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

df = pd.read_csv("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
```

Replace the blanks with 0 as tenure is Zero 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  
 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)
```

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

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

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

df.head(5)
```

```
   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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0  No phone service             DSL             No  ...
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4                No     Fiber optic             No  ...
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0           No          No              No  Month-to-month
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1           No          No              No        One year
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3          Yes          No              No        One year
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```
Yes
```

```
               PaymentMethod MonthlyCharges  TotalCharges  Churn
0           Electronic check          29.85         29.85     No
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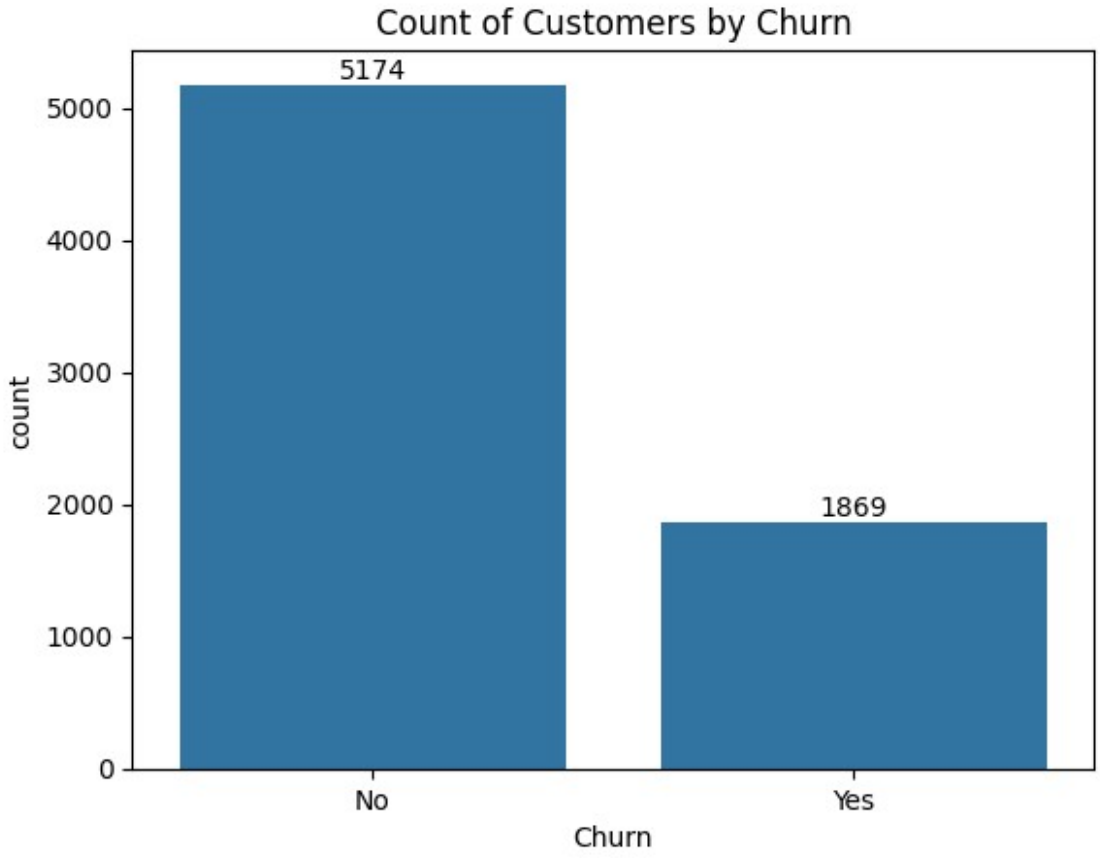
2               Mailed check          53.85        108.15    Yes
3  Bank transfer (automatic)          42.30       1840.75     No
4           Electronic check          70.70        151.65    Yes

[5 rows x 21 columns]
```

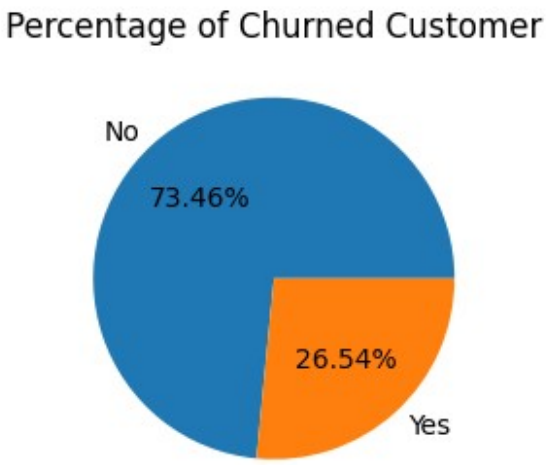
```
ax = sns.countplot(x = 'Churn', data = df)

