```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
df = pd.read_csv('Customer Churn.csv')
df
```

```
      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
1889.5
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
1990.5
7039              Yes    Credit card (automatic)         103.20
7362.9
7040              Yes           Electronic check          29.60
346.45
7041              Yes               Mailed check          74.40
306.6
7042              Yes  Bank transfer (automatic)         105.65
6844.5

     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]
```

```
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
```

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

```
0
```

```
df.describe()
```

```
       SeniorCitizen       tenure  MonthlyCharges
count    7043.000000  7043.000000     7043.000000
mean        0.162147    32.371149       64.761692
```

```
std          0.368612    24.559481        30.090047
min          0.000000     0.000000        18.250000
25%          0.000000     9.000000        35.500000
50%          0.000000    29.000000        70.350000
75%          0.000000    55.000000        89.850000
max          1.000000    72.000000       118.750000
```

```
df.duplicated().sum()
```

```
0
```

```
def conv(value):
    if value == 1:
        return "yes"
    else:
        return "no"
```

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

```
df.head(30)
```

```
    customerID  gender SeniorCitizen Partner Dependents  tenure
PhoneService  \
0   7590-VHVEG  Female            no     Yes         No       1
No
1   5575-GNVDE    Male            no      No         No      34
Yes
2   3668-QPYBK    Male            no      No         No       2
Yes
3   7795-CFOCW    Male            no      No         No      45
No
4   9237-HQITU  Female            no      No         No       2
Yes
5   9305-CDSKC  Female            no      No         No       8
Yes
6   1452-KIOVK    Male            no      No        Yes      22
Yes
7   6713-OKOMC  Female            no      No         No      10
No
8   7892-POOKP  Female            no     Yes         No      28
Yes
9   6388-TABGU    Male            no      No        Yes      62
Yes
10  9763-GRSKD    Male            no     Yes        Yes      13
Yes
11  7469-LKBCI    Male            no      No         No      16
Yes
12  8091-TTVAX    Male            no     Yes         No      58
Yes
13  0280-XJGEX    Male            no      No         No      49
```

```
Yes
14  5129-JLPIS    Male            no      No          No      25
Yes
15  3655-SNQYZ  Female            no     Yes         Yes      69
Yes
16  8191-XWSZG  Female            no      No          No      52
Yes
17  9959-WOFKT    Male            no      No         Yes      71
Yes
18  4190-MFLUW  Female            no     Yes         Yes      10
Yes
19  4183-MYFRB  Female            no      No          No      21
Yes
20  8779-QRDMV    Male            no      No          No       1
No
21  1680-VDCWW    Male            no     Yes          No      12
Yes
22  1066-JKSGK    Male            no      No          No       1
Yes
23  3638-WEABW  Female            no     Yes          No      58
Yes
24  6322-HRPFA    Male            no     Yes         Yes      49
Yes
25  6865-JZNKO  Female            no      No          No      30
Yes
26  6467-CHFZW    Male            no     Yes         Yes      47
Yes
27  8665-UTDHZ    Male            no     Yes         Yes       1
No
28  5248-YGIJN    Male            no     Yes          No      72
Yes
29  8773-HHUOZ  Female            no      No         Yes      17
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  ...
```

