In [1]:
```python
import pandas as pd
import numpy as np
import scikitplot as skplt
import itertools
import matplotlib.pyplot as plt
import seaborn as sn
```

In [2]:
```python
train = pd.read_csv("UNSW_NB15_training-set.csv")
train.head()
```

Out[2]:

	id	dur	proto	service	state	spkts	dpkts	sbytes	dbytes	rate	...	ct_dst_sport_ltm	ct_dst_src_ltm	is_ftp_login	ct_ftp_cmd	ct_flw_http_mthd	ct_src_ltm	ct_srv_dst	is_sm_ips_ports	attack_cat	label
0	1	0.000011	udp	-	INT	2	0	496	0	90909.0902	...	1	2	0	0	0	1	2	0	Normal	0
1	2	0.000008	udp	-	INT	2	0	1762	0	125000.0003	...	1	2	0	0	0	1	2	0	Normal	0
2	3	0.000005	udp	-	INT	2	0	1068	0	200000.0051	...	1	3	0	0	0	1	3	0	Normal	0
3	4	0.000006	udp	-	INT	2	0	900	0	166666.6608	...	1	3	0	0	0	2	3	0	Normal	0
4	5	0.000010	udp	-	INT	2	0	2126	0	100000.0025	...	1	3	0	0	0	2	3	0	Normal	0

5 rows × 45 columns

In [3]:
```python
test = pd.read_csv("UNSW_NB15_testing-set.csv")
test.head()
```

Out[3]:

	id	dur	proto	service	state	spkts	dpkts	sbytes	dbytes	rate	...	ct_dst_sport_ltm	ct_dst_src_ltm	is_ftp_login	ct_ftp_cmd	ct_flw_http_mthd	ct_src_ltm	ct_srv_dst	is_sm_ips_ports	attack_cat	label
0	1	0.121478	tcp	-	FIN	6	4	258	172	74.087490	...	1	1	0	0	0	1	1	0	Normal	0
1	2	0.649902	tcp	-	FIN	14	38	734	42014	78.473372	...	1	2	0	0	0	1	6	0	Normal	0
2	3	1.623129	tcp	-	FIN	8	16	364	13186	14.170161	...	1	3	0	0	0	2	6	0	Normal	0
3	4	1.681642	tcp	ftp	FIN	12	12	628	770	13.677108	...	1	3	1	1	0	2	1	0	Normal	0
4	5	0.449454	tcp	-	FIN	10	6	534	268	33.373826	...	1	40	0	0	0	2	39	0	Normal	0

5 rows × 45 columns

In [4]:
```python
train.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 82332 entries, 0 to 82331
Data columns (total 45 columns):
 #   Column             Non-Null Count  Dtype  
---  ------             --------------  -----  
 0   id                 82332 non-null  int64  
 1   dur                82332 non-null  float64
 2   proto              82332 non-null  object 
 3   service            82332 non-null  object 
 4   state              82332 non-null  object 
 5   spkts              82332 non-null  int64  
 6   dpkts              82332 non-null  int64  
 7   sbytes             82332 non-null  int64  
 8   dbytes             82332 non-null  int64  
 9   rate               82332 non-null  float64
 10  sttl               82332 non-null  int64  
 11  dttl               82332 non-null  int64  
 12  sload              82332 non-null  float64
 13  dload              82332 non-null  float64
 14  sloss              82332 non-null  int64  
 15  dloss              82332 non-null  int64  
 16  sinpkt             82332 non-null  float64
 17  dinpkt             82332 non-null  float64
 18  sjit               82332 non-null  float64
 19  djit               82332 non-null  float64
 20  swin               82332 non-null  int64  
 21  stcpb              82332 non-null  int64  
 22  dtcpb              82332 non-null  int64  
 23  dwin               82332 non-null  int64  
 24  tcprtt             82332 non-null  float64
 25  synack             82332 non-null  float64
 26  ackdat             82332 non-null  float64
 27  smean              82332 non-null  int64  
 28  dmean              82332 non-null  int64  
 29  trans_depth        82332 non-null  int64  
 30  response_body_len  82332 non-null  int64  
 31  ct_srv_src         82332 non-null  int64  
 32  ct_state_ttl       82332 non-null  int64  
 33  ct_dst_ltm         82332 non-null  int64  
 34  ct_src_dport_ltm   82332 non-null  int64  
 35  ct_dst_sport_ltm   82332 non-null  int64  
 36  ct_dst_src_ltm     82332 non-null  int64  
 37  is_ftp_login       82332 non-null  int64  
 38  ct_ftp_cmd         82332 non-null  int64  
 39  ct_flw_http_mthd   82332 non-null  int64  
 40  ct_src_ltm         82332 non-null  int64  
 41  ct_srv_dst         82332 non-null  int64  
 42  is_sm_ips_ports    82332 non-null  int64  
 43  attack_cat         82332 non-null  object 
 44  label              82332 non-null  int64  
dtypes: float64(11), int64(30), object(4)
memory usage: 28.3+ MB
```

In [5]:
```python
test.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 175341 entries, 0 to 175340
Data columns (total 45 columns):
 #   Column             Non-Null Count   Dtype  
---  ------             --------------   -----  
 0   id                 175341 non-null  int64  
 1   dur                175341 non-null  float64
 2   proto              175341 non-null  object 
 3   service            175341 non-null  object 
 4   state              175341 non-null  object 
 5   spkts              175341 non-null  int64  
 6   dpkts              175341 non-null  int64  
 7   sbytes             175341 non-null  int64  
 8   dbytes             175341 non-null  int64  
 9   rate               175341 non-null  float64
 10  sttl               175341 non-null  int64  
 11  dttl               175341 non-null  int64  
 12  sload              175341 non-null  float64
 13  dload              175341 non-null  float64
 14  sloss              175341 non-null  int64  
 15  dloss              175341 non-null  int64  
 16  sinpkt             175341 non-null  float64
 17  dinpkt             175341 non-null  float64
 18  sjit               175341 non-null  float64
 19  djit               175341 non-null  float64
 20  swin               175341 non-null  int64  
 21  stcpb              175341 non-null  int64  
 22  dtcpb              175341 non-null  int64  
 23  dwin               175341 non-null  int64  
 24  tcprtt             175341 non-null  float64
 25  synack             175341 non-null  float64
 26  ackdat             175341 non-null  float64
 27  smean              175341 non-null  int64  
 28  dmean              175341 non-null  int64  
 29  trans_depth        175341 non-null  int64  
 30  response_body_len  175341 non-null  int64  
 31  ct_srv_src         175341 non-null  int64  
 32  ct_state_ttl       175341 non-null  int64  
 33  ct_dst_ltm         175341 non-null  int64  
 34  ct_src_dport_ltm   175341 non-null  int64  
 35  ct_dst_sport_ltm   175341 non-null  int64  
 36  ct_dst_src_ltm     175341 non-null  int64  
 37  is_ftp_login       175341 non-null  int64  
 38  ct_ftp_cmd         175341 non-null  int64  
 39  ct_flw_http_mthd   175341 non-null  int64  
 40  ct_src_ltm         175341 non-null  int64  
 41  ct_srv_dst         175341 non-null  int64  
 42  is_sm_ips_ports    175341 non-null  int64  
 43  attack_cat         175341 non-null  object 
 44  label              175341 non-null  int64  
dtypes: float64(11), int64(30), object(4)
memory usage: 60.2+ MB
```

In [6]:
```python
#delete proto
train = train.drop('proto', axis=1)
test = test.drop('proto', axis=1)
#service and state as numbers
train.state = train.state.map({'FIN':0 , 'INT':1, 'CON':2, 'REQ':3, 'ACC':4, 'RST':5, 'CLO':6})
train.service = train.service.map({'-':0 , 'dns':1, 'http':2, 'smtp':3, 'ftp':4, 'ftp-data':5, 'pop3':6, 'ssh':7, 'ssl':8, 'snmp':9, 'dhcp':10, 'radius':11, 'irc':12})
test.state = test.state.map({'FIN':0 , 'INT':1, 'CON':2, 'REQ':3, 'ACC':4, 'RST':5, 'CLO':6})
test.service = test.service.map({'-':0 , 'dns':1, 'http':2, 'smtp':3, 'ftp':4, 'ftp-data':5, 'pop3':6, 'ssh':7, 'ssl':8, 'snmp':9, 'dhcp':10, 'radius':11, 'irc':12})
train.attack_cat = train.attack_cat.map({'Normal': 0, 'Generic': 1, 'Exploits':2, 'Fuzzers':3, 'DoS':4, 'Reconnaissance':5, 'Analysis':6, 'Backdoor':7, 'Shellcode':8, 'Worms':9 })
test.attack_cat = test.attack_cat.map({'Normal': 0, 'Generic': 1, 'Exploits':2, 'Fuzzers':3, 'DoS':4, 'Reconnaissance':5, 'Analysis':6, 'Backdoor':7, 'Shellcode':8, 'Worms':9 })
```

In [7]:
```python
train = train[np.isfinite(train).all(1)]
test = test[np.isfinite(test).all(1)]
```

In [8]:
```python
percent_missing = train.isnull().sum() * 100 / len(train)
missing_value_df = pd.DataFrame({'column_name': train.columns, 'percent_missing': percent_missing})
missing_value_df.sort_values('percent_missing', inplace=True)
missing_value_df
```

Out[8]:

	column_name	percent_missing
id	id	0.0
synack	synack	0.0
ackdat	ackdat	0.0
smean	smean	0.0
dmean	dmean	0.0
trans_depth	trans_depth	0.0
response_body_len	response_body_len	0.0
ct_srv_src	ct_srv_src	0.0
ct_state_ttl	ct_state_ttl	0.0
tcprtt	tcprtt	0.0
ct_dst_ltm	ct_dst_ltm	0.0
ct_dst_sport_ltm	ct_dst_sport_ltm	0.0
ct_dst_src_ltm	ct_dst_src_ltm	0.0
is_ftp_login	is_ftp_login	0.0
ct_ftp_cmd	ct_ftp_cmd	0.0
ct_flw_http_mthd	ct_flw_http_mthd	0.0
ct_src_ltm	ct_src_ltm	0.0
ct_srv_dst	ct_srv_dst	0.0
is_sm_ips_ports	is_sm_ips_ports	0.0
ct_src_dport_ltm	ct_src_dport_ltm	0.0
dwin	dwin	0.0
dtcpb	dtcpb	0.0
stcpb	stcpb	0.0
dur	dur	0.0
service	service	0.0
state	state	0.0
spkts	spkts	0.0
dpkts	dpkts	0.0
sbytes	sbytes	0.0
dbytes	dbytes	0.0
rate	rate	0.0
sttl	sttl	0.0
dttl	dttl	0.0
sload	sload	0.0
dload	dload	0.0
sloss	sloss	0.0
dloss	dloss	0.0
sinpkt	sinpkt	0.0
dinpkt	dinpkt	0.0
sjit	sjit	0.0
djit	djit	0.0
swin	swin	0.0
attack_cat	attack_cat	0.0
label	label	0.0

In [9]:
```python
percent_missing = test.isnull().sum() * 100 / len(test)
missing_value_df = pd.DataFrame({'column_name': test.columns, 'percent_missing': percent_missing})
missing_value_df.sort_values('percent_missing', inplace=True)
missing_value_df
```

Out[9]:

	column_name	percent_missing
id	id	0.0
synack	synack	0.0
ackdat	ackdat	0.0
smean	smean	0.0
dmean	dmean	0.0
trans_depth	trans_depth	0.0
response_body_len	response_body_len	0.0
ct_srv_src	ct_srv_src	0.0
ct_state_ttl	ct_state_ttl	0.0
tcprtt	tcprtt	0.0
ct_dst_ltm	ct_dst_ltm	0.0
ct_dst_sport_ltm	ct_dst_sport_ltm	0.0
ct_dst_src_ltm	ct_dst_src_ltm	0.0
is_ftp_login	is_ftp_login	0.0
ct_ftp_cmd	ct_ftp_cmd	0.0
ct_flw_http_mthd	ct_flw_http_mthd	0.0
ct_src_ltm	ct_src_ltm	0.0
ct_srv_dst	ct_srv_dst	0.0
is_sm_ips_ports	is_sm_ips_ports	0.0
ct_src_dport_ltm	ct_src_dport_ltm	0.0
dwin	dwin	0.0
dtcpb	dtcpb	0.0
stcpb	stcpb	0.0
dur	dur	0.0
service	service	0.0
state	state	0.0
spkts	spkts	0.0
dpkts	dpkts	0.0
sbytes	sbytes	0.0
dbytes	dbytes	0.0
rate	rate	0.0
sttl	sttl	0.0
dttl	dttl	0.0
sload	sload	0.0
dload	dload	0.0
sloss	sloss	0.0
dloss	dloss	0.0
sinpkt	sinpkt	0.0
dinpkt	dinpkt	0.0
sjit	sjit	0.0
djit	djit	0.0
swin	swin	0.0
attack_cat	attack_cat	0.0
label	label	0.0

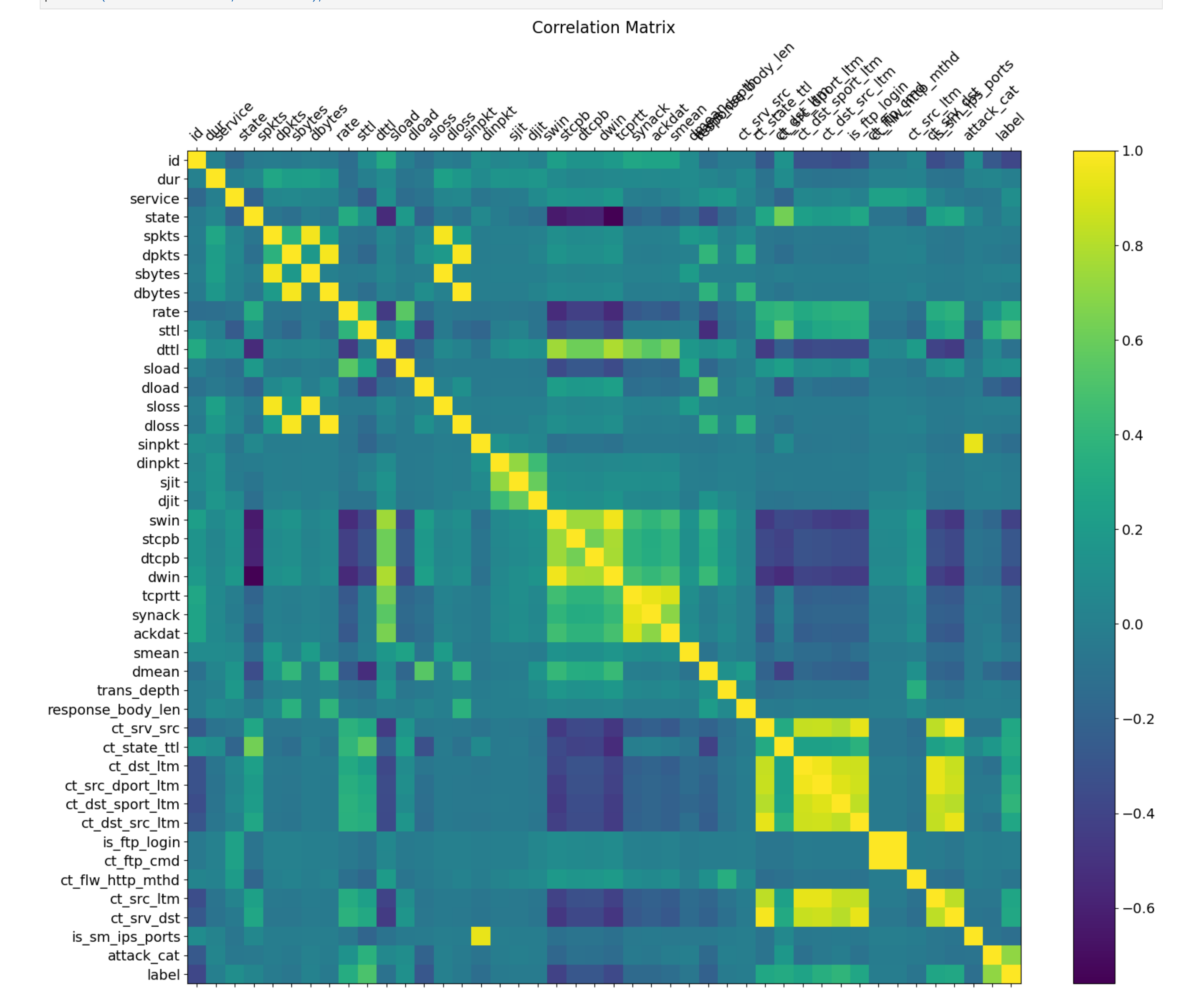
In [10]:
```python
train.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 82332 entries, 0 to 82331
Data columns (total 44 columns):
 #   Column             Non-Null Count  Dtype  
---  ------             --------------  -----  
 0   id                 82332 non-null  int64  
 1   dur                82332 non-null  float64
 2   service            82332 non-null  int64  
 3   state              82332 non-null  int64  
 4   spkts              82332 non-null  int64  
 5   dpkts              82332 non-null  int64  
 6   sbytes             82332 non-null  int64  
 7   dbytes             82332 non-null  int64  
 8   rate               82332 non-null  float64
 9   sttl               82332 non-null  int64  
 10  dttl               82332 non-null  int64  
 11  sload              82332 non-null  float64
 12  dload              82332 non-null  float64
 13  sloss              82332 non-null  int64  
 14  dloss              82332 non-null  int64  
 15  sinpkt             82332 non-null  float64
 16  dinpkt             82332 non-null  float64
 17  sjit               82332 non-null  float64
 18  djit               82332 non-null  float64
 19  swin               82332 non-null  int64  
 20  stcpb              82332 non-null  int64  
 21  dtcpb              82332 non-null  int64  
 22  dwin               82332 non-null  int64  
 23  tcprtt             82332 non-null  float64
 24  synack             82332 non-null  float64
 25  ackdat             82332 non-null  float64
 26  smean              82332 non-null  int64  
 27  dmean              82332 non-null  int64  
 28  trans_depth        82332 non-null  int64  
 29  response_body_len  82332 non-null  int64  
 30  ct_srv_src         82332 non-null  int64  
 31  ct_state_ttl       82332 non-null  int64  
 32  ct_dst_ltm         82332 non-null  int64  
 33  ct_src_dport_ltm   82332 non-null  int64  
 34  ct_dst_sport_ltm   82332 non-null  int64  
 35  ct_dst_src_ltm     82332 non-null  int64  
 36  is_ftp_login       82332 non-null  int64  
 37  ct_ftp_cmd         82332 non-null  int64  
 38  ct_flw_http_mthd   82332 non-null  int64  
 39  ct_src_ltm         82332 non-null  int64  
 40  ct_srv_dst         82332 non-null  int64  
 41  is_sm_ips_ports    82332 non-null  int64  
 42  attack_cat         82332 non-null  int64  
 43  label              82332 non-null  int64  
dtypes: float64(11), int64(33)
memory usage: 28.3 MB
```

In [11]:
```python
test.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 175326 entries, 0 to 175340
Data columns (total 44 columns):
 #   Column             Non-Null Count   Dtype  
---  ------             --------------   -----  
 0   id                 175326 non-null  int64  
 1   dur                175326 non-null  float64
 2   service            175326 non-null  int64  
 3   state              175326 non-null  float64
 4   spkts              175326 non-null  int64  
 5   dpkts              175326 non-null  int64  
 6   sbytes             175326 non-null  int64  
 7   dbytes             175326 non-null  int64  
 8   rate               175326 non-null  float64
 9   sttl               175326 non-null  int64  
 10  dttl               175326 non-null  int64  
 11  sload              175326 non-null  float64
 12  dload              175326 non-null  float64
 13  sloss              175326 non-null  int64  
 14  dloss              175326 non-null  int64  
 15  sinpkt             175326 non-null  float64
 16  dinpkt             175326 non-null  float64
 17  sjit               175326 non-null  float64
 18  djit               175326 non-null  float64
 19  swin               175326 non-null  int64  
 20  stcpb              175326 non-null  int64  
 21  dtcpb              175326 non-null  int64  
 22  dwin               175326 non-null  int64  
 23  tcprtt             175326 non-null  float64
 24  synack             175326 non-null  float64
 25  ackdat             175326 non-null  float64
 26  smean              175326 non-null  int64  
 27  dmean              175326 non-null  int64  
 28  trans_depth        175326 non-null  int64  
 29  response_body_len  175326 non-null  int64  
 30  ct_srv_src         175326 non-null  int64  
 31  ct_state_ttl       175326 non-null  int64  
 32  ct_dst_ltm         175326 non-null  int64  
 33  ct_src_dport_ltm   175326 non-null  int64  
 34  ct_dst_sport_ltm   175326 non-null  int64  
 35  ct_dst_src_ltm     175326 non-null  int64  
 36  is_ftp_login       175326 non-null  int64  
 37  ct_ftp_cmd         175326 non-null  int64  
 38  ct_flw_http_mthd   175326 non-null  int64  
 39  ct_src_ltm         175326 non-null  int64  
 40  ct_srv_dst         175326 non-null  int64  
 41  is_sm_ips_ports    175326 non-null  int64  
 42  attack_cat         175326 non-null  int64  
 43  label              175326 non-null  int64  
dtypes: float64(12), int64(32)
memory usage: 60.2 MB
```

In [12]:
```python
f = plt.figure(figsize=(19, 15))
plt.matshow(train.corr(), fignum=f.number)
plt.xticks(range(train.select_dtypes(['number']).shape[1]), train.select_dtypes(['number']).columns, fontsize=14, rotation=45)
plt.yticks(range(train.select_dtypes(['number']).shape[1]), train.select_dtypes(['number']).columns, fontsize=14)
cb = plt.colorbar()
cb.ax.tick_params(labelsize=14)
plt.title('Correlation Matrix', fontsize=16);
```



variables to modify: 2=service, 6=sbytes, 8=rate, 9=sttl, 11=sload, 31=ct_state_ttl, 33=ct_src_dport_itm, 34=ct_dst_sport_ltm, 39=ct_src_ltm, 40=ct_srv_dst

In [13]:
```python
#new train and test with better distribution and separating y
from sklearn.model_selection import train_test_split
full_df = pd.concat([train, test])
y = full_df['label']
X = full_df.drop(columns=['label'])
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.33, random_state=42)
y_multi_train = X_train['attack_cat']
y_multi_test = X_test['attack_cat']
X_train = X_train.drop(columns=['attack_cat'])
X_test = X_test.drop(columns=['attack_cat'])
print(X_train.shape, X_test.shape, y_train.shape, y_test.shape, y_multi_train.shape, y_multi_test.shape)
```

```
(172630, 42) (85028, 42) (172630,) (85028,) (172630,) (85028,)
```

In [14]:
```python
X_train.describe()
```

Out[14]:

	id	dur	service	state	spkts	dpkts	sbytes	dbytes	rate	sttl	...	ct_dst_ltm	ct_src_dport_ltm	ct_dst_sport_ltm	ct_dst_src_ltm
count	172630.000000	172630.000000	172630.000000	172630.000000	172630.000000	172630.000000	1.726300e+05	1.726300e+05	1.726300e+05	172630.000000	...	172630.000000	172630.000000	172630.000000	172630.000000
mean	72702.044135	1.246084	0.828558	0.656103	19.289098	18.320008	7.976568e+03	1.420564e+04	9.124200e+04	180.026490	...	6.046718	5.238238	4.035104	8.327620
std	48924.185754	5.982475	1.306070	0.692649	125.621549	110.118562	1.595469e+05	1.438928e+05	1.600462e+05	102.484566	...	8.158225	8.151126	5.831771	11.122677
min	1.000000	0.000000	0.000000	0.000000	1.000000	0.000000	2.400000e+01	0.000000e+00	0.000000e+00	0.000000	...	1.000000	1.000000	1.000000	1.000000
25%	32106.250000	0.000008	0.000000	0.000000	2.000000	0.000000	1.140000e+02	0.000000e+00	3.079955e+01	62.000000	...	1.000000	1.000000	1.000000	1.000000
50%	64289.500000	0.004157	0.000000	1.000000	4.000000	2.000000	5.220000e+02	1.780000e+02	2.959929e+03	254.000000	...	2.000000	1.000000	1.000000	3.000000
75%	110678.750000	0.685935	1.000000	1.000000	12.000000	10.000000	1.344000e+03	1.056000e+03	1.250000e+05	254.000000	...	6.000000	4.000000	3.000000	8.000000
max	175340.000000	59.999989	12.000000	6.000000	10646.000000	11018.000000	1.435577e+07	1.465753e+07	1.000000e+06	255.000000	...	59.000000	59.000000	46.000000	65.000000

8 rows × 42 columns

In [15]:
```python
X_test.describe()
```

Out[15]:

	id	dur	service	state	spkts	dpkts	sbytes	dbytes	rate	sttl	...	ct_dst_ltm	ct_src_dport_ltm	ct_dst_sport_ltm	ct_dst_src_ltm	is_ftp_
count	85028.000000	85028.000000	85028.000000	85028.000000	85028.000000	85028.000000	8.502800e+04	8.502800e+04	8.502800e+04	85028.000000	...	85028.000000	85028.000000	85028.000000	85028.000000	85028.0
mean	73044.288811	1.248217	0.828210	0.651362	20.771158	18.913252	9.785258e+03	1.475862e+04	9.126080e+04	179.962918	...	6.058945	5.239062	4.028285	8.314779	0.0
std	48939.817442	5.958224	1.301501	0.689843	154.813052	115.693552	1.995713e+05	1.507861e+05	1.609260e+05	102.495050	...	8.205676	8.181054	5.831403	11.117480	0.1
min	2.000000	0.000000	0.000000	0.000000	1.000000	0.000000	2.400000e+01	0.000000e+00	0.000000e+00	0.000000	...	1.000000	1.000000	1.000000	1.000000	0.0
25%	32414.000000	0.000008	0.000000	0.000000	2.000000	0.000000	1.140000e+02	0.000000e+00	3.076993e+01	62.000000	...	1.000000	1.000000	1.000000	1.000000	0.0
50%	64694.000000	0.004474	0.000000	1.000000	4.000000	2.000000	5.280000e+02	1.780000e+02	2.946955e+03	254.000000	...	2.000000	1.000000	1.000000	3.000000	0.0
75%	111418.250000	0.685551	1.000000	1.000000	12.000000	10.000000	1.400000e+03	1.076000e+03	1.250000e+05	254.000000	...	6.000000	4.000000	3.000000	8.000000	0.0
max	175341.000000	59.999989	12.000000	5.000000	9616.000000	10872.000000	1.296523e+07	1.459086e+07	1.000000e+06	255.000000	...	59.000000	59.000000	46.000000	63.000000	4.0

8 rows × 42 columns

In [16]:
```python
yt=y_test.tolist()
ymt=y_multi_test.tolist()
def countOccurrence(a):
    k = {}
    for j in a:
        if j in k:
            k[j] +=1
        else:
            k[j] =1
    return k
print(countOccurrence(yt))
print(countOccurrence(ymt))
```

```
{1: 54256, 0: 30772}
{3: 7921, 2: 14709, 0: 30772, 5: 4578, 1: 19423, 4: 5357, 7: 780, 8: 513, 9: 66, 6: 909}
```

In [17]:
```python
X_train.to_csv('X_train.csv', index=False)
X_test.to_csv('X_test.csv', index=False)
y_train.to_csv('y_train.csv', index=False)
y_test.to_csv('y_test.csv', index=False)
y_multi_train.to_csv('y_multi_train.csv', index=False)
y_multi_test.to_csv('y_multi_test.csv', index=False)
```

In [18]:
```python
X_train.plot(subplots=True, layout=(7,7), figsize=(30, 30))
```

Out[18]:

```
array([[<Axes: >, <Axes: >, <Axes: >, <Axes: >, <Axes: >, <Axes: >,
        <Axes: >],
       [<Axes: >, <Axes: >, <Axes: >, <Axes: >, <Axes: >, <Axes: >,
        <Axes: >],
       [<Axes: >, <Axes: >, <Axes: >, <Axes: >, <Axes: >, <Axes: >,
        <Axes: >],
       [<Axes: >, <Axes: >, <Axes: >, <Axes: >, <Axes: >, <Axes: >,
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        <Axes: >],
       [<Axes: >, <Axes: >, <Axes: >, <Axes: >, <Axes: >, <Axes: >,
        <Axes: >],
       [<Axes: >, <Axes: >, <Axes: >, <Axes: >, <Axes: >, <Axes: >,
        <Axes: >]], dtype=object)
```

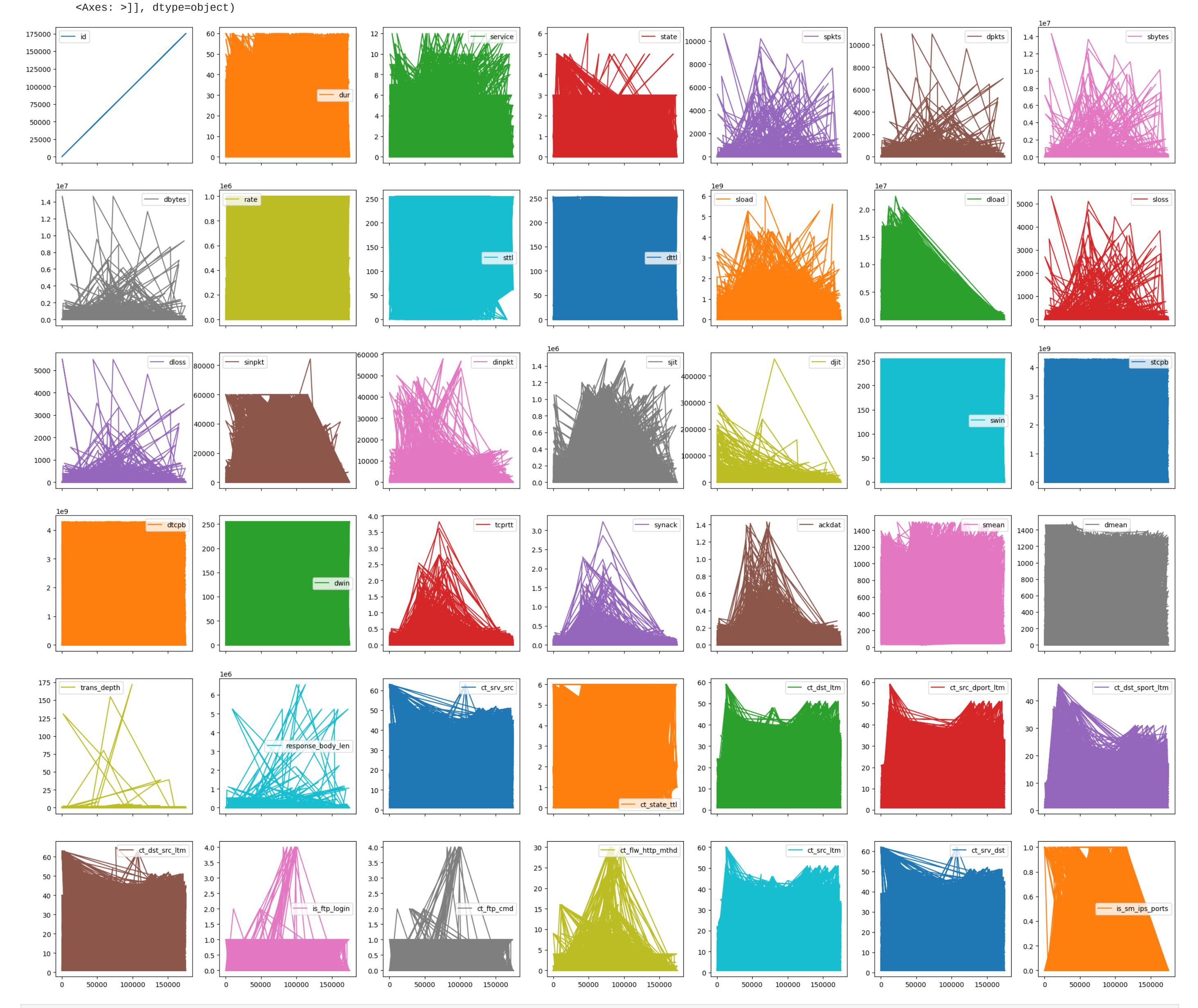

In [19]:
```python
from sklearn.preprocessing import StandardScaler
ss = StandardScaler()
X_train = ss.fit_transform(X_train)
```

In [20]:
```python
X_train = pd.DataFrame(X_train)
X_train.plot(subplots=True, layout=(7,7), figsize=(30, 30))
```

Out[20]:

```
array([[<Axes: >, <Axes: >, <Axes: >, <Axes: >, <Axes: >, <Axes: >,
        <Axes: >],
       [<Axes: >, <Axes: >, <Axes: >, <Axes: >, <Axes: >, <Axes: >,
        <Axes: >],
       [<Axes: >, <Axes: >, <Axes: >, <Axes: >, <Axes: >, <Axes: >,
        <Axes: >],
       [<Axes: >, <Axes: >, <Axes: >, <Axes: >, <Axes: >, <Axes: >,
        <Axes: >],
       [<Axes: >, <Axes: >, <Axes: >, <Axes: >, <Axes: >, <Axes: >,
        <Axes: >],
       [<Axes: >, <Axes: >, <Axes: >, <Axes: >, <Axes: >, <Axes: >,
        <Axes: >],
       [<Axes: >, <Axes: >, <Axes: >, <Axes: >, <Axes: >, <Axes: >,
        <Axes: >]], dtype=object)
```