AI-Python_Final_Assignment

October 17, 2022

1 Assessment Topic

You are a data science consultant. Your client company has a dataset and a bunch of business questions. Therefore, you are required to build an exploratory data analysis pipeline in a Jupyter Notebook to answer these business questions. Your designed and implemented pipeline will be submitted to your client company.

For this practice, a Dataset that has been chosen is from Kaggle which initially from the IBM (Telco customer churn (11.1.3+), 2022) is related to a telco industry with 7k records and 20 features "WA_Fn-UseC_-Telco-Customer-Churn.CSV"

Download link for Dataset:

https://drive.google.com/drive/folders/1tVeHMCC-L7UBGAf5vRRHrLr8qhdkKtRs

2 Business Problem Understanding

In this dataset, one of TelCo industry customers' datasets including demographic data, different service purchases, Monthly and total payments for each customer, and their churn status are available. As a result, I tried to answer and illustrate some questions which are always interesting from the business POV.

3 Variable Description

1. customerID: Unique Values
2. gender: Whether the customer is a male or a female
3. SeniorCitizen: Indicates if the customer is 65 or older (1, 0)/: Yes, No
4. Partner: Whether the customer has a partner or not (Yes, No)
5. Dependents: Whether the customer has dependents or not (Yes, No)
6. Tenure: Number of months the customer has stayed with the company
7. PhoneService: Whether the customer has a phone service or not (Yes, No)
8. MultipleLines: Whether the customer has multiple lines or not (Yes, No, No phone service)
9. InternetService: Customer's internet service provider (DSL, Fiber optic, No)
10. OnlineSecurity: Whether the customer has online security or not (Yes, No, No internet service)
11. OnlineBackup: Whether the customer has online backup or not (Yes, No, No internet service)
12. DeviceProtection: Whether the customer has device protection or not (Yes, No, No internet service)
13. TechSupport: Whether the customer has tech support or not (Yes, No, No internet service)

14. StreamingTV: Whether the customer has streaming TV or not (Yes, No, No internet service)
15. StreamingMovies: Whether the customer has streaming movies or not (Yes, No, No internet service)
16. Contract: The contract term of the customer (Month-to-month, One year, Two year)
17. PaperlessBilling: Whether the customer has paperless billing or not (Yes, No)
18. PaymentMethod: The customer's payment method (Electronic check, Mailed check, Bank transfer (automatic), Credit card (automatic))
19. MonthlyCharges: The amount charged to the customer monthly
20. TotalCharges: The total amount charged to the customer
21. Churn: Customers who left within the last month, the column is called Churn (Yes or No)

4 Importing Libraries

Importing libraries such as: 1. pandas for data analysis. 2. numpy for working with arrays. 3. matplot and seaborn for representing graphs and plots 4. beautifultable and termcolr for table creation

[1]:
```
import os
import datetime

import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from beautifultable import BeautifulTable
```

5 Importing Data

Importing our dataset and indexing customerID as it is a unique ID, it is not a feature that we need to use for our model.

Represent first five rows as default

[2]:
```
df = pd.read_csv("WA_Fn-UseC_-Telco-Customer-Churn.csv")
df.head()
```

[2]:
```
   customerID  gender  SeniorCitizen Partner Dependents  tenure PhoneService  \
0  7590-VHVEG  Female              0     Yes         No       1           No
1  5575-GNVDE    Male              0      No         No      34          Yes
2  3668-QPYBK    Male              0      No         No       2          Yes
3  7795-CFOCW    Male              0      No         No      45           No
4  9237-HQITU  Female              0      No         No       2          Yes

      MultipleLines InternetService OnlineSecurity  … DeviceProtection  \
0  No phone service             DSL             No  …               No
1                No             DSL            Yes  …              Yes
2                No             DSL            Yes  …               No
```

```
3  No phone service             DSL            Yes  …              Yes
4                no     Fiber optic             No  …               No

  TechSupport StreamingTV StreamingMovies        Contract PaperlessBilling  \
0          No          No              No  Month-to-month              Yes
1          No          No              No        One year               No
2          No          No              No  Month-to-month              Yes
3         Yes          No              No        One year               No
4          No          No              No  Month-to-month              Yes

                PaymentMethod MonthlyCharges  TotalCharges Churn
0            Electronic check          29.85         29.85    No
1                Mailed check          56.95        1889.5    No
2                Mailed check          53.85        108.15   Yes
3   Bank transfer (automatic)          42.30       1840.75    No
4            Electronic check          70.70        151.65   Yes

[5 rows x 21 columns]
```

Creating this directory at the beginning to export reports and graphs in case of any request.

[3]:

```
if not os.path.exists(".\Reports"):
    os.mkdir("Reports")
```

Observing the Data types of variables in the dataset.

[4]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 7043 entries, 0 to 7042
Data columns (total 21 columns):
 #   Column            Non-Null Count  Dtype
---  ------            --------------  -----
 0   customerID        7043 non-null   object
 1   gender            7043 non-null   object
 2   SeniorCitizen     7043 non-null   int64
 3   Partner           7043 non-null   object
 4   Dependents        7043 non-null   object
 5   tenure            7043 non-null   int64
 6   PhoneService      7043 non-null   object
 7   MultipleLines     7043 non-null   object
 8   InternetService   7043 non-null   object
 9   OnlineSecurity    7043 non-null   object
 10  OnlineBackup      7043 non-null   object
 11  DeviceProtection  7043 non-null   object
 12  TechSupport       7043 non-null   object
 13  StreamingTV       7043 non-null   object
 14  StreamingMovies   7043 non-null   object
 15  Contract          7043 non-null   object
 16  PaperlessBilling  7043 non-null   object 
 17  PaymentMethod     7043 non-null   object 
 18  MonthlyCharges    7043 non-null   float64
 19  TotalCharges      7043 non-null   object 
 20  Churn             7043 non-null   object 
dtypes: float64(1), int64(2), object(18)
memory usage: 1.1+ MB
```

6 Q1. How many of the customers' records were not inserted correctly or had no values? Find and suggest how to deal with them.

7 Duplicate Checking

[5]:
```
df.duplicated().sum()
```

[5]:
```
0
```

As data explored "TotalCharges" field which contains a numeric value should be a float datatype by nature, but in our data set it is defined as an object after investigation we found some spaces in our values which it has been set to a null value.

For this purpose, we used the regex formula and numpy library to detect "spaces".

[6]:
```
df["TotalCharges"] = df["TotalCharges"].replace(r"\s+", np.nan, regex=True)
df["TotalCharges"] = pd.to_numeric(df["TotalCharges"])
```

As expected the "TotalCharges" field is converted to float64.

[7]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 7043 entries, 0 to 7042
Data columns (total 21 columns):
 #   Column            Non-Null Count  Dtype  
---  ------            --------------  -----  
 0   customerID        7043 non-null   object 
 1   gender            7043 non-null   object 
 2   SeniorCitizen     7043 non-null   int64  
 3   Partner           7043 non-null   object 
 4   Dependents        7043 non-null   object 
 5   tenure            7043 non-null   int64  
 6   PhoneService      7043 non-null   object 
 7   MultipleLines     7043 non-null   object 
 8   InternetService   7043 non-null   object 
 9   OnlineSecurity    7043 non-null   object 
 10  OnlineBackup      7043 non-null   object 
 11  DeviceProtection  7043 non-null   object 
 12  TechSupport       7043 non-null   object
 13  StreamingTV       7043 non-null   object
 14  StreamingMovies   7043 non-null   object
 15  Contract          7043 non-null   object
 16  PaperlessBilling  7043 non-null   object
 17  PaymentMethod     7043 non-null   object
 18  MonthlyCharges    7043 non-null   float64
 19  TotalCharges      7032 non-null   float64
 20  Churn             7043 non-null   object
dtypes: float64(2), int64(2), object(17)
memory usage: 1.1+ MB
```

The following lines indicated null values on related fields.

[8]:

```
df.isnull().sum()
```

[8]:

```
customerID           0
gender               0
SeniorCitizen        0
Partner              0
Dependents           0
tenure               0
PhoneService         0
MultipleLines        0
InternetService      0
OnlineSecurity       0
OnlineBackup         0
DeviceProtection     0
TechSupport          0
StreamingTV          0
StreamingMovies      0
Contract             0
PaperlessBilling     0
PaymentMethod        0
MonthlyCharges       0
TotalCharges        11
Churn                0
dtype: int64
```

The below lines indicate the rows which have null values.

null_idx is deifned to extract the IndexID of null values.

[9]:

```
df[df.isna().any(axis=1)]
null_idx = df[df["TotalCharges"].isna()]
df[df["TotalCharges"].isna()]
```

[9]:

```
      customerID  gender  SeniorCitizen Partner Dependents  tenure  \
488   4472-LVYGI  Female              0     Yes        Yes       0
```

```
753   3115-CZMZD    Male             0      No        Yes       0
936   5709-LVOEQ  Female             0     Yes        Yes       0
1082  4367-NUYAO    Male             0     Yes        Yes       0
1340  1371-DWPAZ  Female             0     Yes        Yes       0
3331  7644-OMVMY    Male             0     Yes        Yes       0
3826  3213-VVOLG    Male             0     Yes        Yes       0
4380  2520-SGTTA  Female             0     Yes        Yes       0
5218  2923-ARZLG    Male             0     Yes        Yes       0
6670  4075-WKNIU  Female             0     Yes        Yes       0
6754  2775-SEFEE    Male             0      No        Yes       0

     PhoneService     MultipleLines InternetService       OnlineSecurity  …  \
488            No  No phone service             DSL                  Yes  …
753           Yes                No              No  No internet service  …
936           Yes                No             DSL                  Yes  …
1082          Yes               Yes              No  No internet service  …
1340           No  No phone service             DSL                  Yes  …
3331          Yes                No              No  No internet service  …
3826          Yes               Yes              No  No internet service  …
4380          Yes                No              No  No internet service  …
5218          Yes                No              No  No internet service  …
6670          Yes               Yes             DSL                   No  …
6754          Yes               Yes             DSL                  Yes  …

         DeviceProtection          TechSupport          StreamingTV  \
488                   Yes                  Yes                  Yes
753   No internet service  No internet service  No internet service
936                   Yes                   No                  Yes
1082  No internet service  No internet service  No internet service
1340                  Yes                  Yes                  Yes
3331  No internet service  No internet service  No internet service
3826  No internet service  No internet service  No internet service
4380  No internet service  No internet service  No internet service
5218  No internet service  No internet service  No internet service
6670                  Yes                  Yes                  Yes
6754                   No                  Yes                   No

          StreamingMovies  Contract PaperlessBilling  \
488                    No  Two year              Yes
753   No internet service  Two year               No
936                   Yes  Two year               No
1082  No internet service  Two year               No
1340                   No  Two year               No
3331  No internet service  Two year               No
3826  No internet service  Two year               No
4380  No internet service  Two year               No
5218  No internet service  One year              Yes
```

```
6670                   No  Two year               No
6754                   No  Two year              Yes

                  PaymentMethod MonthlyCharges  TotalCharges  Churn
488   Bank transfer (automatic)           52.55          NaN     No
753                Mailed check           20.25          NaN     No
936                Mailed check           80.85          NaN     No
1082               Mailed check           25.75          NaN     No
1340    Credit card (automatic)           56.05          NaN     No
3331               Mailed check           19.85          NaN     No
3826               Mailed check           25.35          NaN     No
4380               Mailed check           20.00          NaN     No
5218               Mailed check           19.70          NaN     No
6670               Mailed check           73.35          NaN     No
6754  Bank transfer (automatic)           61.90          NaN     No

[11 rows x 21 columns]
```

```
[10]: null_idx.index
```

```
[10]: Int64Index([488, 753, 936, 1082, 1340, 3331, 3826, 4380, 5218, 6670, 6754],
      dtype='int64')
```

Replacing those null values with corresponding Monthly Charges is make sense as more or less at least it should be included in our Total charges.

```
[11]: df["TotalCharges"].fillna(df["MonthlyCharges"], inplace=True)
      df
```

```
[11]:       customerID  gender  SeniorCitizen Partner Dependents  tenure  \
      0     7590-VHVEG  Female              0     Yes         No       1
      1     5575-GNVDE    Male              0      No         No      34
      2     3668-QPYBK    Male              0      No         No       2
      3     7795-CFOCW    Male              0      No         No      45
      4     9237-HQITU  Female              0      No         No       2
      …          …     …            …     …        …     …
      7038  6840-RESVB    Male              0     Yes        Yes      24
      7039  2234-XADUH  Female              0     Yes        Yes      72
      7040  4801-JZAZL  Female              0     Yes        Yes      11
      7041  8361-LTMKD    Male              1     Yes         No       4
      7042  3186-AJIEK    Male              0      No         No      66

           PhoneService     MultipleLines InternetService OnlineSecurity  …  \
      0              No  No phone service             DSL             No  …
      1             Yes                No             DSL            Yes  …
      2             Yes                No             DSL            Yes  …
      3              No  No phone service             DSL            Yes  …
      4             Yes                No     Fiber optic             No  …
```

```
…           …               …             …            …  …
7038          Yes               Yes             DSL            Yes  …
7039          Yes               Yes     Fiber optic             No  …
7040           No  No phone service             DSL            Yes  …
7041          Yes               Yes     Fiber optic             No  …
7042          Yes                No     Fiber optic            Yes  …

     DeviceProtection TechSupport StreamingTV StreamingMovies        Contract  \
0                  No          No          No              No  Month-to-month
1                 Yes          No          No              No        One year
2                  No          No          No              No  Month-to-month
3                 Yes         Yes          No              No        One year
4                  No          No          No              No  Month-to-month
…               …         …         …             …             …
7038              Yes         Yes         Yes             Yes        One year
7039              Yes          No         Yes             Yes        One year
7040               No          No          No              No  Month-to-month
7041               No          No          No              No  Month-to-month
7042              Yes         Yes         Yes             Yes        Two year

     PaperlessBilling              PaymentMethod MonthlyCharges  TotalCharges  \
0                 Yes           Electronic check          29.85         29.85
1                  No               Mailed check          56.95       1889.50
2                 Yes               Mailed check          53.85        108.15
3                  No  Bank transfer (automatic)          42.30       1840.75
4                 Yes           Electronic check          70.70        151.65
…               …                        …            …           …
7038              Yes               Mailed check          84.80       1990.50
7039              Yes    Credit card (automatic)         103.20       7362.90
7040              Yes           Electronic check          29.60        346.45
7041              Yes               Mailed check          74.40        306.60
7042              Yes  Bank transfer (automatic)         105.65       6844.50

      Churn
0        No
1        No
2       Yes
3        No
4       Yes
…     …
7038     No
7039     No
7040     No
7041    Yes
7042     No

[7043 rows x 21 columns]
```

[12]:
```
df.loc[null_idx.index]
```

[12]:
```
      customerID  gender  SeniorCitizen Partner Dependents  tenure   \
488   4472-LVYGI  Female              0     Yes        Yes       0
753   3115-CZMZD    Male              0      No        Yes       0
936   5709-LVOEQ  Female              0     Yes        Yes       0
1082  4367-NUYAO    Male              0     Yes        Yes       0
1340  1371-DWPAZ  Female              0     Yes        Yes       0
3331  7644-OMVMY    Male              0     Yes        Yes       0
3826  3213-VVOLG    Male              0     Yes        Yes       0
4380  2520-SGTTA  Female              0     Yes        Yes       0
5218  2923-ARZLG    Male              0     Yes        Yes       0
6670  4075-WKNIU  Female              0     Yes        Yes       0
6754  2775-SEFEE    Male              0      No        Yes       0

     PhoneService     MultipleLines InternetService       OnlineSecurity  …   \
488            No  No phone service             DSL                  Yes  …
753           Yes                No              No  No internet service  …
936           Yes                No             DSL                  Yes  …
1082          Yes               Yes              No  No internet service  …
1340           No  No phone service             DSL                  Yes  …
3331          Yes                No              No  No internet service  …
3826          Yes               Yes              No  No internet service  …
4380          Yes                No              No  No internet service  …
5218          Yes                No              No  No internet service  …
6670          Yes               Yes             DSL                   No  …
6754          Yes               Yes             DSL                  Yes  …

         DeviceProtection          TechSupport          StreamingTV  \
488                   Yes                  Yes                  Yes
753   No internet service  No internet service  No internet service
936                   Yes                   No                  Yes
1082  No internet service  No internet service  No internet service
1340                  Yes                  Yes                  Yes
3331  No internet service  No internet service  No internet service
3826  No internet service  No internet service  No internet service
4380  No internet service  No internet service  No internet service
5218  No internet service  No internet service  No internet service
6670                  Yes                  Yes                  Yes
6754                   No                  Yes                   No

          StreamingMovies  Contract PaperlessBilling  \
488                    No  Two year              Yes
753   No internet service  Two year               No
936                   Yes  Two year               No
1082  No internet service  Two year               No
1340                   No  Two year               No
```

```
3331  No internet service  Two year               No
3826  No internet service  Two year               No
4380  No internet service  Two year               No
5218  No internet service  One year              Yes
6670                   No  Two year               No
6754                   No  Two year              Yes

                  PaymentMethod MonthlyCharges  TotalCharges  Churn
488   Bank transfer (automatic)          52.55         52.55     No
753                Mailed check          20.25         20.25     No
936                Mailed check          80.85         80.85     No
1082               Mailed check          25.75         25.75     No
1340    Credit card (automatic)          56.05         56.05     No
3331               Mailed check          19.85         19.85     No
3826               Mailed check          25.35         25.35     No
4380               Mailed check          20.00         20.00     No
5218               Mailed check          19.70         19.70     No
6670               Mailed check          73.35         73.35     No
6754  Bank transfer (automatic)          61.90         61.90     No

[11 rows x 21 columns]
```

As expected all null values are replaced with new values”related Monthly Charges”.

The codes below indicate the unique count and values for each object feature.

[24]:
```python
result = BeautifulTable()
result.header = ["Column", "Values", "Count"]
for i in df.select_dtypes(include="object"):
    result.append_row([i, df[i].unique(), df[i].nunique()])
print(result)
```

```
+------------------+----------------------------------------------------+------+
|    customerID    | ['7590-VHVEG' '5575-GNVDE' '3668-QPYBK' … '4801- | 7043 |
|                  |               JZAZL' '8361-LTMKD'                  |      |
|                  |                   '3186-AJIEK']                    |      |
+------------------+----------------------------------------------------+------+
|      gender      |                 ['Female' 'Male']                  |  2   |
+------------------+----------------------------------------------------+------+
|     Partner      |                    ['Yes' 'No']                    |  2   |
+------------------+----------------------------------------------------+------+
|    Dependents    |                    ['No' 'Yes']                    |  2   |
+------------------+----------------------------------------------------+------+
|   PhoneService   |                    ['No' 'Yes']                    |  2   |
+------------------+----------------------------------------------------+------+
|  MultipleLines   |           ['No phone service' 'No' 'Yes']          |  3   |
+------------------+----------------------------------------------------+------+
| InternetService  |              ['DSL' 'Fiber optic' 'No']            |  3   |
+------------------+----------------------------------------------------+------+
|  OnlineSecurity  |         ['No' 'Yes' 'No internet service']         |   3   |
+------------------+----------------------------------------------------+-------+
|   OnlineBackup   |         ['Yes' 'No' 'No internet service']         |   3   |
+------------------+----------------------------------------------------+-------+
| DeviceProtection |         ['No' 'Yes' 'No internet service']         |   3   |
+------------------+----------------------------------------------------+-------+
|   TechSupport    |         ['No' 'Yes' 'No internet service']         |   3   |
+------------------+----------------------------------------------------+-------+
|   StreamingTV    |         ['No' 'Yes' 'No internet service']         |   3   |
+------------------+----------------------------------------------------+-------+
| StreamingMovies  |         ['No' 'Yes' 'No internet service']         |   3   |
+------------------+----------------------------------------------------+-------+
|     Contract     |      ['Month-to-month' 'One year' 'Two year']      |   3   |
+------------------+----------------------------------------------------+-------+
| PaperlessBilling |                    ['Yes' 'No']                    |   2   |
+------------------+----------------------------------------------------+-------+
|  PaymentMethod   | ['Electronic check' 'Mailed check' 'Bank transfer  |   4   |
|                  |                    (automatic)'                    |       |
|                  |             'Credit card (automatic)']             |       |
+------------------+----------------------------------------------------+-------+
|      Churn       |                    ['No' 'Yes']                    |   2   |
+------------------+----------------------------------------------------+-------+
```

A for loop has been used to generate all object columns with corresponding values in a table. No issue is observed in categorical values.

8 Missing Values

Presentation of Null Values, As it is sorted as Descending there are no missing values; the first 10 rows are selected.

[14]:

```
msd = df.isnull().sum().sort_values(ascending=False).head(5)
msd_per = round(msd / len(df) * 100, 2)
pd.DataFrame({"Null Values (Count)": msd, "Percentage (%)": msd_per.values})
```

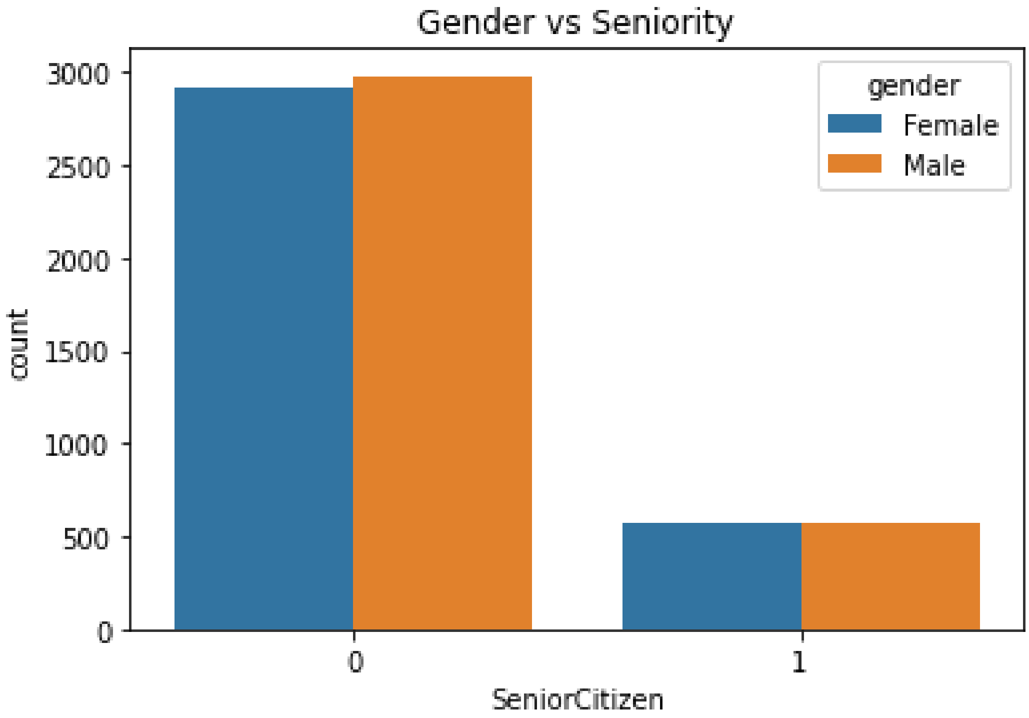
[14]:

```
                  Null Values (Count)  Percentage (%)
customerID                          0             0.0
DeviceProtection                    0             0.0
TotalCharges                        0             0.0
MonthlyCharges                      0             0.0
PaymentMethod                       0             0.0
```

In conclusion, there was no duplicate or missing values. and also there was no wrong entry in other fields. there were some wrong values (counted 11), which was “Space” in the “TotalCharges” field and it is replaced with the “MonthlyCharges” field accordingly. Our assumption is that the “Total Charges” of each customer should be bigger than or equal to “Monthly Charges”.

9 Q2. How many costumers of this Company are Female and Male with their seniority status?

```
[15]: sns.countplot(x="SeniorCitizen", hue="gender", data=df)
plt1 = plt.xticks(rotation=0)
plt1 = plt.title("Gender vs Seniority")
plt.show()
df.iloc[:, [0, 1, 2]].groupby(["gender", "SeniorCitizen"]).count()
```



```
[15]:                       customerID
gender SeniorCitizen
Female 0                      2920
       1                       568
Male   0                      2981
       1                       574
```

To answer this question, we used a plot to visualize the request and also used the “iloc” and “groupby” features of the pandas library to aggregate and represent the corresponding values.

10 Q3. What is the Max Total Charge and is related to which customer and what is the average Total Charge for all customers?

[16]:

```
totalAvg = [round(df["TotalCharges"].mean(), 2)]
df_new = df.iloc[:, [0, 1, 19]].nlargest(1, ["TotalCharges"])
df_new["Total Average"] = totalAvg
df_new
```

[16]:

```
      customerID gender  TotalCharges  Total Average
4610  2889-FPWRM   Male        8684.8         2279.8
```

To answer this question first we select specific columns and find related values with “nlargest” method. also we defined a new column to represent the average value of “TotalCharges” field.

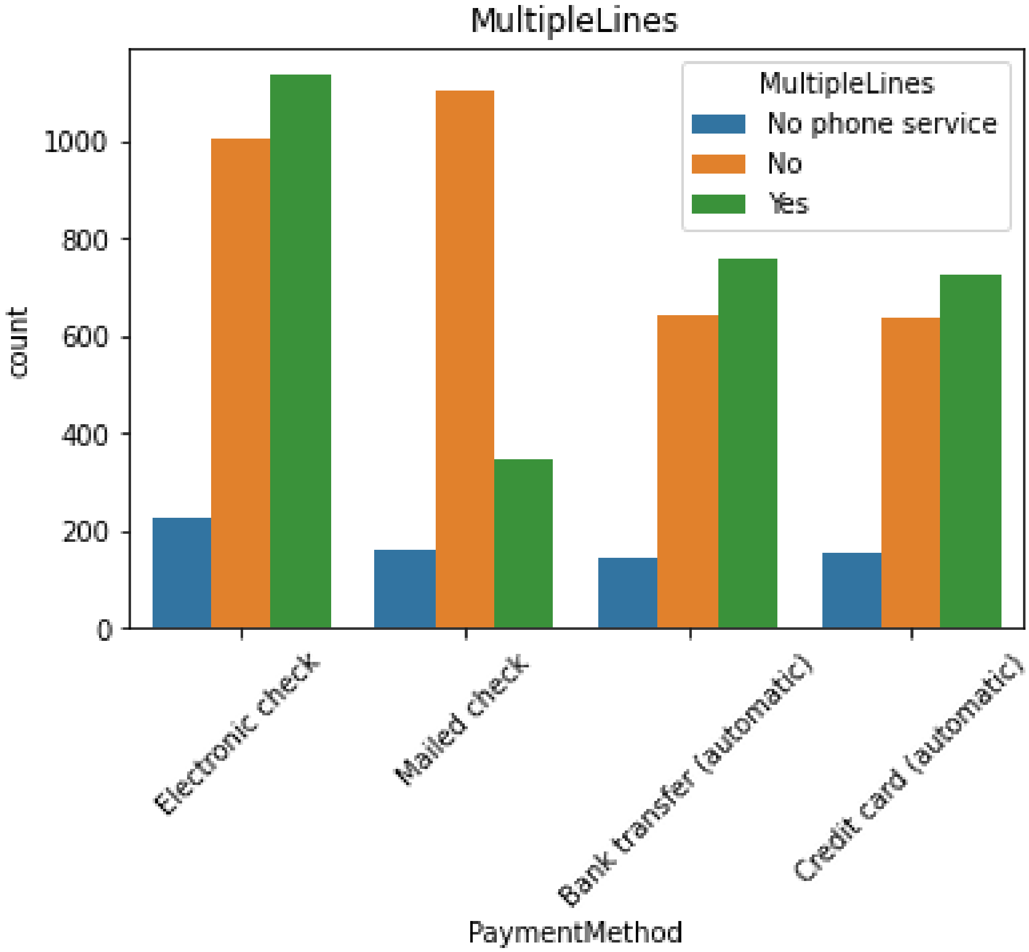
11 Q4. What is the churn status of customers in comparison with their subscribed products or services?

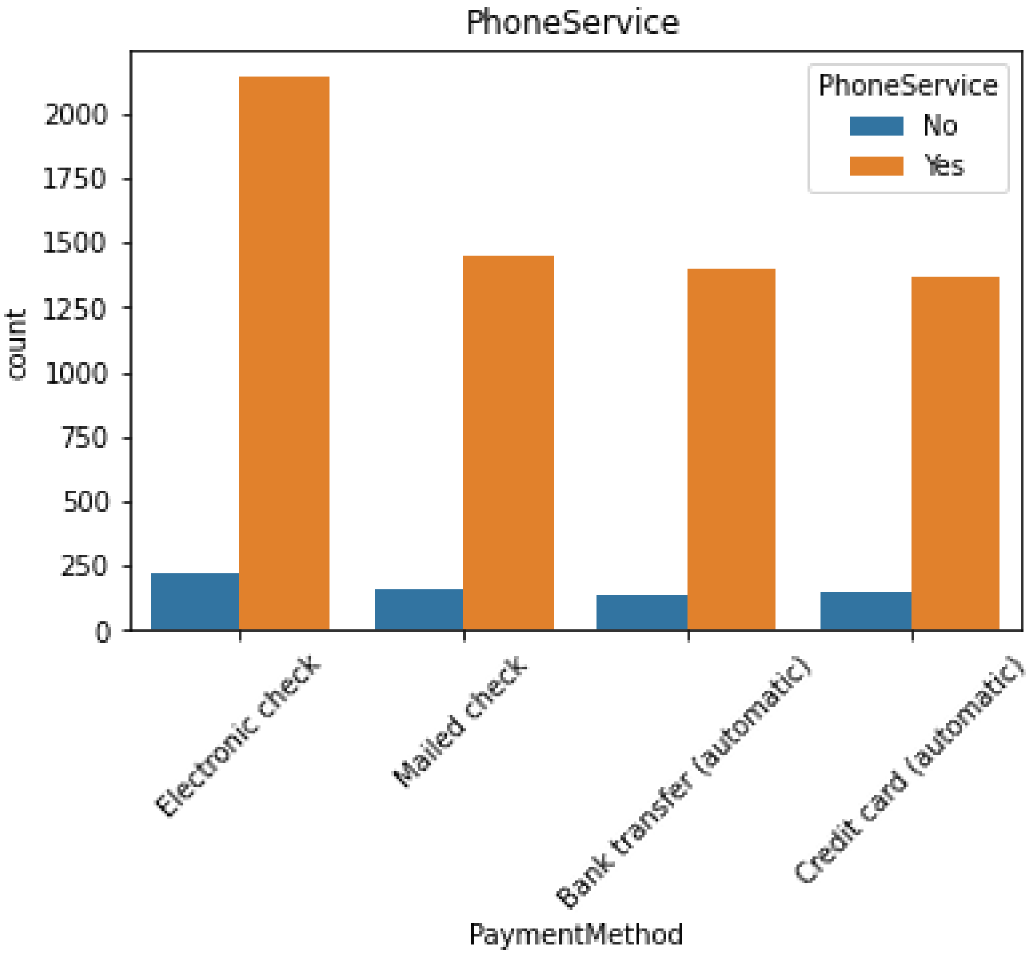
[17]:

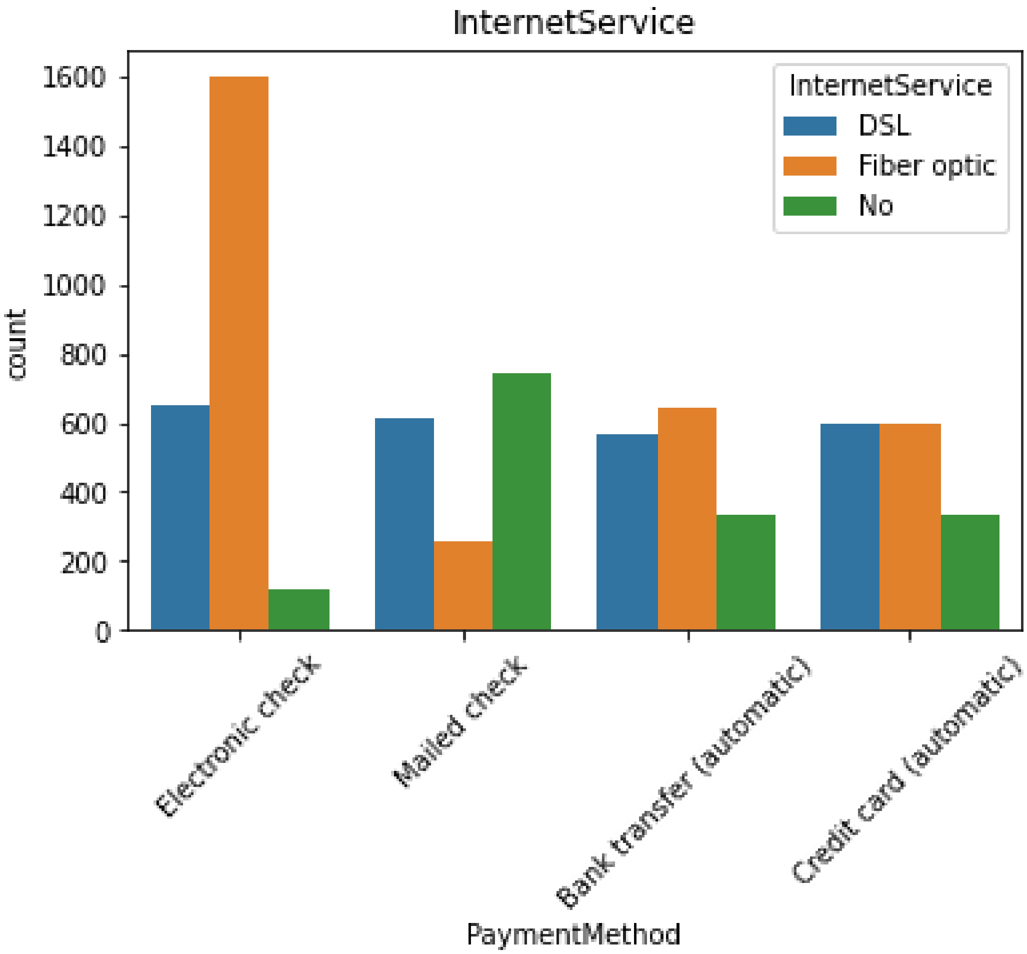
```
def chart():
    plt_drw = df_column.split()
    for word in plt_drw:
        sns.countplot(x="PaymentMethod", hue=word, data=df)
        plt1 = plt.xticks(rotation=45)
        plt1 = plt.title(word)
        plt.show()
        print("\n")
```

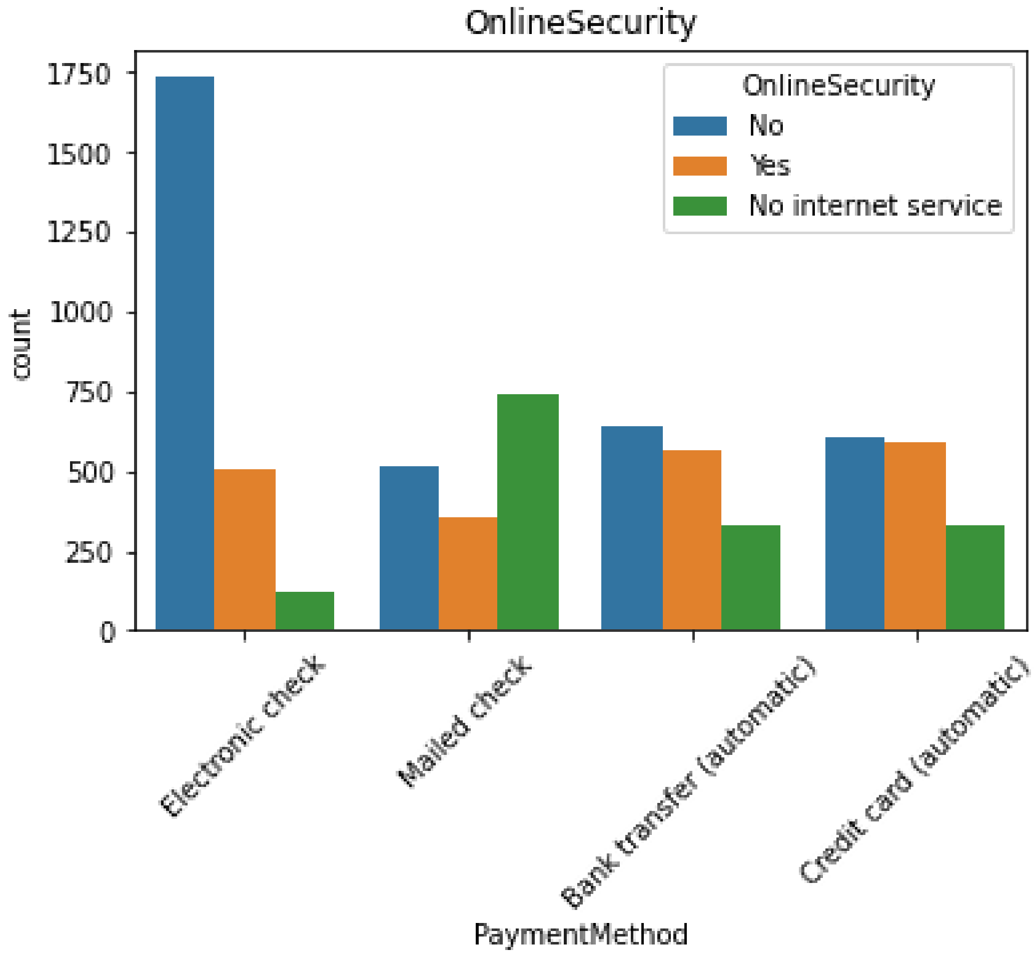
[18]:

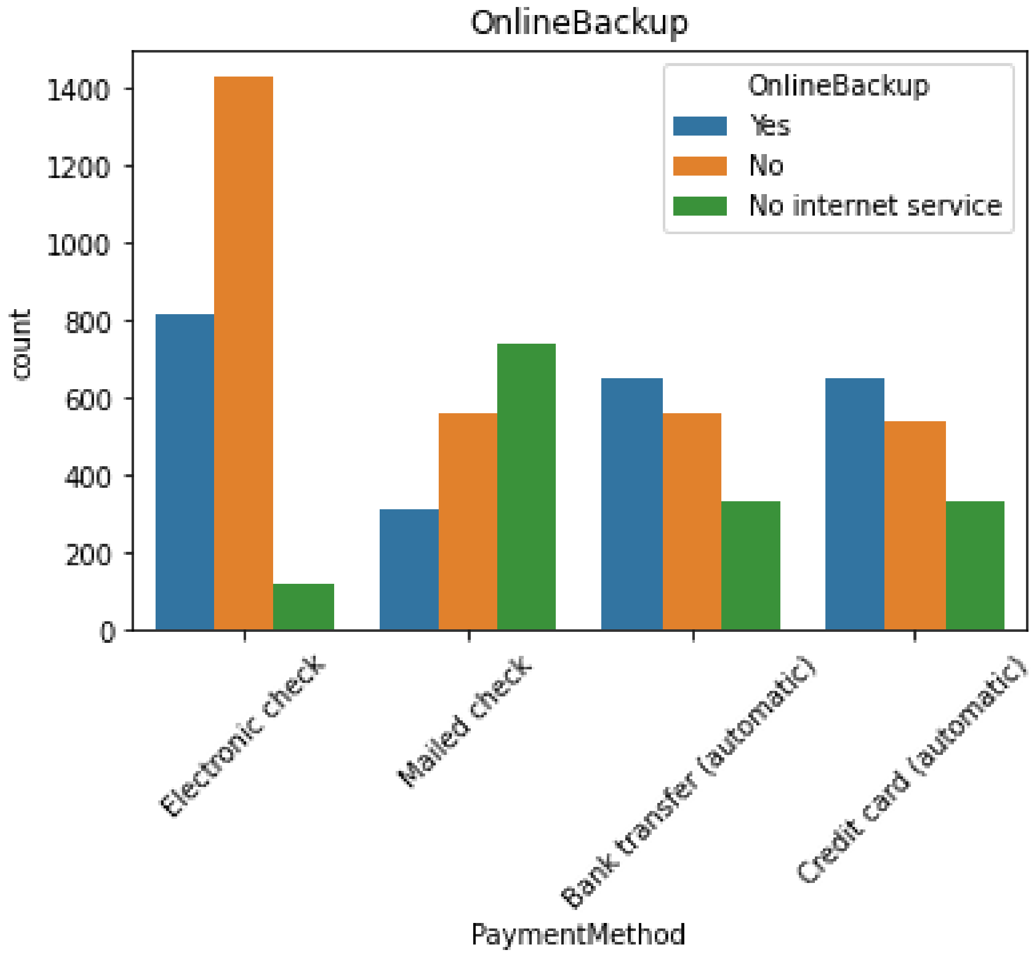
```
df_column = """
    MultipleLines PhoneService InternetService
    OnlineSecurity OnlineBackup DeviceProtection
    TechSupport StreamingTV StreamingMovies
"""
chart()
```

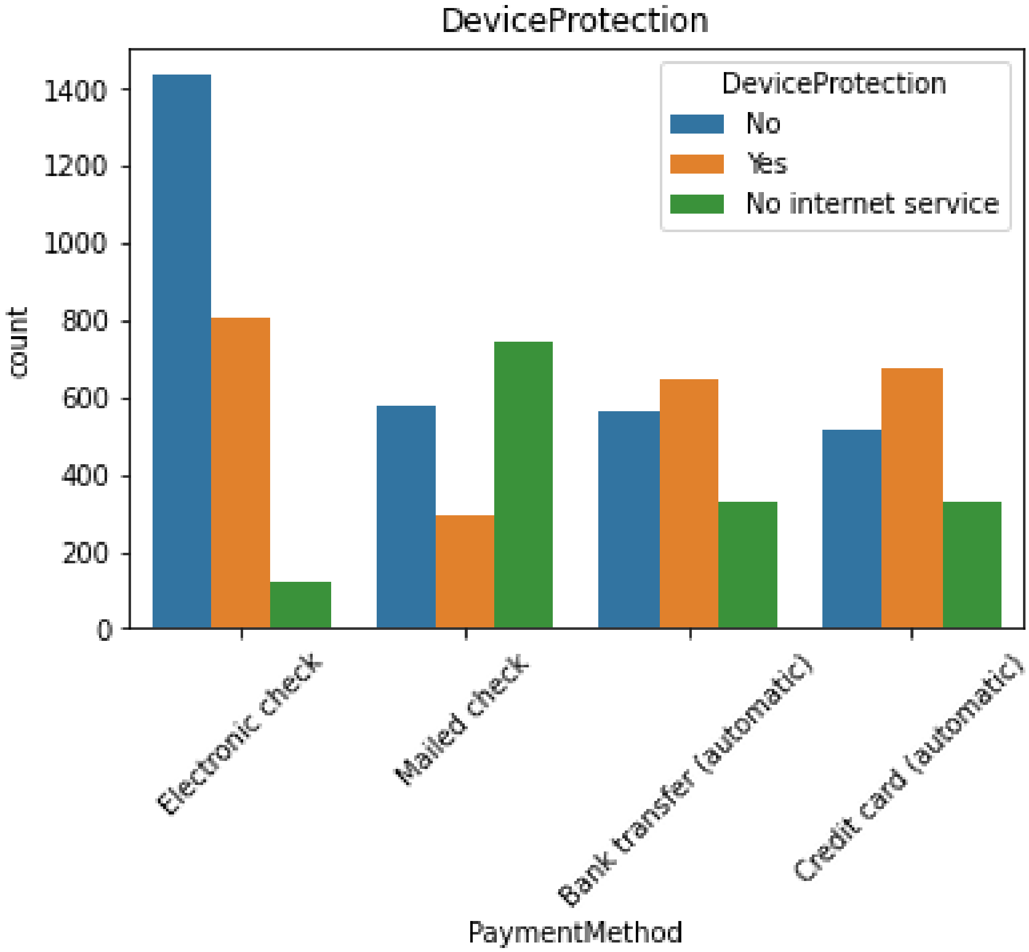

MultipleLines
MultipleLines
No phone service
No
Yes
count
0
200
400
600
800
1000
Electronic check
Mailed check
Bank transfer (automatic)
Credit card (automatic)
PaymentMethod

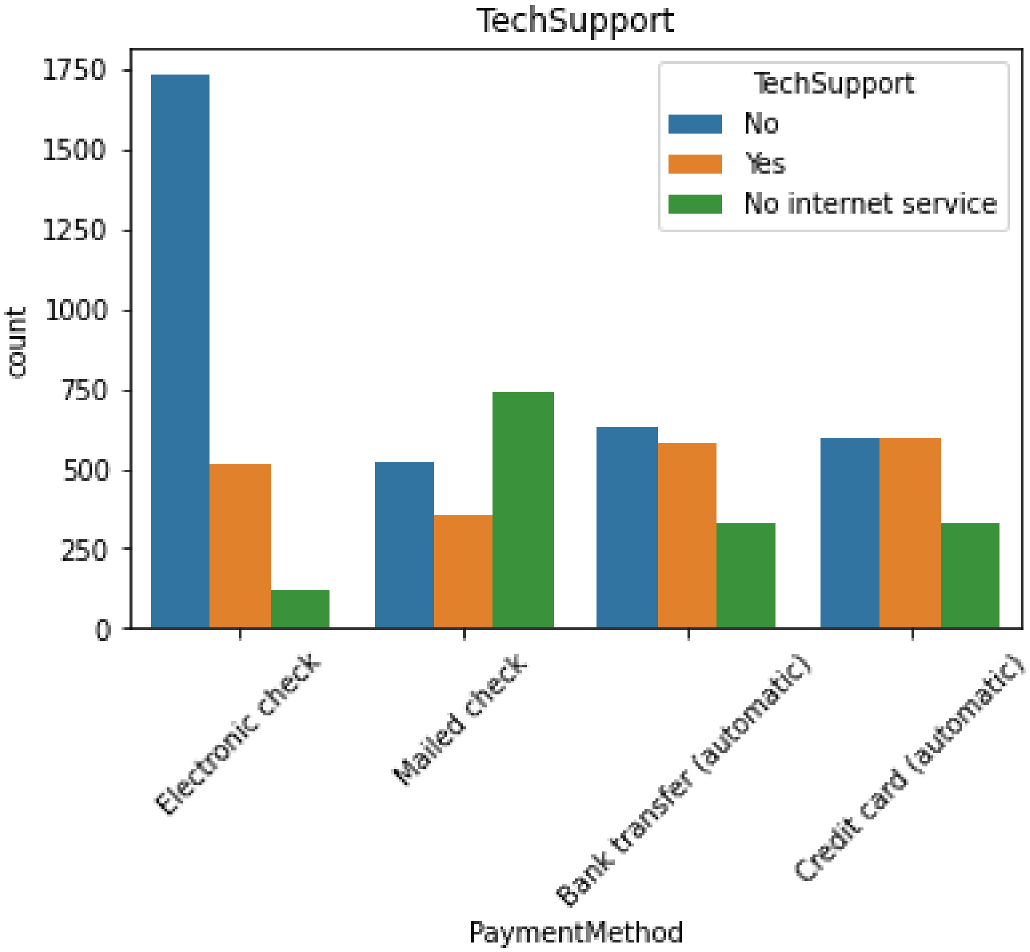

PhoneService
count
2000
1750
1500
1250
1000
750
500
250
0
PhoneService
No
Yes
Electronic check
Mailed check
Bank transfer (automatic)
Credit card (automatic)
PaymentMethod

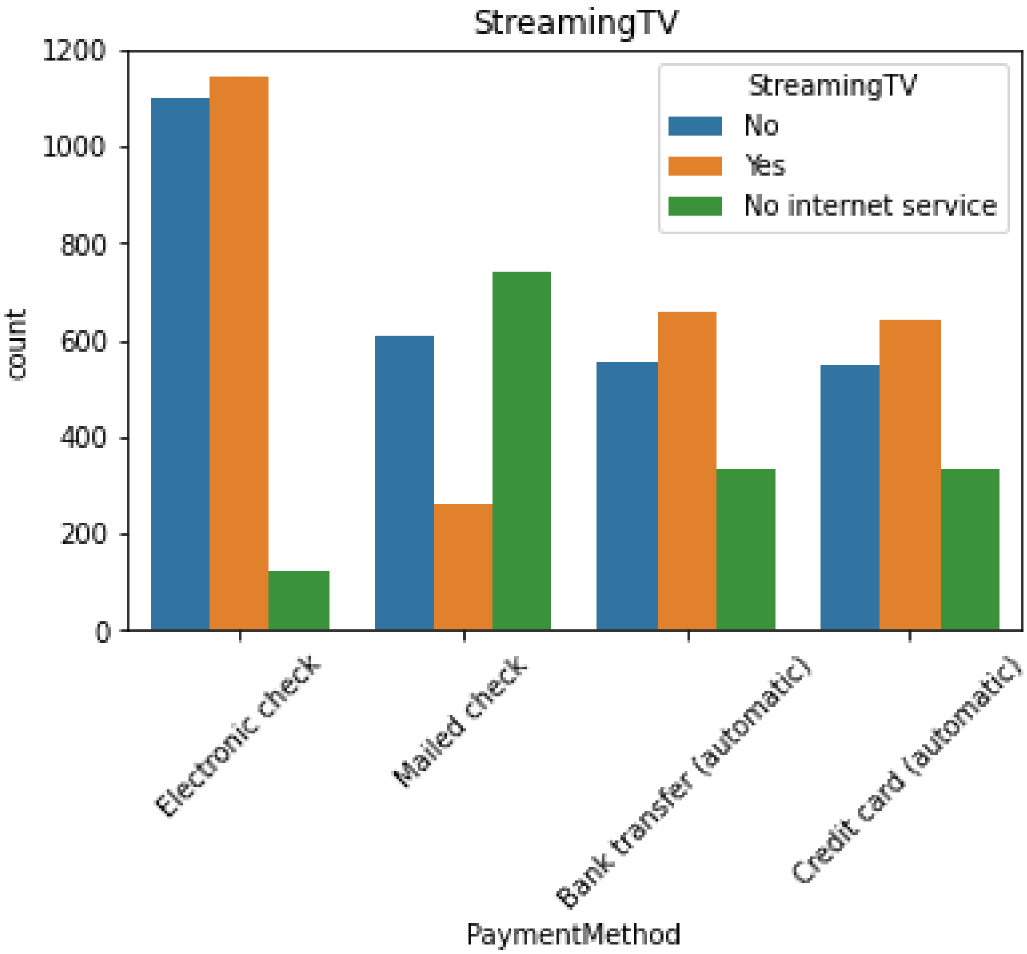

InternetService
count
1600
1400
1200
1000
800
600
400
200
0
InternetService
DSL
Fiber optic
No
Electronic check
Mailed check
Bank transfer (automatic)
Credit card (automatic)
PaymentMethod

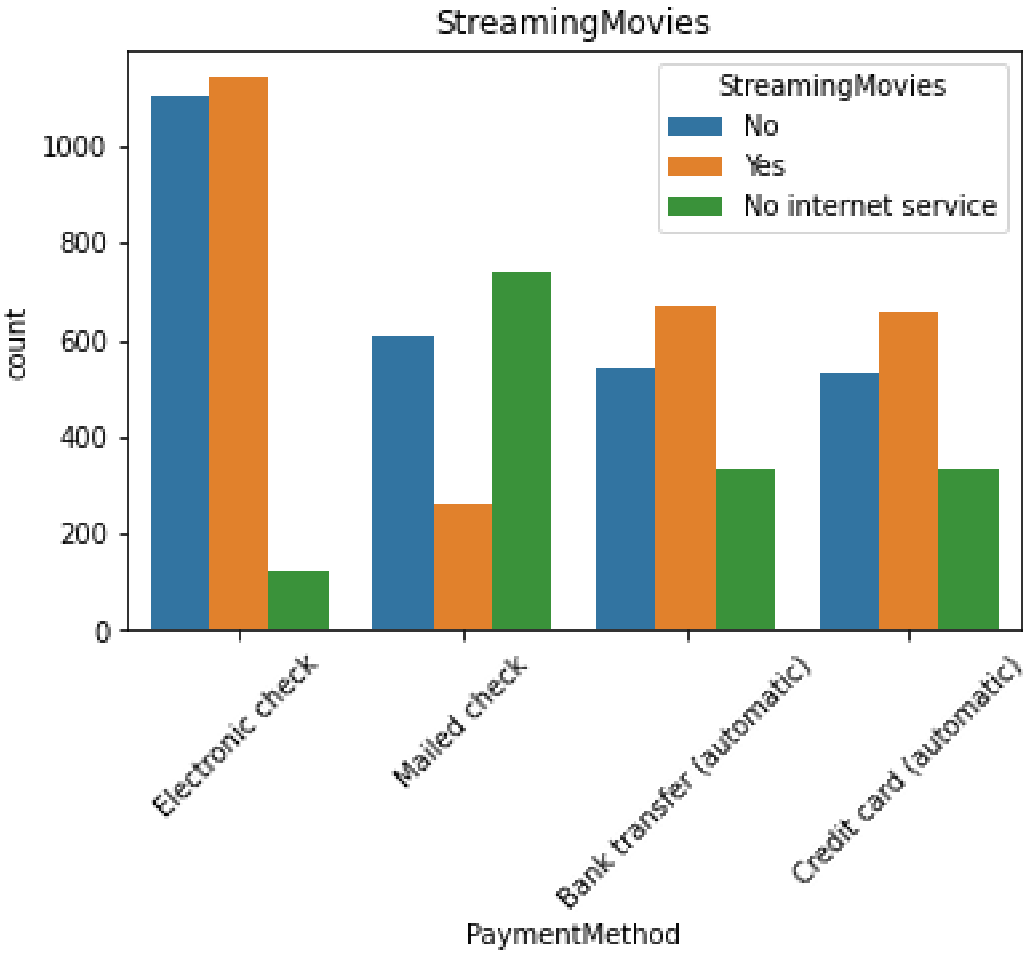

OnlineSecurity
1750
1500
1250
1000
750
500
250
0
count
OnlineSecurity
No
Yes
No internet service
Electronic check
Mailed check
Bank transfer (automatic)
Credit card (automatic)
PaymentMethod


OnlineBackup
OnlineBackup
Yes
No
No internet service
count
0
200
400
600
800
1000
1200
1400
Electronic check
Mailed check
Bank transfer (automatic)
Credit card (automatic)
PaymentMethod


DeviceProtection
DeviceProtection
No
Yes
No internet service
count
1400
1200
1000
800
600
400
200
0
Electronic check
Mailed check
Bank transfer (automatic)
Credit card (automatic)
PaymentMethod


TechSupport
count
1750
1500
1250
1000
750
500
250
0
TechSupport
No
Yes
No internet service
Electronic check
Mailed check
Bank transfer (automatic)
Credit card (automatic)
PaymentMethod


StreamingTV
1200
1000
800
600
400
200
0
count
StreamingTV
No
Yes
No internet service
Electronic check
Mailed check
Bank transfer (automatic)
Credit card (automatic)
PaymentMethod



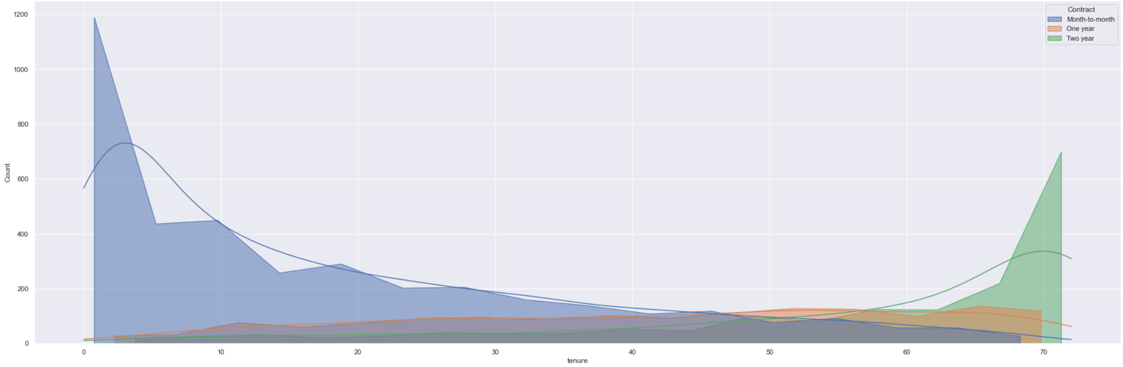
To answer this question first of all we defined a “function” and used a for loop to avoid repeating a code. then we selected the columns which refer to different services and products then we called a function to represent related charts.

As illustrated for example “Multiple Lines” have less “Mailed check” in comparison to the other types, or those segments who are using “Fiber Optics” more are paying via “Electronic Check”. for all charts we could have similar analysis and make a decision how to promote a campaign or announce them.

12 Q5. Please let us know the distribution of tenancy of customers in comparison with their contracts.

```
[19]: sns.set(rc={"figure.figsize": (31.7, 10.27)})
      plt_cntrc = sns.histplot(
          data=df, x="tenure", hue="Contract", multiple="dodge", kde=True,␣
        ↪element="poly"
      )
      plt_cntrc
```

```
[19]: <AxesSubplot:xlabel='tenure', ylabel='Count'>
```

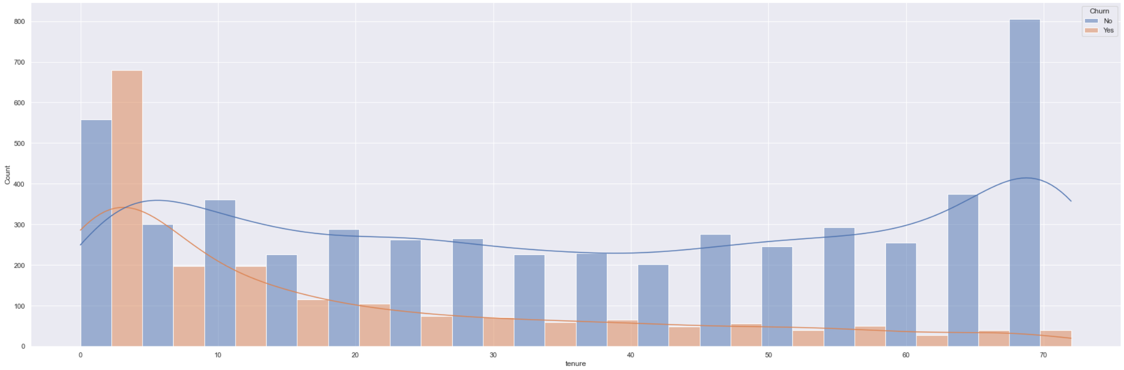


From the above histogram chart, we realized that most new customers have short-term contracts “Month-to-month” and as long as they are using services for years, it is illustrated that they are switching to long-term as “Two-year” contracts which means they are more loyal to this company.

13 Q6. Please investigate and find if there is any correlation between customers’ tenure and their churn status.

```
[20]: sns.set(rc={"figure.figsize": (31.7, 10.27)})
      plt_tnr = sns.histplot(data=df, x="tenure", hue="Churn", multiple="dodge",␣
        ↪kde=True)
      plt_tnr
```

```
[20]: <AxesSubplot:xlabel='tenure', ylabel='Count'>
```

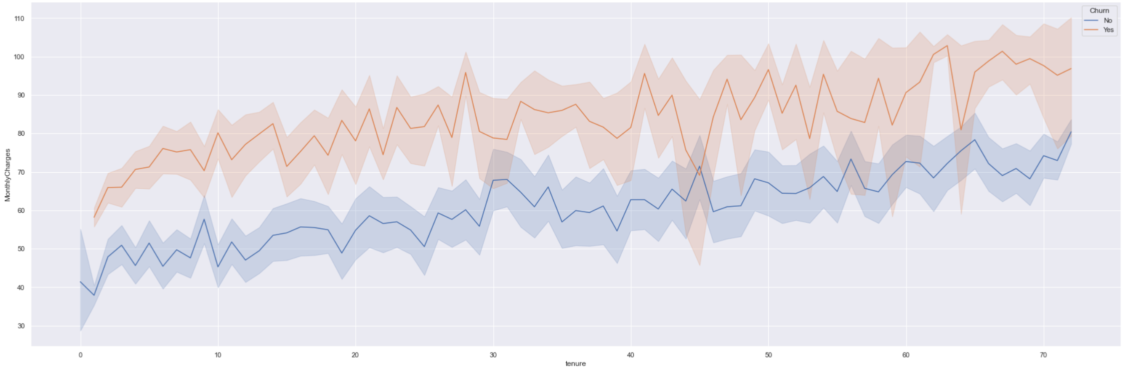


According to the above plot, we realized that most churned subscribers are those who have less than three-month tenure, and how long it passed the churn rate is reduced and stands at a fixed rate. so in the initial month, we need to run some campaigns and find the issues which might be could engage customers to use services.

14 Q7. Please illustrate the trend of Churn rate charges vs Tenure and "Monthly Charges", also need to save the related graph in a specific path and make sure won't be overwritten on previous files.

[21]:

```
sns.set(rc={"figure.figsize": (31.7, 10.27)})
sns_plt = sns.lineplot(data=df, x="tenure", y="MonthlyCharges", hue="Churn")
```



[22]:

```
fig = sns_plt.get_figure()
fig.savefig(
    ".\Reports\Tenure-vs-MonthlyCharges-"
    + datetime.datetime.now().strftime(format="%Y-%m-%d-%H-%M")
    + ".png"
)
```

To answer this question we used a line plot and as we realized the best way to illustrate a meaningful trend is what we have done above, which shows mostly the trends of “Monthly Charges” vs “Churn in the area of tenancy.

as it is observable both parameters follow the same trend, but in some cases, we have a drop in churn which could be caused by any campaigns or other factors that impacted to have a reduction in some periods.

to save this report we created a path: “Reports” and put some parameters to pick up the date and time (Hour and Minute) of saving to make sure there will be no overwritten will happen whenever the command was run on existing files.

15 Summary

As we explained at the beginning we tried to consult an imaginary company in the data science field to illustrate and visualize their data to value them.

The chosen dataset was related to the Telco industry and at first, we tried to have some cleaning up and pre-processing of the data and answer some questions regarding available records, for this purpose we tried to use some methods from Pandas and NumPy library also use some condition and defining a function to avoid repeating codes and make it reusable.

on the other hand, we use some plot libraries such as seaborn and plots to visualize our datasets. and use the OS library to make a directory and save requested files.

16 Reference:

- Kaggle.com. 2022. Telco Customer Churn. [online] Available at: https://www.kaggle.com/datasets/blastchar/telco-customer-churn?select=WA_Fn-UseC_-Telco-Customer-Churn.csv [Accessed 19 August 2022].
- Community.ibm.com. 2022. Telco customer churn (11.1.3+). [online] Available at: https://community.ibm.com/community/user/businessanalytics/blogs/steven-macko/2019/07/11/telco-customer-churn-1113 [Accessed 19 August 2022].