_of_accident_Other  \
0                                     False                   False
1                                     False                   False
2                                     False                   False
3                                     False                   False
4                                     False                   False

   Cause_of_accident_Overloading  Cause_of_accident_Overspeed  \
0                          False                        False
1                          False                        False
2                          False                        False
3                          False                        False
4                          False                        False

   Cause_of_accident_Overtaking  Cause_of_accident_Overturning  \
0                         False                          False
1                          True                          False
2                         False                          False
3                         False                          False
4                          True                          False

   Cause_of_accident_Turnover  Cause_of_accident_Unknown
0                       False                     False
1                       False                     False
2                       False                     False
3                       False                     False
4                       False                     False

[5 rows x 105 columns]
```

Seperating Independent and Dependent

[51]:
```
x=df3.drop(['Accident_severity'],axis=1)
x.shape
```

[51]:
```
(12316, 104)
```

[52]:
```
x.head()
```

[52]:
```
   Number_of_vehicles_involved  Number_of_casualties  \
0                            2                     2
1                            2                     2
2                            2                     2
3                            2                     2
4                            2                     2
```

```
   Age_band_of_driver_31-50  Age_band_of_driver_Over 51  \
0                     False                       False
1                      True                       False
2                     False                       False
3                     False                       False
4                     False                       False

   Age_band_of_driver_Under 18  Age_band_of_driver_Unknown  \
0                        False                       False
1                        False                       False
2                        False                       False
3                        False                       False
4                        False                       False

   Vehicle_driver_relation_Other  Vehicle_driver_relation_Owner  \
0                          False                          False
1                          False                          False
2                          False                          False
3                          False                          False
4                          False                          False

   Vehicle_driver_relation_Unknown  Driving_experience_2-5yr  …  \
0                            False                     False  …
1                            False                     False  …
2                            False                     False  …
3                            False                     False  …
4                            False                      True  …

   Cause_of_accident_No distancing  \
0                            False
1                            False
2                            False
3                            False
4                            False

   Cause_of_accident_No priority to pedestrian  \
0                                        False
1                                        False
2                                        False
3                                        False
4                                        False

   Cause_of_accident_No priority to vehicle  Cause_of_accident_Other  \
0                                     False                    False
1                                     False                    False
2                                     False                    False
3                                     False                    False
```

```
4                                    False                    False

   Cause_of_accident_Overloading  Cause_of_accident_Overspeed  \
0                          False                        False
1                          False                        False
2                          False                        False
3                          False                        False
4                          False                        False

   Cause_of_accident_Overtaking  Cause_of_accident_Overturning  \
0                         False                         False
1                          True                         False
2                         False                         False
3                         False                         False
4                          True                         False

   Cause_of_accident_Turnover  Cause_of_accident_Unknown
0                       False                      False
1                       False                      False
2                       False                      False
3                       False                      False
4                       False                      False

