PE29 Vasu Kalariya

IMLA Lab Assi 2 Data Preprocessing

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

```
ds = pd.read_csv('FireData.csv')
ds
```

	_id	Area_of_Origin	Building_Status	Business_Impact	Civilian_Casualties	Count_of_Persons_Rescued	Estimated_Dollar_Loss	Estimated_Number_Of_Persons_Displaced	Exposures	Ext_agen
0	190306	81 - Engine Area	NaN	NaN	0	0	1000.0	NaN	NaN	

```
ds.isnull().sum()
```

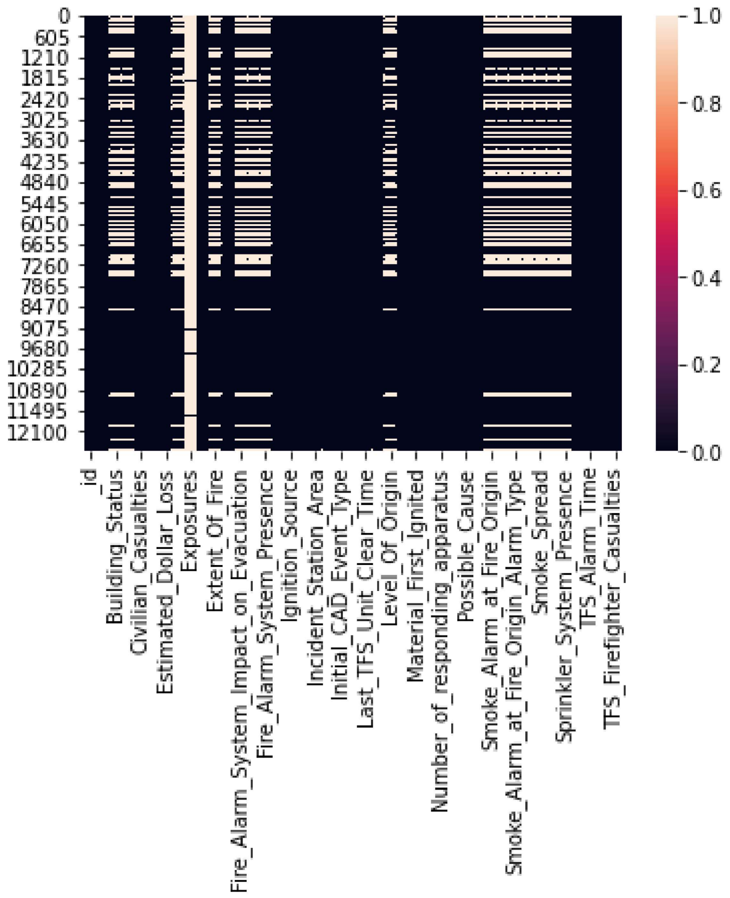
```
_id                                                          0
Area_of_Origin                                               0
Building_Status                                           3482
Business_Impact                                           3484
Civilian_Casualties                                          0
Count_of_Persons_Rescued                                     0
Estimated_Dollar_Loss                                        1
Estimated_Number_Of_Persons_Displaced                     3483
Exposures                                                12408
Ext_agent_app_or_defer_time                                  0
Extent_Of_Fire                                            3484
Final_Incident_Type                                          0
Fire_Alarm_System_Impact_on_Evacuation                    3484
Fire_Alarm_System_Operation                               3484
Fire_Alarm_System_Presence                                3484
Fire_Under_Control_Time                                      1
Ignition_Source                                              0
Incident_Number                                              0
Incident_Station_Area                                        0
Incident_Ward                                               74
Initial_CAD_Event_Type                                       0
Intersection                                                 1
Last_TFS_Unit_Clear_Time                                     0
Latitude                                                     1
Level_Of_Origin                                           3484
Longitude                                                    1
Material_First_Ignited                                       0
Method_Of_Fire_Control                                       0
Number_of_responding_apparatus                               0
Number_of_responding_personnel                               0
Possible_Cause                                               0
Property_Use                                                 1
Smoke_Alarm_at_Fire_Origin                                3484
Smoke_Alarm_at_Fire_Origin_Alarm_Failure                  3484
Smoke_Alarm_at_Fire_Origin_Alarm_Type                     3484
Smoke_Alarm_Impact_on_Persons_Evacuating_Impact_on_Evacuation    3484
Smoke_Spread                                              3484
Sprinkler_System_Operation                                3484
Sprinkler_System_Presence                                 3484
Status_of_Fire_On_Arrival                                    0
TFS_Alarm_Time                                               0
TFS_Arrival_Time                                             0
TFS_Firefighter_Casualties                                   0
dtype: int64
```

```
ds.shape
```

```
(12687, 43)
```

```
sns.heatmap(ds.isnull())
```

```
<AxesSubplot:>
```



```
ds.dropna(subset=['Building_Status'], inplace = True)
```

```
ds.isnull().sum()
