Loading the libraries

First we will load some basic libraries for our purposes

In [1]:
```
import pandas as pd
import numpy as np
import matplotlib.gridspec as gridspec
import seaborn as sns
import matplotlib.pyplot as plt
import warnings

from sklearn.preprocessing import LabelEncoder, OrdinalEncoder
from sklearn.preprocessing import OneHotEncoder
from sklearn.preprocessing import PowerTransformer, StandardScaler,Normalizer,RobustScaler,MaxAbsScaler,MinMaxScaler,QuantileTrar
from sklearn.preprocessing import FunctionTransformer
from sklearn.preprocessing import PolynomialFeatures
from sklearn.neighbors import KNeighborsClassifier
from sklearn.preprocessing import KBinsDiscretizer
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
```

Loading the dataset from the system

In [3]:
```
df=pd.read_csv('C:\\Users\\Shashwat Saket\\Downloads\\Fraud.csv')
```

Performing EDA

In [4]:
```
df.head()
```

Out[4]:

	step	type	amount	nameOrig	oldbalanceOrg	newbalanceOrig	nameDest	oldbalanceDest	newbalanceDest	isFraud	isFlaggedFraud
0	1	PAYMENT	9839.64	C1231006815	170136.0	160296.36	M1979787155	0.0	0.0	0	0
1	1	PAYMENT	1864.28	C1666544295	21249.0	19384.72	M2044282225	0.0	0.0	0	0
2	1	TRANSFER	181.00	C1305486145	181.0	0.00	C553264065	0.0	0.0	1	0
3	1	CASH_OUT	181.00	C840083671	181.0	0.00	C38997010	21182.0	0.0	1	0
4	1	PAYMENT	11668.14	C2048537720	41554.0	29885.86	M1230701703	0.0	0.0	0	0

In [5]:
```
df.describe()
```

Out[5]:

	step	amount	oldbalanceOrg	newbalanceOrig	oldbalanceDest	newbalanceDest	isFraud	isFlaggedFraud
count	6.362620e+06	6.362620e+06	6.362620e+06	6.362620e+06	6.362620e+06	6.362620e+06	6.362620e+06	6.362620e+06
mean	2.433972e+02	1.798619e+05	8.338831e+05	8.551137e+05	1.100702e+06	1.224996e+06	1.290820e-03	2.514687e-06
std	1.423320e+02	6.038582e+05	2.888243e+06	2.924049e+06	3.399180e+06	3.674129e+06	3.590480e-02	1.585775e-03
min	1.000000e+00	0.000000e+00	0.000000e+00	0.000000e+00	0.000000e+00	0.000000e+00	0.000000e+00	0.000000e+00
25%	1.560000e+02	1.338957e+04	0.000000e+00	0.000000e+00	0.000000e+00	0.000000e+00	0.000000e+00	0.000000e+00
50%	2.390000e+02	7.487194e+04	1.420800e+04	0.000000e+00	1.327057e+05	2.146614e+05	0.000000e+00	0.000000e+00
75%	3.350000e+02	2.087215e+05	1.073152e+05	1.442584e+05	9.430367e+05	1.111909e+06	0.000000e+00	0.000000e+00
max	7.430000e+02	9.244552e+07	5.958504e+07	4.958504e+07	3.560159e+08	3.561793e+08	1.000000e+00	1.000000e+00

In [6]:
```
df.columns
```

Out[6]:
```
Index(['step', 'type', 'amount', 'nameOrig', 'oldbalanceOrg', 'newbalanceOrig',
       'nameDest', 'oldbalanceDest', 'newbalanceDest', 'isFraud',
       'isFlaggedFraud'],
      dtype='object')
```

In [7]:
```
df.isnull().sum().values
```

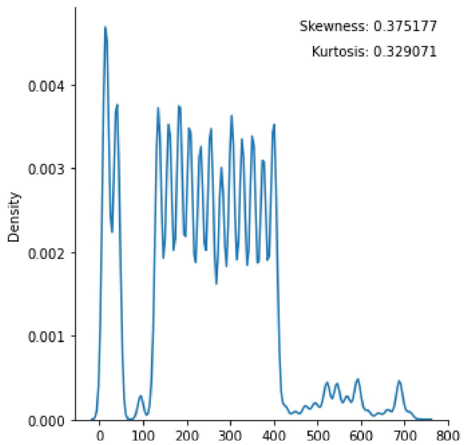
Out[7]:
```
array([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0], dtype=int64)
```

In [8]:
```
df.shape
```

Out[8]:
```
(6362620, 11)
```

In [9]:

```
graph=['step','amount','isFraud', 'oldbalanceOrg', 'newbalanceOrig','oldbalanceDest', 'newbalanceDest']
for i in graph:
    g = sns.displot(data=df, x=df[i],kind ='kde')
    for ax in g.axes.ravel():
            ax.text(x=0.97, y=0.97, transform=ax.transAxes, s="Skewness: %f" % df[i].skew(),\
                fontsize=10, verticalalignment='top', horizontalalignment='right')
            ax.text(x=0.97, y=0.91, transform=ax.transAxes, s="Kurtosis: %f" % df[i].kurt(),\
                fontsize=10, verticalalignment='top', horizontalalignment='right')
```



Analysing the skewness and kurtosis

This demonstrates a very high skewness and kurtosis so we can remove it using log transform later

In [39]:

```
label= "isFraud"
X = df.drop(label, axis='columns')
y = df[label].to_numpy()
```

In [11]:

```
X
```

Out[11]:

	step	type	amount	nameOrig	oldbalanceOrg	newbalanceOrig	nameDest	oldbalanceDest	newbalanceDest	isFlaggedFraud
0	1	PAYMENT	9839.64	C1231006815	170136.00	160296.36	M1979787155	0.00	0.00	0
1	1	PAYMENT	1864.28	C1666544295	21249.00	19384.72	M2044282225	0.00	0.00	0
2	1	TRANSFER	181.00	C1305486145	181.00	0.00	C553264065	0.00	0.00	0
3	1	CASH_OUT	181.00	C840083671	181.00	0.00	C38997010	21182.00	0.00	0
4	1	PAYMENT	11668.14	C2048537720	41554.00	29885.86	M1230701703	0.00	0.00	0
...	...	...	...	...	...	...	...	...	...	...
6362615	743	CASH_OUT	339682.13	C786484425	339682.13	0.00	C776919290	0.00	339682.13	0
6362616	743	TRANSFER	6311409.28	C1529008245	6311409.28	0.00	C1881841831	0.00	0.00	0
6362617	743	CASH_OUT	6311409.28	C1162922333	6311409.28	0.00	C1365125890	68488.84	6379898.11	0
6362618	743	TRANSFER	850002.52	C1685995037	850002.52	0.00	C2080388513	0.00	0.00	0
6362619	743	CASH_OUT	850002.52	C1280323807	850002.52	0.00	C873221189	6510099.11	7360101.63	0

6362620 rows × 10 columns

In [12]:

```
col=['type','amount','oldbalanceOrg','newbalanceOrig','oldbalanceDest','newbalanceDest']
col2=['amount','oldbalanceOrg','newbalanceOrig','oldbalanceDest','newbalanceDest']
```

In [13]:

```
X_train,X_test,y_train,y_test=train_test_split(X,y,stratify=y)
```

In [14]:

```
X_new=X_train[col2]
```

In [15]:

```
X_new=StandardScaler().fit_transform(X_new)
```

In [16]:

```
drop_X_train = X.select_dtypes(exclude=['object'])
```

In [17]:
```
drop_X_train
```

Out[17]:

	step	amount	oldbalanceOrg	newbalanceOrig	oldbalanceDest	newbalanceDest	isFlaggedFraud
0	1	9839.64	170136.00	160296.36	0.00	0.00	0
1	1	1864.28	21249.00	19384.72	0.00	0.00	0
2	1	181.00	181.00	0.00	0.00	0.00	0
3	1	181.00	181.00	0.00	21182.00	0.00	0
4	1	11668.14	41554.00	29885.86	0.00	0.00	0
...	...	...	...	...	...	...	...
6362615	743	339682.13	339682.13	0.00	0.00	339682.13	0
6362616	743	6311409.28	6311409.28	0.00	0.00	0.00	0
6362617	743	6311409.28	6311409.28	0.00	68488.84	6379898.11	0
6362618	743	850002.52	850002.52	0.00	0.00	0.00	0
6362619	743	850002.52	850002.52	0.00	6510099.11	7360101.63	0

6362620 rows × 7 columns

In [18]:
```
X['type'].unique()
```

Out[18]:
```
array(['PAYMENT', 'TRANSFER', 'CASH_OUT', 'DEBIT', 'CASH_IN'],
      dtype=object)
```

In [19]:
```
object_cols = [col for col in df.columns if df[col].dtype == "object"]
```

In [20]:
```
object_cols
```

Out[20]:
```
['type', 'nameOrig', 'nameDest']
```

In [ ]:
```

```

In [21]:
```
good_label_cols = [col for col in object_cols if
                   set(X_train[col]) == set(X_test[col])]
```

In [22]:
```
label_encoder=LabelEncoder()
X_train['type']=label_encoder.fit_transform(X_train['type'])
X_test['type']=label_encoder.fit_transform(X_test['type'])
```

```
C:\Users\SHASHW~1\AppData\Local\Temp/ipykernel_7108/341610649.py:2: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-ve
rsus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy)
  X_train['type']=label_encoder.fit_transform(X_train['type'])
C:\Users\SHASHW~1\AppData\Local\Temp/ipykernel_7108/341610649.py:3: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-ve
rsus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy)
  X_test['type']=label_encoder.fit_transform(X_test['type'])
```

In [23]:
```
catcol=X_train['type']
```

In [24]:
```
X_train_new=X_train[col]
X_test_new=X_test[col]
```

In [25]:
```
catcol.shape
```

Out[25]:
```
(4771965,)
```

In [26]:
```
X_train_new
```

Out[26]:

	type	amount	oldbalanceOrg	newbalanceOrig	oldbalanceDest	newbalanceDest
1521042	0	326041.32	14703825.95	15029867.26	493495.76	167454.45
1074638	1	16093.87	0.00	0.00	447802.91	463896.78
3455349	1	49301.07	0.00	0.00	5356546.69	5405847.76
1414451	1	15723.78	206059.87	190336.10	212319.65	228043.43
6267792	1	321965.50	0.00	0.00	1792304.98	2114270.49
...	...	...	...	...	...	...
2509086	1	97171.64	0.00	0.00	876514.52	973686.17
4886085	1	143375.09	0.00	0.00	256633.47	400008.56
2716271	3	1012.03	21368.00	20355.97	0.00	0.00
5543719	3	9944.82	12212.00	2267.18	0.00	0.00
3132777	1	459250.73	0.00	0.00	1928380.92	2548962.78

4771965 rows × 6 columns

In [27]:
```
X_test_new
```

Out[27]:

	type	amount	oldbalanceOrg	newbalanceOrig	oldbalanceDest	newbalanceDest
5113549	0	284896.37	5550390.96	5835287.32	1335474.91	1050578.55
5407182	1	9618.72	2490.95	0.00	763957.30	773576.03
5970691	1	22480.43	0.00	0.00	137403.79	159884.22
6131344	0	56403.97	269445.00	325848.97	2928694.84	2872290.88
1081641	0	137060.58	75503.00	212563.58	8367211.43	8462201.26
...	...	...	...	...	...	...
3776993	0	123196.81	10201.00	133397.81	165125.48	41928.67
6181371	1	374616.37	504259.00	129642.63	634150.38	1008766.76
231565	1	182791.04	25959.00	0.00	0.00	182791.04
80435	4	1236993.88	0.00	0.00	1330123.54	2321500.51
3852408	3	5054.25	0.00	0.00	0.00	0.00

1590655 rows × 6 columns

In [28]:
```
for i in X_train_new:
    X_train_new[i]=np.log(X_train_new[i]+1)
```

```
C:\Users\SHASHW~1\AppData\Local\Temp/ipykernel_7108/3228474689.py:2: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-ve
rsus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy)
  X_train_new[i]=np.log(X_train_new[i]+1)
```

In [29]:
```
for i in X_test_new:
    X_test_new[i]=np.log(X_test_new[i]+1)
```

```
C:\Users\SHASHW~1\AppData\Local\Temp/ipykernel_7108/2854076662.py:2: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-ve
rsus-a-copy (https://pandas.pydata.org/pandas-docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy)
  X_test_new[i]=np.log(X_test_new[i]+1)
```

In [30]:
```
X_train_new.skew()
```

Out[30]:
```
type             -0.294838
amount           -0.553923
oldbalanceOrg    -0.260134
newbalanceOrig    0.439752
oldbalanceDest   -0.212621
newbalanceDest   -0.386209
dtype: float64
```

In [31]:

```
X_Train=StandardScaler().fit_transform(X_train_new)
X_Test=StandardScaler().fit_transform(X_test_new)
```

In [40]:

```
# Model training on some basic Classifiers
```

In [32]:

```
model=LogisticRegression()
model.fit(X_Train,y_train)
```

Out[32]:

```
LogisticRegression()
```

In [33]:

```
model.predict(X_Test)
```

Out[33]:

```
array([0, 0, 0, ..., 0, 0, 0], dtype=int64)
```

In [34]:

```
model.score(X_Train,y_train)
```

Out[34]:

```
0.9993084609799108
```

In [35]:

```
model.score(X_Test,y_test)
```

Out[35]:

```
0.9993040602770557
```

In [36]:

```
from sklearn.svm import SVC
from sklearn.model_selection import GridSearchCV
```

In [37]:

```
svc=SVC()
svc.fit(X_Train,y_train)
```

Out[37]:

```
SVC()
```

In [38]:

```
# svr = SVC()
# svr_CV = GridSearchCV(svr, param_grid={'kernel': ['linear', 'poly', 'rbf', 'sigmoid'],
#                                         'tol': [1e-4]},
#                       cv=None, verbose=False)
# svr_CV.fit(X_Train, y_train)
# print(svr_CV.best_params_)
# acc_metrics_calc(1,svr_CV,X_Train,X_Test,y_train,y_test)
# (Would have gone with grid search for searching the best parameters.)
```

In [44]:

```
from sklearn import metrics
preds = svc.predict(X_Train)
targs = y_train
print("accuracy: ", metrics.accuracy_score(targs, preds))
print("precision: ", metrics.precision_score(targs, preds))
print("recall: ", metrics.recall_score(targs, preds))
print("f1: ", metrics.f1_score(targs, preds))
print("area under curve (auc): ", metrics.roc_auc_score(targs, preds))
train_preds = preds
```

```
accuracy:  0.9995852861452252
precision:  0.994792899408284
recall:  0.6823051948051948
f1:  0.8094366875300916
area under curve (auc):  0.8411502892930546
```

In [ ]:

```

```

In [ ]:

```

```