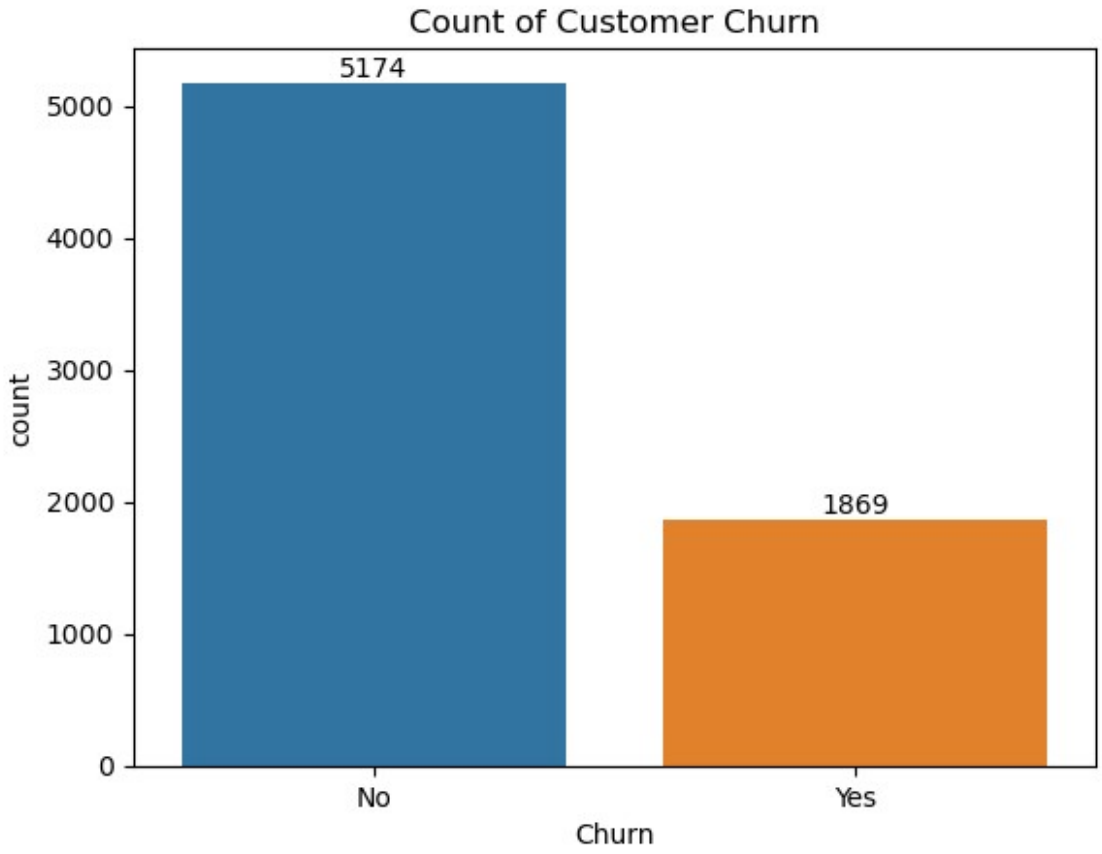
```
14                No     Fiber optic                  Yes  ...
15               Yes     Fiber optic                  Yes  ...
16                No              No  No internet service  ...
17               Yes     Fiber optic                  Yes  ...
18                No             DSL                   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  ...

             TechSupport          StreamingTV      StreamingMovies  \
0                     No                   No                   No
1                     No                   No                   No
2                     No                   No                   No
3                    Yes                   No                   No
4                     No                   No                   No
5                     No                  Yes                  Yes
6                     No                  Yes                   No
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                    No                  Yes                  Yes
13                    No                  Yes                  Yes
14                   Yes                  Yes                  Yes
15                   Yes                  Yes                  Yes
16  No internet service  No internet service  No internet service
17                    No                  Yes                  Yes
18                   Yes                   No                   No
19                    No                   No                  Yes
20                    No                   No                  Yes
21  No internet service  No internet service  No internet service
22  No internet service  No internet service  No internet service
23                   Yes                   No                   No
24                   Yes                   No                   No
25                    No                   No                   No
26                    No                  Yes                  Yes
27                    No                   No                   No
28                   Yes                  Yes                  Yes
29                    No                  Yes                  Yes
```

```
          Contract PaperlessBilling              PaymentMethod
MonthlyCharges  \
0   Month-to-month              Yes           Electronic check
29.85
1         One year               No               Mailed check
56.95
2   Month-to-month              Yes               Mailed check
53.85
3         One year               No  Bank transfer (automatic)
42.30
4   Month-to-month              Yes           Electronic check
70.70
5   Month-to-month              Yes           Electronic check
99.65
6   Month-to-month              Yes    Credit card (automatic)
89.10
7   Month-to-month               No               Mailed check
29.75
8   Month-to-month              Yes           Electronic check
104.80
9         One year               No  Bank transfer (automatic)
56.15
10  Month-to-month              Yes               Mailed check
49.95
11        Two year               No    Credit card (automatic)
18.95
12        One year               No    Credit card (automatic)
100.35
13  Month-to-month              Yes  Bank transfer (automatic)
103.70
14  Month-to-month              Yes           Electronic check
105.50
15        Two year               No    Credit card (automatic)
113.25
16        One year               No               Mailed check
20.65
17        Two year               No  Bank transfer (automatic)
106.70
18  Month-to-month               No    Credit card (automatic)
55.20
19  Month-to-month              Yes           Electronic check
90.05
20  Month-to-month              Yes           Electronic check
39.65
21        One year               No  Bank transfer (automatic)
19.80
22  Month-to-month               No               Mailed check
20.15
23        Two year              Yes    Credit card (automatic)
```

```
59.90
24  Month-to-month               No    Credit card (automatic)
59.60
25  Month-to-month              Yes  Bank transfer (automatic)
55.30
26  Month-to-month              Yes           Electronic check
99.35
27  Month-to-month               No           Electronic check
30.20
28        Two year              Yes    Credit card (automatic)
90.25
29  Month-to-month              Yes               Mailed check
64.70

   TotalCharges  Churn SeniorCitizen
0         29.85     No            None
1        1889.5     No            None
2        108.15    Yes            None
3       1840.75     No            None
4        151.65    Yes            None
5         820.5    Yes            None
6        1949.4     No            None
7         301.9     No            None
8       3046.05    Yes            None
9       3487.95     No            None
10       587.45     No            None
11        326.8     No            None
12       5681.1     No            None
13       5036.3    Yes            None
14      2686.05     No            None
15      7895.15     No            None
16      1022.95     No            None
17      7382.25     No            None
18       528.35    Yes            None
19       1862.9     No            None
20        39.65    Yes             yes
21       202.25     No            None
22        20.15    Yes            None
23       3505.1     No            None
24       2970.3     No            None
25       1530.6     No            None
26      4749.15    Yes            None
27         30.2    Yes            None
28      6369.45     No            None
29       1093.1    Yes            None

[30 rows x 22 columns]
```

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

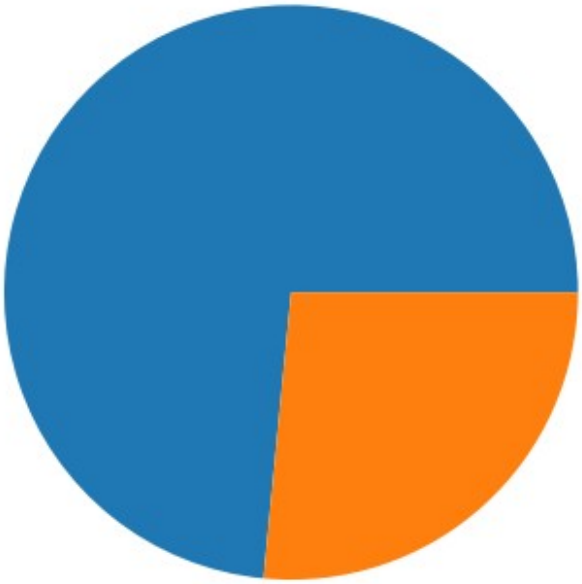
```
ax = sns.countplot(x = 'Churn', data = df)

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



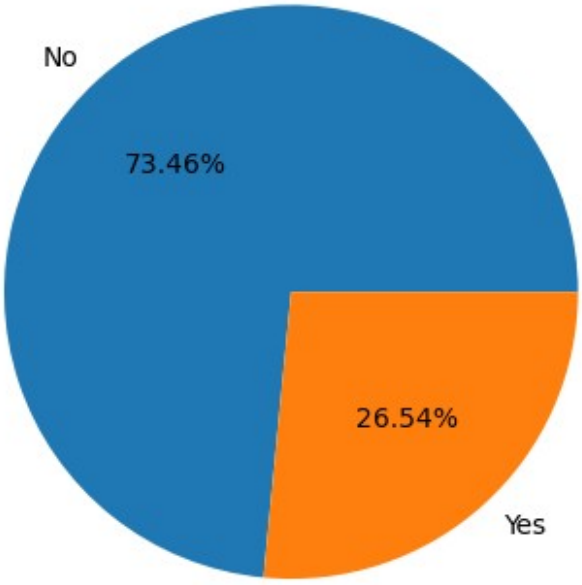

```
gb = df.groupby("Churn").agg({'Churn':"count"})
gb
#plt.pie(gb['Churn'])
#plt.show()
```

Churn	Churn
No	5174
Yes	1869

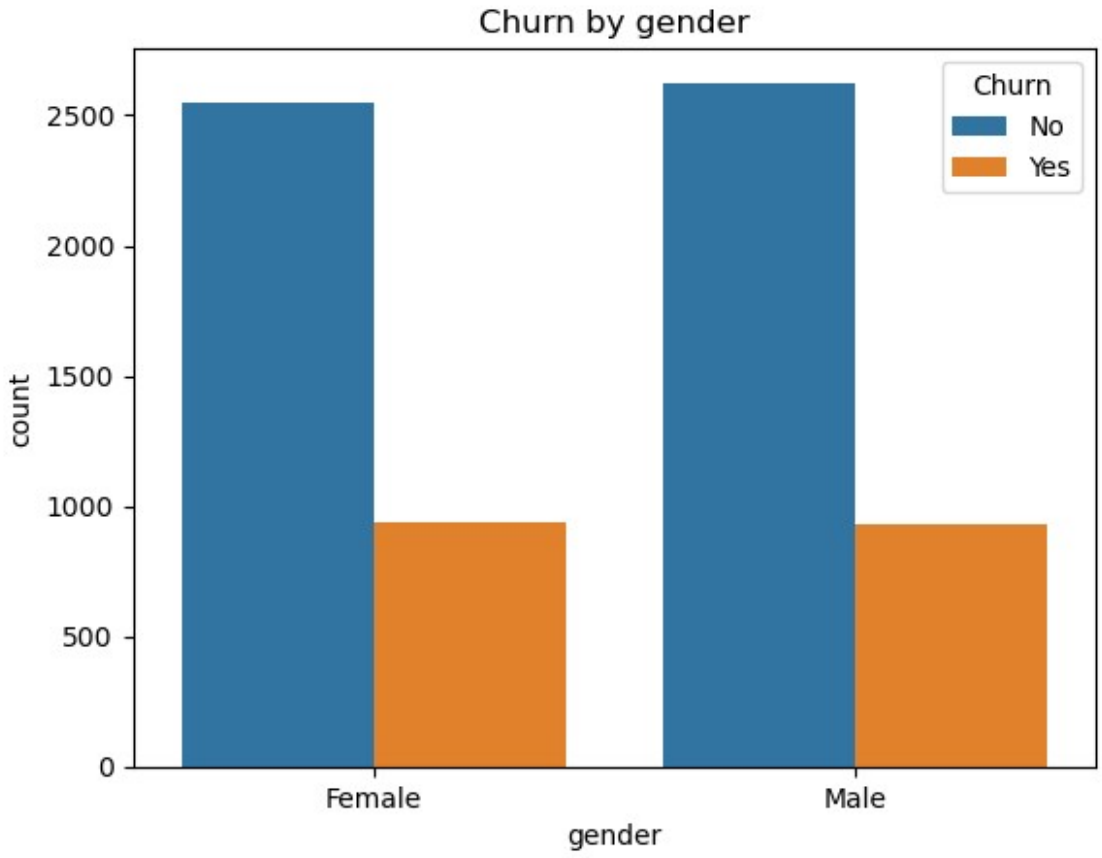
```
gb = df.groupby("Churn").agg({'Churn':"count"})
plt.pie(gb['Churn'])
plt.show()
```



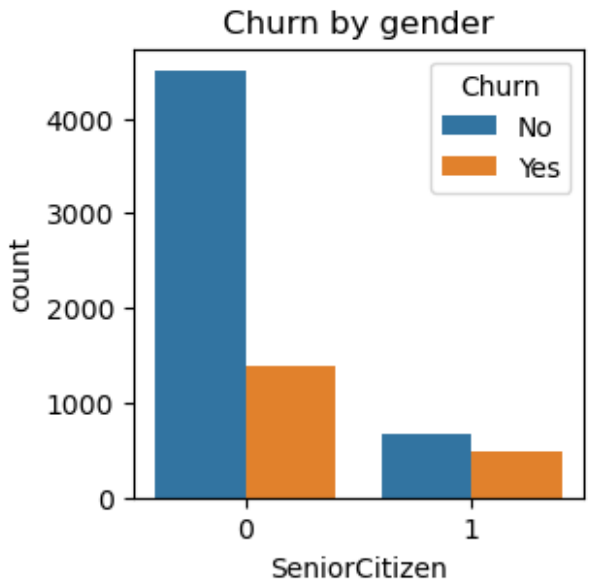
```
gb = df.groupby("Churn").agg({'Churn':"count"})
plt.pie(gb['Churn'], labels = gb.index,autopct = "%1.2f%%")
plt.show()
```



```
#from the given pie chart we can conclude that 26.54% of our customer
have chuend out


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

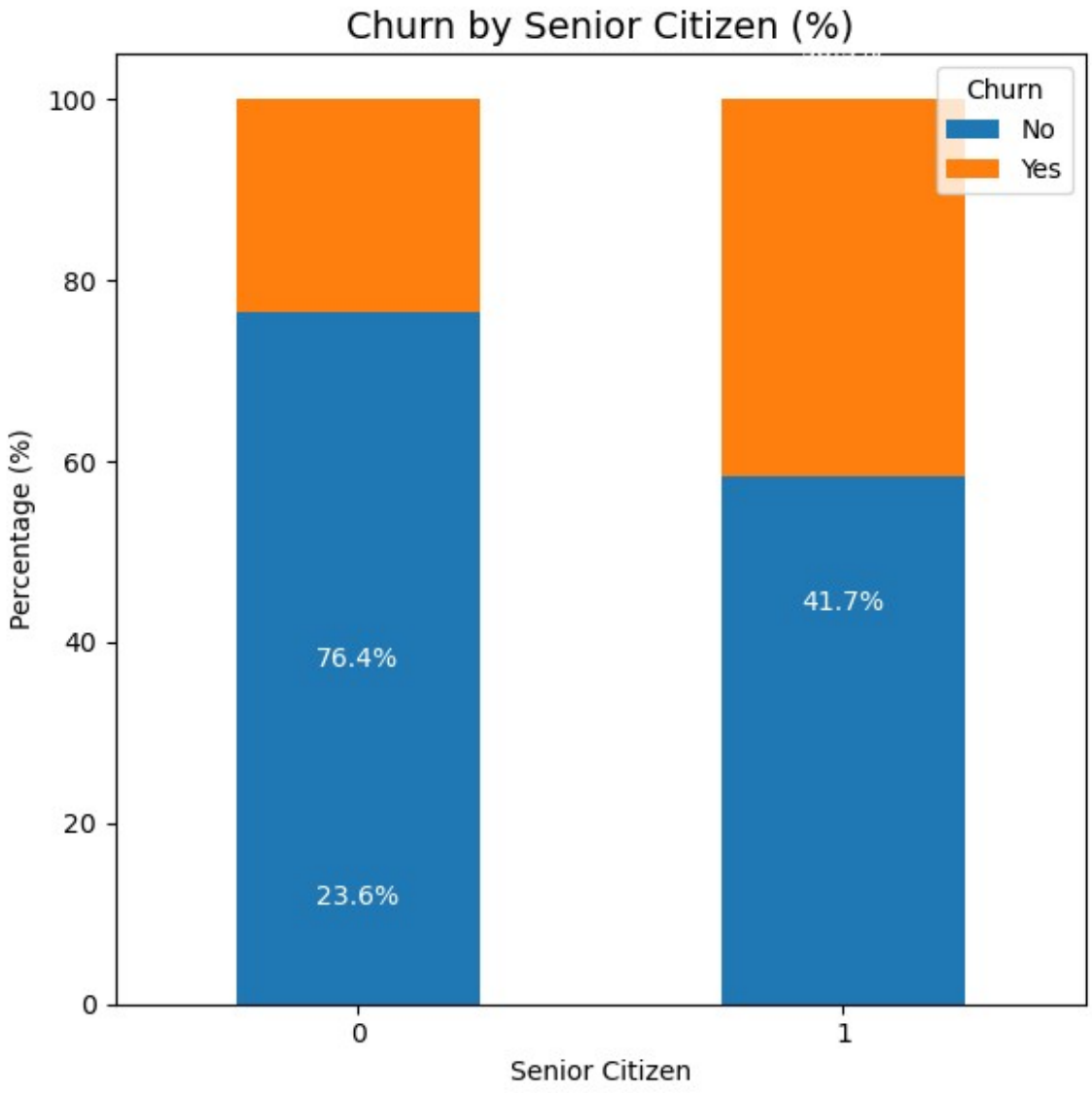



```
plt.figure(figsize = (3,3))
sns.countplot(x= "SeniorCitizen",data = df,hue = "Churn")
plt.title("Churn by gender")
plt.show()
```

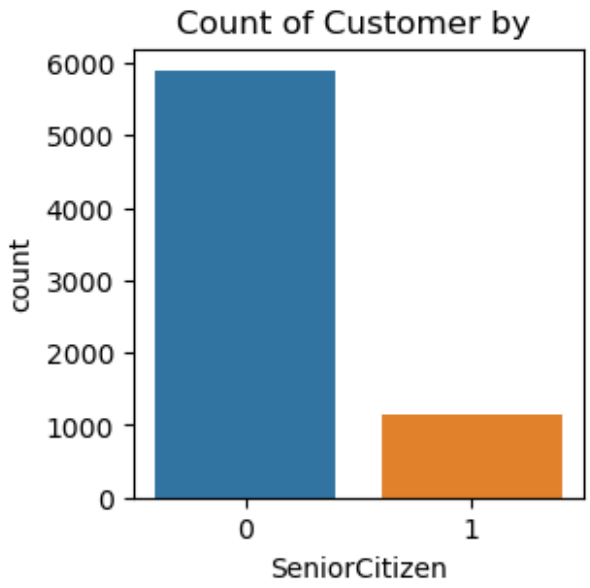



```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns

# Assuming 'df' is your DataFrame and it contains 'SeniorCitizen' and
'Churn' columns
# Prepare data for stacked bar chart
data = df.groupby(['SeniorCitizen',
'Churn']).size().reset_index(name='Count')
data_pivot = data.pivot(index='SeniorCitizen', columns='Churn',
values='Count')

# Calculate percentages
data_pivot_percent = data_pivot.div(data_pivot.sum(axis=1), axis=0) *
100

# Plotting the stacked bar chart
fig, ax = plt.subplots(figsize=(6, 6))
data_pivot_percent.plot(kind='bar', stacked=True, ax=ax,
color=['#1f77b4', '#ff7f0e'])

# Add percentage labels on the bars
for i, col in enumerate(data_pivot_percent.columns):
    for j, val in enumerate(data_pivot_percent[col]):
        if val > 0:  # Skip adding labels for 0%
            ax.text(j, data_pivot_percent.iloc[:j, i].sum() + val / 2,
f'{val:.1f}%',
                    ha='center', va='center', color='white',
fontsize=10)

# Customization
```

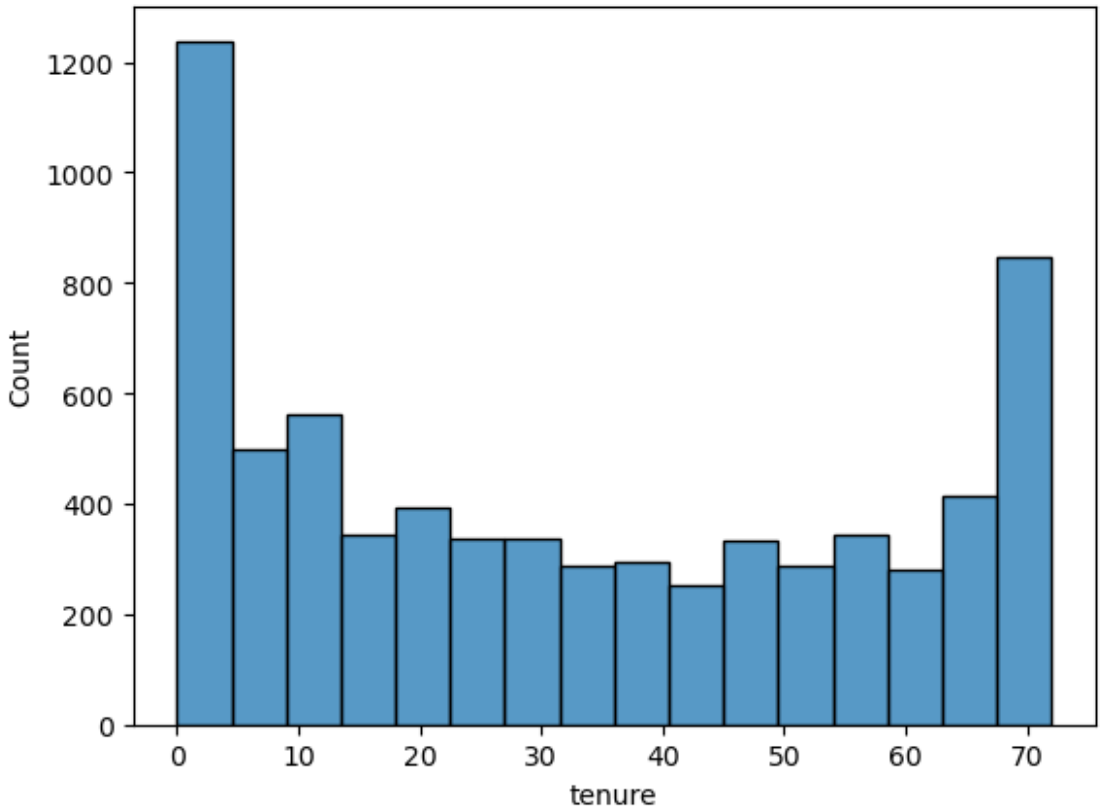
```
plt.title('Churn by Senior Citizen (%)', fontsize=14)
plt.ylabel('Percentage (%)')
plt.xlabel('Senior Citizen')
plt.xticks(rotation=0)
plt.legend(title='Churn', loc='upper right')
plt.tight_layout()
plt.show()
```



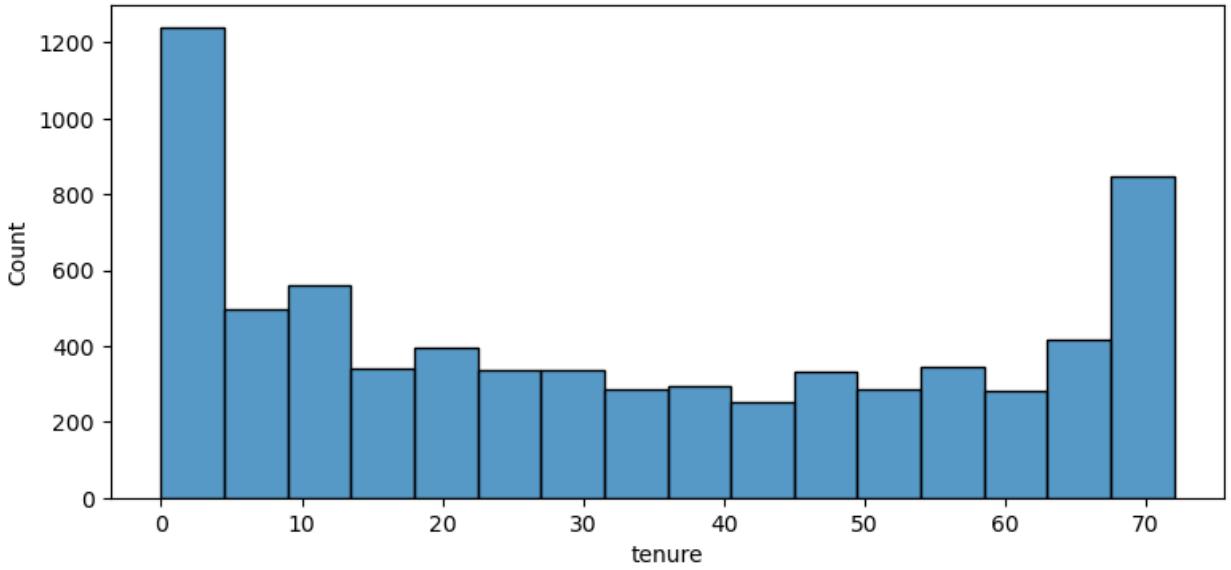

```
plt.figure(figsize = (3,3))
sns.countplot(x = "SeniorCitizen",data = df)
plt.title("Count of Customer by ")
plt.show()
```



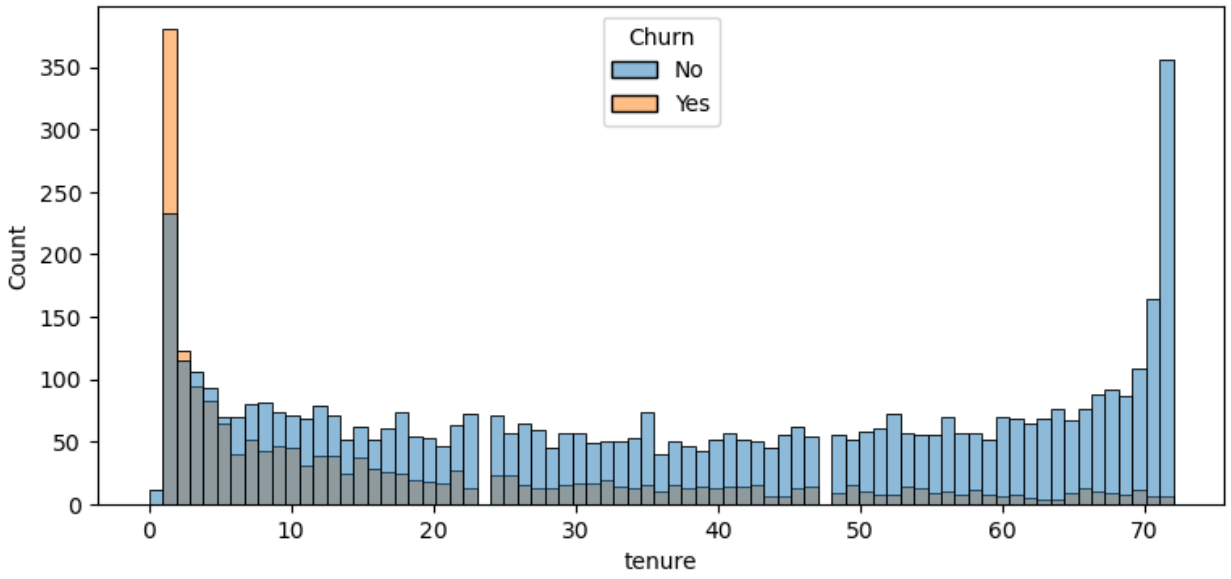

```
sns.histplot(x= "tenure", data = df)
plt.show()
```



```
plt.figure(figsize = (9,4))
sns.histplot(x= "tenure", data = df)
plt.show()
```

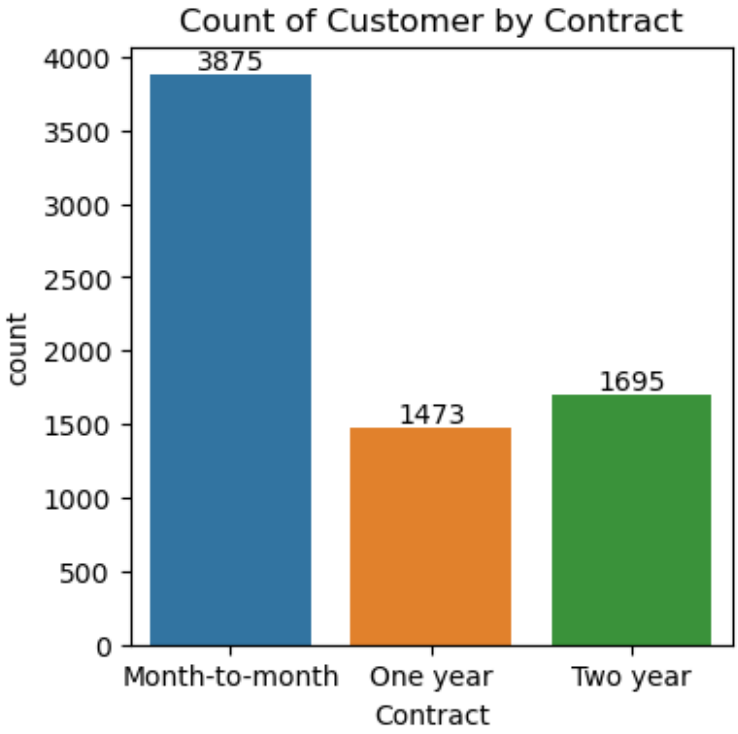



```
plt.figure(figsize = (9,4))
sns.histplot(x= "tenure", data = df,bins = 75 , hue = "Churn")
plt.show()
```




```
#people who have used our service for a long time have stayed and
people who have used our service
```

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

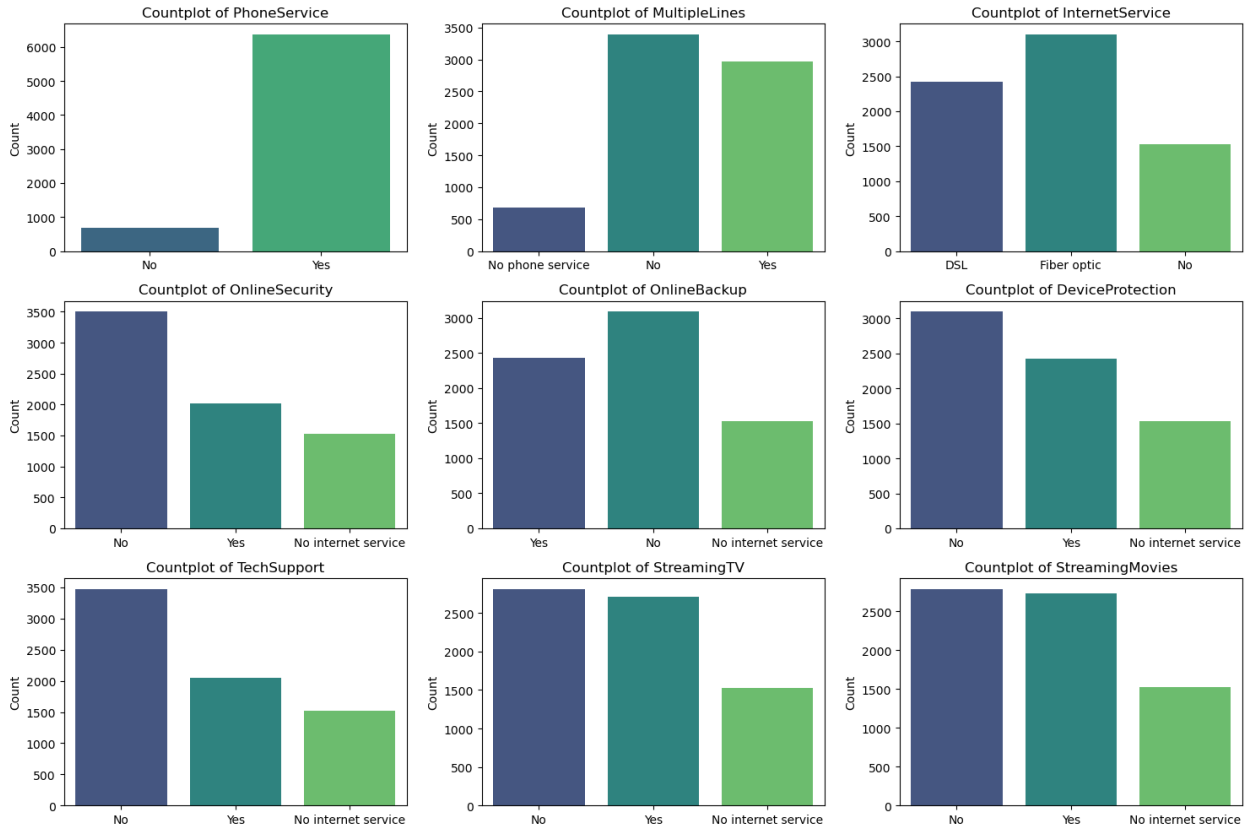



```
df.columns.values
```

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

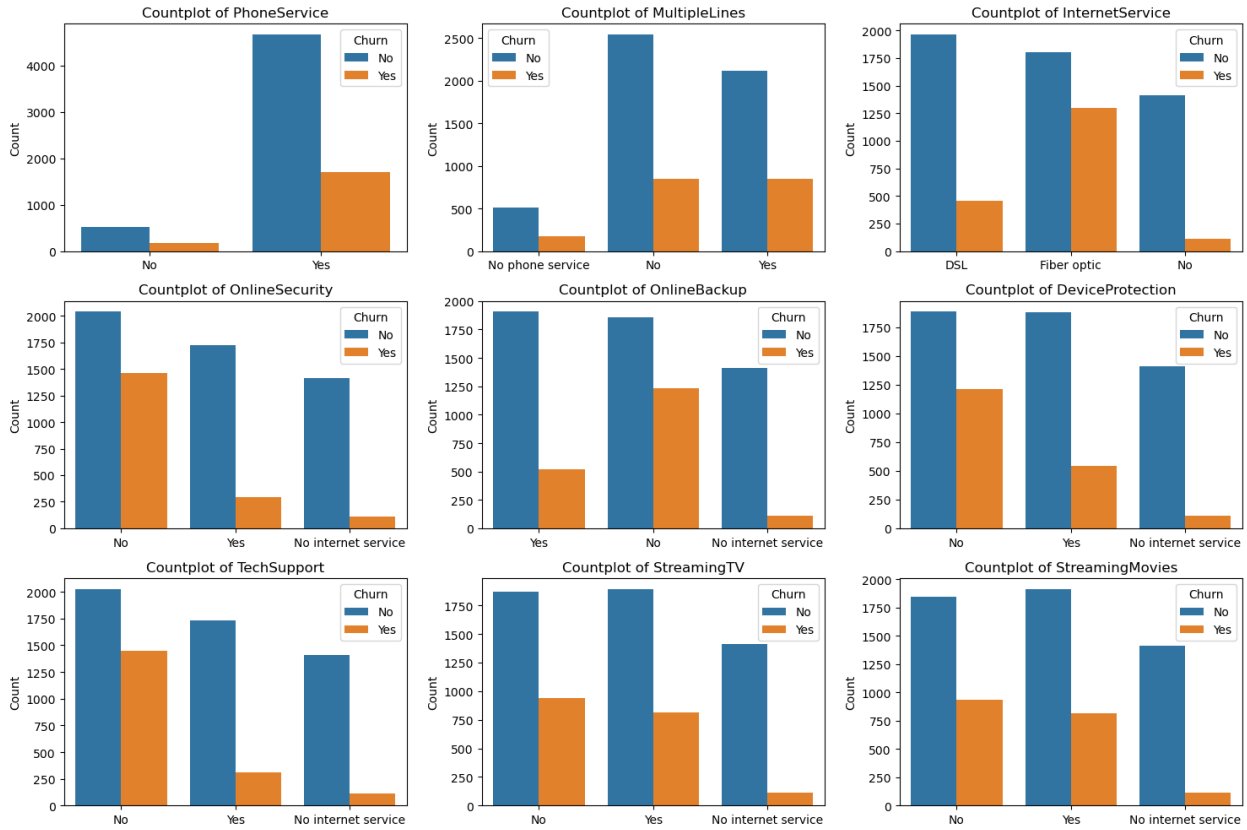
```
import matplotlib.pyplot as plt
import seaborn as sns

# List of columns to plot
columns = ['PhoneService', 'MultipleLines', 'InternetService',
           'OnlineSecurity', 'OnlineBackup', 'DeviceProtection',
           'TechSupport', 'StreamingTV', 'StreamingMovies']

# Set up the figure and axes for subplots
n_cols = 3  # Number of columns in the grid
```

```
n_rows = -(-len(columns) // n_cols)  # Calculate rows needed, rounding up
fig, axes = plt.subplots(n_rows, n_cols, figsize=(15, 10))

# Flatten axes array for easy iteration
axes = axes.flatten()

# Create a countplot for each column
for i, col in enumerate(columns):
    sns.countplot(data=df, x=col, ax=axes[i], palette="viridis")
    axes[i].set_title(f'Countplot of {col}')
    axes[i].set_xlabel('')
    axes[i].set_ylabel('Count')

# Remove unused subplots if columns < total grid spaces
for j in range(i + 1, len(axes)):
    fig.delaxes(axes[j])

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

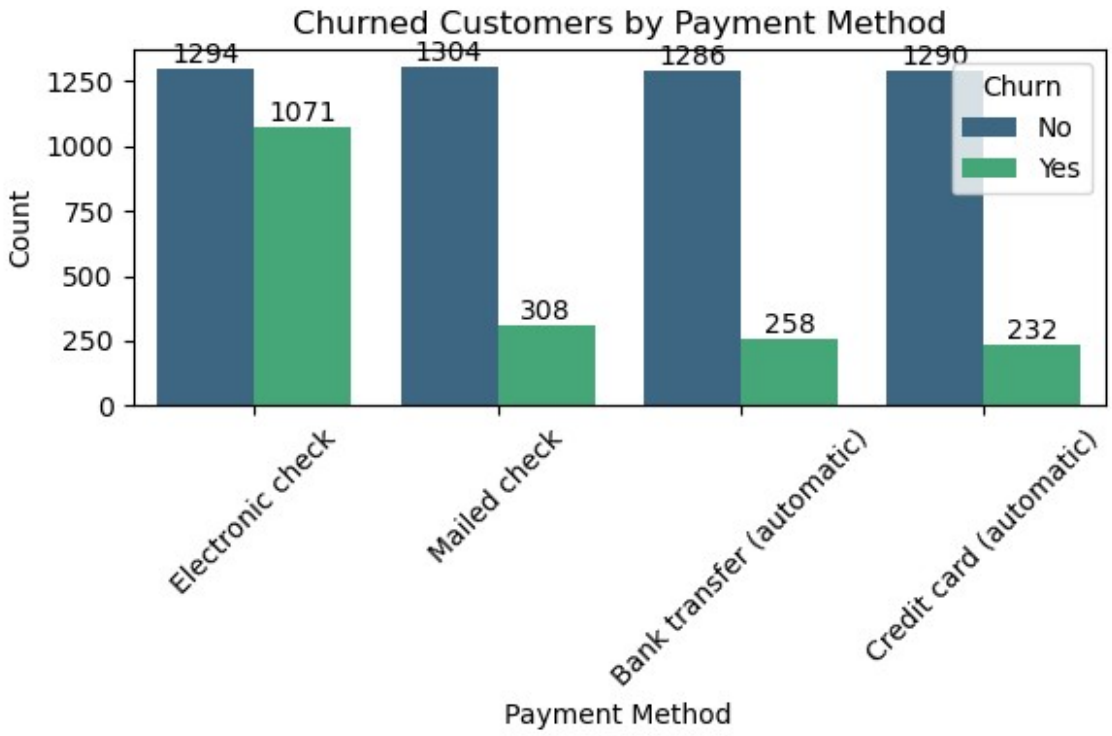



```
import matplotlib.pyplot as plt
import seaborn as sns
```

```python
# List of columns to plot
columns = ['PhoneService', 'MultipleLines', 'InternetService',
           'OnlineSecurity', 'OnlineBackup', 'DeviceProtection',
           'TechSupport', 'StreamingTV', 'StreamingMovies']

# Set up the figure and axes for subplots
n_cols = 3  # Number of columns in the grid
n_rows = -(-len(columns) // n_cols)  # Calculate rows needed, rounding
up
fig, axes = plt.subplots(n_rows, n_cols, figsize=(15, 10))

# Flatten axes array for easy iteration
axes = axes.flatten()

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

# Remove unused subplots if columns < total grid spaces
for j in range(i + 1, len(axes)):
    fig.delaxes(axes[j])

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




```
plt.figure(figsize=(6, 4))  # Corrected `figure` parameter to
`figsize`
ax = sns.countplot(x="PaymentMethod", data=df, hue="Churn",
palette="viridis")

# Adding bar labels
for container in ax.containers:
    ax.bar_label(container, fmt='%d')

plt.title("Churned Customers by Payment Method")
plt.xlabel("Payment Method")
plt.ylabel("Count")
plt.xticks(rotation=45)  # Rotate x-axis labels for better visibility
plt.tight_layout()  # Adjust layout to prevent overlapping
plt.show()
```


Churned Customers by Payment Method
Count
Payment Method
Churn
No
Yes
1294
1071
1304
308
1286
258
1290
232
0
250
500
750
1000
1250
Electronic check
Mailed check
Bank transfer (automatic)
Credit card (automatic)