[5 rows x 104 columns]
```

[53]:
```
y=df3.iloc[:,2]
y.head()
```

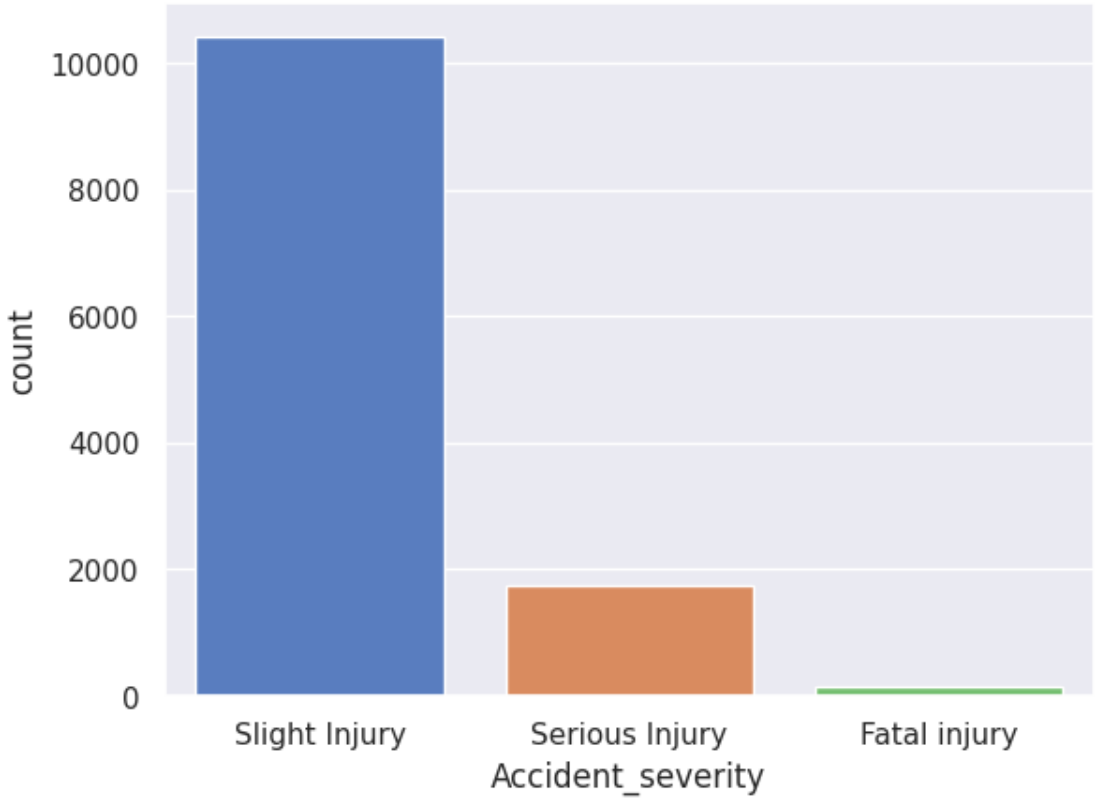
[53]:
```
0     Slight Injury
1     Slight Injury
2    Serious Injury
3     Slight Injury
4     Slight Injury
Name: Accident_severity, dtype: object
```

[54]:
```
y.value_counts()
```

[54]:
```
Accident_severity
Slight Injury     10415
Serious Injury     1743
Fatal injury        158
Name: count, dtype: int64
```

[55]:
```
sns.countplot(x = y, palette='muted')
```

[55]:
```
<Axes: xlabel='Accident_severity', ylabel='count'>
```



Oversampling

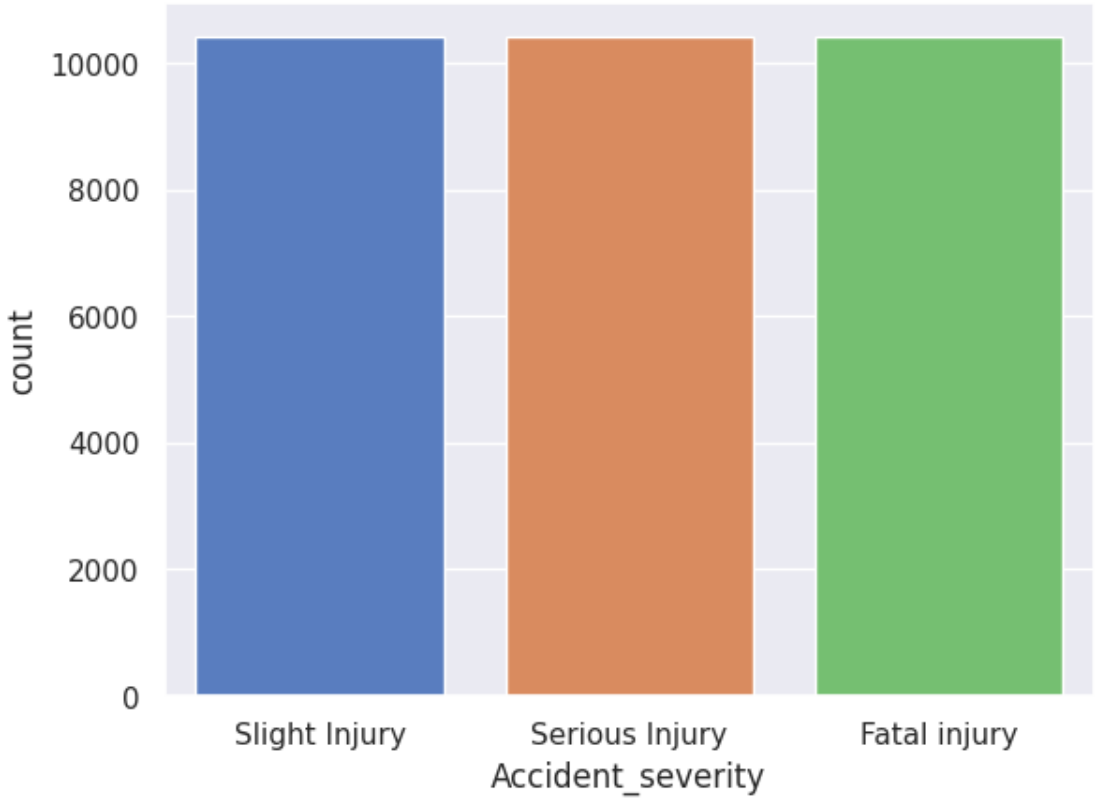
[56]:
```
from imblearn.over_sampling import SMOTE
oversample=SMOTE()
xo,yo=oversample.fit_resample(x,y)
```

[57]:
```
y1=pd.DataFrame(yo)
y1.value_counts()
```

[57]:
```
Accident_severity
Fatal injury         10415
Serious Injury       10415
Slight Injury        10415
Name: count, dtype: int64
```

[58]:
```
sns.countplot(x = yo, palette='muted')
```

[58]:
```
<Axes: xlabel='Accident_severity', ylabel='count'>
```



Splitting Data

[59]:
```
from sklearn.model_selection import train_test_split
#splitting 70% of the data to training data and 30% of data to testing data
x_train,x_test,y_train,y_test=train_test_split(xo,yo,test_size=0.
↪30,random_state=42)
```

[60]:
```
print(x_train.shape,x_test.shape,y_train.shape,y_test.shape)
```

```
(21871, 104) (9374, 104) (21871,) (9374,)
```

KNN MODEL CREATION

[61]:
```
#KNN model alg
from sklearn.neighbors import KNeighborsClassifier
model_KNN=KNeighborsClassifier(n_neighbors=5)
model_KNN.fit(x_train,y_train)
```

[61]:
```
KNeighborsClassifier()
```

Prediction

[62]:
```
y_pred=model_KNN.predict(x_test)
```

[63]:
```
y_pred
```

[63]:
```
array(['Serious Injury', 'Serious Injury', 'Slight Injury', …,
       'Fatal injury', 'Serious Injury', 'Serious Injury'], dtype=object)
```

[64]:
```
from sklearn.metrics import␣
↪classification_report,confusion_matrix,accuracy_score,ConfusionMatrixDisplay
```

Classification Report

[65]:
```
report_KNN=classification_report(y_test,y_pred)
print(report_KNN)
```

```
              precision    recall  f1-score   support

  Fatal injury       0.79      1.00      0.88      3126
Serious Injury       0.64      0.90      0.75      3144
 Slight Injury       0.97      0.32      0.48      3104

      accuracy                           0.74      9374
     macro avg       0.80      0.74      0.70      9374
  weighted avg       0.80      0.74      0.71      9374
```

Accuracy Score

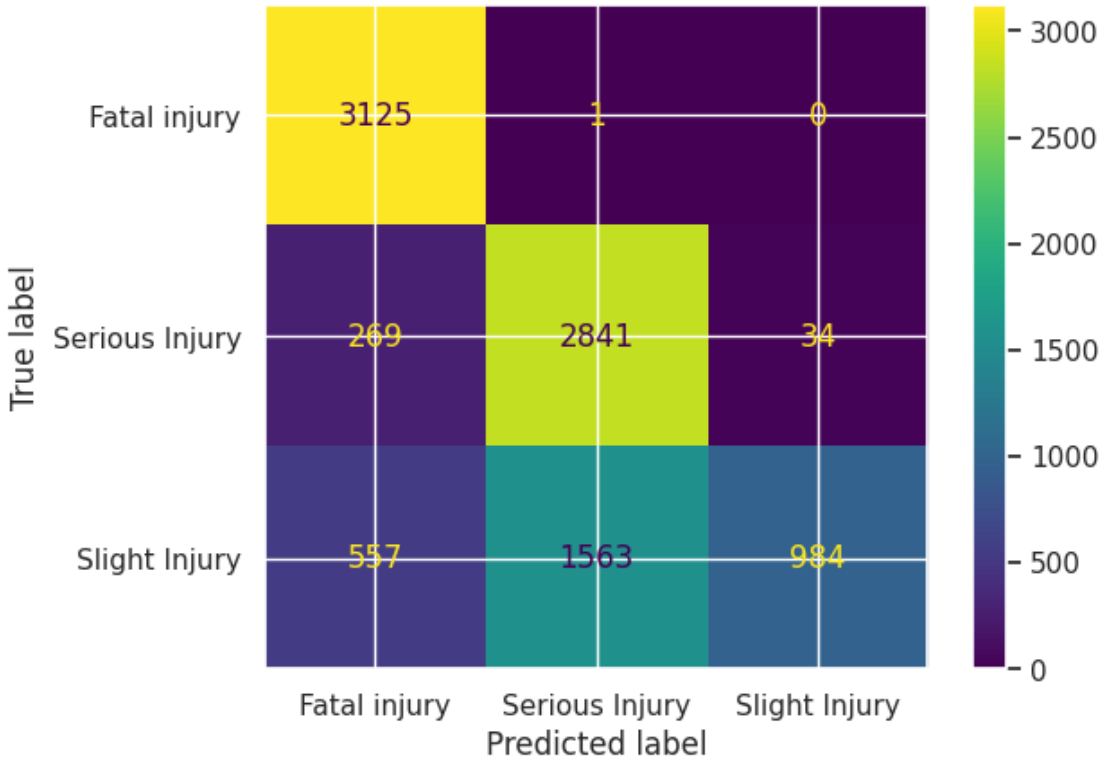
[68]:
```
accuracy_KNN=accuracy_score(y_test,y_pred)
print(accuracy_KNN)
```

```
0.7414124173245146
```

Confusion Matrix

[67]:
```
matrix_KNN=confusion_matrix(y_test,y_pred)
print(matrix_KNN,'\n')
print(ConfusionMatrixDisplay.from_predictions(y_test,y_pred))
```

```
[[3125    1    0]
 [ 269 2841   34]
 [ 557 1563  984]]

<sklearn.metrics._plot.confusion_matrix.ConfusionMatrixDisplay object at
0x7d203404ff10>
```


Fatal injury
Serious Injury
Slight Injury
True label
3125
1
0
269
2841
34
557
1563
984
Fatal injury
Serious Injury
Slight Injury
Predicted label
3000
2500
2000
1500
1000
500
0

[ ]: