telco-churn-analysis

February 4, 2025

```
[43]: import numpy as np
      import pandas as pd
      import matplotlib as mpl
      import matplotlib.pyplot as plt
      import seaborn as sns
```

```
[44]: df = pd.read_csv("Customer Churn.csv")
      df.head(40)
```

```
[44]:     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
      5   9305-CDSKC  Female              0      No         No       8          Yes
      6   1452-KIOVK    Male              0      No        Yes      22          Yes
      7   6713-OKOMC  Female              0      No         No      10           No
      8   7892-POOKP  Female              0     Yes         No      28          Yes
      9   6388-TABGU    Male              0      No        Yes      62          Yes
      10  9763-GRSKD    Male              0     Yes        Yes      13          Yes
      11  7469-LKBCI    Male              0      No         No      16          Yes
      12  8091-TTVAX    Male              0     Yes         No      58          Yes
      13  0280-XJGEX    Male              0      No         No      49          Yes
      14  5129-JLPIS    Male              0      No         No      25          Yes
      15  3655-SNQYZ  Female              0     Yes        Yes      69          Yes
      16  8191-XWSZG  Female              0      No         No      52          Yes
      17  9959-WOFKT    Male              0      No        Yes      71          Yes
      18  4190-MFLUW  Female              0     Yes        Yes      10          Yes
      19  4183-MYFRB  Female              0      No         No      21          Yes
      20  8779-QRDMV    Male              1      No         No       1           No
      21  1680-VDCWW    Male              0     Yes         No      12          Yes
      22  1066-JKSGK    Male              0      No         No       1          Yes
      23  3638-WEABW  Female              0     Yes         No      58          Yes
      24  6322-HRPFA    Male              0     Yes        Yes      49          Yes
      25  6865-JZNKO  Female              0      No         No      30          Yes
      26  6467-CHFZW    Male              0     Yes        Yes      47          Yes
```

```
27  8665-UTDHZ    Male             0     Yes    Yes       1        No
28  5248-YGIJN    Male             0     Yes     No      72       Yes
29  8773-HHUOZ  Female             0      No    Yes      17       Yes
30  3841-NFECX  Female             1     Yes     No      71       Yes
31  4929-XIHVW    Male             1     Yes     No       2       Yes
32  6827-IEAUQ  Female             0     Yes    Yes      27       Yes
33  7310-EGVHZ    Male             0      No     No       1       Yes
34  3413-BMNZE    Male             1      No     No       1       Yes
35  6234-RAAPL  Female             0     Yes    Yes      72       Yes
36  6047-YHPVI    Male             0      No     No       5       Yes
37  6572-ADKRS  Female             0      No     No      46       Yes
38  5380-WJKOV    Male             0      No     No      34       Yes
39  8168-UQWWF  Female             0      No     No      11       Yes


         MultipleLines InternetService      OnlineSecurity  … \
0   No phone service             DSL                    No  …
1                 No             DSL                   Yes  …
2                 No             DSL                   Yes  …
3   No phone service             DSL                   Yes  …
4                 No     Fiber optic                    No  …
5                Yes     Fiber optic                    No  …
6                Yes     Fiber optic                    No  …
7   No phone service             DSL                   Yes  …
8                Yes     Fiber optic                    No  …
9                 No             DSL                   Yes  …
10                No             DSL                   Yes  …
11                No              No  No internet service  …
12               Yes     Fiber optic                    No  …
13               Yes     Fiber optic                    No  …
14                No     Fiber optic                   Yes  …
15               Yes     Fiber optic                   Yes  …
16                No              No  No internet service  …
17               Yes     Fiber optic                   Yes  …
18                No             DSL                    No  …
19                No     Fiber optic                    No  …
20  No phone service             DSL                    No  …
21                No              No  No internet service  …
22                No              No  No internet service  …
23               Yes             DSL                    No  …
24                No             DSL                   Yes  …
25                No             DSL                   Yes  …
26               Yes     Fiber optic                    No  …
27  No phone service             DSL                    No  …
28               Yes             DSL                   Yes  …
29                No             DSL                    No  …
30               Yes     Fiber optic                   Yes  …
31                No     Fiber optic                    No  …
```

32	No	DSL	Yes	…
33	No	No	No internet service	…
34	No	DSL	No	…
35	Yes	Fiber optic	Yes	…
36	No	Fiber optic	No	…
37	No	Fiber optic	No	…
38	Yes	Fiber optic	No	…
39	Yes	Fiber optic	No	…

	DeviceProtection	TechSupport	StreamingTV \
0	No	No	No
1	Yes	No	No
2	No	No	No
3	Yes	Yes	No
4	No	No	No
5	Yes	No	Yes
6	No	No	Yes
7	No	No	No
8	Yes	Yes	Yes
9	No	No	No
10	No	No	No
11	No internet service	No internet service	No internet service
12	Yes	No	Yes
13	Yes	No	Yes
14	Yes	Yes	Yes
15	Yes	Yes	Yes
16	No internet service	No internet service	No internet service
17	Yes	No	Yes
18	Yes	Yes	No
19	Yes	No	No
20	Yes	No	No
21	No internet service	No internet service	No internet service
22	No internet service	No internet service	No internet service
23	No	Yes	No
24	No	Yes	No
25	No	No	No
26	No	No	Yes
27	No	No	No
28	Yes	Yes	Yes
29	No	No	Yes
30	Yes	Yes	No
31	Yes	No	Yes
32	Yes	Yes	No
33	No internet service	No internet service	No internet service
34	No	No	No
35	No	Yes	Yes
36	No	No	No

```
37                 Yes                No                    No
38                 Yes                No                   Yes
39                 Yes                No                   Yes


          StreamingMovies        Contract PaperlessBilling  \
0                     No  Month-to-month              Yes
1                     No        One year               No
2                     No  Month-to-month              Yes
3                     No        One year               No
4                     No  Month-to-month              Yes
5                    Yes  Month-to-month              Yes
6                     No  Month-to-month              Yes
7                     No  Month-to-month               No
8                    Yes  Month-to-month              Yes
9                     No        One year               No
10                    No  Month-to-month              Yes
11   No internet service        Two year               No
12                   Yes        One year               No
13                   Yes  Month-to-month              Yes
14                   Yes  Month-to-month              Yes
15                   Yes        Two year               No
16   No internet service        One year               No
17                   Yes        Two year               No
18                    No  Month-to-month               No
19                   Yes  Month-to-month              Yes
20                   Yes  Month-to-month              Yes
21   No internet service        One year               No
22   No internet service  Month-to-month               No
23                    No        Two year              Yes
24                    No  Month-to-month               No
25                    No  Month-to-month              Yes
26                   Yes  Month-to-month              Yes
27                    No  Month-to-month               No
28                   Yes        Two year              Yes
29                   Yes  Month-to-month              Yes
30                    No        Two year              Yes
31                   Yes  Month-to-month              Yes
32                    No        One year               No
33   No internet service  Month-to-month               No
34                    No  Month-to-month               No
35                    No        Two year               No
36                    No  Month-to-month              Yes
37                    No  Month-to-month              Yes
38                   Yes  Month-to-month              Yes
39                   Yes  Month-to-month              Yes


          PaymentMethod MonthlyCharges  TotalCharges Churn
```

4

```
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              Electronic check      99.65     820.5    Yes
6       Credit card (automatic)      89.10    1949.4    No
7                 Mailed check       29.75     301.9    No
8              Electronic check     104.80   3046.05    Yes
9    Bank transfer (automatic)       56.15   3487.95    No
10                Mailed check       49.95    587.45    No
11      Credit card (automatic)      18.95     326.8    No
12      Credit card (automatic)     100.35    5681.1    No
13   Bank transfer (automatic)      103.70    5036.3    Yes
14             Electronic check     105.50   2686.05    No
15      Credit card (automatic)     113.25   7895.15    No
16                Mailed check       20.65   1022.95    No
17   Bank transfer (automatic)      106.70   7382.25    No
18      Credit card (automatic)      55.20    528.35    Yes
19             Electronic check      90.05    1862.9    No
20             Electronic check      39.65     39.65    Yes
21   Bank transfer (automatic)       19.80    202.25    No
22                Mailed check       20.15     20.15    Yes
23      Credit card (automatic)      59.90    3505.1    No
24      Credit card (automatic)      59.60    2970.3    No
25   Bank transfer (automatic)       55.30    1530.6    No
26             Electronic check      99.35   4749.15    Yes
27             Electronic check      30.20      30.2    Yes
28      Credit card (automatic)      90.25   6369.45    No
29                Mailed check       64.70    1093.1    Yes
30      Credit card (automatic)      96.35   6766.95    No
31      Credit card (automatic)      95.50    181.65    No
32                Mailed check       66.15   1874.45    No
33   Bank transfer (automatic)       20.20      20.2    No
34   Bank transfer (automatic)       45.25     45.25    No
35   Bank transfer (automatic)       99.90    7251.7    No
36             Electronic check      69.70     316.9    Yes
37      Credit card (automatic)      74.80    3548.3    No
38             Electronic check     106.35   3549.25    Yes
39   Bank transfer (automatic)       97.85    1105.4    Yes

[40 rows x 21 columns]
```

[45]: `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
```

1 Replace and Change Dtype

```python
[46]: df["TotalCharges"] = df["TotalCharges"].replace(" ","0")
      df["TotalCharges"] = df["TotalCharges"].astype("float")
```

```python
[47]: df.isnull().sum()
```

```
[47]: 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          0
Churn                 0
dtype: int64
```

[48]: `df.describe()`

[48]:
```
       SeniorCitizen       tenure  MonthlyCharges  TotalCharges
count    7043.000000  7043.000000     7043.000000   7043.000000
mean        0.162147    32.371149       64.761692   2279.734304
std         0.368612    24.559481       30.090047   2266.794470
min         0.000000     0.000000       18.250000      0.000000
25%         0.000000     9.000000       35.500000    398.550000
50%         0.000000    29.000000       70.350000   1394.550000
75%         0.000000    55.000000       89.850000   3786.600000
max         1.000000    72.000000      118.750000   8684.800000
```

[49]: `df["customerID"].duplicated().sum()`

[49]: 0

2 Column Transformtion

[50]:
```python
def conv(value):      # Create Function TO Modify column "senior citizen"
    if value == 1:    # it contain value in the forn of 1 or 0 convert to Yes or
 ↪NO
        return "Yes"a1a1
    else:
        return "No"

df["SeniorCitizen"] = df["SeniorCitizen"].apply(conv) #coverting
```

[101]:
```python
ax = sns.countplot(x = df["Churn"])

ax.bar_label(ax.containers[0])
plt.title("Count of customer by Churn")
plt.show()
```

Count of customer by Churn
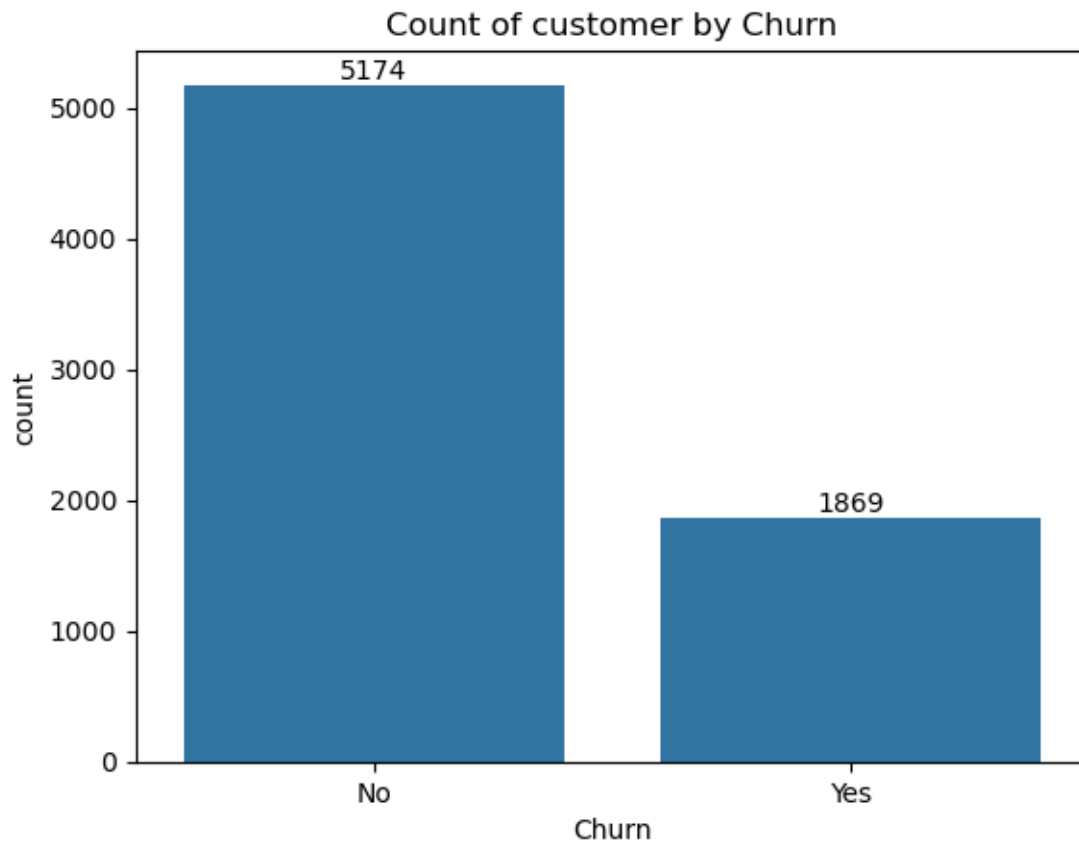

```
[105]: plt.figure(figsize = (3,4))
       gb = df.groupby("Churn").agg({"Churn":"count"})
       plt.pie(gb["Churn"],labels = gb.index,autopct = "%1.2f%%")

       plt.title("Percentage of Customer by Churn",fontsize = 15)
       plt.show()
```

Percentage of Customer by Churn
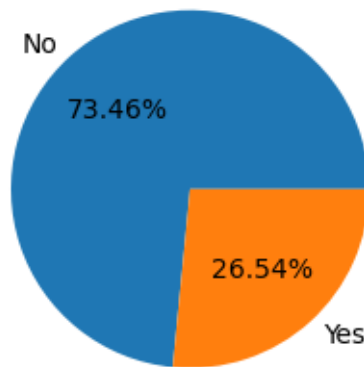
#from given pie chart we can concklude that 26.54% customer churned out

#now explore the reason behind it

```python
[113]: plt.figure(figsize = (4,4))
       sns.countplot(x = "gender",data = df,hue = "Churn")
       plt.title("Churn by Gender")
       plt.show()
```
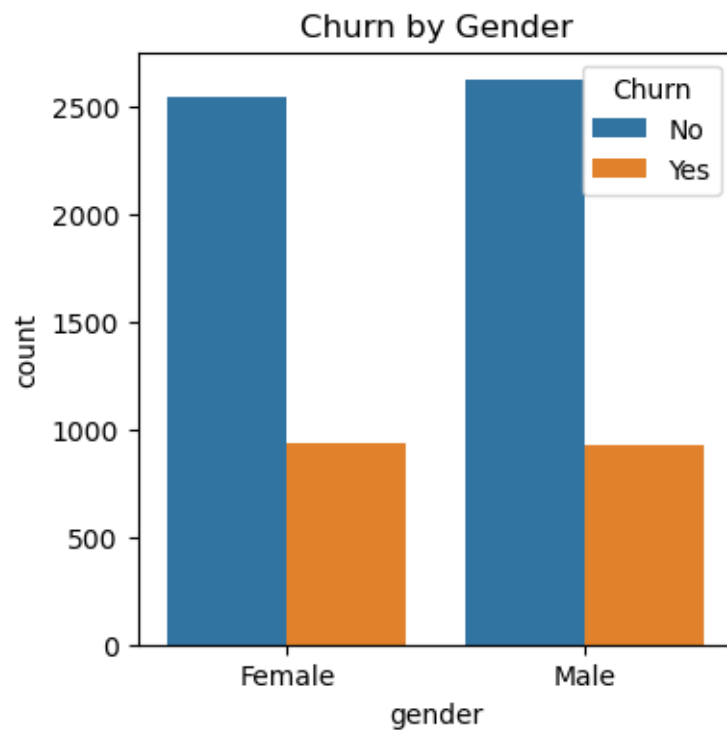
```
[162]: plt.figure(figsize = (6,4))
       ax = sns.countplot(x = "SeniorCitizen",data = df)
       ax.bar_label(ax.containers[0],label_type = "center")

       plt.title("Count of Customer by Senior Citizen ")
       plt.show()
```
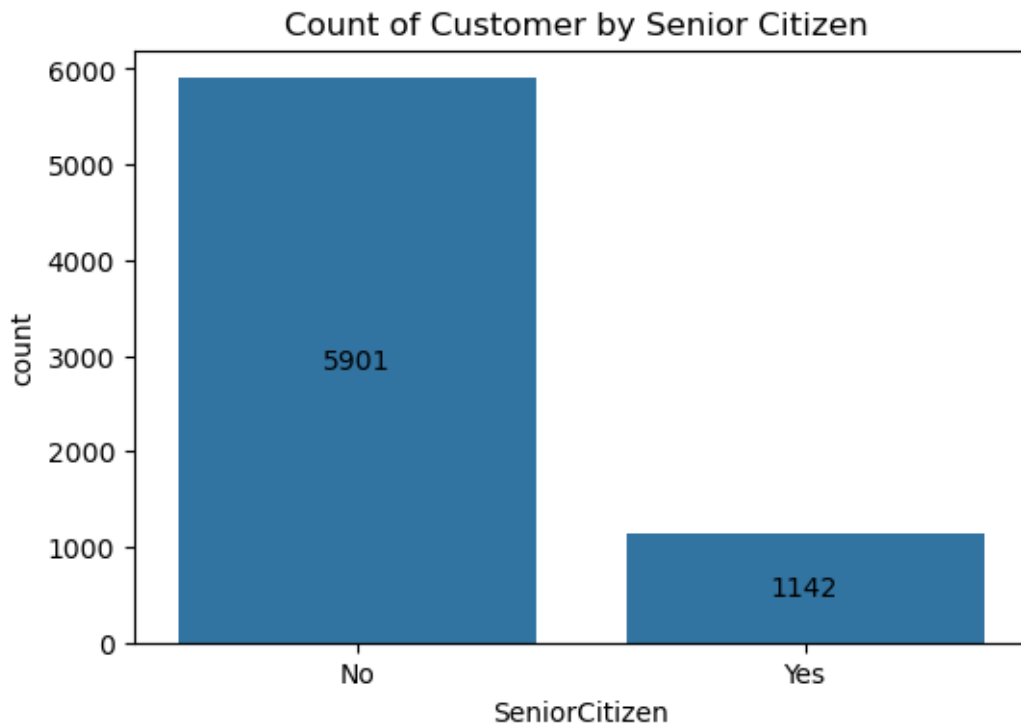


```
[156]: grouped = df.groupby(['SeniorCitizen', 'Churn']).size().unstack(fill_value=0)
       percentages = grouped.div(grouped.sum(axis=1), axis=0) * 100
       ax = percentages.plot(kind='bar', stacked=True, figsize=(6, 6),␣
        ↪edgecolor='black')

       for bars in ax.containers:
           ax.bar_label(bars, fmt='%.0f%%', label_type='center')

       plt.title("Churn by SeniorCitizen (%)", fontsize=14)
       plt.xlabel("SeniorCitizen", fontsize=12)
       plt.ylabel("Percentage (%)", fontsize=12)
       plt.tight_layout()
       plt.show()
```

```
# print(grouped)
# print(percentages)
```


Churn by SeniorCitizen (%)
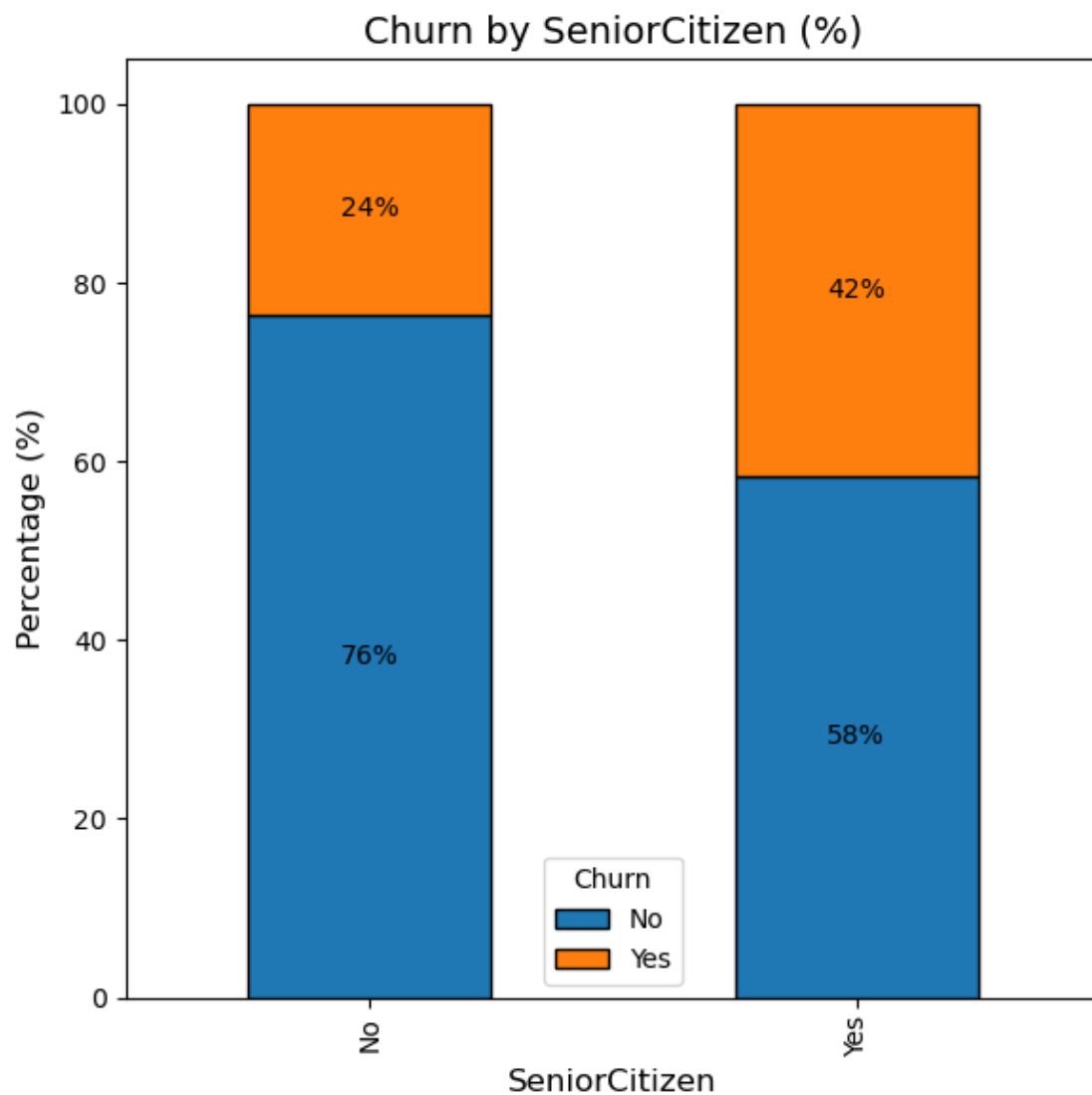
#Comparative a grater percentage of people in SeniorCitizen category has Churned.

```
[166]: plt.figure(figsize = (9,4))
       sns.histplot(x = "tenure",data = df,bins = 72,hue = "Churn")
       plt.show()
```
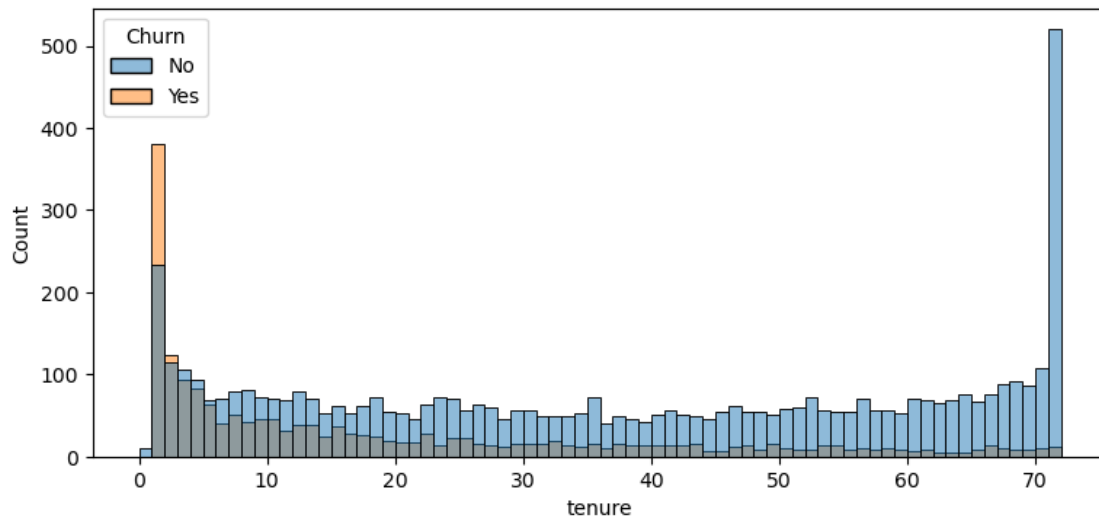
#People who have use our services for longtime have stay and people who have used our services for 1# or 2# month have churned

```
[174]:  plt.figure(figsize = (6,4))
        ax = sns.countplot(x = "Contract",data = df,hue = "Churn")

        for container in ax.containers:
            ax.bar_label(container, fmt='%d',label_type = "center")

        plt.title("Count of Customer by Senior Citizen ")
        plt.show()
```

Count of Customer by Senior Citizen
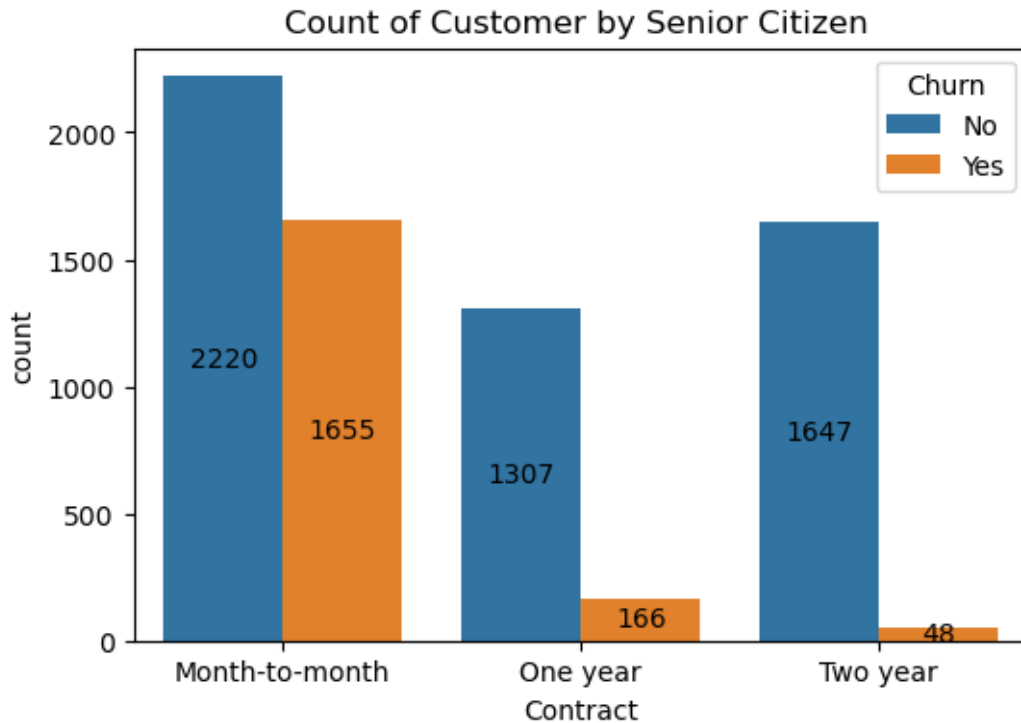
#People who have month to month contract likely to churn then from who have 1 or 2 years of contract

```
[180]: df.columns.values
```

```
[180]: array(['customerID', 'gender', 'SeniorCitizen', 'Partner', 'Dependents',
              'tenure', 'PhoneService', 'MultipleLines', 'InternetService',
              'OnlineSecurity', 'OnlineBackup', 'DeviceProtection',
              'TechSupport', 'StreamingTV', 'StreamingMovies', 'Contract',
              'PaperlessBilling', 'PaymentMethod', 'MonthlyCharges',
              'TotalCharges', 'Churn'], dtype=object)
```

```
[198]: columns = ['PhoneService','MultipleLines', 'InternetService', 'OnlineSecurity',
       ↪'OnlineBackup',
                  'DeviceProtection', 'TechSupport', 'StreamingTV', 'StreamingMovies']

       # Create subplots
       num_cols = len(columns)
       fig, axes = plt.subplots(nrows=3, ncols=3, figsize=(20, 20))  # Adjust rows/
       ↪columns for layout
       axes = axes.flatten()  # Flatten to iterate easily

       for i, col in enumerate(columns):
```

```
    sns.countplot(x=col, data=df, ax=axes[i],hue = df["Churn"])
    axes[i].set_title(f"Count of {col}")
    axes[i].set_xlabel(col)
    axes[i].set_ylabel("Count")




# Adjust layout
plt.tight_layout()
plt.show()
```
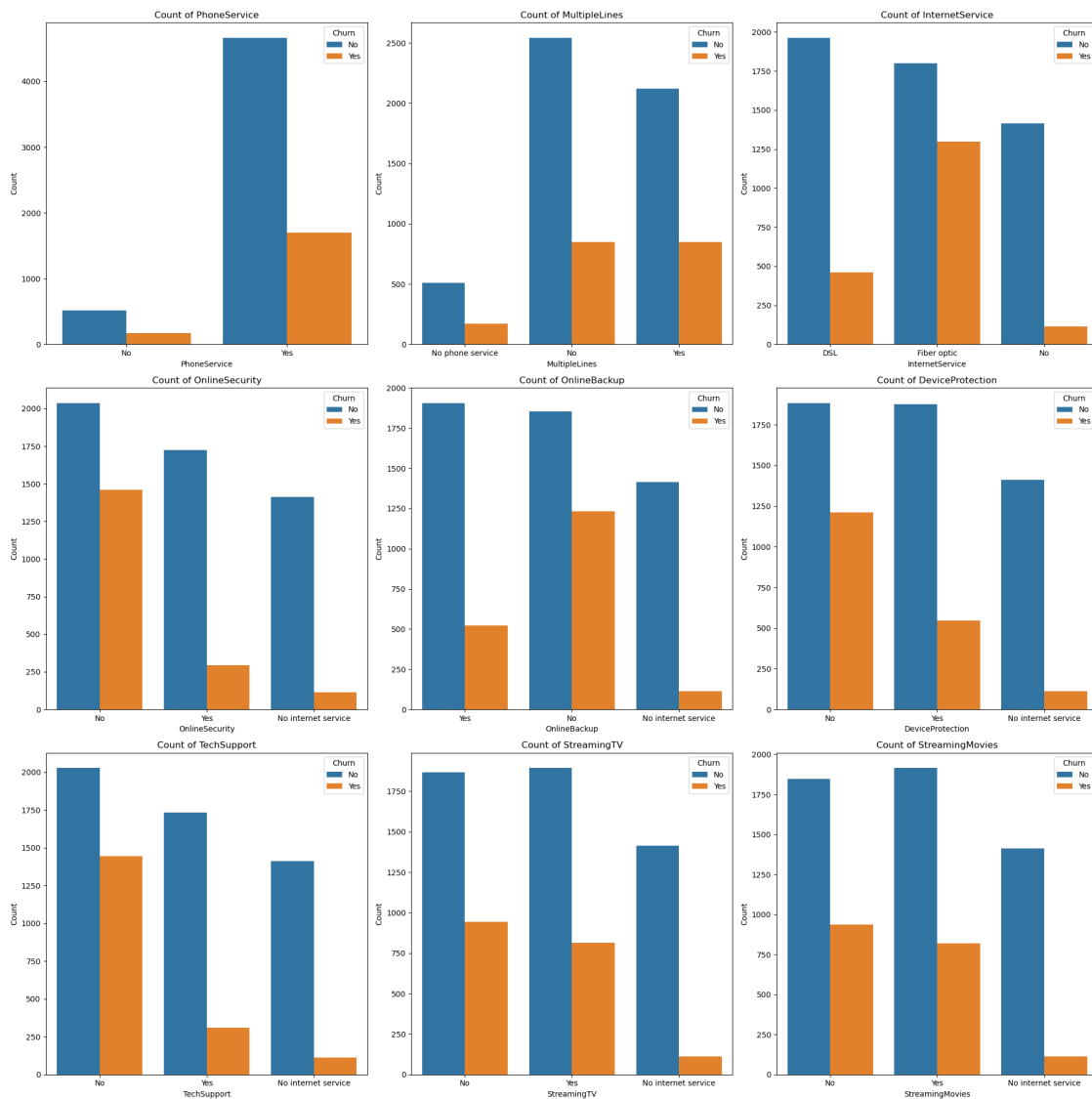

#Features like InternetService and OnlineSecurity show noticeable differences in churn behavior, with certain categories having higher churn rates. For example, customers with "No" OnlineSecurity

or "Fiber optic" InternetService seem to have higher churn. These insights can help identify service-related factors influencing customer churn.

```python
[200]: plt.figure(figsize = (6,4))
       ax = sns.countplot(x = "PaymentMethod",data = df,hue = "Churn")

       for container in ax.containers:
           ax.bar_label(container, fmt='%d',label_type = "center")

       plt.title("Churn Customer by Payment Method ")
       plt.xticks(rotation = 45)
       plt.show()
```
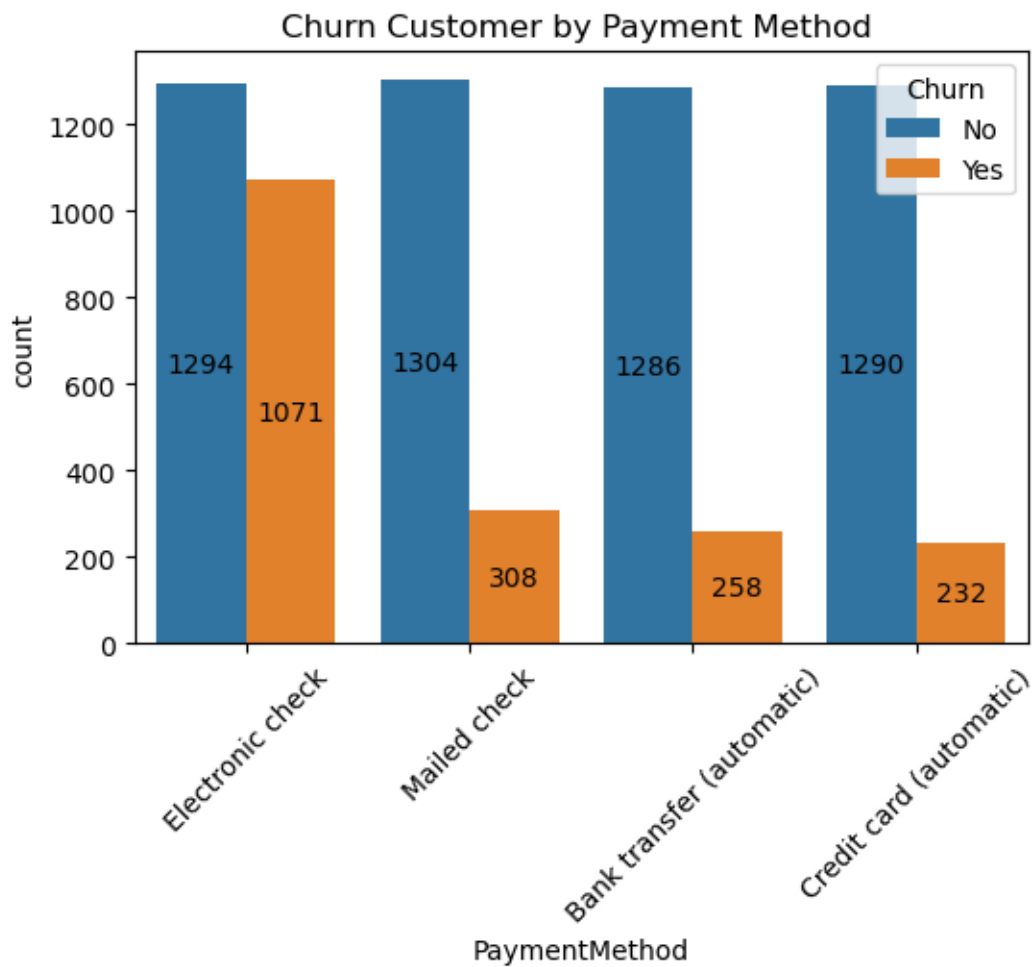

#Customer is likely to churn when he is using elctronic check as a Payment method

```
[ ]:
```