

```
In [1]: import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

```
In [2]: df = pd.read_csv('Customer Churn.csv')
```

```
In [3]: df.head()
```

```
Out[3]:
```

	customerID	gender	SeniorCitizen	Partner	Dependents	tenure	PhoneS
--	------------	--------	---------------	---------	------------	--------	--------

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	
---	------------	--------	---	----	----	---	--

5 rows x 21 columns

```
In [4]: df
```

Out [4]:

	customerID	gender	SeniorCitizen	Partner	Dependents	tenure	Pho
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	

7043 rows × 21 columns

In [5]: `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

```

replacing blanks with 0 as tenure is 0 and no total charges are recorded

```

In [6]: df["TotalCharges"] = df["TotalCharges"].replace(" ", "0")
        df["TotalCharges"] = df["TotalCharges"].astype("float")

```

```

In [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            7043 non-null   float64
20  Churn                   7043 non-null   object
dtypes: float64(2), int64(2), object(17)
memory usage: 1.1+ MB
```

```
In [8]: df.isnull().sum().sum()
```

```
Out[8]: 0
```

```
In [9]: df.describe()
```

```
Out[9]:
```

	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

```
In [10]: df["customerID"].duplicated().sum()
```

```
Out[10]: 0
```

```
In [11]: def conv(value):
          if value == 1:
              return "yes"
          else:
              return "no"

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

```
In [22]: df.head()
```

```
Out[22]:
```

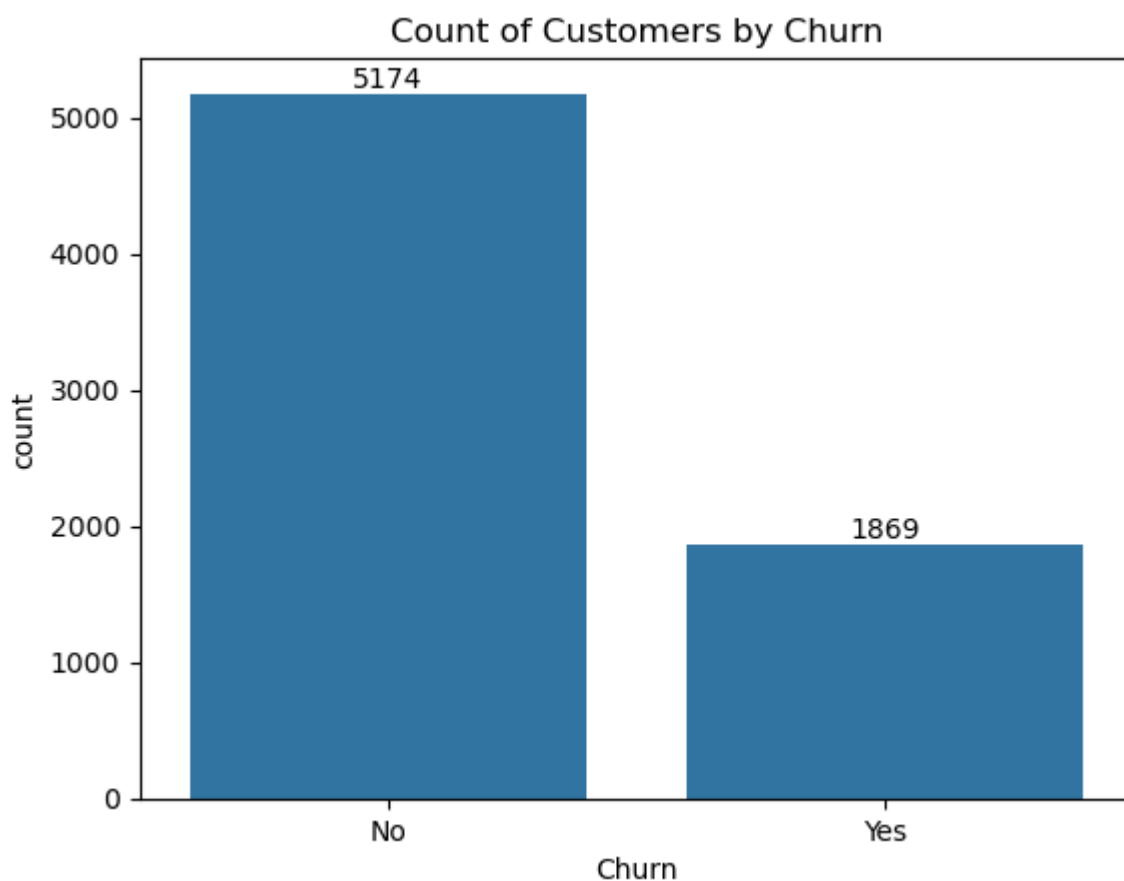
	customerID	gender	SeniorCitizen	Partner	Dependents	tenure	PhoneS
0	7590-VHVEG	Female	no	Yes	No	1	
1	5575-GNVDE	Male	no	No	No	34	
2	3668-QPYBK	Male	no	No	No	2	
3	7795-CFOCW	Male	no	No	No	45	
4	9237-HQITU	Female	no	No	No	2	

5 rows × 21 columns

converted 0 and 1 values of senior citizen to yes/no to make it easier to understand

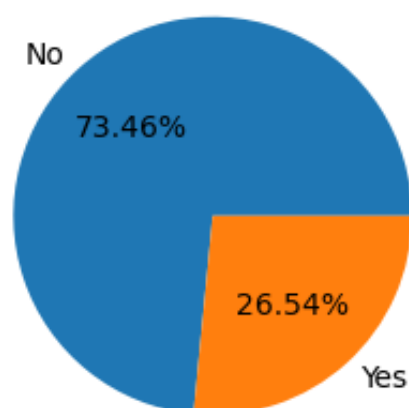
```
In [12]: ax = sns.countplot(x = 'Churn', data = df)