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




```
plt.figure(figsize = (3,4))
gb = df.groupby("Churn").agg({'Churn':"count"})

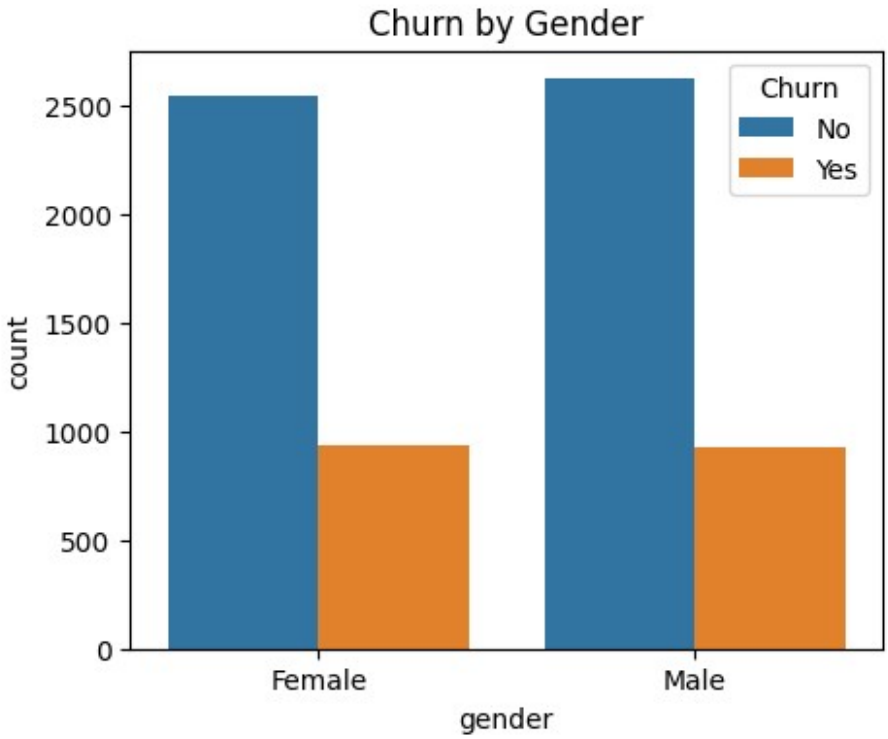
plt.pie(gb['Churn'], labels = gb.index, autopct = "%1.2f%%")
plt.title("Percentage of Churned Customer")
plt.show()
```



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

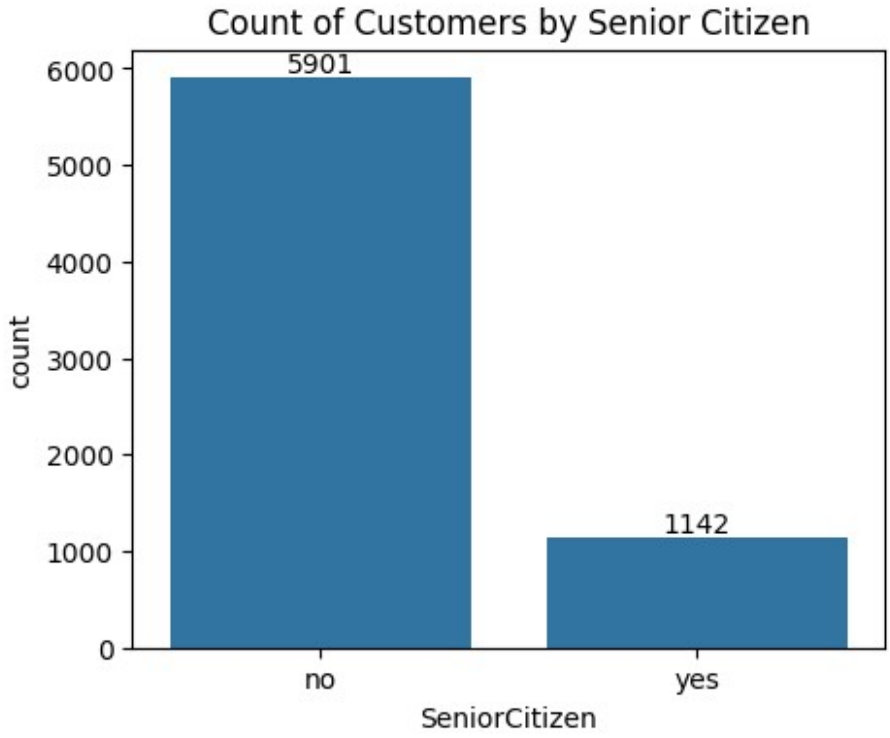
```
plt.figure(figsize = (5,4))

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