```

```
_id                                                                 0
Area_of_Origin                                                      0
Building_Status                                                     0
Business_Impact                                                     2
Civilian_Casualties                                                 0
Count_of_Persons_Rescued                                            0
Estimated_Dollar_Loss                                               0
Estimated_Number_Of_Persons_Displaced                               1
Exposures                                                        8994
Ext_agent_app_or_defer_time                                         0
Extent_Of_Fire                                                      2
Final_Incident_Type                                                 0
Fire_Alarm_System_Impact_on_Evacuation                              2
Fire_Alarm_System_Operation                                         2
Fire_Alarm_System_Presence                                          2
Fire_Under_Control_Time                                             0
Ignition_Source                                                     0
Incident_Number                                                     0
Incident_Station_Area                                               0
```

```
Incident_Ward                                                      30
Initial_CAD_Event_Type                                              0
Intersection                                                        0
Last_TFS_Unit_Clear_Time                                            0
Latitude                                                            0
Level_Of_Origin                                                     2
Longitude                                                           0
Material_First_Ignited                                              0
Method_Of_Fire_Control                                              0
Number_of_responding_apparatus                                      0
Number_of_responding_personnel                                      0
Possible_Cause                                                      0
Property_Use                                                        0
Smoke_Alarm_at_Fire_Origin                                          2
Smoke_Alarm_at_Fire_Origin_Alarm_Failure                            2
Smoke_Alarm_at_Fire_Origin_Alarm_Type                               2
Smoke_Alarm_Impact_on_Persons_Evacuating_Impact_on_Evacuation       2
Smoke_Spread                                                        2
Sprinkler_System_Operation                                          2
Sprinkler_System_Presence                                           2
Status_of_Fire_On_Arrival                                           0
TFS_Alarm_Time                                                      0
TFS_Arrival_Time                                                    0
TFS_Firefighter_Casualties                                          0
dtype: int64
```

```
ds['Exposures'].unique()
```

```
array([nan,  1.,  3.,  2.,  4.,  6.,  5.,  7.])
```

```
Exposures1 = ds.iloc[:,8:9].values
Exposures2 = ds.iloc[:,8:9].values
Exposures3 = ds.iloc[:,8:9].values
Exposures1
```

```
array([[nan],
       [nan],
       [nan],
       ...,
       [nan],
       [nan],
       [nan]])
```

Imputer for Missing values

```
from sklearn.impute import SimpleImputer
si1 = SimpleImputer(missing_values=np.nan, strategy='mean')
si1.fit(Exposures1)
Exposures1 = si1.transform(Exposures1)
Exposures1 = pd.DataFrame(Exposures1, columns=['Exposures1'])
Exposures1
```

```
      Exposures1
   0    1.649289
   1    1.649289
   2    1.649289
   3    1.649289
   4    1.649289
 ...         ...
9200    1.649289
9201    1.649289
9202    1.649289
9203    1.649289
9204    1.649289
9205 rows × 1 columns
```

```
si2 = SimpleImputer(missing_values=np.nan,strategy='median')
si2.fit(Exposures2)
Exposures2 = si2.transform(Exposures2)
Exposures2 = pd.DataFrame(Exposures2, columns=['Exposures2'])
Exposures2
```

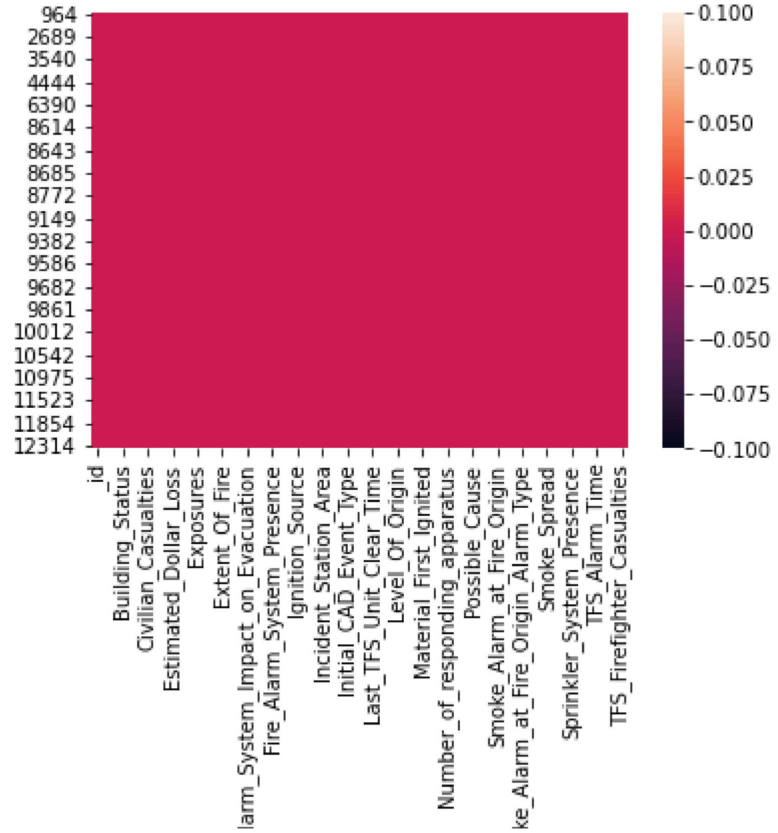
```
ds.isnull().sum()
```

```
    _id                                                                   0
    Area_of_Origin                                                        0
    Building_Status                                                       0
    Business_Impact                                                       2
    Civilian_Casualties                                                   0
    Count_of_Persons_Rescued                                              0
    Estimated_Dollar_Loss                                                 0
    Estimated_Number_Of_Persons_Displaced                                 1
    Exposures                                                          8994
    Ext_agent_app_or_defer_time                                           0
    Extent_Of_Fire                                                        2
    Final_Incident_Type                                                   0
    Fire_Alarm_System_Impact_on_Evacuation                                2
    Fire_Alarm_System_Operation                                           2
    Fire_Alarm_System_Presence                                            2
    Fire_Under_Control_Time                                               0
    Ignition_Source                                                       0
    Incident_Number                                                       0
    Incident_Station_Area                                                 0
    Incident_Ward                                                        30
    Initial_CAD_Event_Type                                                0
    Intersection                                                          0
    Last_TFS_Unit_Clear_Time                                              0
    Latitude                                                              0
    Level_Of_Origin                                                       2
    Longitude                                                             0
    Material_First_Ignited                                                0
    Method_Of_Fire_Control                                                0
    Number_of_responding_apparatus                                        0
    Number_of_responding_personnel                                        0
    Possible_Cause                                                        0
    Property_Use                                                          0
    Smoke_Alarm_at_Fire_Origin                                            2
    Smoke_Alarm_at_Fire_Origin_Alarm_Failure                              2
    Smoke_Alarm_at_Fire_Origin_Alarm_Type                                 2
    Smoke_Alarm_Impact_on_Persons_Evacuating_Impact_on_Evacuation         2
    Smoke_Spread                                                          2
    Sprinkler_System_Operation                                            2
    Sprinkler_System_Presence                                             2
    Status_of_Fire_On_Arrival                                             0
    TFS_Alarm_Time                                                        0
    TFS_Arrival_Time                                                      0
    TFS_Firefighter_Casualties                                            0
    dtype: int64
```

```
ds.dropna(axis=0, how="any", thresh=None, subset=None, inplace=True)
```

```
sns.heatmap(ds.isnull())
```

```
<AxesSubplot:>
```



```
ds = ds.reset_index()
```

```
ds['Estimated_Dollar_Loss'] = ds['Estimated_Dollar_Loss'].astype('int64')
ds['Estimated_Dollar_Loss'].unique()
```

```
array([   2000,     200,    5000,   70000,  100000,    7500,   10000,
           400,   90000,    1000,   20000,    2500,   25000,   50000,
         30000,   40000,  350000,     500,   60000,    9000, 1000000,
         80000,  500000,  400000, 5000000,  250000,  200000,  750000,
        800000,  125000,  700000,   34000,  300000,    9999, 2000000,
         75000, 1500000,  150000,    4000,   15000,    7000,     250,
        120000,      20,  175000,   18000,   65000,   12000,   35000,
         49800,  600000,   55000,     100, 1850000,    8000], dtype=int64)
```

Normalisation using Max Min, L1 , L2 , Zscore

```
Estimated_Dollar_Loss = ds.iloc[:, 6:7].values
```

```
from sklearn import preprocessing
min_max = preprocessing.MinMaxScaler()
Estimated_Dollar_Loss= min_max.fit_transform(Estimated_Dollar_Loss)
Estimated_Dollar_Loss = pd.DataFrame(Estimated_Dollar_Loss,columns = ['Estimated_Dollar_Loss'])
Estimated_Dollar_Loss
```

	Estimated_Dollar_Loss
0	0.0
1	0.0
2	0.0
3	0.0
4	0.0
...	...
206	0.0
207	0.0
208	0.0
209	0.0
210	0.0

211 rows × 1 columns

```
Estimated_Dollar_Loss2 = ds.iloc[:, 6:7].values

from sklearn.preprocessing import Normalizer
Data_normalizer= Normalizer(norm='l1').fit(Estimated_Dollar_Loss2)
Estimated_Dollar_Loss2 = Data_normalizer.transform(Estimated_Dollar_Loss2)
Estimated_Dollar_Loss2 = pd.DataFrame(Estimated_Dollar_Loss2,columns = ['Estimated_Dollar_Loss2'])
Estimated_Dollar_Loss2
```

	Estimated_Dollar_Loss2
0	0.0
1	0.0
2	0.0
3	0.0
4	0.0
...	...
206	0.0
207	0.0
208	0.0
209	0.0
210	0.0

211 rows × 1 columns

```
Estimated_Dollar_Loss3 = ds.iloc[:, 6:7].values
```

```
from sklearn.preprocessing import Normalizer
Data_normalizer= Normalizer(norm='l2').fit(Estimated_Dollar_Loss3)
Estimated_Dollar_Loss3 = Data_normalizer.transform(Estimated_Dollar_Loss3)
Estimated_Dollar_Loss3 = pd.DataFrame(Estimated_Dollar_Loss3,columns = ['Estimated_Dollar_Loss3'])
Estimated_Dollar_Loss3
```

```
      Estimated_Dollar_Loss3
  0                      0.0
  1                      0.0
  2                      0.0
  3                      0.0
  4                      0.0
 ...                     ...
 206                     0.0
 207                     0.0
 208                     0.0
 209                     0.0
 210                     0.0
211 rows × 1 columns
```

```
Estimated_Number_Of_Persons_Displaced = ds.iloc[:, 7:8].values
```

```
from scipy import stats
Estimated_Number_Of_Persons_Displaced = stats.zscore(Estimated_Number_Of_Persons_Displaced)
Estimated_Number_Of_Persons_Displaced = pd.DataFrame(Estimated_Number_Of_Persons_Displaced,columns = ['Estimated_Number_Of
Estimated_Number_Of_Persons_Displaced
```

	Estimated_Number_Of_Persons_Displaced
0	-0.467214
1	-0.471048
2	-0.460825
3	-0.322387
4	-0.258493

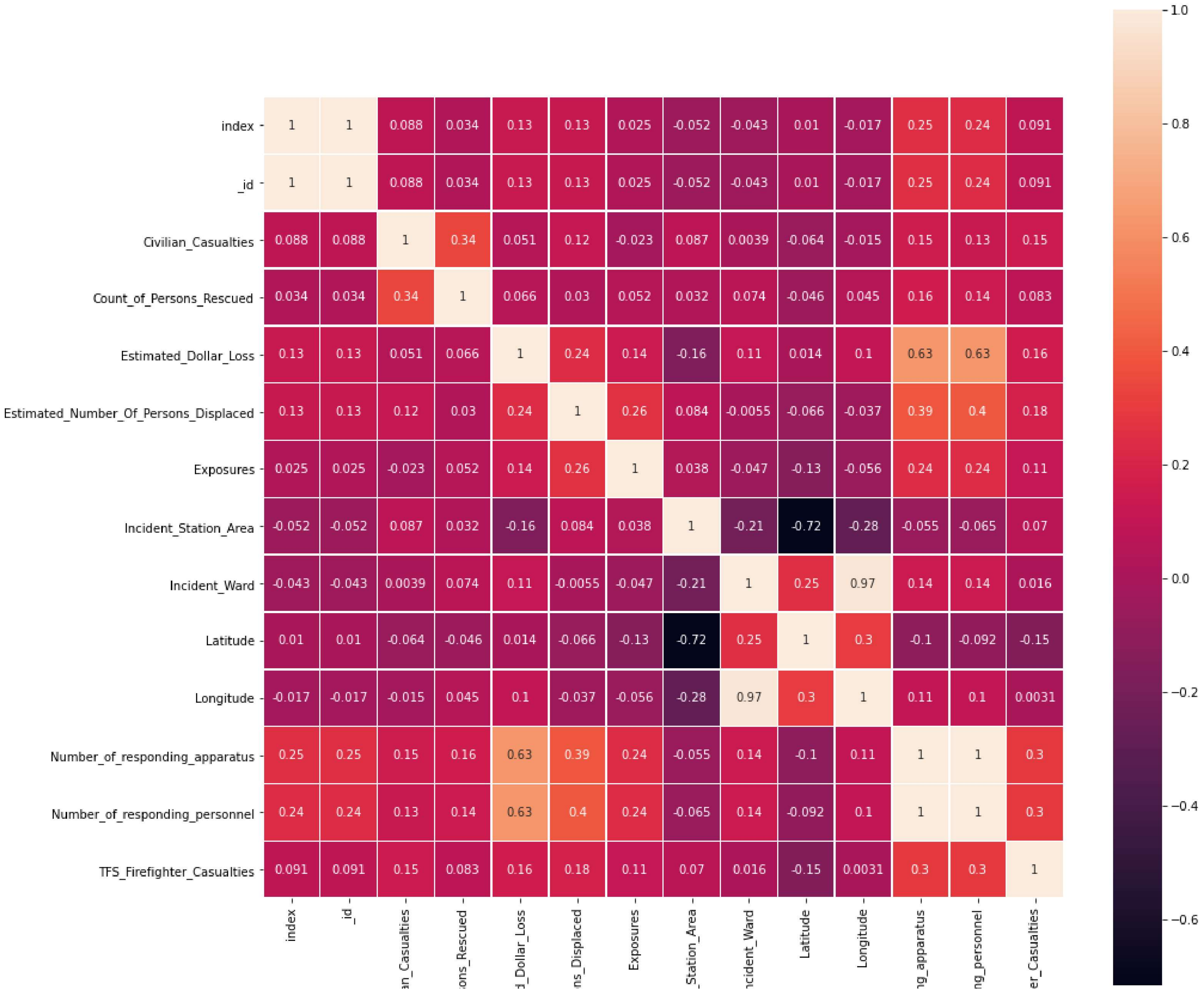
Feature Selection using Correlation Coefficient

```
ds.corr(method ='pearson')
```

	index	_id	Civilian_Casualties	Count_of_Persons_Rescued	Estimated_Dollar_Loss	Estimated_Number_Of_Persons_Displaced	Exposures	Incident_Stat
index	1.000000	1.000000	0.088213	0.034237	0.128786	0.125300	0.025089	-
_id	1.000000	1.000000	0.088213	0.034237	0.128786	0.125300	0.025089	-
Civilian_Casualties	0.088213	0.088213	1.000000	0.336775	0.050592	0.120813	-0.022841	
Count_of_Persons_Rescued	0.034237	0.034237	0.336775	1.000000	0.066351	0.030255	0.051705	
Estimated_Dollar_Loss	0.128786	0.128786	0.050592	0.066351	1.000000	0.236972	0.135748	-
Estimated_Number_Of_Persons_Displaced	0.125300	0.125300	0.120813	0.030255	0.236972	1.000000	0.255827	
Exposures	0.025089	0.025089	-0.022841	0.051705	0.135748	0.255827	1.000000	
Incident_Station_Area	-0.051774	-0.051774	0.087232	0.032444	-0.160756	0.083949	0.037605	
Incident_Ward	-0.043413	-0.043413	0.003947	0.074149	0.109913	-0.005542	-0.046863	-
Latitude	0.010110	0.010110	-0.064315	-0.046431	0.013641	-0.066485	-0.130792	-
Longitude	-0.017260	-0.017260	-0.014582	0.044854	0.103475	-0.037393	-0.055659	-
Number_of_responding_apparatus	0.249495	0.249495	0.152842	0.163182	0.629676	0.391738	0.241793	-
Number_of_responding_personnel	0.239354	0.239354	0.134114	0.144415	0.630974	0.396794	0.241166	-
TFS_Firefighter_Casualties	0.091333	0.091333	0.147323	0.083274	0.162295	0.176266	0.109110	

```
plt.subplots(figsize=(15,15))
sns.heatmap(ds.corr(), annot = True,annot_kws={'size': 10},linewidths=.5,square=True)
```

```
<AxesSubplot:>
```



Encoding of categorical values

```
Final_Incident_Type = ds.loc[:, ['Final_Incident_Type']].values
```

```
from sklearn.preprocessing import LabelEncoder
le = LabelEncoder()
Final_Incident_Type = le.fit_transform(Final_Incident_Type)
Final_Incident_Type = pd.DataFrame(Final_Incident_Type,columns = ['Final_Incident_Type(Explosion)'])
Final_Incident_Type
```

```
C:\Users\kalar\anaconda3\lib\site-packages\sklearn\utils\validation.py:72: DataConversionWarning: A column-vector y was passed when a 1d array was expected. Please change the shape of y to (n_s
  return f(**kwargs)
```

	Final_Incident_Type(Explosion)
0	0
1	0
2	0
3	0
4	0
...	...
206	0
207	0
208	0
209	0
210	0

211 rows × 1 columns

```
Method_Of_Fire_Control = pd.get_dummies(ds['Method_Of_Fire_Control'])
Method_Of_Fire_Control
```

