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

df = pd.read_csv("Telco-Customer-Churn.csv")
df.head(5)
```

```
   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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```
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 2   SeniorCitizen     7043 non-null   int64
 3   Partner           7043 non-null   object
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 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
```

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

```
np.int64(0)
```

```
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()
```

```
np.int64(0)
```

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

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

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

```
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
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4  9237-HQITU  Female            no      No         No       2
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      MultipleLines InternetService OnlineSecurity  ...
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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
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2          No          No              No  Month-to-month
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3         Yes          No              No        One year
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               PaymentMethod MonthlyCharges  TotalCharges  Churn
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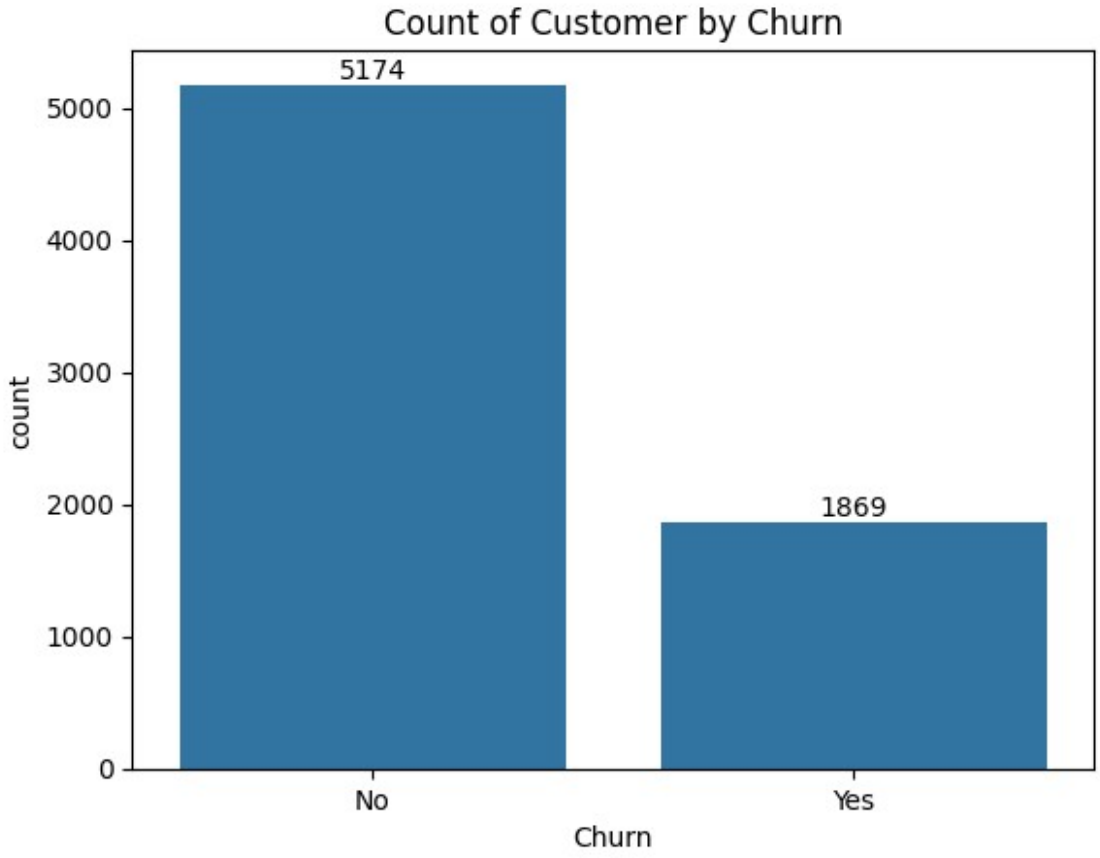
3  Bank transfer (automatic)          42.30       1840.75     No
4           Electronic check          70.70        151.65    Yes
```

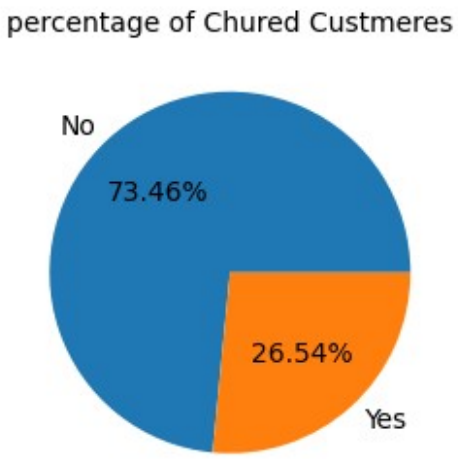
```
[5 rows x 21 columns]
```

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

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

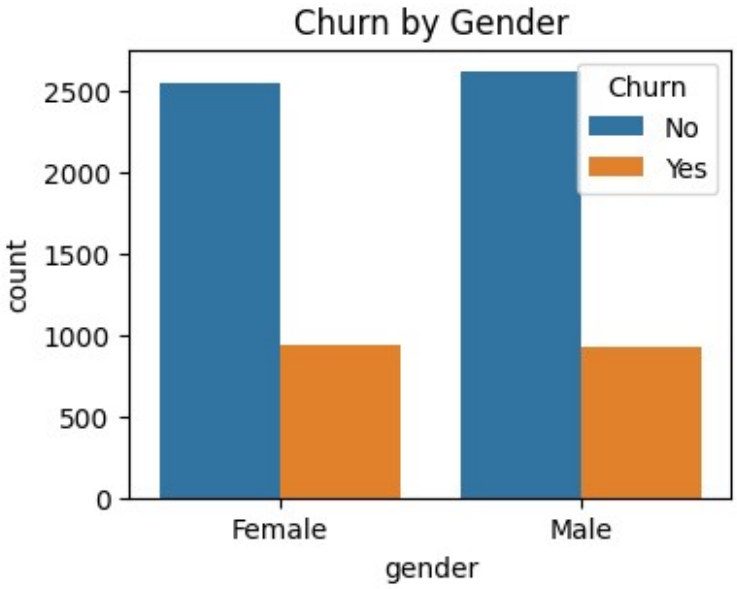



```
plt.figure(figsize = (3,4))
gb = df['Churn'].value_counts()
plt.pie(gb,labels = gb.index, autopct = "%1.2f%%")
plt.title("percentage of Chured Custmeres", fontsize = 10)
plt.show()
```

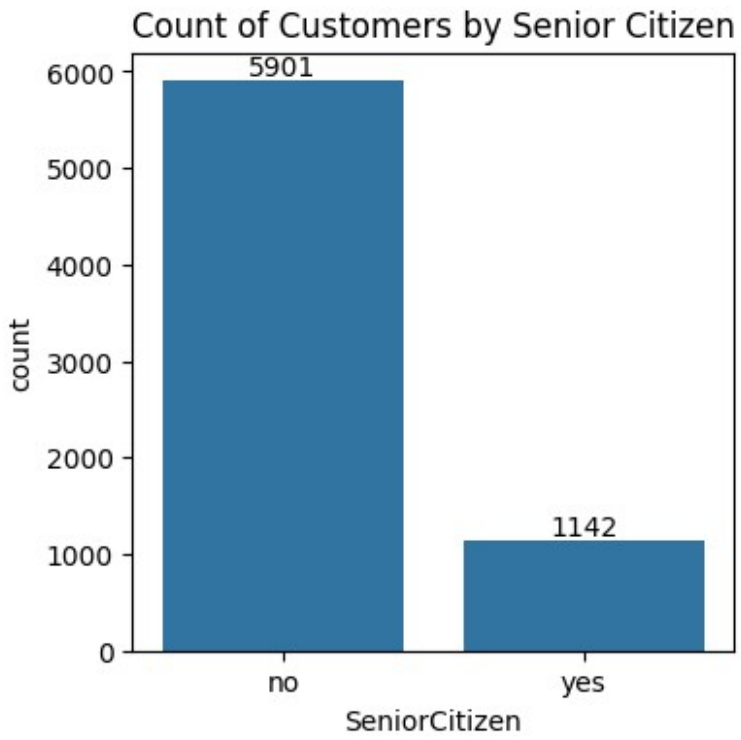


#from the given pie chart we can conclude that 26.54% of our customers out. #not let's explore the reason behind it

```
plt.figure(figsize = (4,3))
sns.countplot(x= "gender", data = df, hue =  "Churn")
plt.title("Churn by Gender".)
plt.show()
```




```
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()
```



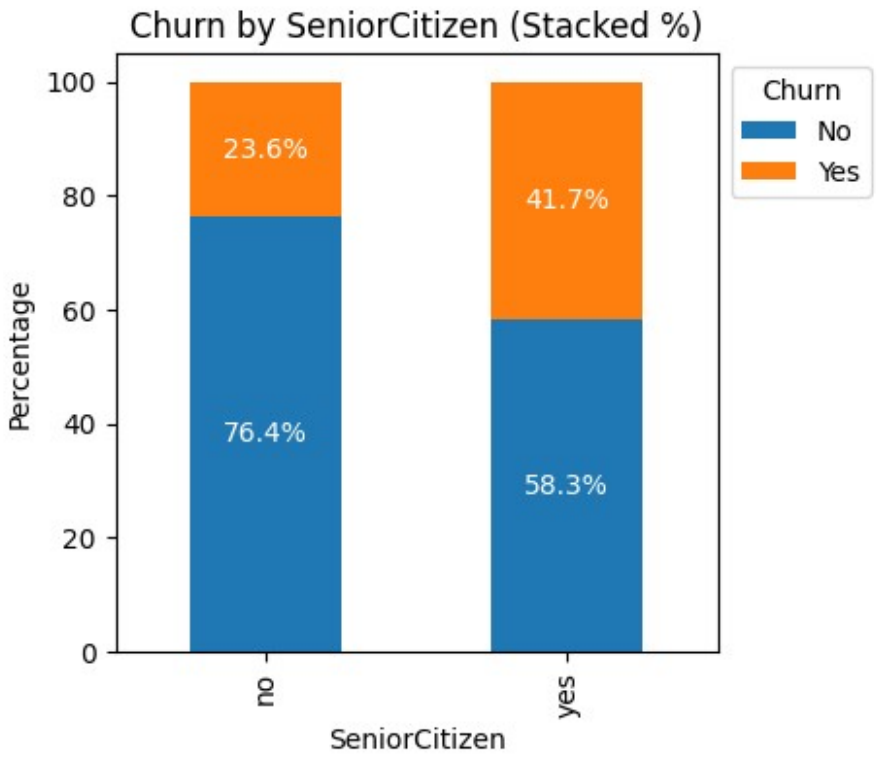

```
df_grouped = df.groupby(["SeniorCitizen", "Churn"]).size().unstack()
df_percent = df_grouped.div(df_grouped.sum(axis=1), axis=0) * 100

# Define custom colors (based on your image)
custom_colors = ["#1f77b4", "#ff7f0e"]  # Dark Blue & Dark Orange

# Plot
fig, ax = plt.subplots(figsize=(4, 4))
df_percent.plot(kind="bar", stacked=True, color=custom_colors, ax=ax)

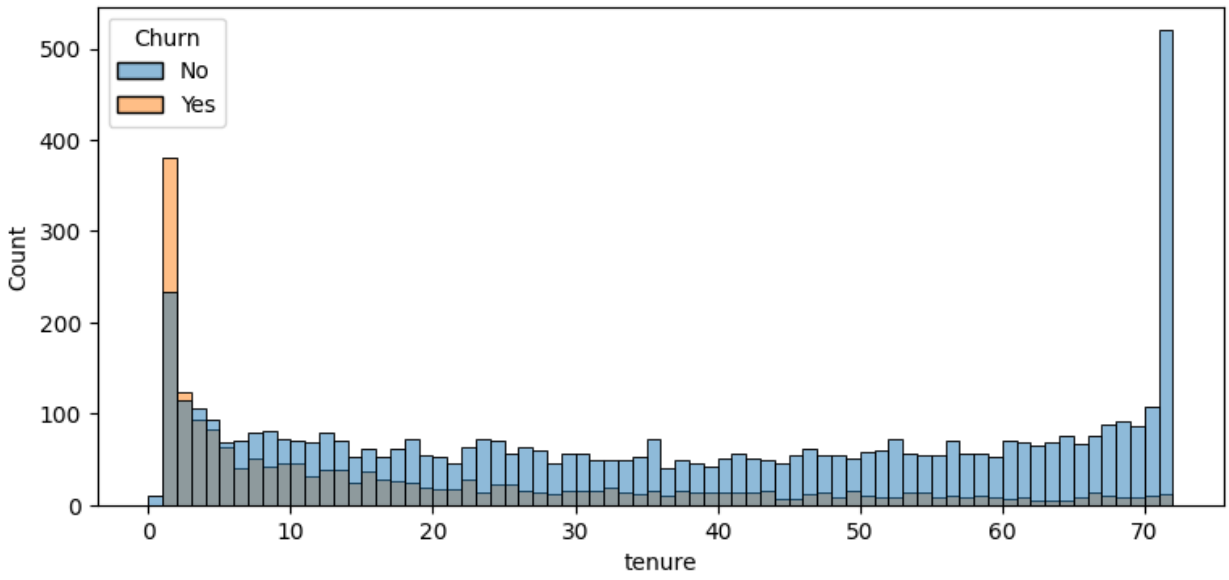
# Annotate bars with percentages
for bars in ax.containers:
    ax.bar_label(bars, fmt='%.1f%%', label_type='center',
color='white', fontsize=10)

plt.title("Churn by SeniorCitizen (Stacked %)")
plt.ylabel("Percentage")
plt.xlabel("SeniorCitizen")
plt.legend(title="Churn", bbox_to_anchor = (1.0,1.0))
plt.show()
```



#comparative a greater pecentage of people in senior citizen category have churned

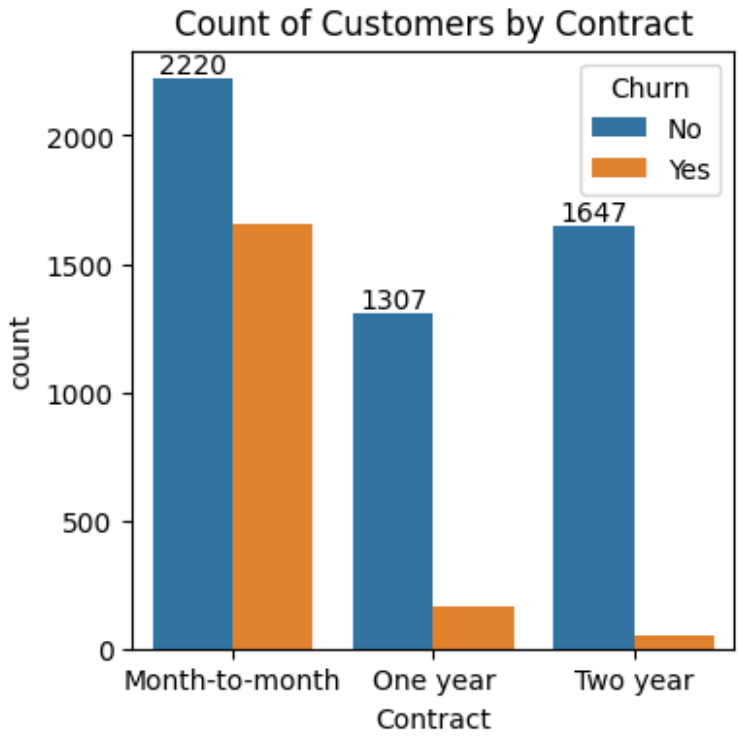
```
plt.figure(figsize = (9,4))
sns.histplot(x = "tenure", data=df, bins = 72, hue = "Churn")
plt.show()
```



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

#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 o=likely to churn then from those who have 1 to 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)
```

```
# Define the columns for subplots
columns = ['PhoneService', 'MultipleLines', 'InternetService',
           'OnlineSecurity', 'OnlineBackup', 'DeviceProtection',
           'TechSupport', 'StreamingTV', 'StreamingMovies']

# Set up the figure and axes
```

```
fig, axes = plt.subplots(nrows=3, ncols=3, figsize=(15, 12))  # 3x3
grid
axes = axes.flatten()  # Flatten for easy iteration

# Define the complete color palette
custom_palette = {
    "Yes": "#ff7f0e",
    "No": "#1f77b4",
    "No internet service": "#81B29A",
    "No phone service": "#F2CC8F",
    "DSL": "#F0A500",  # Added missing color for DSL
    "Fiber optic": "#0077B6"  # Added missing color for Fiber optic
}

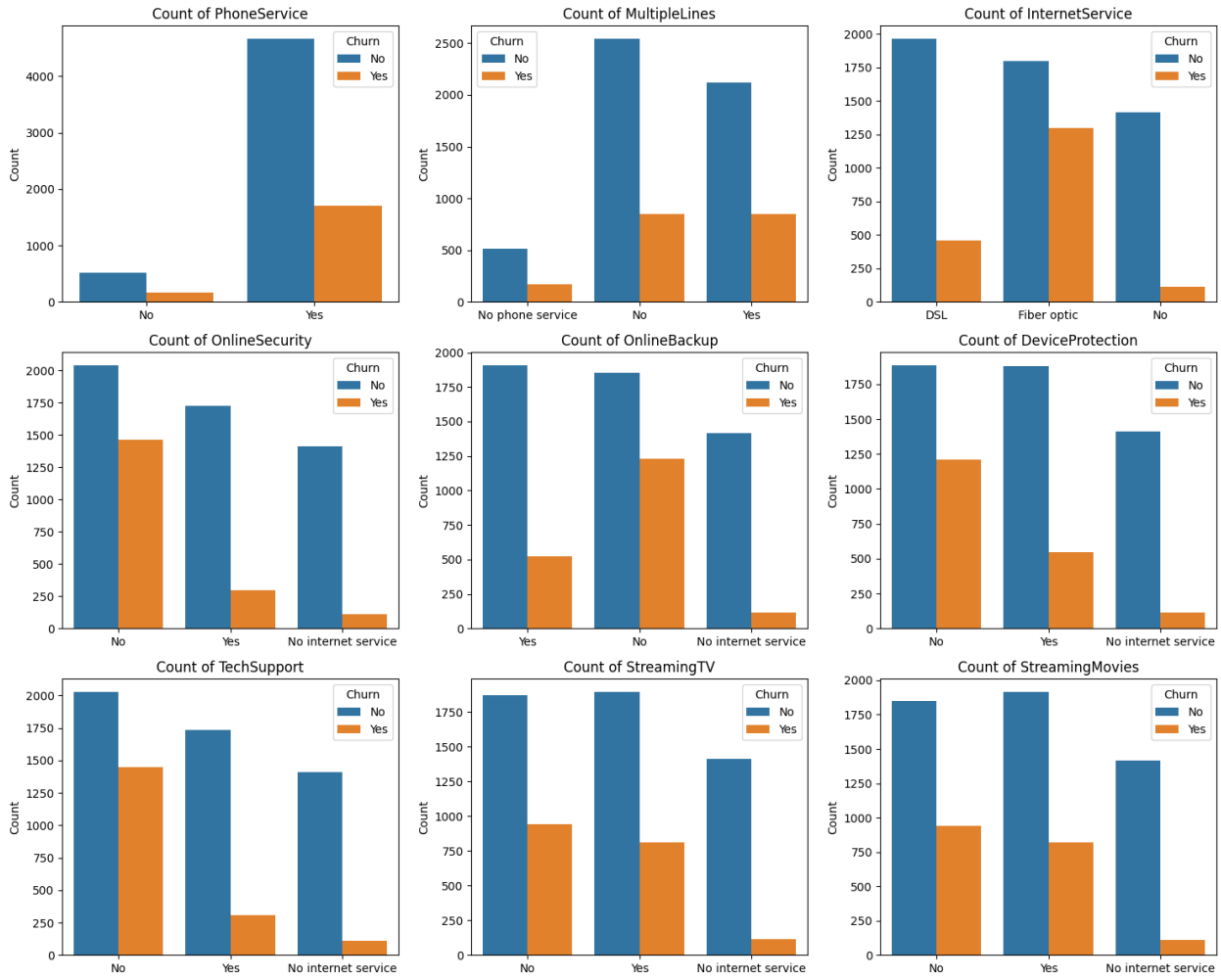
# Plot countplots
for i, col in enumerate(columns):
    # Get unique values in the current column
    unique_vals = df[col].unique()

    # Ensure that custom_palette includes all unique values
    for val in unique_vals:
        if val not in custom_palette:
            custom_palette[val] = "#808080"  # Default color for
missing values

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

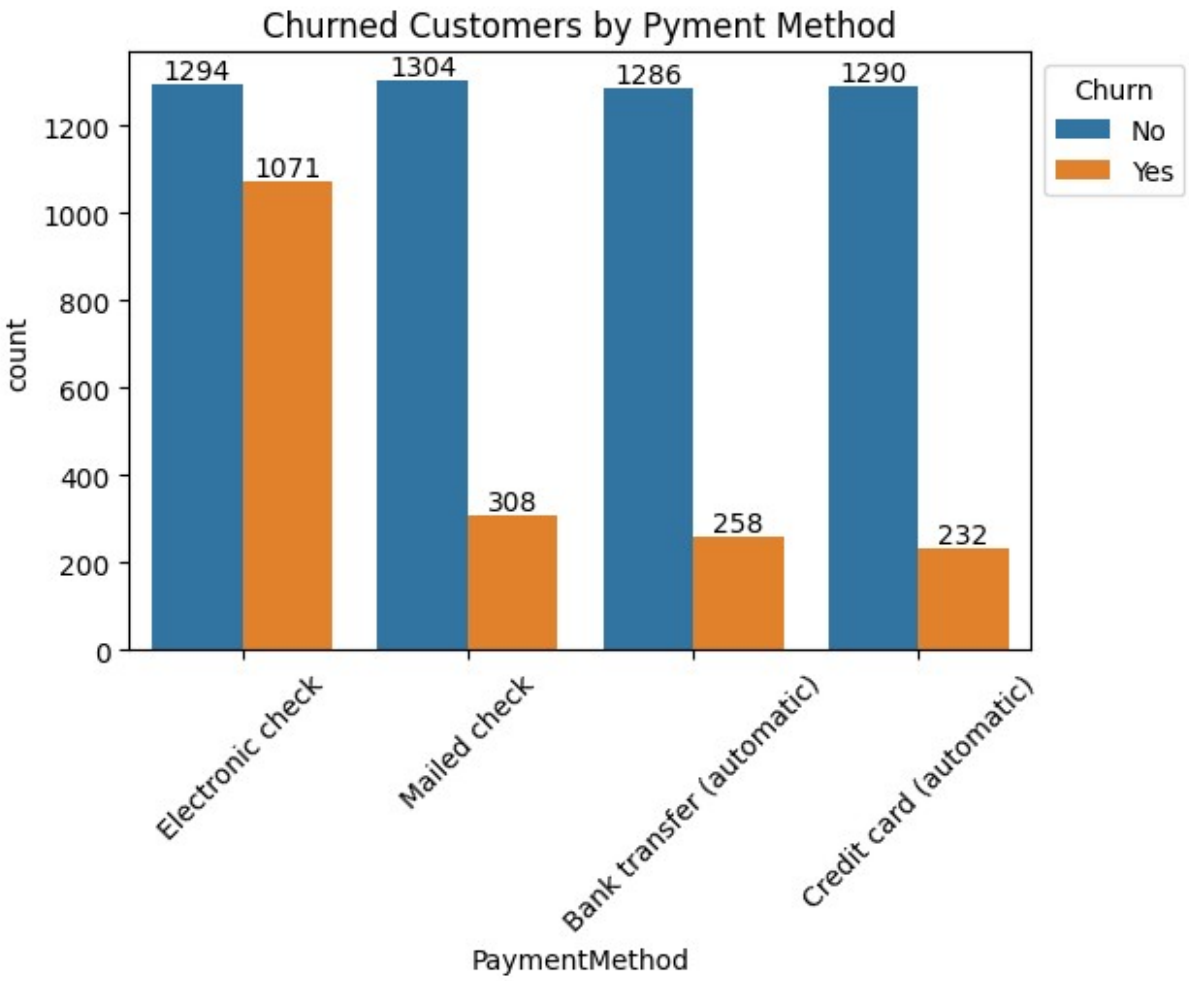
    # No need to add legend if hue is the same as the column
    # Remove this line to prevent warnings
    # axes[i].legend(title=col, loc="upper right")

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



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

```
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 Pyment Method")
plt.xticks(rotation = 45)
plt.legend(title="Churn", bbox_to_anchor = (1.0,1.0))
plt.show()
```



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