```
plt.figure(figsize = (5,4))

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



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

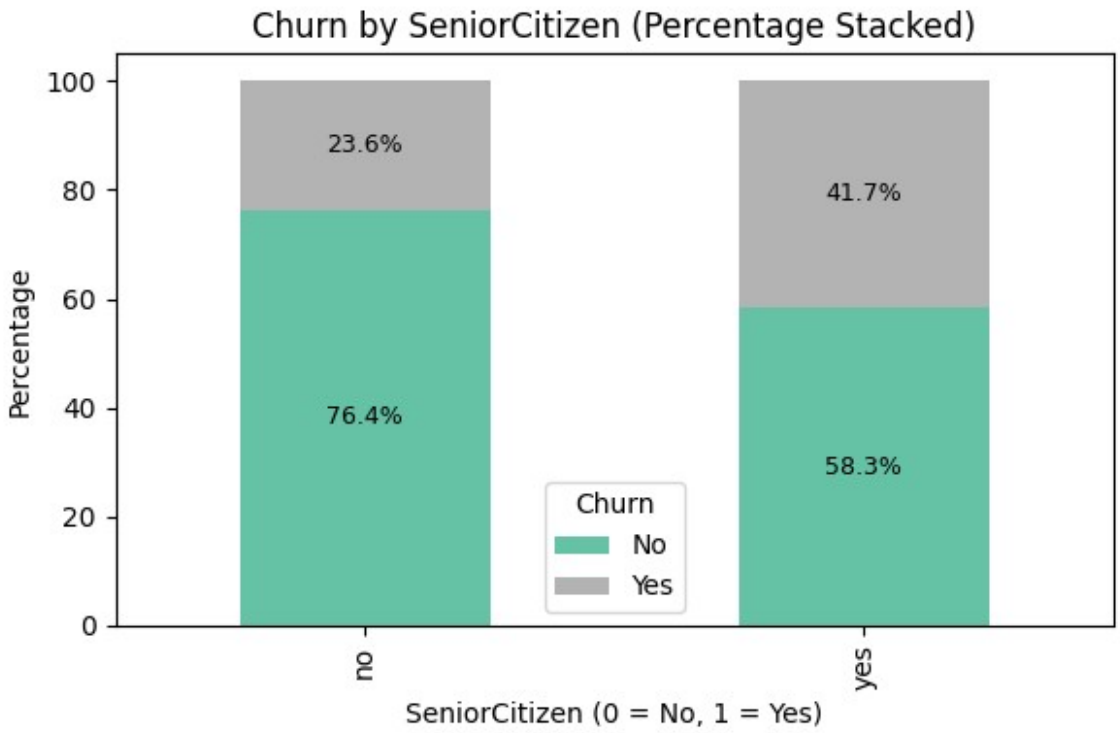
```
# Step 1: Create a crosstab of SeniorCitizen vs Churn
ct = pd.crosstab(df['SeniorCitizen'], df['Churn'])

# Step 2: Convert counts to percentages row-wise (relative to total of
each SeniorCitizen group)
ct_percent = ct.div(ct.sum(axis=1), axis=0) * 100

# Step 3: Plot
ax = ct_percent.plot(kind='bar', stacked=True, figsize=(6, 4),
colormap='Set2')

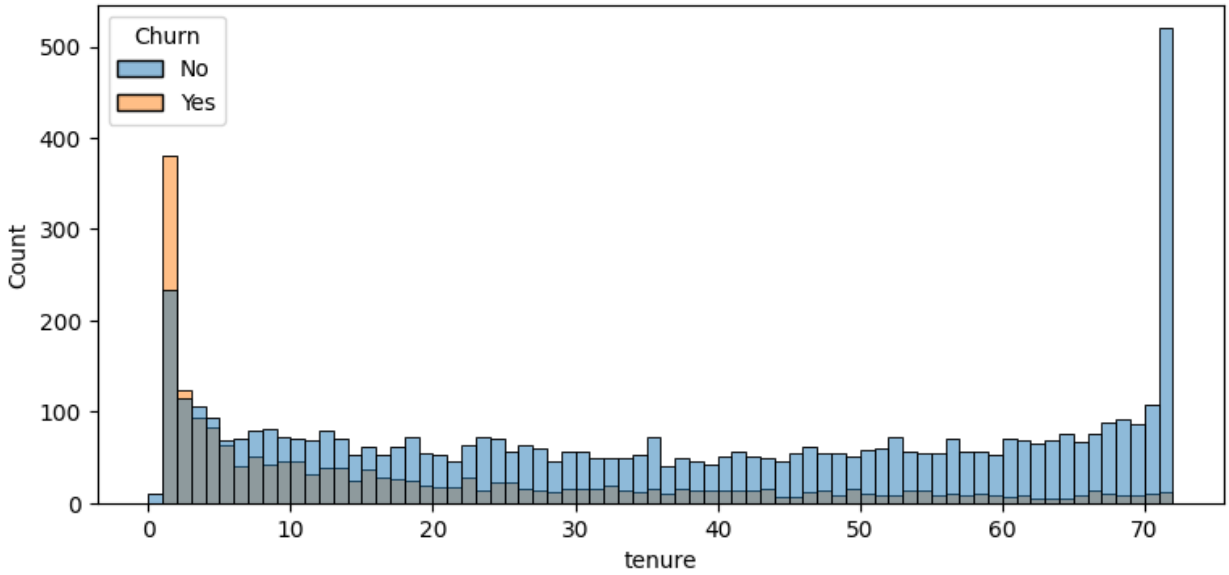
# Add percentage labels
for container in ax.containers:
    ax.bar_label(container, fmt='%.1f%%', label_type='center',
fontsize=9, color='black')
```

```
# Final touches
plt.title("Churn by SeniorCitizen (Percentage Stacked)")
plt.ylabel("Percentage")
plt.xlabel("SeniorCitizen (0 = No, 1 = Yes)")
plt.legend(title="Churn")
plt.tight_layout()
plt.show()
```




```
plt.figure(figsize = (9,4))

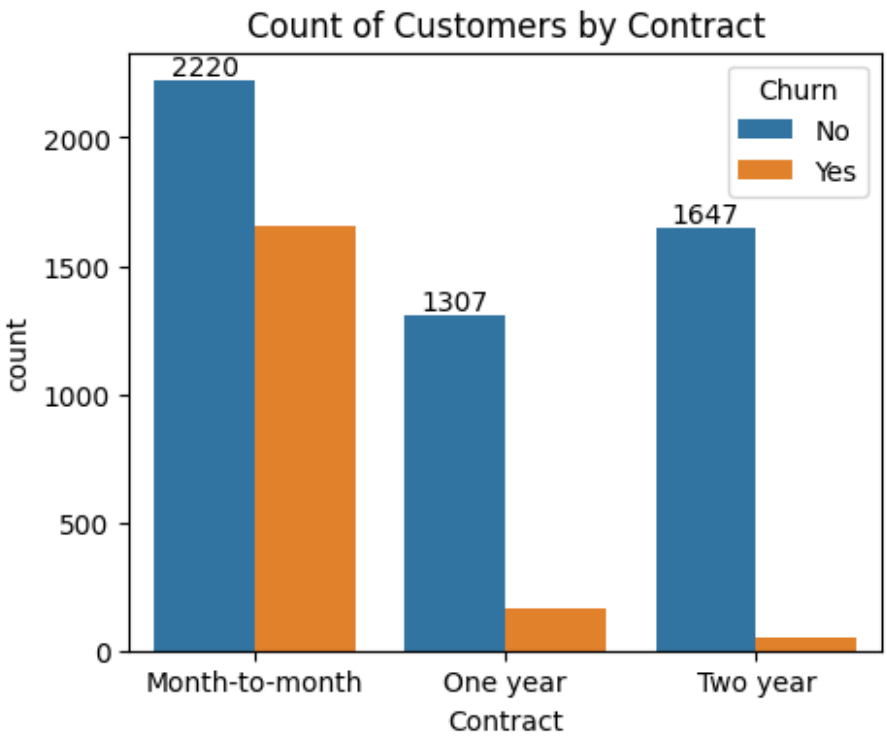
sns.histplot(x= "tenure", data = df, bins= 72, hue = "Churn")
plt.show()
```



people who have used our services for long time have stayed and people who used our services for 1 or 2 months have chruned

```
plt.figure(figsize = (5,4))

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 chern than from those who have 1 or 2 years of 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)
```

```
# List of service-related columns
service_cols = ['PhoneService', 'MultipleLines', 'InternetService',
                'OnlineSecurity', 'OnlineBackup', 'DeviceProtection',
                'TechSupport', 'StreamingTV', 'StreamingMovies']

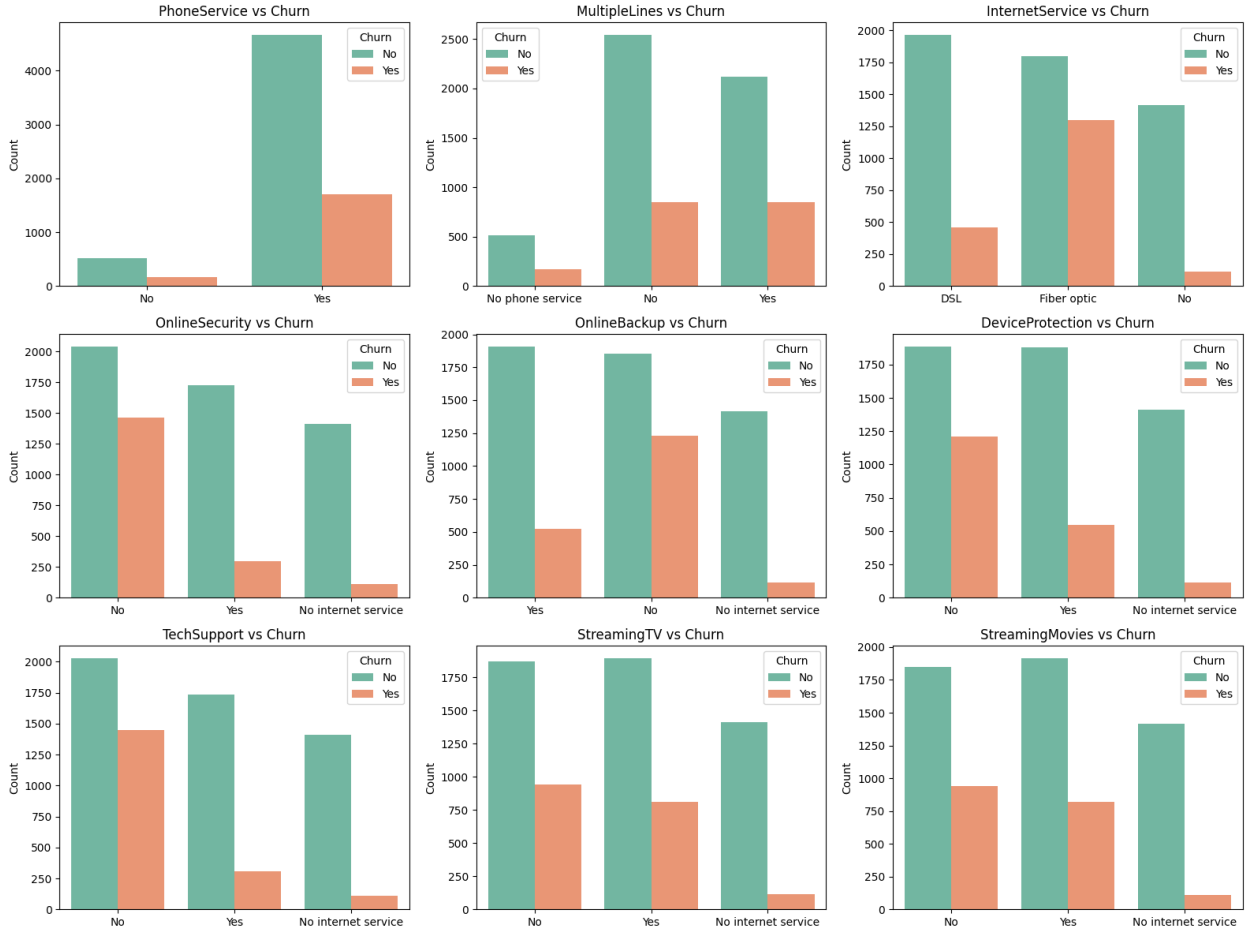
# Set up subplot grid (e.g., 3 rows x 3 columns)
fig, axes = plt.subplots(nrows=3, ncols=3, figsize=(16, 12))
axes = axes.flatten()  # Flatten 2D axes array to 1D for easy
iteration

# Plot each column
for i, col in enumerate(service_cols):
    sns.countplot(x=col, data=df, ax=axes[i], palette="Set2",
```

```
hue="Churn")
    axes[i].set_title(f"{col} vs Churn")
    axes[i].set_xlabel("")
    axes[i].set_ylabel("Count")
    axes[i].legend(title="Churn")

# Remove any unused subplots (if any)
for j in range(len(service_cols), len(axes)):
    fig.delaxes(axes[j])

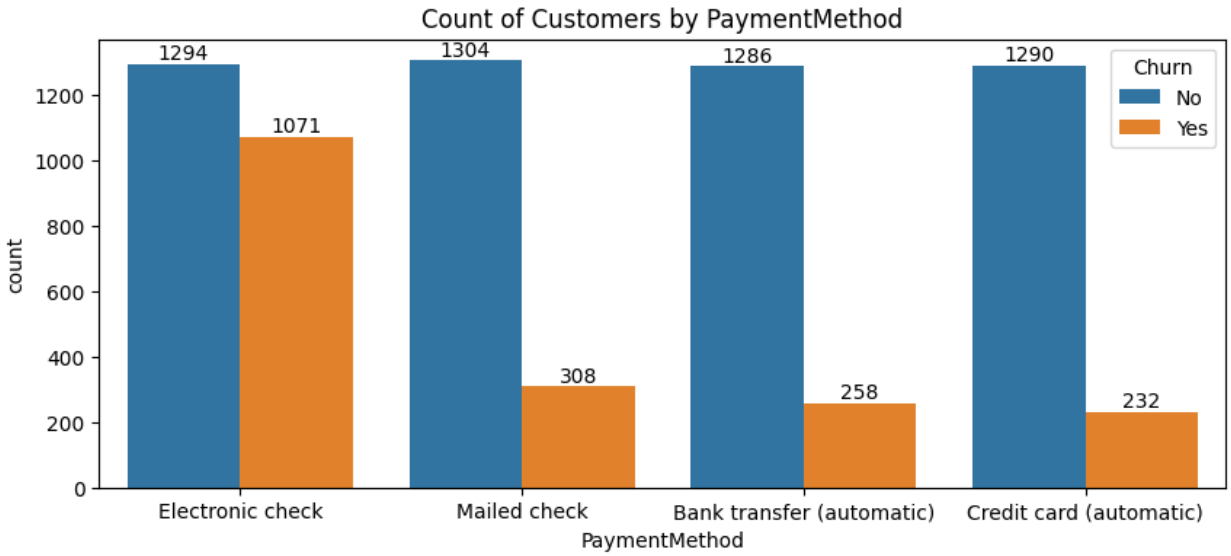
plt.tight_layout()
plt.show()
```



Customers who lacked additional services (like OnlineSecurity, TechSupport, and DeviceProtection) showed higher churn rates compared to those who used them. In contrast, customers with Fiber optic internet or multiple streaming services also exhibited relatively higher churn. Notably, churn was low among customers with PhoneService and OnlineBackup, suggesting these features may contribute to retention.

```
plt.figure(figsize = (10,4))

ax = sns.countplot(x = "PaymentMethod", data = df, hue = "Churn")
ax.bar_label (ax.containers[0])
ax.bar_label (ax.containers[1])
plt.title("Count of Customers by PaymentMethod")
plt.show()
```



customers are likely to churn when they are using electronic check as a payment method.