	1 - Extinguished by fire department	3 - Extinguished by occupant	4 - Fire self extinguished	5 - Action taken unclassified
0	1	0	0	0
1	0	0	1	0
2	1	0	0	0

```
Method_Of_Fire_Control1 = ds.loc[:,['Method_Of_Fire_Control']].values

from sklearn.compose import ColumnTransformer
from sklearn.preprocessing import OneHotEncoder

ct = ColumnTransformer(transformers = [('encoder',OneHotEncoder(), [0])],remainder='passthrough')
Method_Of_Fire_Control1 = np.array(ct.fit_transform(Method_Of_Fire_Control1))
print(Method_Of_Fire_Control1)
```

```
  (0, 0)	1.0
  (1, 2)	1.0
  (2, 0)	1.0
  (3, 0)	1.0
  (4, 0)	1.0
  (5, 0)	1.0
  (6, 0)	1.0
  (7, 0)	1.0
  (8, 0)	1.0
  (9, 0)	1.0
  (10, 1)	1.0
  (11, 0)	1.0
  (12, 1)	1.0
  (13, 0)	1.0
  (14, 1)	1.0
  (15, 0)	1.0
  (16, 0)	1.0
  (17, 0)	1.0
  (18, 0)	1.0
  (19, 0)	1.0
  (20, 0)	1.0
  (21, 0)	1.0
  (22, 0)	1.0
  (23, 0)	1.0
  (24, 0)	1.0
  :	:
  (186, 0)	1.0
  (187, 0)	1.0
  (188, 0)	1.0
  (189, 0)	1.0
  (190, 0)	1.0
  (191, 3)	1.0
  (192, 0)	1.0
  (193, 0)	1.0
  (194, 0)	1.0
  (195, 0)	1.0
  (196, 0)	1.0
  (197, 0)	1.0
  (198, 0)	1.0
  (199, 0)	1.0
  (200, 0)	1.0
  (201, 0)	1.0
  (202, 0)	1.0
  (203, 0)	1.0
  (204, 0)	1.0
  (205, 0)	1.0
  (206, 0)	1.0
  (207, 0)	1.0
  (208, 0)	1.0
  (209, 0)	1.0
  (210, 0)	1.0
```

```
Method_Of_Fire_Control2 = ds.loc[:,['Method_Of_Fire_Control']].values
Method_Of_Fire_Control2 = Method_Of_Fire_Control2.ravel()

from sklearn.feature_extraction.text import CountVectorizer
from sklearn.feature_extraction.text import TfidfVectorizer
vectorizer = CountVectorizer()
Method_Of_Fire_Control2 = vectorizer.fit_transform(Method_Of_Fire_Control2)
print(Method_Of_Fire_Control2)
```

```
  (0, 3)	1
  (0, 1)	1
  (0, 4)	1
  (0, 2)	1
  (1, 3)	1
  (1, 4)	1
  (1, 6)	1
  (2, 3)	1
  (2, 1)	1
  (2, 4)	1
  (2, 2)	1
  (3, 3)	1
  (3, 1)	1
  (3, 4)	1
  (3, 2)	1
  (4, 3)	1
  (4, 1)	1
  (4, 4)	1
  (4, 2)	1
  (5, 3)	1
  (5, 1)	1
  (5, 4)	1
  (5, 2)	1
  (6, 3)	1
  (6, 1)	1
  :	:
  (204, 2)	1
  (205, 3)	1
  (205, 1)	1
  (205, 4)	1
  (205, 2)	1
  (206, 3)	1
  (206, 1)      1
  (206, 4)      1
  (206, 2)      1
  (207, 3)      1
  (207, 1)      1
  (207, 4)      1
  (207, 2)      1
  (208, 3)      1
  (208, 1)      1
  (208, 4)      1
  (208, 2)      1
  (209, 3)      1
  (209, 1)      1
  (209, 4)      1
  (209, 2)      1
  (210, 3)      1
  (210, 1)      1
  (210, 4)      1
  (210, 2)      1
```

Feature Reduction using Variance Threshold

```
from sklearn import datasets
df = datasets.load_iris(as_frame=True)
X = df.data
y = df.target
print(X)
```

```
     sepal length (cm)  sepal width (cm)  petal length (cm)  petal width (cm)
0                  5.1               3.5                1.4               0.2
1                  4.9               3.0                1.4               0.2
2                  4.7               3.2                1.3               0.2
3                  4.6               3.1                1.5               0.2
4                  5.0               3.6                1.4               0.2
..                 ...               ...                ...               ...
145                6.7               3.0                5.2               2.3
146                6.3               2.5                5.0               1.9
147                6.5               3.0                5.2               2.0
148                6.2               3.4                5.4               2.3
149                5.9               3.0                5.1               1.8

[150 rows x 4 columns]
```

```
from sklearn.feature_selection import VarianceThreshold

selector = VarianceThreshold()
selector.fit_transform(X,y)
```

```
array([[5.1, 3.5, 1.4, 0.2],
       [4.9, 3. , 1.4, 0.2],
       [4.7, 3.2, 1.3, 0.2],
       [4.6, 3.1, 1.5, 0.2],
       [5. , 3.6, 1.4, 0.2],
       [5.4, 3.9, 1.7, 0.4],
       [4.6, 3.4, 1.4, 0.3],
       [5. , 3.4, 1.5, 0.2],
       [4.4, 2.9, 1.4, 0.2],
       [4.9, 3.1, 1.5, 0.1],
       [5.4, 3.7, 1.5, 0.2],
       [4.8, 3.4, 1.6, 0.2],
       [4.8, 3. , 1.4, 0.1],
       [4.3, 3. , 1.1, 0.1],
       [5.8, 4. , 1.2, 0.2],
       [5.7, 4.4, 1.5, 0.4],
       [5.4, 3.9, 1.3, 0.4],
       [5.1, 3.5, 1.4, 0.3],
       [5.7, 3.8, 1.7, 0.3],
       [5.1, 3.8, 1.5, 0.3],
       [5.4, 3.4, 1.7, 0.2],
       [5.1, 3.7, 1.5, 0.4],
       [4.6, 3.6, 1. , 0.2],
       [5.1, 3.3, 1.7, 0.5],
       [4.8, 3.4, 1.9, 0.2],
       [5. , 3. , 1.6, 0.2],
       [5. , 3.4, 1.6, 0.4],
       [5.2, 3.5, 1.5, 0.2],
       [5.2, 3.4, 1.4, 0.2],
       [4.7, 3.2, 1.6, 0.2],
       [4.8, 3.1, 1.6, 0.2],
       [5.4, 3.4, 1.5, 0.4],
       [5.2, 4.1, 1.5, 0.1],
       [5.5, 4.2, 1.4, 0.2],
       [4.9, 3.1, 1.5, 0.2],
       [5. , 3.2, 1.2, 0.2],
       [5.5, 3.5, 1.3, 0.2],
       [4.9, 3.6, 1.4, 0.1],
       [4.4, 3. , 1.3, 0.2],
       [5.1, 3.4, 1.5, 0.2],
       [5. , 3.5, 1.3, 0.3],
       [4.5, 2.3, 1.3, 0.3],
       [4.4, 3.2, 1.3, 0.2],
       [5. , 3.5, 1.6, 0.6],
       [5.1, 3.8, 1.9, 0.4],
       [4.8, 3. , 1.4, 0.3],
       [5.1, 3.8, 1.6, 0.2],
       [4.6, 3.2, 1.4, 0.2],
       [5.3, 3.7, 1.5, 0.2],
       [5. , 3.3, 1.4, 0.2],
       [7. , 3.2, 4.7, 1.4],
       [6.4, 3.2, 4.5, 1.5],
       [6.9, 3.1, 4.9, 1.5],
       [5.5, 2.3, 4. , 1.3],
       [6.5, 2.8, 4.6, 1.5],
       [5.7, 2.8, 4.5, 1.3],
       [6.3, 3.3, 4.7, 1.6],
       [4.9, 2.4, 3.3, 1. ],
       [6.6, 2.9, 4.6, 1.3]
```

● ×