WEEK 8 : DELIVERABLES

BANK MARKETING CAMPAIGN

‘DATA SCIENCE’

GROUP NAME: DATA SCIENCE MASTER
NAME : ABHIMANYU GANGANI
EMAIL : Agangani97@gmail.com
COUNTRY : UNITED KINGDOM
COLLEGE : ANGLIA RUSKIN UNIVERSITY
SPECIALIZATION : DATA SCIENCE

PROBLEM DESCRIPTION :

ABC Bank wants to sell it's term deposit product to customers and before launching the product they want to develop a model which help them in understanding whether a particular customer will buy their product or not.
To achieve this task they have consulted an analytics consultancy to automate the process of classification.
The Analytics company have to come up with an ML model to shortlist the customers whose chances to buy the product is higher. This will lead marketing team to target on the given lead.

BUSINESS UNDERSTANDING :

There's been a revenue decline for the ABC bank and to overcome that they want to come up with the actions needed to be taken. With analysis they came to know that customers are not depositing as frequently as before. Banks make investments from the investment made by customers to make high profits.

Banks also urges customers to buy other products such as insurance and Different kind of deposits. They want to check the customers from existing data they pursue and filter the customers having higher chances of buying any new schemes or products from the bank.

DATA UNDERSTANDING :

Data belongs to a banking organisation and corresponds to marketing campaigns. These campaigns are based on phone calls. More than one call to the same client tells whether the bank term deposit (product) was subscribed by client or not.

There are four datasets provided for this classification problem. We are having 2 pairs of test and train datasets.
Bank.csv and Bank_full.csv are one pair having 16 features and Bank_additional.csv and Bank_additional_full.csv are having 20 features.
Bank.csv is the older version of bank_additional.csv.

Below are the details of all four datasets:

File	Dataset Type	Description
Bank.csv	Test	4521 observations(10% of train data) and 16 features
Bank_full.csv	Train	45211 observations and 16 features
Bank_additional.csv	Test	4111 observations(10% of train data) and 20 features
Bank_additional_full.csv	Train	41118 observations and 20 features

Datatype and Description of columns:

```
Data columns (total 21 columns):
 #   Column             Dtype       Description
---  ------             -----       -----------
 0   age                int64       Age of Client.
 1   job                object      Type of Job.
 2   marital            object      Marital Status.
 3   education          object      Level of Education.
 4   default            object      Has credit in default?
 5   housing            object      Has housing loan?
 6   loan               object      Has personal loan?
 7   contact            object      How client has been communicated?
 8   month              object      last contacted month.
 9   day_of_week        object      last contacted day.
 10  duration           int64       duration of communication(seconds).
 11  campaign           int64       number of contacts performed in
                                    Campaign.
 12  pdays              int64       number of days passed after contact.
 13  previous           int64       number of total contacts performed.
 14  poutcome           object      outcome of the previous campaign.
 15  emp.var.rate       float64     Employment variation rate.
 16  cons.price.idx     float64     Consumer price index.
 17  cons.conf.idx      float64     Consumer confidence index.
 18  euribor3m          float64     Euribor 3 months rate.
 19  nr.employed        float64     number of employees.
 20  y                  object      has the client subscribed product.
dtypes: float64(5), int64(5), object(11)
```

- First 7 features are the client information.
- Features 8-11 are last contact information.

- Features 12-15 are other important details regarding contact.
- Features 16-20 are economic and social features.
- The 21^{st} feature is the target variable(dependent).

Data Problems :

Missing Attribute:

None of the dataset contains any missing value.

```
#Checking null values
bank_add_full.isnull().sum()

age               0
job               0
marital           0
education         0
default           0
housing           0
loan              0
contact           0
month             0
day_of_week       0
duration          0
campaign          0
pdays             0
previous          0
poutcome          0
emp.var.rate      0
cons.price.idx    0
cons.conf.idx     0
euribor3m         0
nr.employed       0
y                 0
dtype: int64
```

```
#Checking null values
bank_add.isnull().sum()

age               0
job               0
marital           0
education         0
default           0
housing           0
loan              0
contact           0
month             0
day_of_week       0
duration          0
campaign          0
pdays             0
previous          0
poutcome          0
emp.var.rate      0
cons.price.idx    0
cons.conf.idx     0
euribor3m         0
nr.employed       0
y                 0
dtype: int64
```

```
#Checking null values
bank_full.isnull().sum()

age          0
job          0
marital      0
education    0
default      0
balance      0
housing      0
loan         0
contact      0
day          0
month        0
duration     0
campaign     0
pdays        0
previous     0
poutcome     0
y            0
dtype: int64
```

```
#Checking null values
bank.isnull().sum()

age          0
job          0
marital      0
education    0
default      0
balance      0
housing      0
loan         0
contact      0
day          0
month        0
duration     0
campaign     0
pdays        0
previous     0
poutcome     0
y            0
dtype: int64
```

Value Counts :

Some of the variables consists of value counts as “Unknown” which is significantly high. ***<u>So we assume “Unknown” as another category for these variables.</u>***

```
admin.             10422
blue-collar         9254
technician          6743
services            3969
management          2924
retired             1720
entrepreneur        1456
self-employed       1421
housemaid           1060
unemployed          1014
student              875
unknown              330
Name: job, dtype: int64

------------------------------
married     24928
single      11568
divorced     4612
unknown        80
Name: marital, dtype: int64

------------------------------
university.degree      12168
high.school             9515
basic.9y                6045
professional.course     5243
basic.4y                4176
basic.6y                2292
unknown                 1731
illiterate                18
Name: education, dtype: int64

------------------------------
no         32588
unknown     8597
yes            3
Name: default, dtype: int64

------------------------------
yes        21576
no         18622
unknown      990
Name: housing, dtype: int64

------------------------------
no         33950
yes         6248
unknown      990
Name: loan, dtype: int64
```

<u>Duplicate Counts :</u>

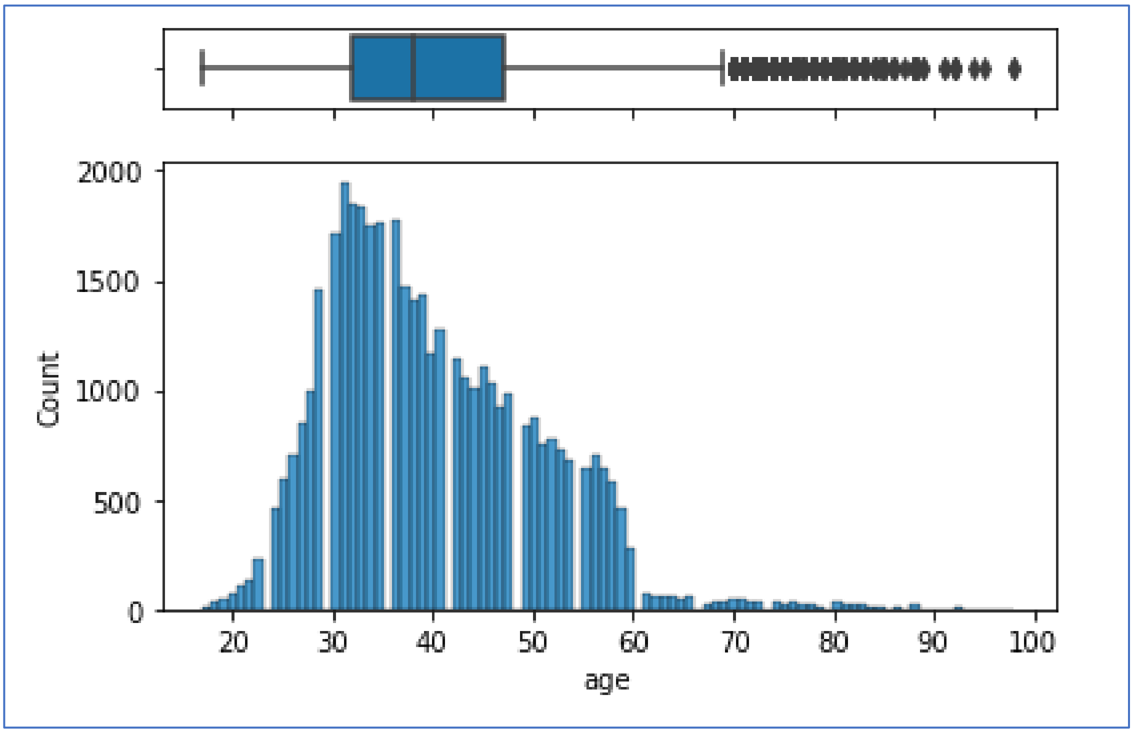
```
In [70]: #Checking the count of duplicates in bank_add_full dataset
         print(f'There are {bank_add_full.duplicated().sum()} duplicates in bank_addition_full.')
         bank_add_full.drop_duplicates(inplace=True, keep= 'first')

         There are 12 duplicates in bank_addition_full.
```

There are 12 duplicates present in the bank_additonal_full dataset, we will remove the duplicates using drop_duplicates function.

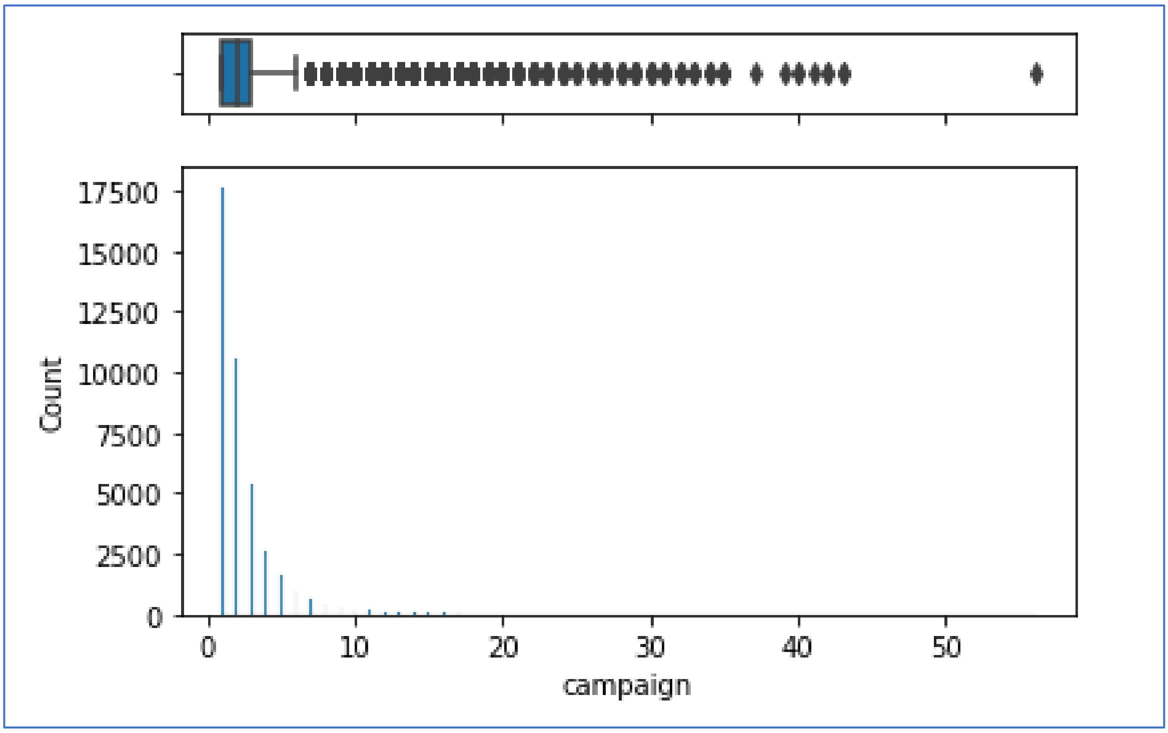
Outliers :

Outliers are the values which lie at above 3 standard deviation distance fr om the other Values in normal distribution.
It might occur due to improper collection of the data. . Outliers can disturb our analysis by changing the mean on normal distribution graph. F ollowing variables consists of significant outliers.

- 'Age' Feature :



- 'Campaign Feature :



<u>The maximum value for 'age' variable is 98 and that of 'campaign' variable is 56 and both are significant values.</u>
Since model is needed to be generalized to reflect the real world data we are not going to remove these outliers as these seems to be realistic value
.

<u>Skewness and Kurtosis:</u>

Skewness is a **measure of symmetry, or more precisely, the lack of symmetry**. A distribution, or data set, is symmetric if it looks the same to the left and right of the center point. Kurtosis is a measure of whether the data are heavy-tailed or light-tailed relative to a normal distribution.

```
#Checking skewness
import warnings
warnings.filterwarnings('ignore')
bank_add_full.skew(axis=0, skipna=True)
```

```
age                0.784560
duration           3.262808
campaign           4.762044
pdays             -4.921386
previous           3.831396
emp.var.rate      -0.724061
cons.price.idx    -0.230853
cons.conf.idx      0.302876
euribor3m         -0.709194
nr.employed       -1.044317
dtype: float64
```

```
bank_add_full.kurt(axis=0, skipna=True)
```

```
age                0.791113
duration          20.243771
campaign          36.971857
pdays             22.221553
previous          20.102164
emp.var.rate      -1.062698
cons.price.idx    -0.829851
cons.conf.idx     -0.359097
euribor3m         -1.406791
nr.employed       -0.003540
dtype: float64
```

GITHUB LINK : https://github.com/AbhimanyuGangani/Week_7_Bank_Marketing/tree/main/Week_8_Bank_Marketing