Credit Card Fraud Detection ETL Process

In [ ]:
```
# packages
import numpy as np
import pandas as pd
from pandas_profiling import ProfileReport
```

In [ ]:
```
# Import data
df = pd.read_csv('/application_data.csv')
cd = pd.read_csv('/columns_description.csv', encoding='cp1252')
```

Inspect dataset

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

Out[ ]:

	SK_ID_CURR	TARGET	NAME_CONTRACT_TYPE	CODE_GENDER	FLAG_OWN_CAR	FLAG_OV
0	100002	1	Cash loans	M	N	
1	100003	0	Cash loans	F	N	
2	100004	0	Revolving loans	M	Y	
3	100006	0	Cash loans	F	N	
4	100007	0	Cash loans	M	N	

5 rows × 122 columns

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

Out[ ]:
```
(307511, 122)
```

In [ ]:
```
# Checking datatypes
# df.dtypes
```

1. Drop duplicates in ID column

In [ ]:
```
df.drop_duplicates(subset=['SK_ID_CURR']).shape
```

Out[ ]:
```
(307511, 72)
```

2. Check null values

67 columns have null values

In [ ]:
```
#checking percentage of null values in all columns
df_nulls = df.isnull().mean() * 100

#Number of columns having null values
len(df_nulls[df_nulls.values>0])
```

Out[ ]:
```
67
```

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50 vars have more than 30% missing

In [ ]:
```
df_nulls = df_nulls[df_nulls.values > 30]
len(df_nulls)
```

Out[ ]:
```
50
```

Exclude these vars, 72 vars left

In [ ]:
```
#Removing columns with more than 40 percent null values in the dataset
df.drop(df_nulls.index, axis=1, inplace = True)
df.shape
```

Out[ ]:
```
(307511, 72)
```

Check missing condition

In [ ]:
```
df.isnull().sum()[df.isnull().sum()>0]
```

Out[ ]:
```
AMT_ANNUITY                    12
AMT_GOODS_PRICE               278
NAME_TYPE_SUITE              1292
CNT_FAM_MEMBERS                 2
EXT_SOURCE_2                  660
EXT_SOURCE_3                60965
OBS_30_CNT_SOCIAL_CIRCLE     1021
DEF_30_CNT_SOCIAL_CIRCLE     1021
OBS_60_CNT_SOCIAL_CIRCLE     1021
DEF_60_CNT_SOCIAL_CIRCLE     1021
DAYS_LAST_PHONE_CHANGE          1
AMT_REQ_CREDIT_BUREAU_HOUR  41519
AMT_REQ_CREDIT_BUREAU_DAY   41519
AMT_REQ_CREDIT_BUREAU_WEEK  41519
AMT_REQ_CREDIT_BUREAU_MON   41519
AMT_REQ_CREDIT_BUREAU_QRT   41519
AMT_REQ_CREDIT_BUREAU_YEAR  41519
dtype: int64
```

Check vars description

In [ ]:
```
null = list(df.isnull().sum()[df.isnull().sum()>0].index)
cd[cd['Row'].isin(null)]
```

Out[ ]:

	Unnamed: 0	Row	Description	Special
9	12	AMT_ANNUITY	Loan annuity	NaN
10	13	AMT_GOODS_PRICE	For consumer loans it is the price of the good...	NaN
11	14	NAME_TYPE_SUITE	Who was accompanying client when he was applyi...	NaN
29	32	CNT_FAM_MEMBERS	How many family members does client have	NaN
42	45	EXT_SOURCE_2	Normalized score from external data source	normalized
43	46	EXT_SOURCE_3	Normalized score from external data source	normalized
91	94	OBS_30_CNT_SOCIAL_CIRCLE	How many observation of client's social surrou...	NaN

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	Unnamed: 0	Row	Description	Special
92	95	DEF_30_CNT_SOCIAL_CIRCLE	How many observation of client's social surrou...	NaN
93	96	OBS_60_CNT_SOCIAL_CIRCLE	How many observation of client's social surrou...	NaN
94	97	DEF_60_CNT_SOCIAL_CIRCLE	How many observation of client's social surrou...	NaN
95	98	DAYS_LAST_PHONE_CHANGE	How many days before application did client ch...	NaN
116	119	AMT_REQ_CREDIT_BUREAU_HOUR	Number of enquiries to Credit Bureau about the...	NaN
117	120	AMT_REQ_CREDIT_BUREAU_DAY	Number of enquiries to Credit Bureau about the...	NaN
118	121	AMT_REQ_CREDIT_BUREAU_WEEK	Number of enquiries to Credit Bureau about the...	NaN
119	122	AMT_REQ_CREDIT_BUREAU_MON	Number of enquiries to Credit Bureau about the...	NaN
120	123	AMT_REQ_CREDIT_BUREAU_QRT	Number of enquiries to Credit Bureau about the...	NaN
121	124	AMT_REQ_CREDIT_BUREAU_YEAR	Number of enquiries to Credit Bureau about the...	NaN
125	179	AMT_ANNUITY	Annuity of previous application	NaN
129	183	AMT_GOODS_PRICE	Goods price of good that client asked for (if ...	NaN
143	197	NAME_TYPE_SUITE	Who accompanied client when applying for the p...	NaN

It is ok to remove some vars

In [ ]:
```
# make a list of vars with more than 600 missing values
df_nulls = list(df.isnull().sum()[df.isnull().sum()>600].index)
df_nulls.remove("NAME_TYPE_SUITE") # not include this since it seems cool
df_nulls.append("DAYS_LAST_PHONE_CHANGE")
# drop vars in that list
df.drop(labels=df_nulls,axis=1,inplace=True)
df.isnull().sum()[df.isnull().sum()>0]
```

Out[ ]:
```
AMT_GOODS_PRICE      278
NAME_TYPE_SUITE     1292
CNT_FAM_MEMBERS        2
dtype: int64
```

Check description to see if anyone else needs to be delete

In [ ]:
```
cd
```

Out[ ]:

	Unnamed: 0	Row	Description	Special
0	1	SK_ID_CURR	ID of loan in our sample	NaN
		TARGET	Target variable (1 - client with payment diffi...	NaN

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	Unnamed: 0	Row	Description	Special
2	5	NAME_CONTRACT_TYPE	Identification if loan is cash or revolving	NaN
3	6	CODE_GENDER	Gender of the client	NaN
4	7	FLAG_OWN_CAR	Flag if the client owns a car	NaN
...	...	...	...	...
155	209	DAYS_FIRST_DUE	Relative to application date of current applic...	time only relative to the application
156	210	DAYS_LAST_DUE_1ST_VERSION	Relative to application date of current applic...	time only relative to the application
157	211	DAYS_LAST_DUE	Relative to application date of current applic...	time only relative to the application
158	212	DAYS_TERMINATION	Relative to application date of current applic...	time only relative to the application
159	213	NFLAG_INSURED_ON_APPROVAL	Did the client requested insurance during the ...	NaN

160 rows × 4 columns

Remove meaningless flags

In [ ]:
```
#FLAG vars are meaningless
flag_col = df.filter(regex='^FLAG',axis=1).columns.tolist()
flag_col.remove('FLAG_OWN_CAR')
flag_col.remove('FLAG_OWN_REALTY')

#Delete all indicator FLAG columns as they are not relevant to our analysis
df.drop(flag_col, axis = 1, inplace = True)
```

34 vars survive

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

Out[ ]:
```
(307511, 33)
```

Imputing null variables

In [ ]:
```
impute = list(df.isnull().sum()[df.isnull().sum() > 0].index)
df[impute].head(10)
```

Out[ ]:

	NAME_TYPE_SUITE	CNT_FAM_MEMBERS
0	Unaccompanied	1.0
1	Family	2.0
2	Unaccompanied	1.0
3	Unaccompanied	2.0
4	Unaccompanied	1.0

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	NAME_TYPE_SUITE	CNT_FAM_MEMBERS
6	Unaccompanied	3.0
7	Unaccompanied	2.0
8	Children	2.0
9	Unaccompanied	1.0

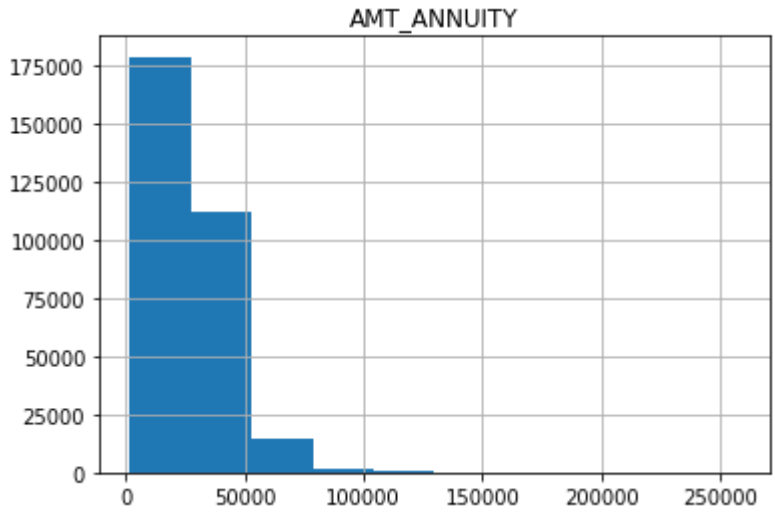
In [ ]:
```
#calculating mean, median and mode for AMT_ANNUITY and AMT_GOODS_PRICE
print("AMT_ANNUITY")
print('Mean: ', df['AMT_ANNUITY'].mean())
print('Median: ', df['AMT_ANNUITY'].median())
print('Mode: ', df['AMT_ANNUITY'].mode())

print("-----------------------------------")
print("AMT_GOODS_PRICE")
print('Mean: ', df['AMT_GOODS_PRICE'].mean())
print('Median: ', df['AMT_GOODS_PRICE'].median())
print('Mode: ', df['AMT_GOODS_PRICE'].mode())
```

```
AMT_ANNUITY
Mean:  27108.48784108536
Median:  24903.0
Mode:  0    9000.0
dtype: float64
-----------------------------------
AMT_GOODS_PRICE
Mean:  538396.2074288895
Median:  450000.0
Mode:  0    450000.0
dtype: float64
```

In [ ]:
```
df.hist(column="AMT_ANNUITY")
```

Out[ ]:
```
array([[<matplotlib.axes._subplots.AxesSubplot object at 0x7fd8841d6d50>]],
      dtype=object)
```



In [ ]:
```
df.hist(column="AMT_GOODS_PRICE")
```

Out[ ]:
```
array([[<matplotlib.axes._subplots.AxesSubplot object at 0x7fd88404f750>]],
      dtype=object)
```

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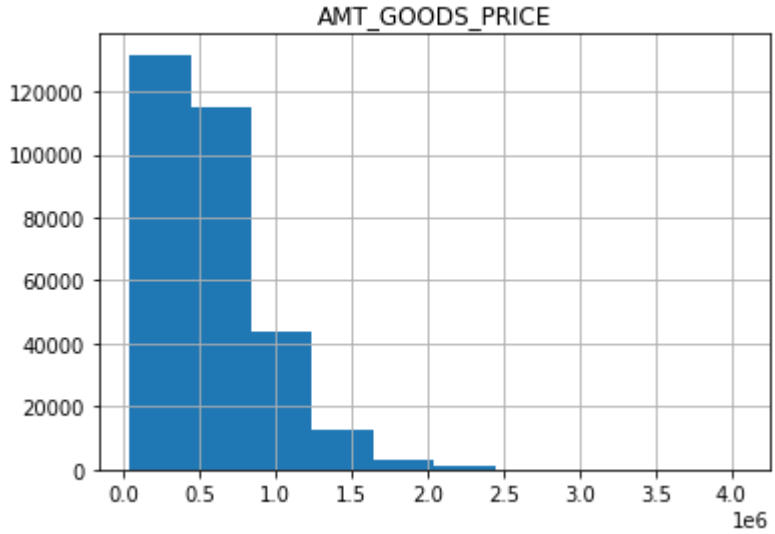


Impute AMT_ANNUITY with median, AMT_GOODS_PRICE with mean

In [ ]:
```
df['AMT_ANNUITY'].fillna(df['AMT_ANNUITY'].median(), inplace=True)
df['AMT_GOODS_PRICE'].fillna(df['AMT_GOODS_PRICE'].mean(), inplace=True)
```

For NAME TYPE SUITE I add the most common one

In [ ]:
```
df.NAME_TYPE_SUITE.value_counts()
```

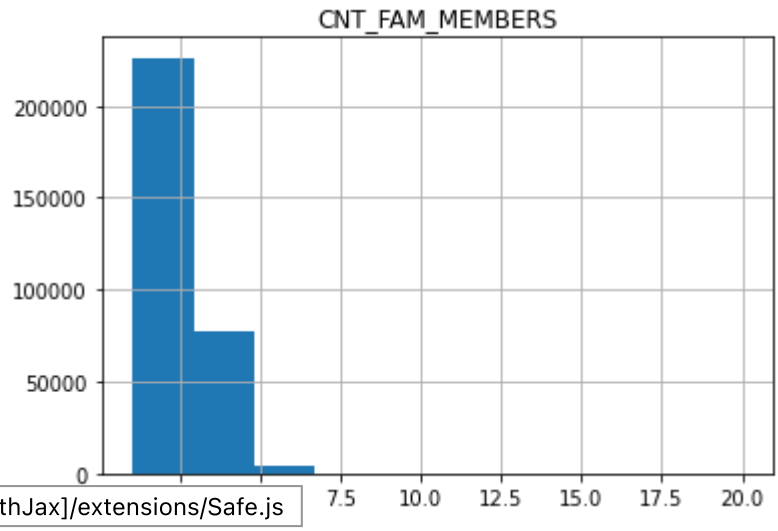
Out[ ]:
```
Unaccompanied      248526
Family              40149
Spouse, partner     11370
Children             3267
Other_B              1770
Other_A               866
Group of people       271
Name: NAME_TYPE_SUITE, dtype: int64
```

In [ ]:
```
df['NAME_TYPE_SUITE'].fillna('Unaccompanied', inplace=True)
```

For CNT_FAM_MEMBERS I add median

In [ ]:
```
df.hist(column='CNT_FAM_MEMBERS')
```

Out[ ]:
```
array([[<matplotlib.axes._subplots.AxesSubplot object at 0x7fd883f3f5d0>]],
      dtype=object)
```



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In [ ]:
```
df['CNT_FAM_MEMBERS'].fillna(df['CNT_FAM_MEMBERS'].median(), inplace=True)
```

Finish imputing

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

Out[ ]:
```
SK_ID_CURR                    0
TARGET                        0
NAME_CONTRACT_TYPE            0
CODE_GENDER                   0
FLAG_OWN_CAR                  0
FLAG_OWN_REALTY               0
CNT_CHILDREN                  0
AMT_INCOME_TOTAL              0
AMT_CREDIT                    0
AMT_ANNUITY                   0
AMT_GOODS_PRICE               0
NAME_TYPE_SUITE               0
NAME_INCOME_TYPE              0
NAME_EDUCATION_TYPE           0
NAME_FAMILY_STATUS            0
NAME_HOUSING_TYPE             0
REGION_POPULATION_RELATIVE    0
DAYS_BIRTH                    0
DAYS_EMPLOYED                 0
DAYS_REGISTRATION             0
DAYS_ID_PUBLISH               0
CNT_FAM_MEMBERS               0
REGION_RATING_CLIENT          0
REGION_RATING_CLIENT_W_CITY   0
WEEKDAY_APPR_PROCESS_START    0
HOUR_APPR_PROCESS_START       0
REG_REGION_NOT_LIVE_REGION    0
REG_REGION_NOT_WORK_REGION    0
LIVE_REGION_NOT_WORK_REGION   0
REG_CITY_NOT_LIVE_CITY        0
REG_CITY_NOT_WORK_CITY        0
LIVE_CITY_NOT_WORK_CITY       0
ORGANIZATION_TYPE             0
dtype: int64
```

Correcting format

CNT_FAM_MEMBERS cannot be float. Converting to integer

In [ ]:
```
df.CNT_FAM_MEMBERS = df.CNT_FAM_MEMBERS.apply(lambda x: int(x))
```

DAYS_EMPLOYED, DAY_REGISTRATION, DAYS_ID_PUBLISH should be a positive value

In [ ]:
```
df.DAYS_EMPLOYED = df.DAYS_EMPLOYED.apply(lambda x: abs(x))
df.DAYS_REGISTRATION = df.DAYS_REGISTRATION.apply(lambda x: abs(x))
df.DAYS_ID_PUBLISH = df.DAYS_ID_PUBLISH.apply(lambda x: abs(x))
```

make days_birth just age

In [ ]:
```
#Dividing by -365.25 to include leap years
df['Age'] = df['DAYS_BIRTH'] //-365.25
```

In [ ]:
```
df.drop('DAYS_BIRTH', axis = 1, inplace = True)
```

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Done

In [ ]:
```
# df.head(10)
```

In [ ]:
```
from pandas_profiling import ProfileReport
```

In [ ]:
```
profile = ProfileReport(df, html={'style':{'full_width':True}})
```

In [ ]:
```
profile.to_notebook_iframe()
```

Overview

Dataset statistics

Number of variables	33
Number of observations	307511
Missing cells	0
Missing cells (%)	0.0%
Duplicate rows	0
Duplicate rows (%)	0.0%
Total size in memory	77.4 MiB
Average record size in memory	264.0 B

Variable types

Numeric	13
Categorical	18
Boolean	2

Alerts

`ORGANIZATION_TYPE` has a high cardinality: 58 distinct values	**High cardinality**
`CNT_CHILDREN` is highly correlated with `CNT_FAM_MEMBERS`	**High correlation**
ghly correlated with `AMT_ANNUITY` and 1 other	**High correlation**

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In [ ]:
```
profile.to_file("Analysis.html")
```

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