tca-pyt-1

July 7, 2025

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

[5]:
```
df = pd.read_csv("Customer Churn.csv")
df.head()
```

[5]:

	customerID	gender	SeniorCitizen	Partner	Dependents	tenure	PhoneService	MultipleLines	InternetService	OnlineSecurity	…	DeviceProtection	TechSupport	StreamingTV	StreamingMovies	Contract	PaperlessBilling	PaymentMethod	MonthlyCharges	TotalCharges	Churn
0	7590-VHVEG	Female	0	Yes	No	1	No	No phone service	DSL	No	…	No	No	No	No	Month-to-month	Yes	Electronic check	29.85	29.85	No
1	5575-GNVDE	Male	0	No	No	34	Yes	No	DSL	Yes	…	Yes	No	No	No	One year	No	Mailed check	56.95	1889.5	No
2	3668-QPYBK	Male	0	No	No	2	Yes	No	DSL	Yes	…	No	No	No	No	Month-to-month	Yes	Mailed check	53.85	108.15	Yes
3	7795-CFOCW	Male	0	No	No	45	No	No phone service	DSL	Yes	…	Yes	Yes	No	No	One year	No	Bank transfer (automatic)	42.30	1840.75	No
4	9237-HQITU	Female	0	No	No	2	Yes	No	Fiber optic	No	…	No	No	No	No	Month-to-month	Yes	Electronic check	70.70	151.65	Yes

[5 rows x 21 columns]

[6]:
```
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
```

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

[7]:
```
df["TotalCharges"] = df["TotalCharges"].replace(" ","0")
df["TotalCharges"] = df["TotalCharges"].astype("float")
```

[8]:
```
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
```

[12]:
```
df.isnull().sum().sum()
```

[12]:
```
0
```

[13]:
```
df.describe()
```

[13]:

	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

[17]:
```
df["customerID"].duplicated().sum()
```

[17]:
```
0
```

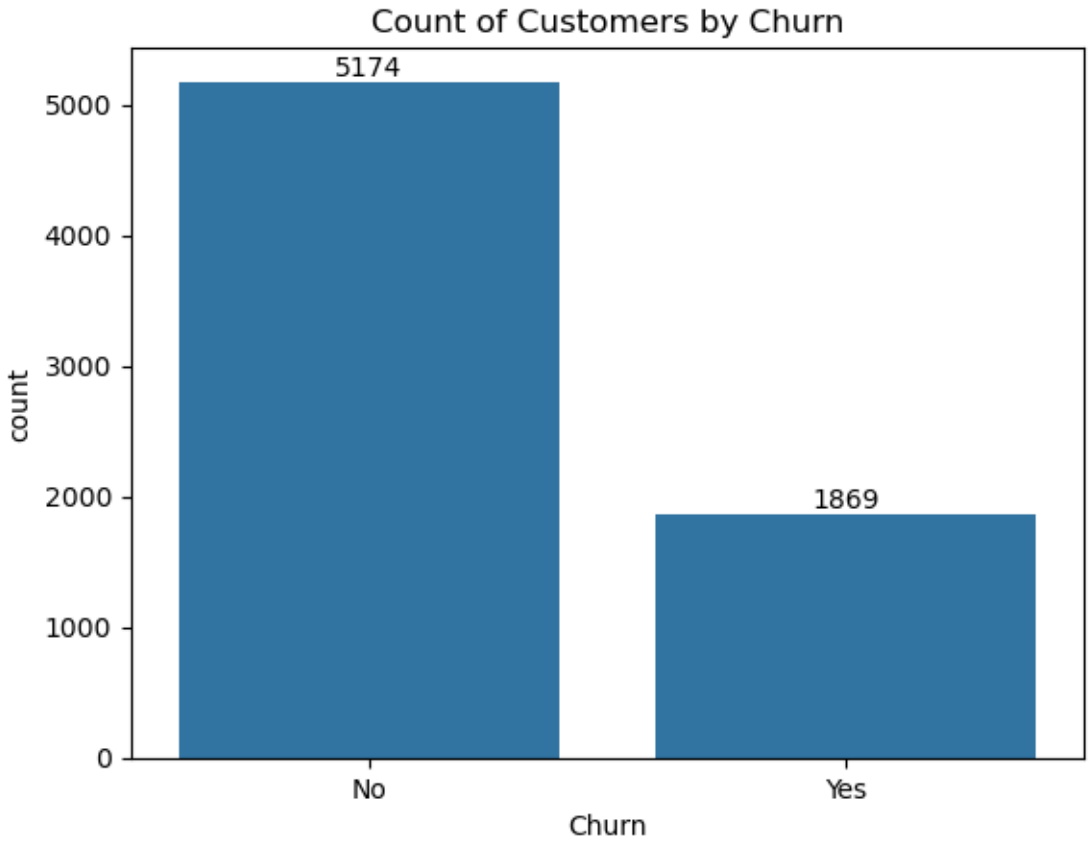
[18]:
```
def conv(value):
    if value == 1:
        return "yes"
    else:
        return "no"
```

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

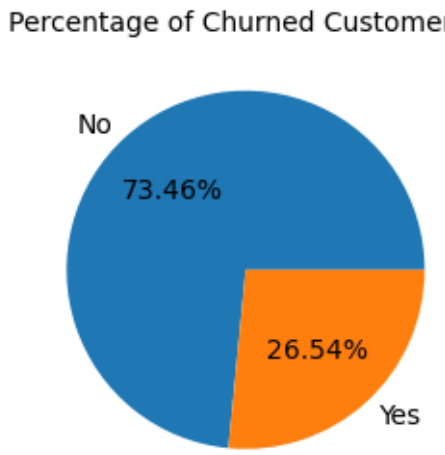
2 Converted 0 and 1 values of senior citizen to yes/no to make it easier to understand

[34]:
```
ax = sns.countplot(x = "Churn", data = df)

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

[34]:
```
<function matplotlib.pyplot.show(close=None, block=None)>
```



[35]:
```
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()
```

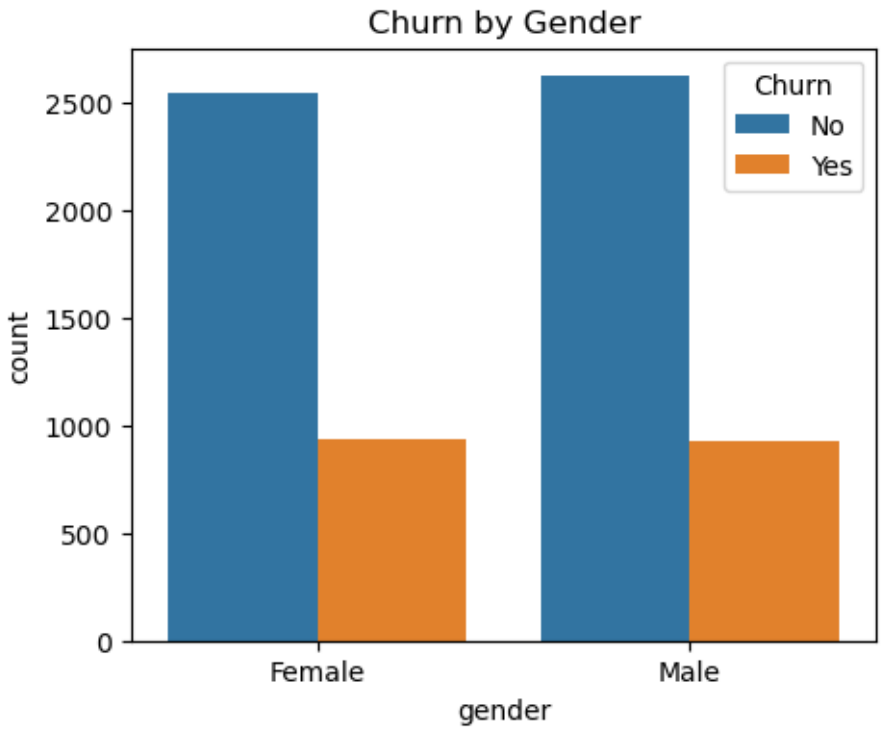


3 from the given pie chart we can conclude that 26.54% of our customer have churned out.

4 Now lets explore the reason behind it

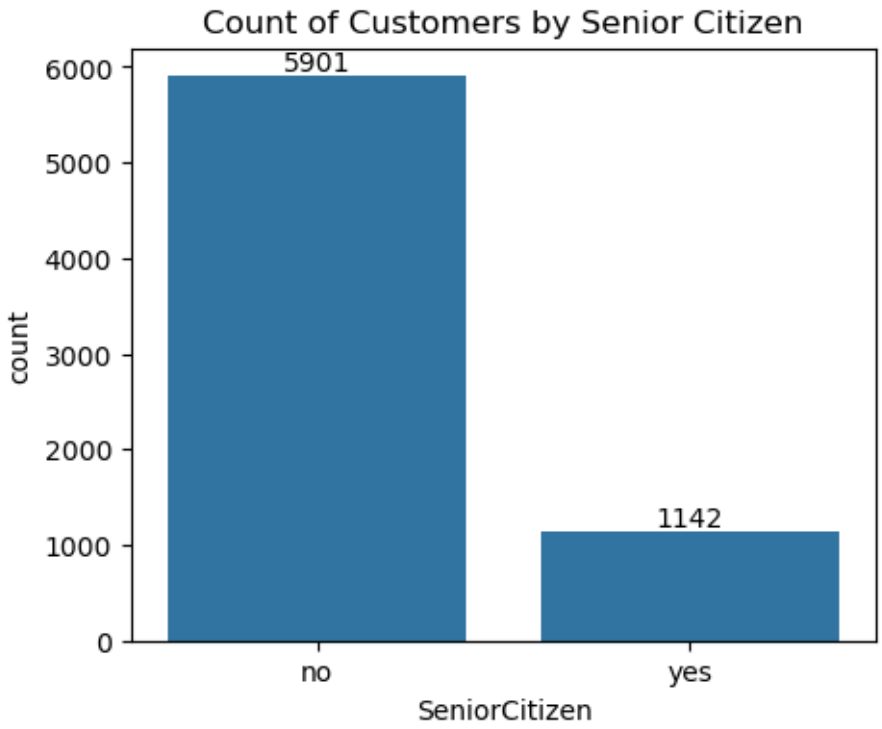
[43]:
```
plt.figure(figsize = (5,4))
sns.countplot(x = "gender",data = df, hue = "Churn")
plt.title("Churn by Gender")
plt.show
```

[43]:
```
<function matplotlib.pyplot.show(close=None, block=None)>
```



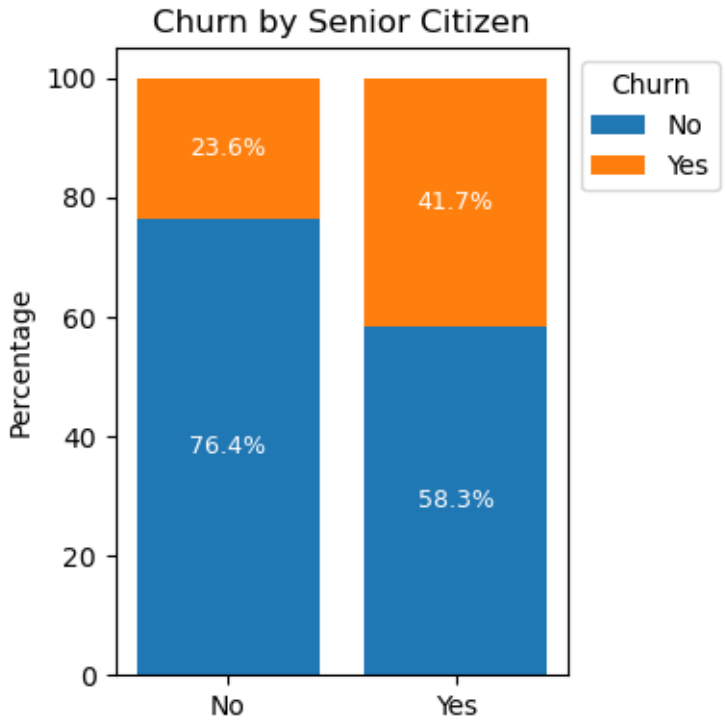
[64]:
```
plt.figure(figsize = (5,4))
ax = sns.countplot(x = "SeniorCitizen",data = df)
ax.bar_label(ax.containers[0])
plt.title("Count of Customers by Senior Citizen")
plt.show
```

[64]: <function matplotlib.pyplot.show(close=None, block=None)>



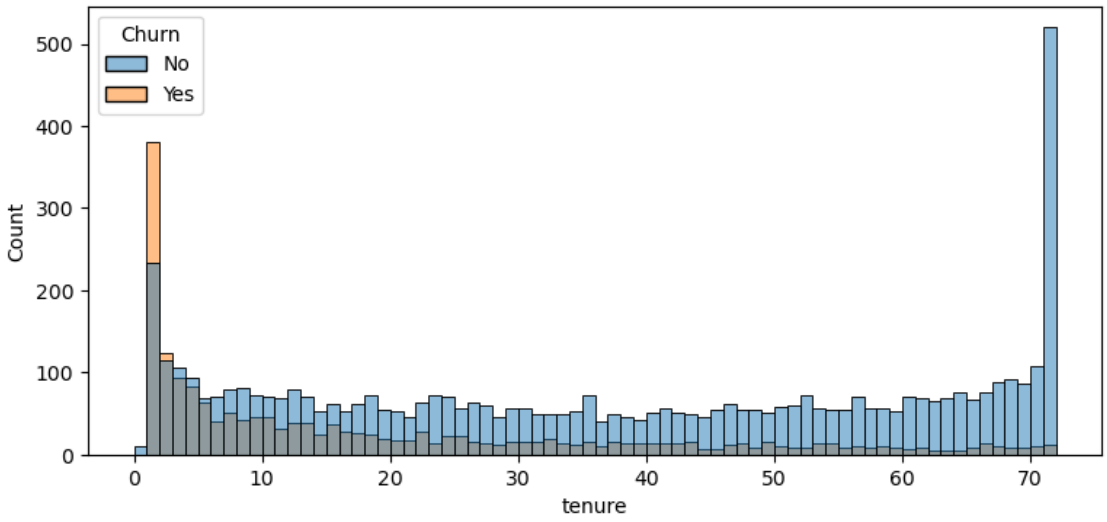
[67]:
```
# Group and calculate count by SeniorCitizen and Churn
grouped = df.groupby(["SeniorCitizen", "Churn"]).size().unstack(fill_value=0)

# Calculate row-wise percentage
percentages = grouped.divide(grouped.sum(axis=1), axis=0) * 100

# Plot
colors = ['#1f77b4', '#ff7f0e']  # Blue for 'No', Orange for 'Yes'
fig, ax = plt.subplots(figsize=(4, 4))

bottom = [0] * len(percentages)
for idx, churn_status in enumerate(['No', 'Yes']):
    values = percentages[churn_status]
    ax.bar(
        percentages.index,
        values,
        bottom=bottom,
        label=churn_status,
        color=colors[idx]
    )

    # Add % text inside each segment
    for i, (val, btm) in enumerate(zip(values, bottom)):
```

```
        ax.text(i, btm + val / 2, f'{val:.1f}%', ha='center', va='center',␣
↪color='white', fontsize=9)

    # Update bottom for stacking
    bottom = [btm + val for btm, val in zip(bottom, values)]

# Formatting
ax.set_xticks([0, 1])
ax.set_xticklabels(['No', 'Yes'])  # 0 = Not SeniorCitizen, 1 = SeniorCitizen
ax.set_title("Churn by Senior Citizen")
ax.set_ylabel("Percentage")
ax.legend(title="Churn", bbox_to_anchor = (1,1))
plt.tight_layout()
plt.show()
```



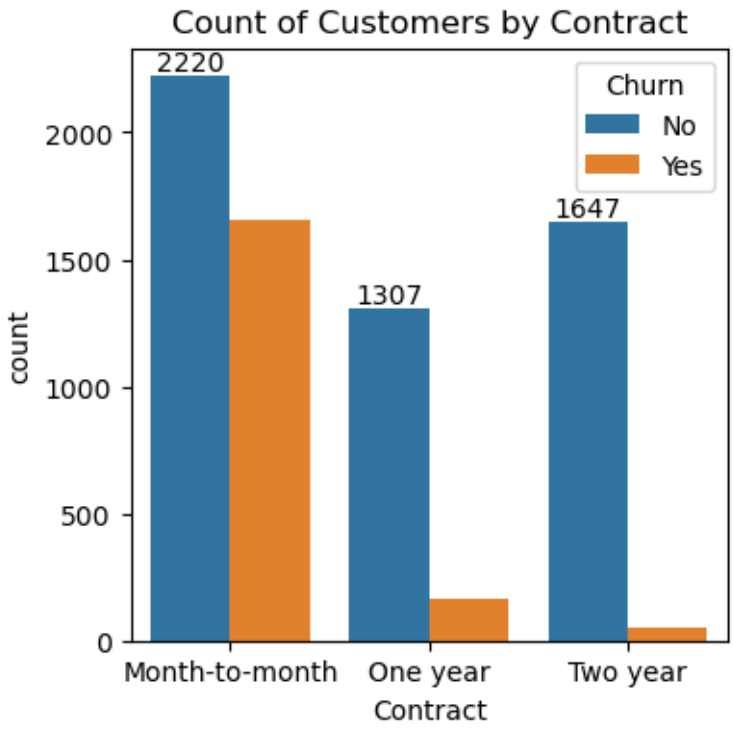
5 Comparative a greater percentage of people in senior citizen category have churned

[71]:
```
plt.figure(figsize = (9,4))
sns.histplot(x = "tenure", data = df, bins = 72,  hue = "Churn")
plt.show()
```



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

[74]:
```
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()
```



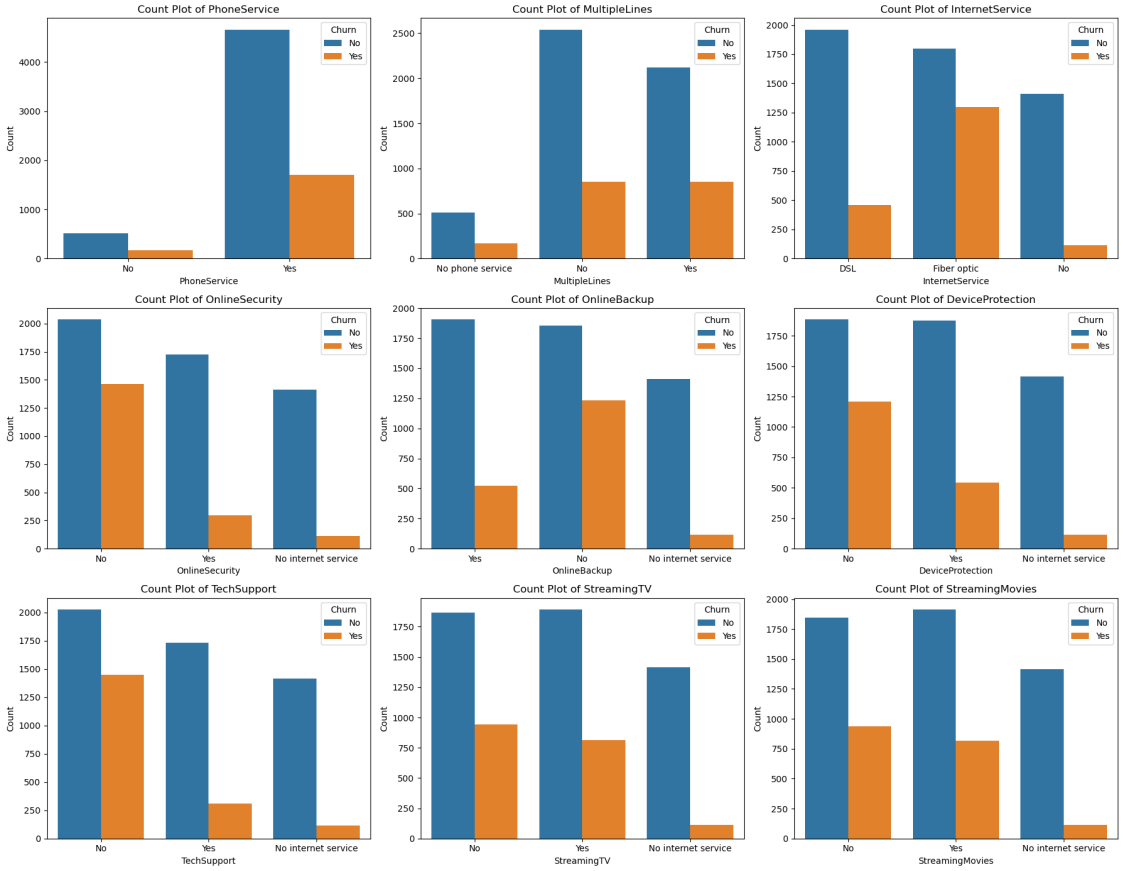
7 People who have month to month contract are likely to churn then from those who have 1 or 2 years or contract.

[75]:
```
df.columns.values
```

[75]:
```
array(['customerID', 'gender', 'SeniorCitizen', 'Partner', 'Dependents',
       'tenure', 'PhoneService', 'MultipleLines', 'InternetService',
       'OnlineSecurity', 'OnlineBackup', 'DeviceProtection',
       'TechSupport', 'StreamingTV', 'StreamingMovies', 'Contract',
       'PaperlessBilling', 'PaymentMethod', 'MonthlyCharges',
       'TotalCharges', 'Churn'], dtype=object)
```

[83]:
```
# Columns to plot
cols = ['PhoneService', 'MultipleLines', 'InternetService',
        'OnlineSecurity', 'OnlineBackup', 'DeviceProtection',
        'TechSupport', 'StreamingTV', 'StreamingMovies']

# Set figure size
plt.figure(figsize=(18, 14))

# Loop through each column and create a subplot
for i, col in enumerate(cols, 1):
```

```
    plt.subplot(3, 3, i)  # 3 rows, 3 columns
    sns.countplot(data=df, x=col, hue = df["Churn"])
    plt.title(f'Count Plot of {col}')
    plt.xlabel(col)
    plt.ylabel('Count')
    plt.xticks(rotation=0)  # Rotate if needed for readability

# Improve spacing
plt.tight_layout()
plt.show()
```

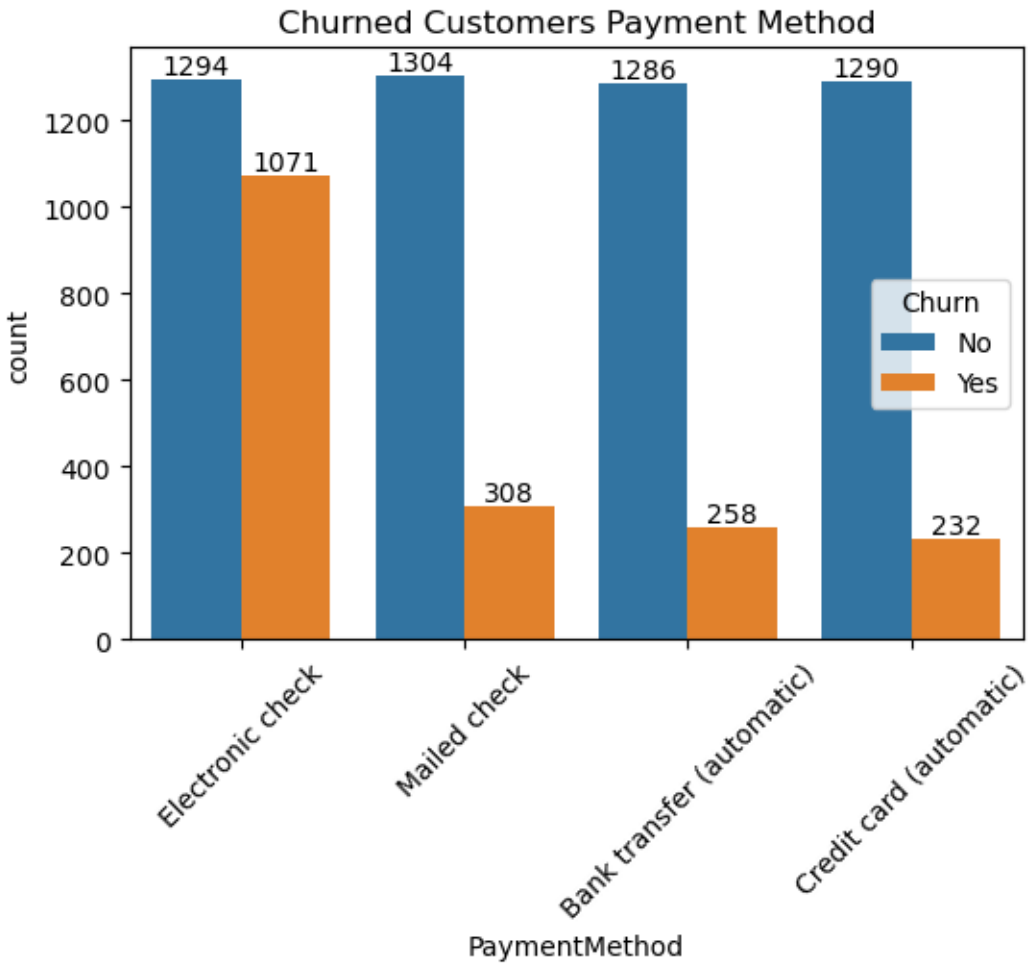


8 **Most customers who did not churn are concentrated in categories like having PhoneService, OnlineSecurity = No, and StreamingTV = No.**

9 **Churn is relatively higher among customers who have Fiber optic InternetService and lack online features like OnlineSecurity, TechSupport, and DeviceProtection.**

10 **The "No internet service" group consistently shows low churn, likely because they don't use those services.**

[89]:
```
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 Payment Method")
plt.xticks(rotation = 45)
plt.show()
```



11 Customer is likely to churn when he is using electronic check as a payment method.

[ ]:

[ ]: