```python
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns

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

```
   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]
```

```
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

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

df.info()
```

```
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 5   tenure            7043 non-null   int64
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 7   MultipleLines     7043 non-null   object
 8   InternetService   7043 non-null   object
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 11  DeviceProtection  7043 non-null   object
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 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
```

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

```
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
```

```
df.describe()
```

```
       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
```

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

```
0
```

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

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

```
   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
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Yes
3  7795-CFOCW    Male            no      No         No      45
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0  No phone service             DSL             No  ...
No
1                No             DSL            Yes  ...
Yes
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3  No phone service             DSL            Yes  ...
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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       1889.50     No
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3  Bank transfer (automatic)          42.30       1840.75     No
4           Electronic check          70.70        151.65    Yes

[5 rows x 21 columns]
```
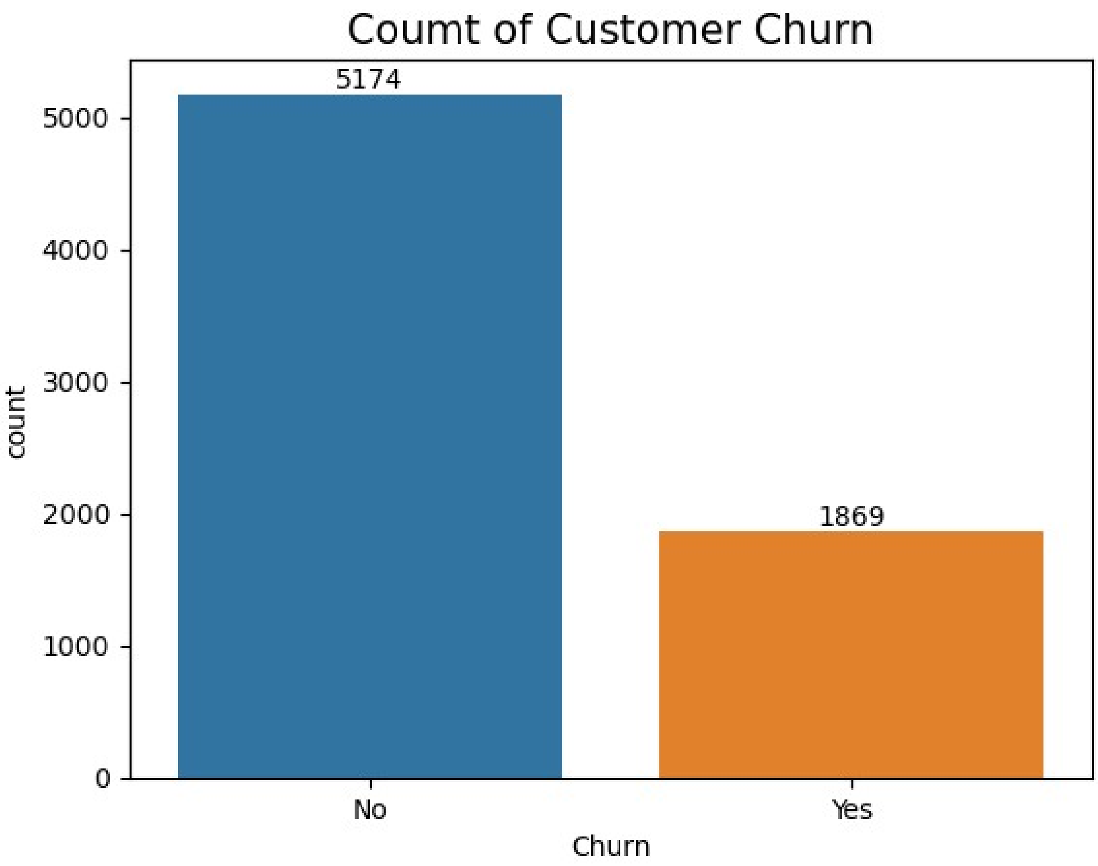
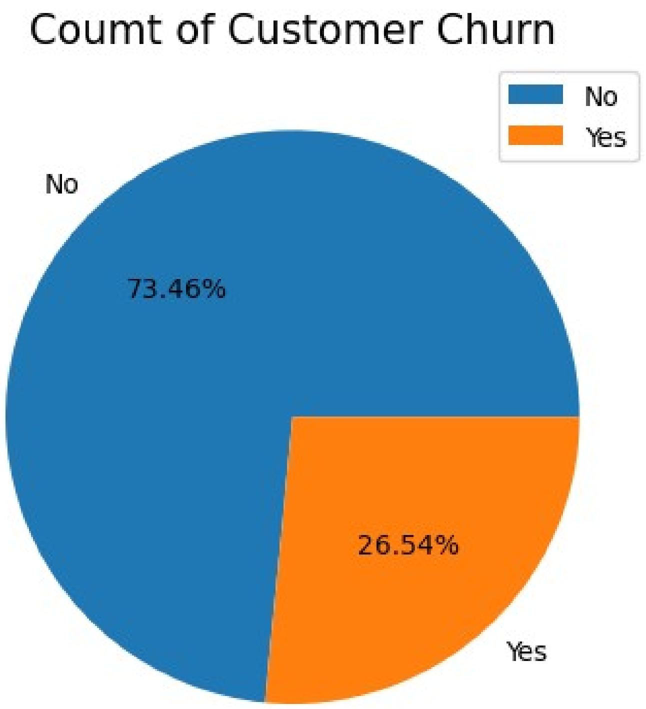

converted 0 and 1 values of senior citizen to yes and no to make it easier to understand

```
ax = sns.countplot(x = 'Churn',data = df)
ax.bar_label(ax.containers[0])
plt.title("Coumt of Customer Churn",fontsize=15)

plt.show()
```

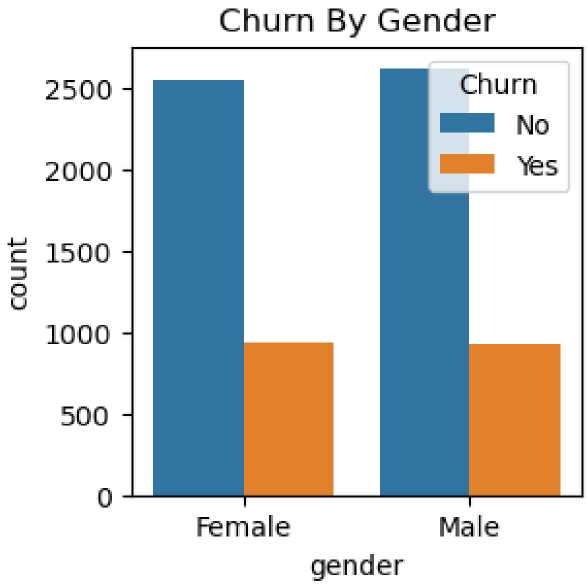


```
gb = df.groupby('Churn').agg({'Churn':"count"})
plt.pie(gb['Churn'],labels = gb.index, autopct = "%1.2f%%")
plt.title("Coumt of Customer Churn",fontsize=15)
plt.legend()
plt.show()
```

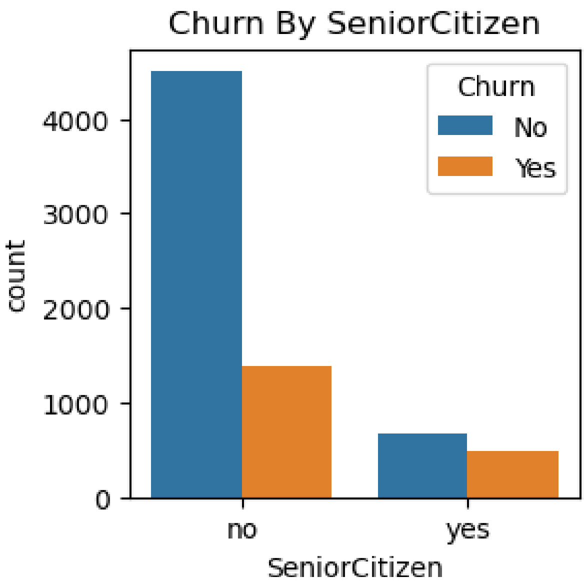


from the given pie chart we can conclude that 26.54% of our customers have churned out. not let's explore the reason behind it

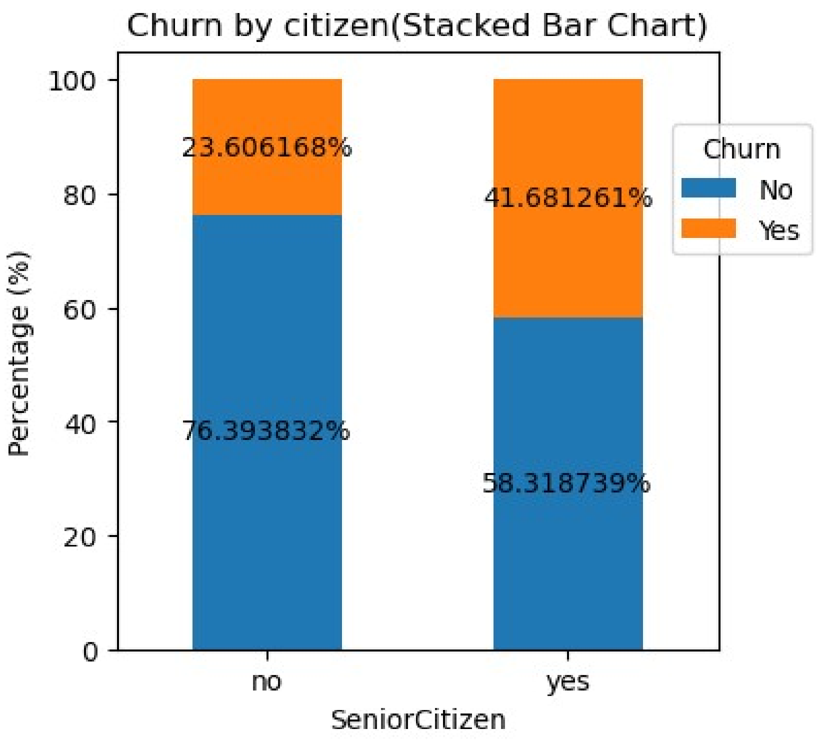
```
plt.figure(figsize = (3,3))
sns.countplot(x = "gender",data = df, hue = "Churn")
plt.title("Churn By Gender")
plt.show()
```



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

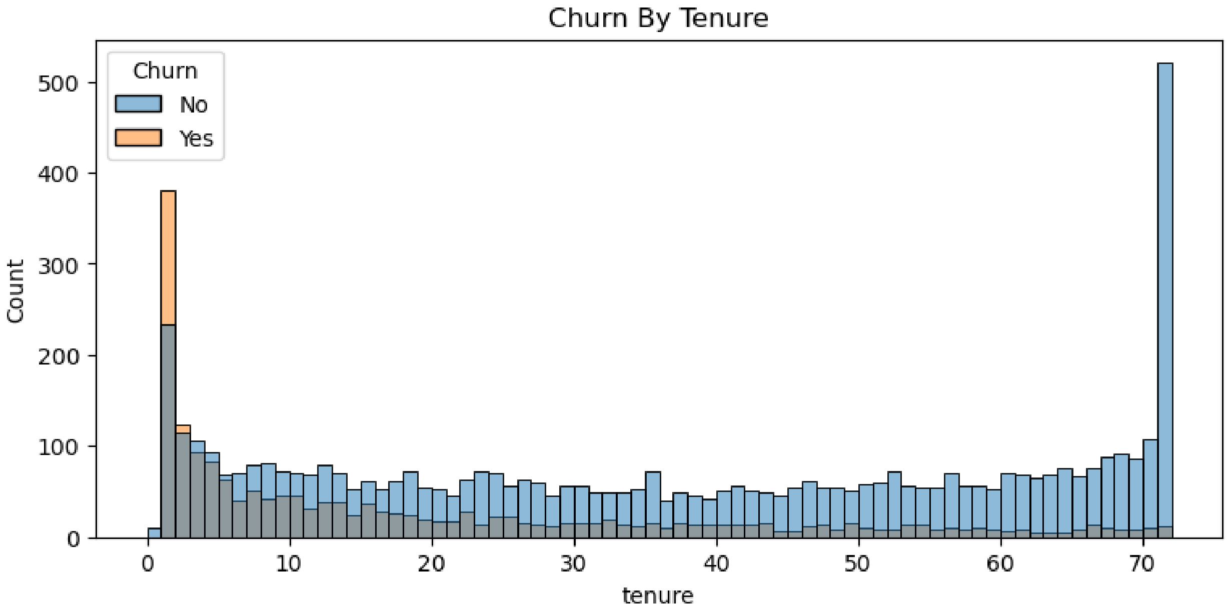


```
total_counts = df.groupby('SeniorCitizen')
['Churn'].value_counts(normalize=True).unstack()*100
fig, ax = plt.subplots(figsize=(4,4))
total_counts.plot(kind="bar" , stacked=True, ax=ax)
for p in ax.patches:
    width, height = p.get_width(), p.get_height()
    x, y = p.get_xy()
    ax.text(x + width / 2, y+height/2, f'{height:1f}%',
ha='center',va='center')

plt.title('Churn by 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()
```



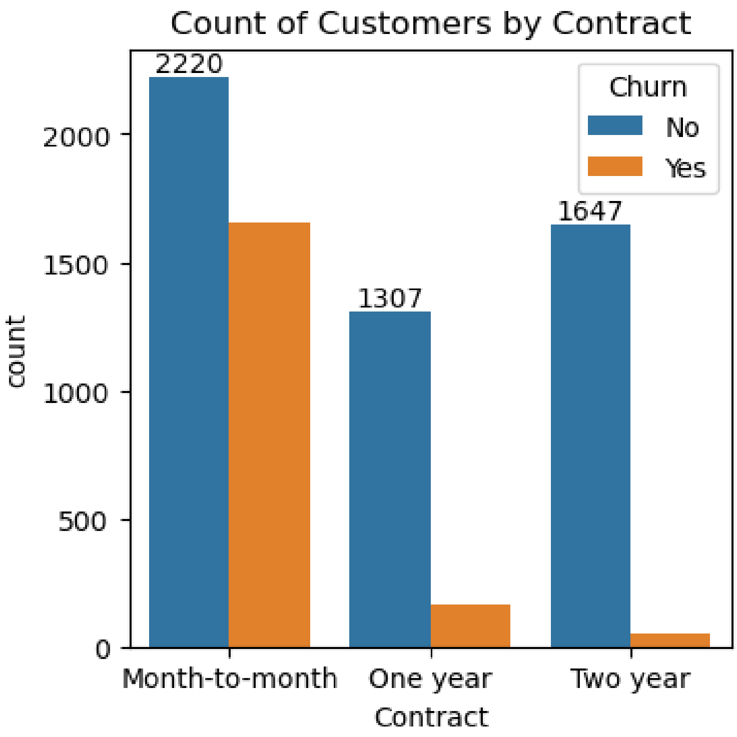
comparative a greated percentafe of people in senior citizen category have churned.

```
plt.figure(figsize = (9,4))
sns.histplot(x = "tenure",data = df, bins = 72, hue = "Churn")
plt.title("Churn By Tenure")
plt.show()
```



people who have used our srevices for a long time have stayed and people who have used our services 1 or 2 months have churned

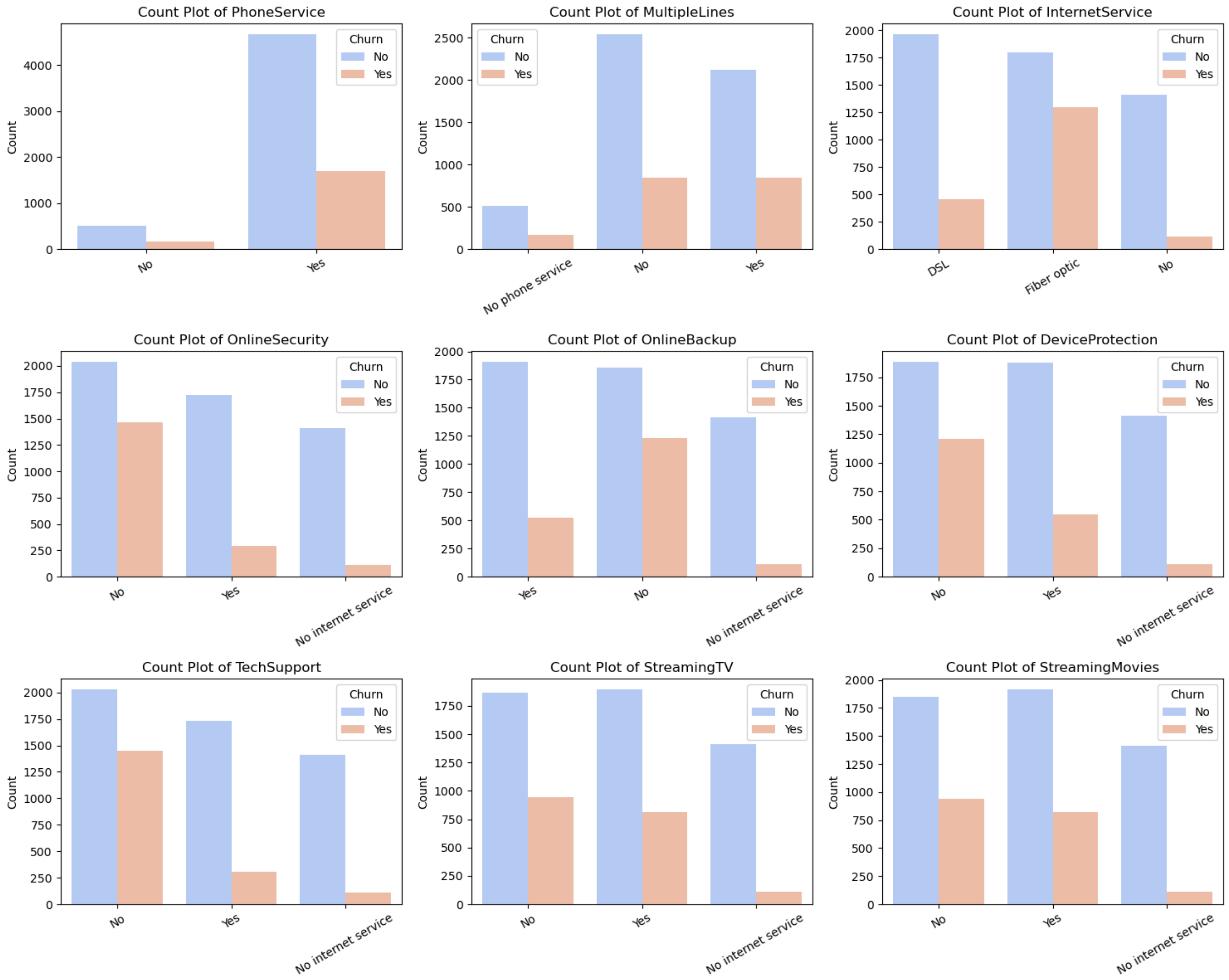
```
plt.figure(figsize = (4,4))
ax = sns.countplot(x = "Contract", data = df,hue='Churn')
ax.bar_label(ax.containers[0])
plt.title("Count of Customers by Contract")

plt.show()
```



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

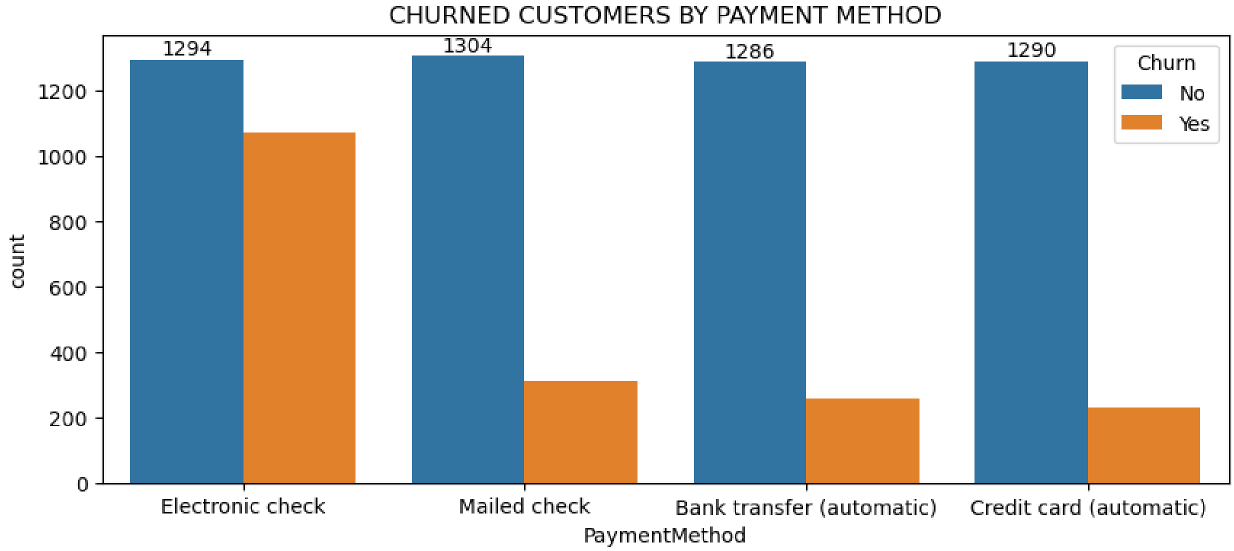
```
df.columns.values

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

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

```
fig, axes = plt.subplots(nrows=3, ncols=3, figsize=(15, 12))
axes = axes.flatten()


for i, col in enumerate(columns):
    sns.countplot(x=df[col], ax=axes[i],
palette="coolwarm",hue=df['Churn'])
    axes[i].set_title(f'Count Plot of {col}')
    axes[i].set_xlabel('')
    axes[i].set_ylabel('Count')
    axes[i].tick_params(axis='x', rotation=30)


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



Higher churn rates are observed for customers with Fiber optic InternetService or those lacking security/protection features, highlighting areas for retention strategies.

```
plt.figure(figsize = (10,4))
ax = sns.countplot(x = "PaymentMethod", data = df, hue = "Churn")
ax.bar_label(ax.containers[0])
plt.title("CHURNED CUSTOMERS BY PAYMENT METHOD")
plt.show()
```



customers is likely to churn when he is using electronic check as a payment method