Marketing Research Assignment

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> - We used Python Libraries(Numpy, Pandas, Matplotlib, scipy) to explore the Data.
> - We wrote this document by using Jupyter Notebook, Typora, and Markdown.
> - Due to the lack of spcae, many pre-processing processes have been omitted. You can see all raw codes in the link below. https://github.com/saanghyuk/deep_learning_2019_fall/tree/master/MarketingResearch (Github)

Form the two hypotheses to the Data

Data	Hypothesis Question
Credit Risk	Is the total savings(combined checking and savings account balance) of Population 2800?
Credit Risk	Does the total savings(combined checking and savings account balance) have a correlation with the number of months as a customer of the bank?
Facebook	Does the Hours online/week have a correlation with Friends?

In [1]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import matplotlib as mpl
from pandas.plotting import scatter_matrix
import seaborn as sns
sns.set(style="ticks", color_codes=True)

%matplotlib inline



mpl.rcParams['axes.unicode_minus'] = False
```

In [2]:

```
df = pd.read_excel('Data_Sets.xlsx')
```

Explore the Data

There are 10 columns in this Data

In [67]:

```
data.head()
```

Out[67]:

	Loan Purpose	Checking	Savings	Months Customer	Months Employed	Gender	Marital Status	Age	Housing	Year
1	Small Appliance	0	739	13	12	M	Single	23	Own	
2	Furniture	0	1230	25	0	M	Divorced	32	Own	
3	New Car	0	389	19	119	M	Single	38	Own	
4	Furniture	638	347	13	14	M	Single	36	Own	
5	Education	963	4754	40	45	M	Single	31	Rent	

We have to divde Categorical and Numerical Data to deep dive into Data.

In [19]:

```
cate_list = ['Loan Purpose','Gender', 'Marital Status', 'Housing', 'Job', 'Credit Risk']
num_list = ['Checking ', 'Savings', 'Months Customer','Months Employed',
           'Age', 'Years' ]
```

In [75]:

```
cate_data = data[cate_list]
```

In [76]:

```
num_data = data[num_list]
num_data = num_data.infer_objects()
```

We want to see the approximate description of these two data

In [79]:

```
cate_data.describe()
```

Out[79]:

	Loan Purpose	Gender	Marital Status	Housing	Job	Credit Risk
count	425	425	425	425	425	425
unique	10	2	3	3	4	2
top	Small Appliance	M	Single	Own	Skilled	Low
freq	105	290	233	292	271	214

In [80]:

```
num_data.describe()
```

Out[80]:

	Checking	Savings	Months Customer	Months Employed	Age	Years
count	425.000000	425.000000	425.000000	425.000000	425.000000	425.000000
mean	1048.014118	1812.562353	22.896471	31.896471	34.397647	2.840000
std	3147.183472	3597.285020	12.267599	32.259321	11.045126	1.087146
min	0.000000	0.000000	5.000000	0.000000	18.000000	1.000000
25%	0.000000	228.000000	13.000000	6.000000	26.000000	2.000000
50%	0.000000	596.000000	19.000000	20.000000	32.000000	3.000000
75%	560.000000	921.000000	28.000000	47.000000	41.000000	4.000000
max	19812.000000	19811.000000	73.000000	119.000000	73.000000	4.000000

I want to sum 'Checking' and 'Savings' as 'saving_total' column.

In [81]:

```
frames = [cate_data, num_data]
```

In [82]:

```
data_2 = pd.concat(frames, axis=1, sort=False)

data_2['saving_total'] = data_2['Checking ']+data_2['Savings']
```

In [83]:

```
assign_data=data_2
```

assign_data is the final version data after pre-processing

In [84]:

```
#Data Check (5 rows)
assign_data.head()
```

Out[84]:

	Loan Purpose	Gender	Marital Status	Housing	Job	Credit Risk	Checking	Savings	Months Customer
1	Small Appliance	M	Single	Own	Unskilled	Low	0	739	13
2	Furniture	M	Divorced	Own	Skilled	High	0	1230	25
3	New Car	M	Single	Own	Management	High	0	389	19
4	Furniture	M	Single	Own	Unskilled	High	638	347	13
5	Education	M	Single	Rent	Skilled	Low	963	4754	40

In [33]:

```
num_data.describe()
```

Out[33]:

	Checking	Savings	Months Customer	Months Employed	Age	Years
count	425.000000	425.000000	425.000000	425.000000	425.000000	425.000000
mean	1048.014118	1812.562353	22.896471	31.896471	34.397647	2.840000
std	3147.183472	3597.285020	12.267599	32.259321	11.045126	1.087146
min	0.000000	0.000000	5.000000	0.000000	18.000000	1.000000
25%	0.000000	228.000000	13.000000	6.000000	26.000000	2.000000
50%	0.000000	596.000000	19.000000	20.000000	32.000000	3.000000
75%	560.000000	921.000000	28.000000	47.000000	41.000000	4.000000
max	19812.000000	19811.000000	73.000000	119.000000	73.000000	4.000000

1. Is the total savings(combined checking and savings account balance) of Population 2800?

One population Mean Testing about Savings
sample mean = 2860.576471
sample std = 4826.993904

H0 : μ=2800
H1 : μ≠2800

In [86]:

```
import statsmodels.api as sm
import numpy as np
import pandas as pd
```

In [96]:

```
savings_total = assign_data['saving_total']
```

In [97]:

```
print('The number of data : ',len(savings_total))
print('Sample Mean : ', savings_total.mean())
print('Sample Std : ', savings_total.std())
```

```
The number of data :  425
Sample Mean :  2860.576470588235
Sample Std :  4826.993904117601
```

In [98]:

```
sm.stats.ztest(savings_total, value=2800, alternative='two-sided')
```

Out[98]:

```
(0.2587150425540816, 0.7958551123461524)
```

P-value pretty high here, and then we can't reject the H0

In [ ]:

```

```

2. Does the total savings(combined checking and savings account balance) have a correlation with the number of months as a customer of the bank?

H0 : Two variables are not correlated.
H1 : Two variables are correlated.

In [92]:

```
from scipy.stats import pearsonr
```

In [93]:

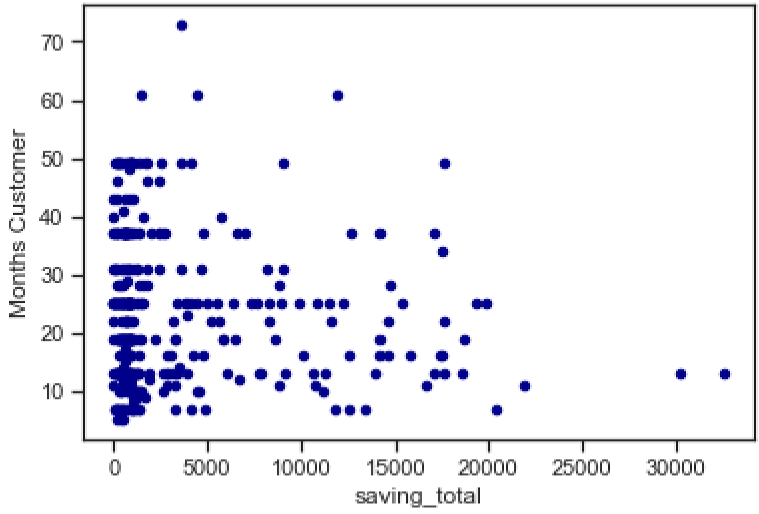
```
savings=assign_data['saving_total']
```

In [94]:

```
months_customer=assign_data['Months Customer']
```

In [95]:

```
ax1 = assign_data.plot.scatter(x='saving_total', y='Months Customer', c='DarkBlu
e')
```



In [90]:

```
corr, p = pearsonr(savings, months_customer)
```

In [91]:

```
print(corr, p)
```

```
-0.061210007817111819 0.2079070784127837
```

correlation coefficient = -0.061210007817111819
p-value = 0.2079070784127837

In this pearsonr function, The null hypothesis is that the two variables are uncorrelated. The p-value is a number between zero and one that represents the probability that your data would have arisen if the null hypothesis were true.

corr is near 0, and P-value is really big.
So, we cannot reject the null hypothesis(Uncorrelated)

In [ ]:

```

```

Start pre-processing of Facebook Data

In [121]:

```
df = pd.read_excel('Data_Sets.xlsx', 'Facebook')
```

In [117]:

```
df1=df
df1.head()
```

Out[117]:

	FACEBOOK SURVEY DATA	Unnamed: 1	Unnamed: 2	Unnamed: 3
0	NaN	NaN	NaN	NaN
1	Student	Gender	Hours online/week	Friends
2	1	female	4	150
3	2	female	10	400
4	5	female	9	260

In [118]:

```
df1 = df1.shift(-1)
```

In [123]:

```
new_col_names = pd.Series(df1.iloc[0])
df1.columns=list(new_col_names)
```

In [124]:

```
df1=df1.drop(df1.index[0])
df1=df1.drop(df1.index[33])
df1.head()
```

Out[124]:

	Student	Gender	Hours online/week	Friends
1	1	female	4	150
2	2	female	10	400
3	5	female	9	260
4	6	female	5	70
5	7	female	7	90

In [109]:

```
df1=df1.drop(df1.index[0])
df1=df1.drop(df1.index[33])
df1.head()
```

Out[109]:

	FACEBOOK SURVEY DATA	Unnamed: 1	Unnamed: 2	Unnamed: 3
1	1	female	4	150
2	2	female	10	400
3	5	female	9	260
4	6	female	5	70
5	7	female	7	90

In [126]:

```
df2= df1.infer_objects()
```

In [129]:

```
assign2_data = df2
```

Final version data after preprocessing = assign2_data

3. Does the Hours online/week have a correlation with Friends?

H0 : Two variables are not correlated.
H1 : Two variables are correlated.

In [130]:

```
hours=assign2_data['Hours online/week']
friends=assign2_data['Friends']
```

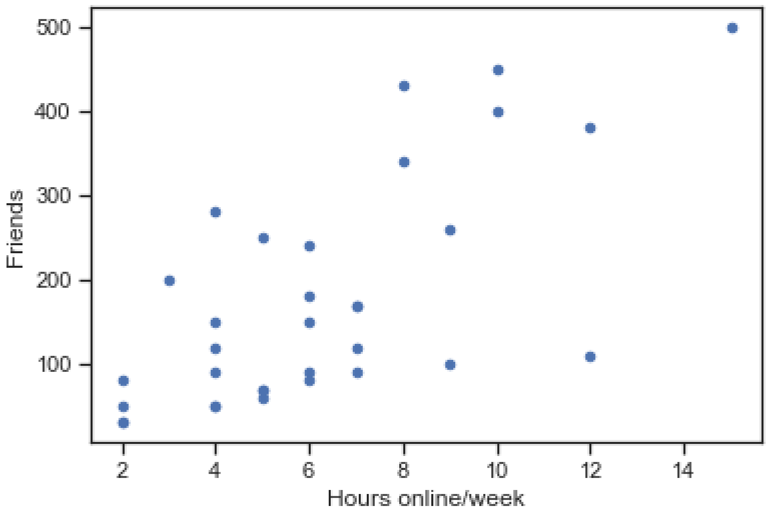
In [133]:

```
assgin2_data.plot.scatter(x='Hours online/week', y='Friends')
```

```
'c' argument looks like a single numeric RGB or RGBA sequence, which
should be avoided as value-mapping will have precedence in case its
length matches with 'x' & 'y'.  Please use a 2-D array with a single
row if you really want to specify the same RGB or RGBA value for all
points.
```

Out[133]:

```
<matplotlib.axes._subplots.AxesSubplot at 0x1c22287c18>
```



In [134]:

```
corr, p = pearsonr(hours, friends)
```

In [135]:

```
print(corr, p)
```

```
0.6918339795143523 8.224280934770067e-06
```

Correlation is about 0.7, and p-value is 8.22e-06(So Low).
So, We can reject the null hypothesis(No-correlation) This two data can be positively-correlated.