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



```
In [13]: 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 Churned Customeres", fontsize = 10)
plt.show()
```

Percentage of Churned Customeres

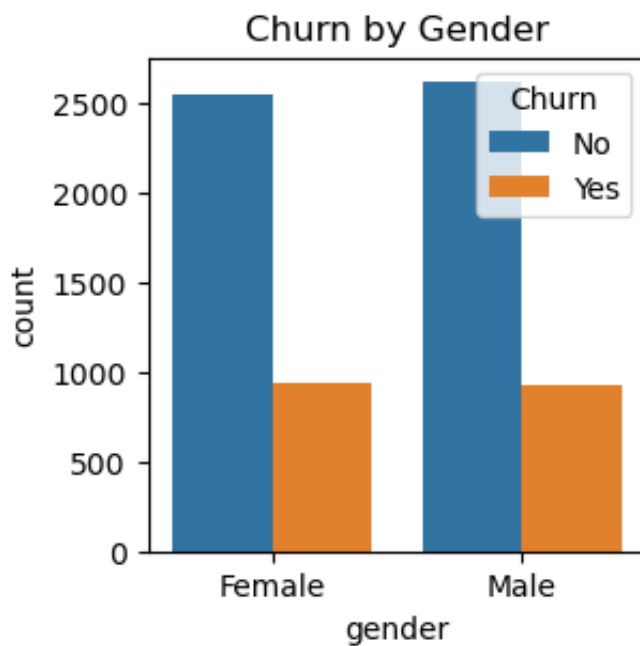


from the given pie chart we can conclude that 26.54% of our customers have churned out.

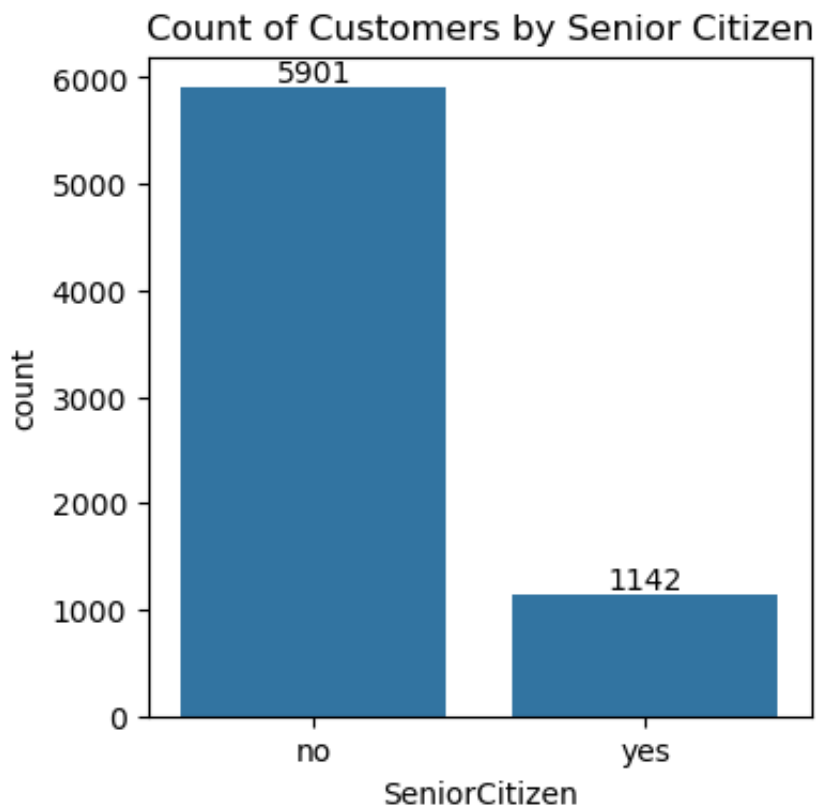
And now let's explore the reason behind it

```
In [14]: plt.figure(figsize = (3,3))
```

```
sns.countplot(x = "gender", data = df, hue = "Churn")  
plt.title("Churn by Gender")  
plt.show()
```



```
In [23]: plt.figure(figsize = (4,4))  
ax = sns.countplot(x = "SeniorCitizen", data = df)  
ax.bar_label(ax.containers[0])  
plt.title("Count of Customers by Senior Citizen")  
plt.show()
```



```
In [16]: total_counts = df.groupby('SeniorCitizen')['Churn'].value_counts(no
```

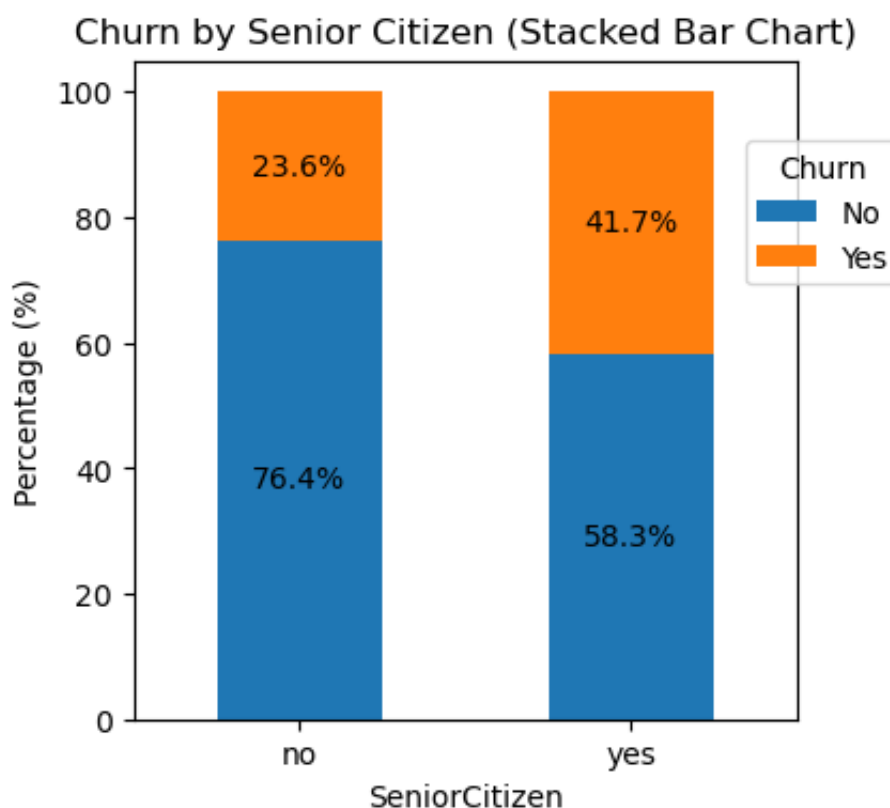
```
fig, ax = plt.subplots(figsize=(4, 4))

total_counts.plot(kind='bar', stacked=True, ax=ax, color=['#1f77b4', '#ff7f0e'])

for p in ax.patches:
    width, height = p.get_width(), p.get_height()
    x, y = p.get_xy()
    ax.text(x + width / 2, y + height / 2, f'{height:.1f}%', ha='center')

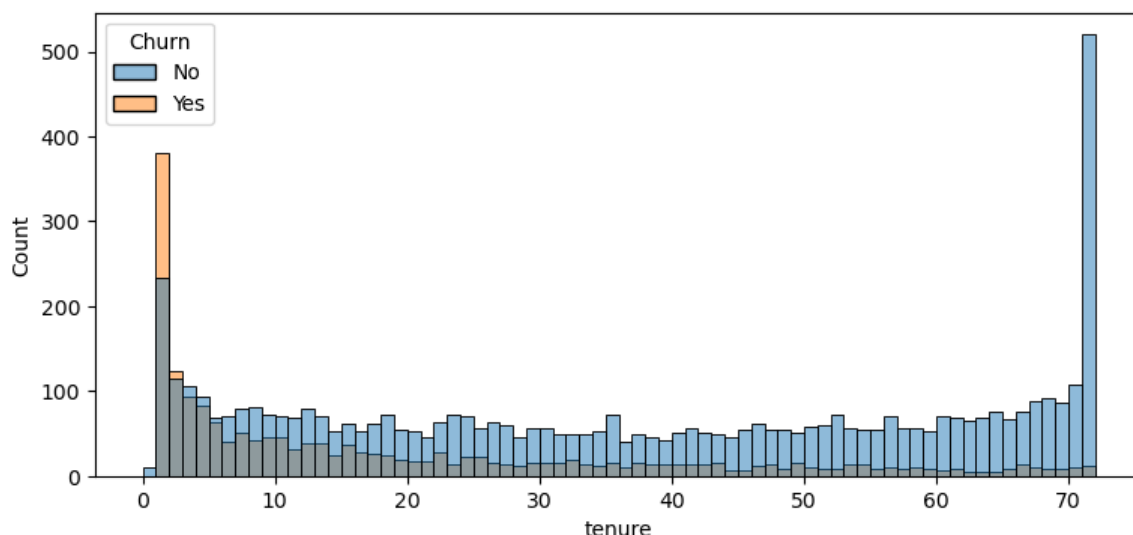
plt.title('Churn by Senior Citizen (Stacked Bar Chart)')
plt.xlabel('SeniorCitizen')
plt.ylabel('Percentage (%)')
plt.xticks(rotation=0)
plt.legend(title='Churn', bbox_to_anchor = (0.9,0.9))

plt.show()
```



comparative a greater percentage of people in senior citizen category have churned

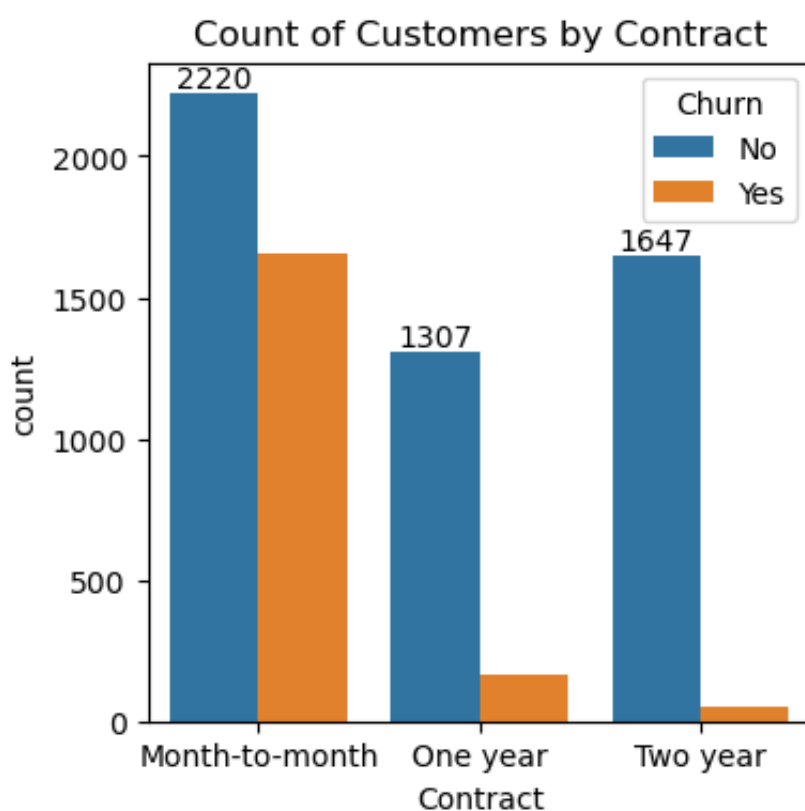
```
In [17]: plt.figure(figsize = (9,4))
sns.histplot(x = "tenure", data = df, bins = 72, hue = "Churn")
plt.show()
```

people who have used our services for a long time have stayed and people who have used our services

While those who used the service for 1 or 2 months have churned

```
In [18]: plt.figure(figsize = (4,4))
ax = sns.countplot(x = "Contract", data = df, hue = "Churn")
ax.bar_label(ax.containers[0])
plt.title("Count of Customers by Contract")
plt.show()
```



people who have month to month contract are likely to churn then from those who have 1 or 2 years or contract.

```
In [19]: df.columns.values
```

```
Out[19]: array(['customerID', 'gender', 'SeniorCitizen', 'Partner', 'Dependents',
               'tenure', 'PhoneService', 'MultipleLines', 'InternetService',
               'OnlineSecurity', 'OnlineBackup', 'DeviceProtection',
               'TechSupport', 'StreamingTV', 'StreamingMovies', 'Contract',
               'PaperlessBilling', 'PaymentMethod', 'MonthlyCharges',
               'TotalCharges', 'Churn'], dtype=object)
```

```
In [20]: columns = ['PhoneService', 'MultipleLines', 'InternetService', 'OnlineBackup', 'DeviceProtection', 'TechSupport', 'StreamingTV', 'StreamingMovies', 'Contract', 'PaperlessBilling', 'PaymentMethod', 'MonthlyCharges', 'TotalCharges', 'Churn']

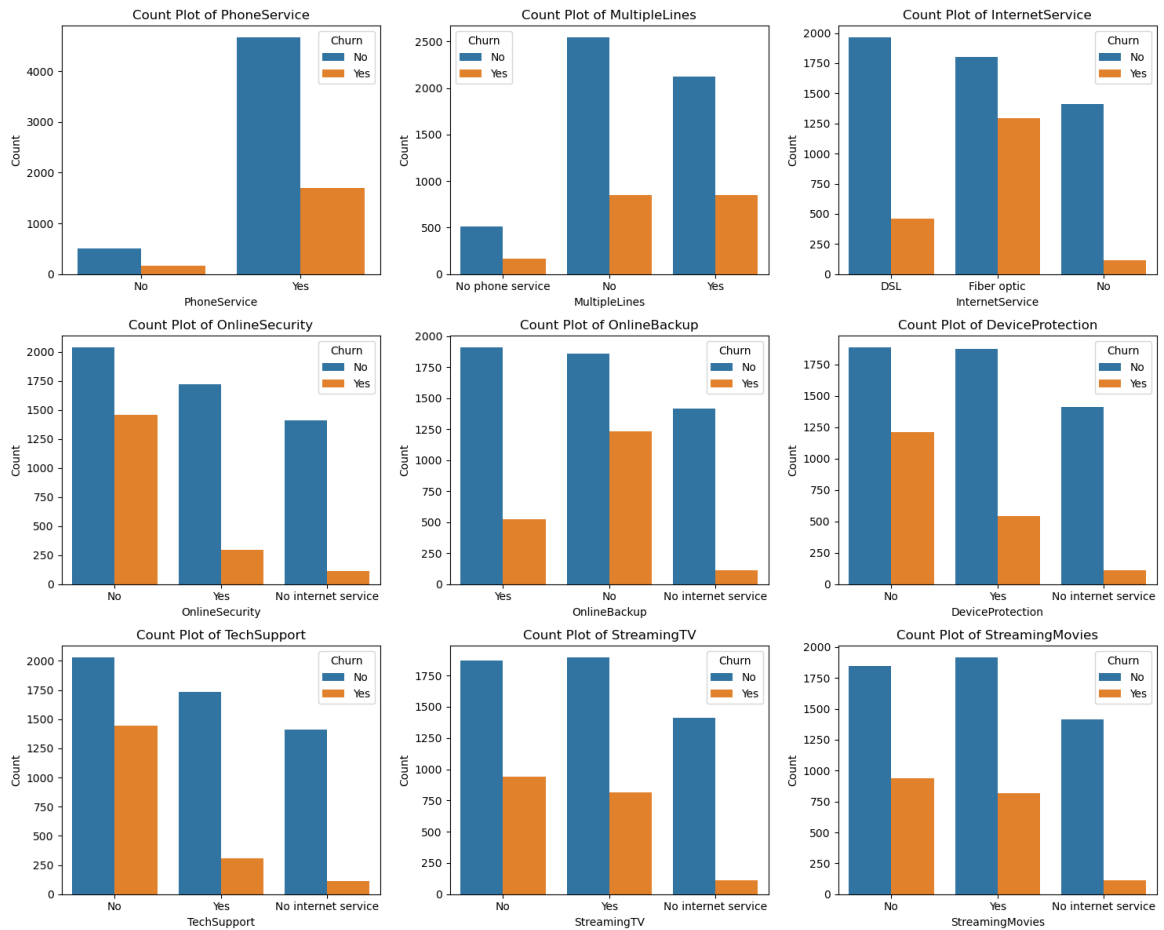
n_cols = 3
n_rows = (len(columns) + n_cols - 1) // n_cols
fig, axes = plt.subplots(n_rows, n_cols, figsize=(15, n_rows * 4))

axes = axes.flatten()

for i, col in enumerate(columns):
    sns.countplot(x=col, data=df, ax=axes[i], hue = df["Churn"])
    axes[i].set_title(f'Count Plot of {col}')
    axes[i].set_xlabel(col)
    axes[i].set_ylabel('Count')

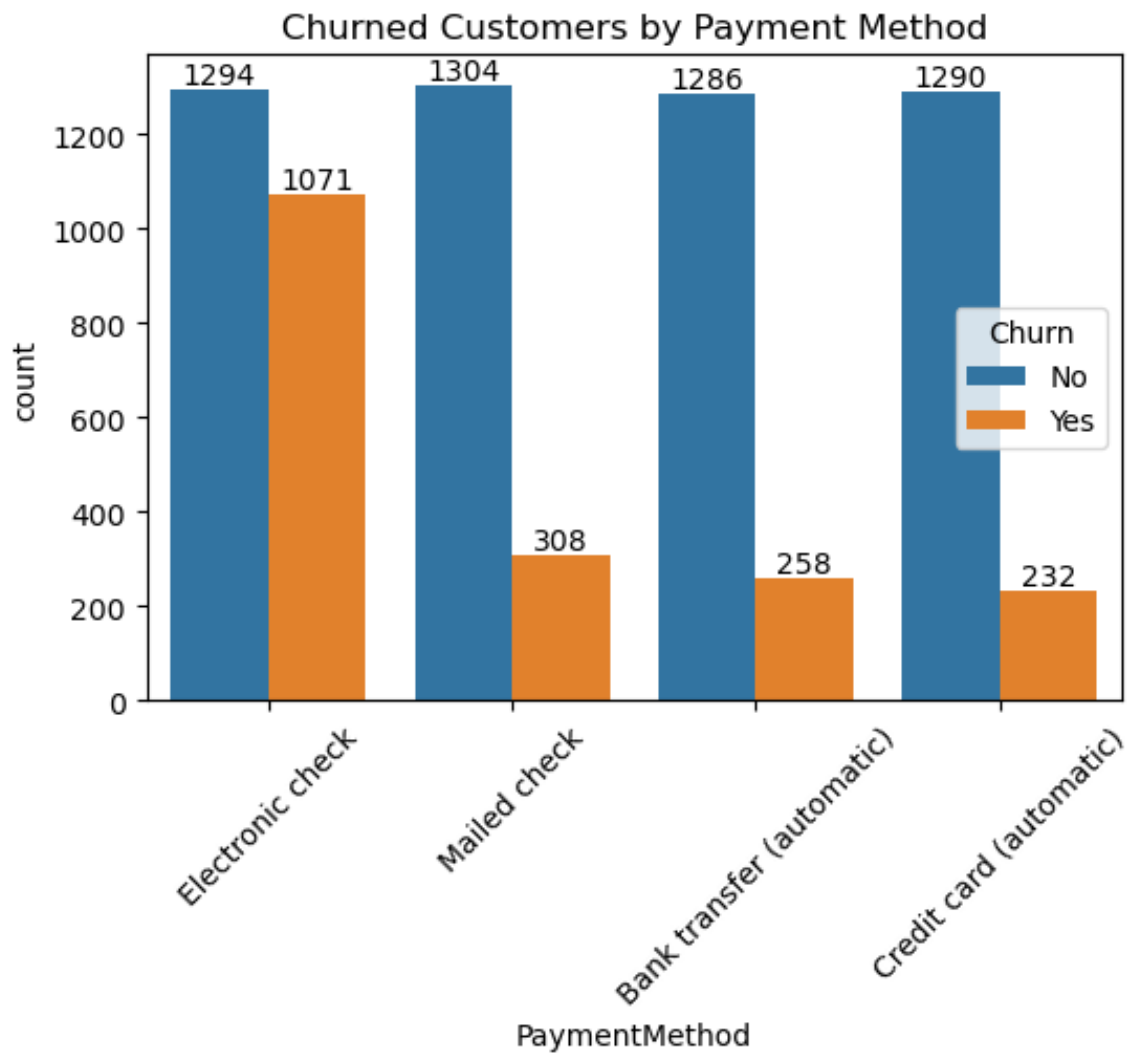
for j in range(i + 1, len(axes)):
    fig.delaxes(axes[j])

plt.tight_layout()
plt.show()
```



The majority of customers who do not churn tend to have services like PhoneService, InternetService (particularly DSL), and OnlineSecurity enabled. For services like OnlineBackup, TechSupport, and StreamingTV, churn rates are noticeably higher when these services are not used or are unavailable.

```
In [21]: plt.figure(figsize = (6,4))
ax = sns.countplot(x = "PaymentMethod", data = df, hue = "Churn")
ax.bar_label(ax.containers[0])
ax.bar_label(ax.containers[1])
plt.title("Churned Customers by Payment Method")
plt.xticks(rotation = 45)
plt.show()
```



It can be observed that customer is likely to churn when he is using electronic check as a payment method.

In []: