telco-customer-churn-analysis

September 21, 2024

[62]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
```

[63]:
```
df = pd.read_csv(r"C:\Users\Jyoti\Downloads\Customer churn Analysis\Telecom␣
↪Customers Churn.csv",encoding= 'unicode_escape' )
```

[42]:
```
df.head(5)
```

[42]:

	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]
```

1 Replacing Blanks with 0 as Tenure is 0 and Total charges is not recorded.

2 Converted Totalcharges data type from object to Float

[12]:
```
df["TotalCharges"]=df["TotalCharges"].replace(" ","0")
df["TotalCharges"]=df["TotalCharges"].astype("float")
```

[13]:
```
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
```

3 Finding null values

[64]:
```
df.isnull().sum()
```

[64]:
```
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
```

[15]:
```
df.describe()
```

[15]:

	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

[16]:
```
df["customerID"].duplicated().sum()
```

[16]:
```
0
```

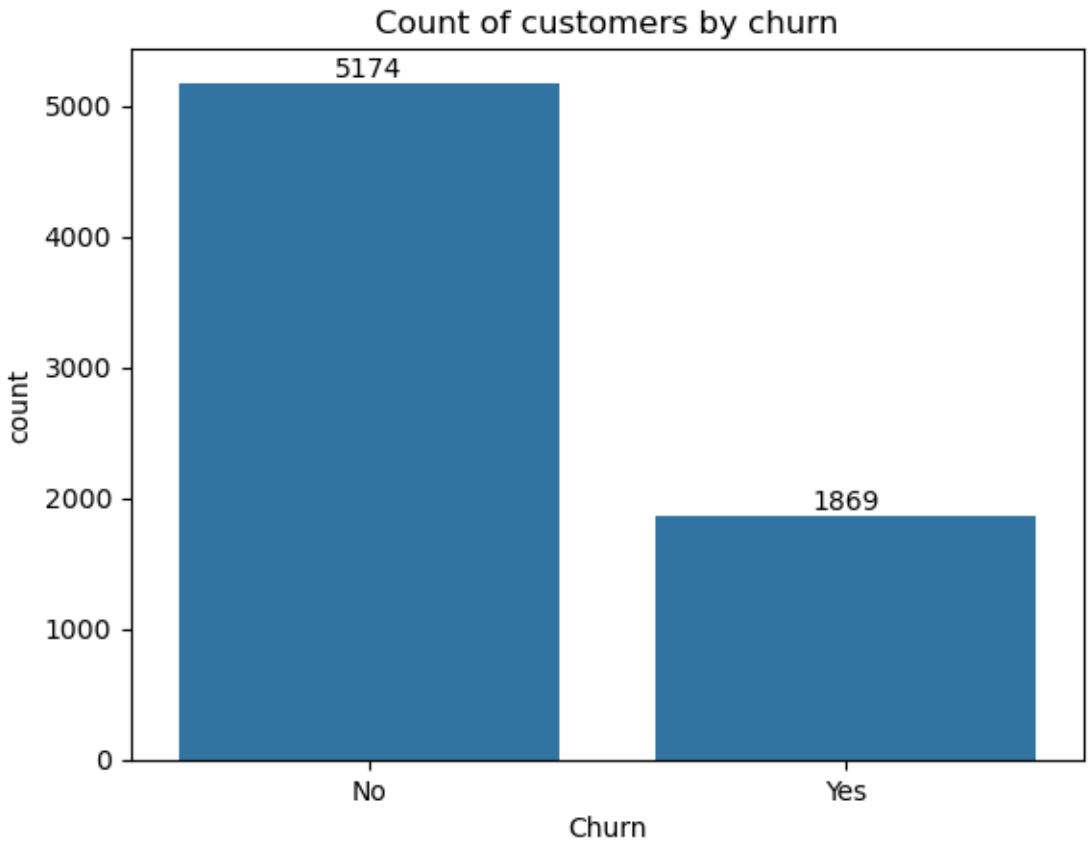
[65]:
```
def conv(value):
    if value==1:
        return "Yes"
    else:
```

```
        return "No"
df["SeniorCitizen"]=df["SeniorCitizen"].apply(conv)
```

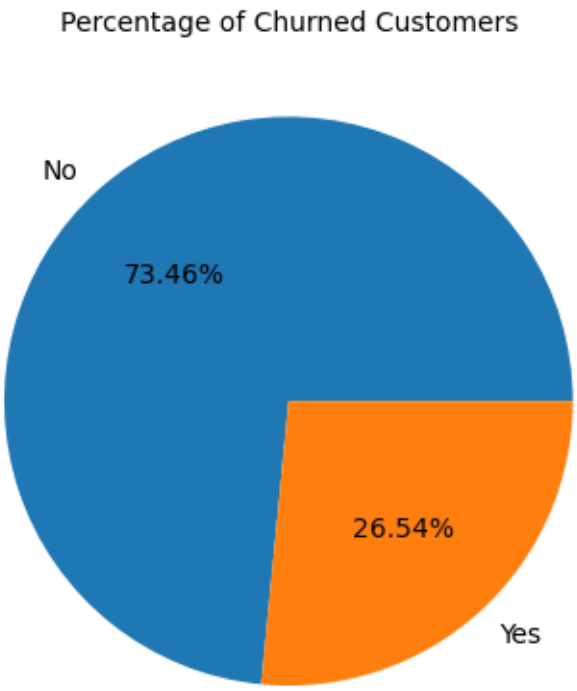
4 converted 0 and 1 Senior citizen value to yes/No for basic understanding

[43]:
```
ax=sns.countplot(x ='Churn', data = df)

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



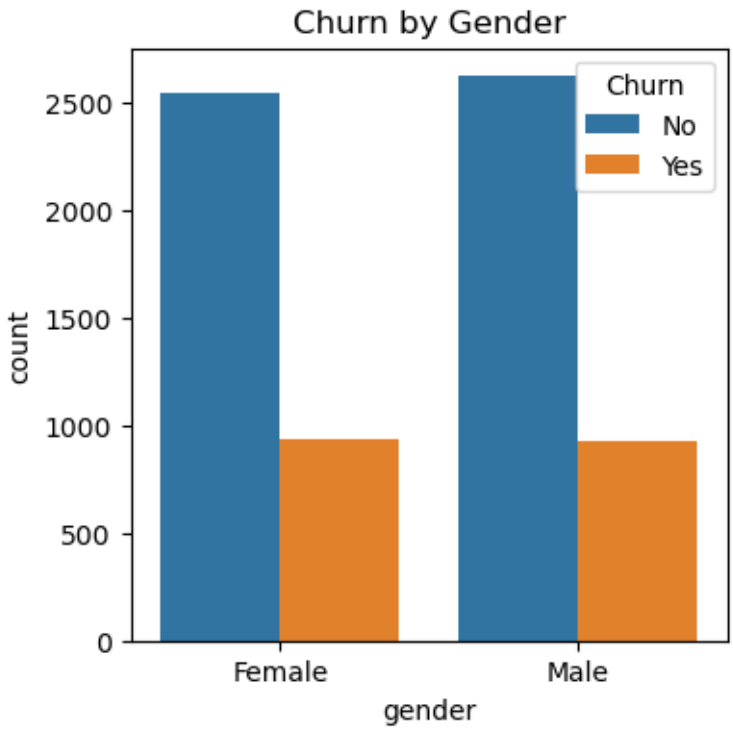
[31]:
```
gb=df.groupby("Churn").agg({'Churn':"count"})
plt.pie(gb['Churn'], labels=gb.index, autopct="%1.2f%%")
plt.title("Percentage of Churned Customers",fontsize=10)
plt.show()
```



5 From the above pie chart we see that 26.54% customers habe churned out

6 Let's Explore the reason behind it

[37]:
```
plt.figure(figsize=(4,4))
sns.countplot(x ='gender', data = df, hue="Churn")
plt.title("Churn by Gender")
plt.show()
```



[66]:
```
# Calculate counts for each combination of gender and Churn
count_data = df.groupby(['gender', 'Churn']).size().unstack(fill_value=0)

# Calculate percentage
percent_data = count_data.div(count_data.sum(axis=1), axis=0) * 100

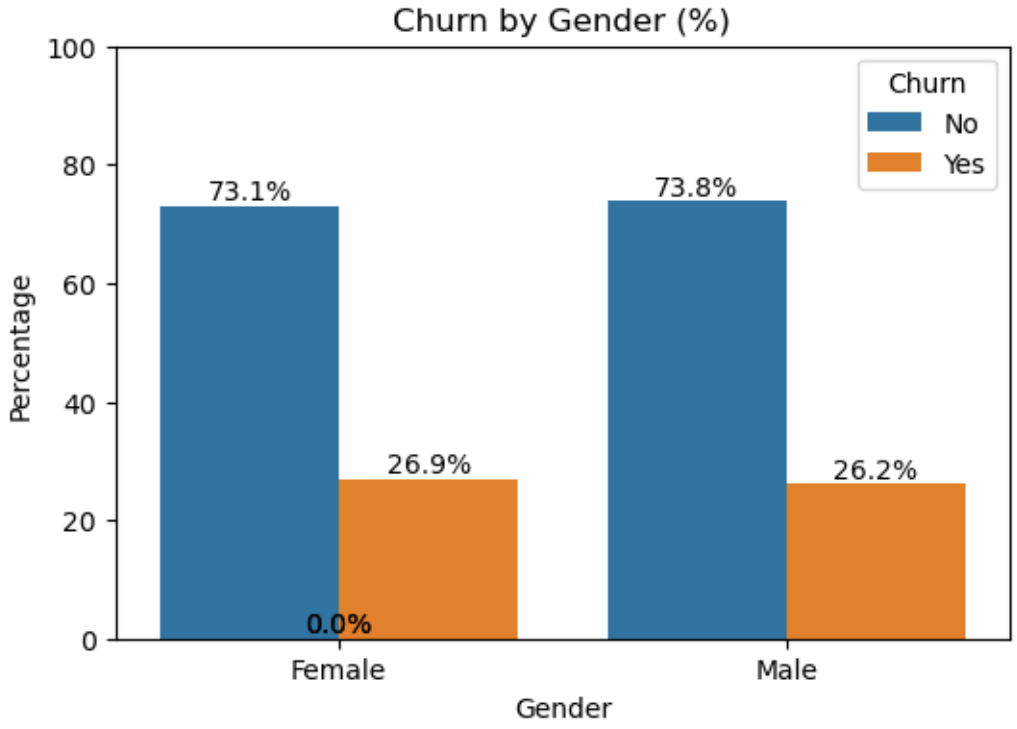
# Reset index for plotting
percent_data = percent_data.reset_index().melt(id_vars='gender',␣
 ↪value_name='percentage', var_name='Churn')

# Plotting
plt.figure(figsize=(6, 4))
bar_plot = sns.barplot(data=percent_data, x='gender', y='percentage',␣
 ↪hue='Churn')

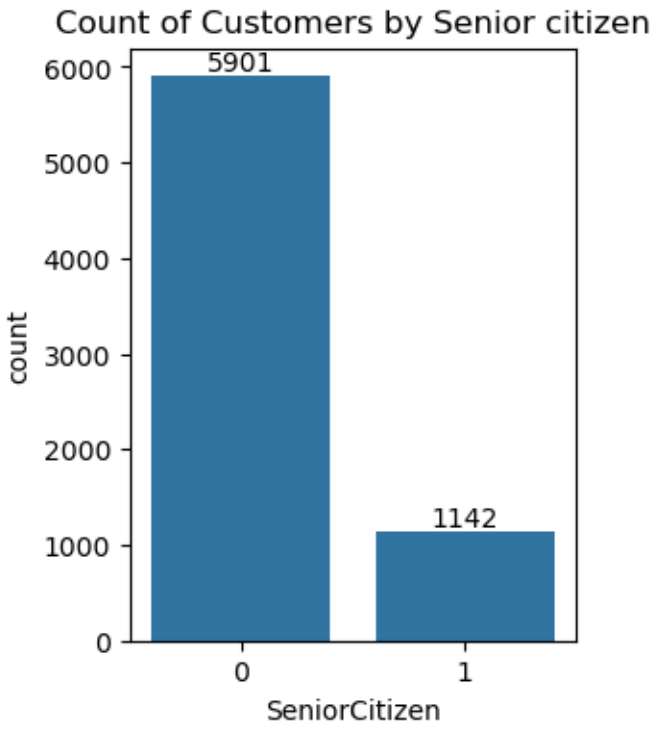
# Adding percentage labels on top of the bars
for p in bar_plot.patches:
    height = p.get_height()
    bar_plot.annotate(f"{height:.1f}%", (p.get_x() + p.get_width() / 2.,␣
 ↪height),
                      ha='center', va='bottom')

plt.title("Churn by Gender (%)")
```

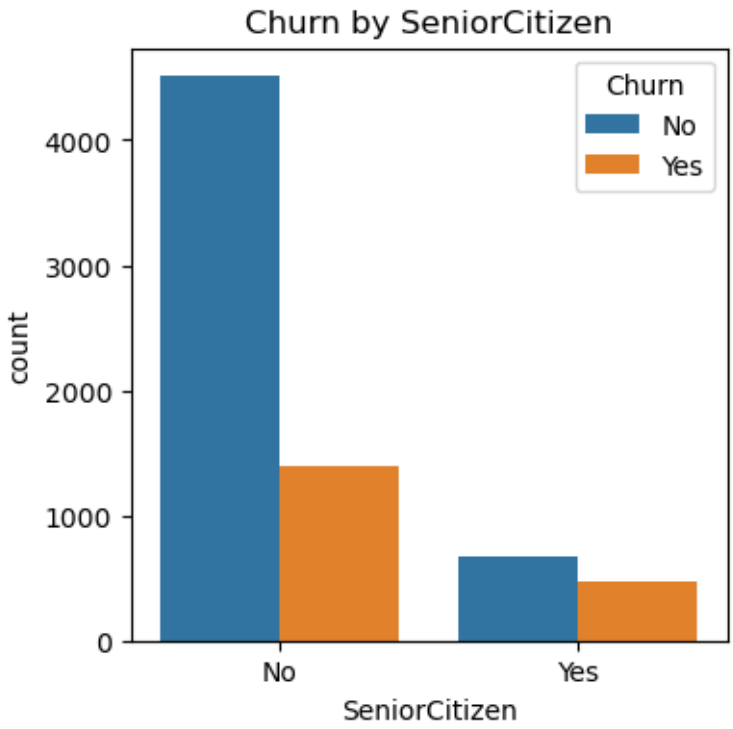
```
plt.xlabel("Gender")
plt.ylabel("Percentage")
plt.legend(title='Churn')
plt.xticks(rotation=0)
plt.ylim(0, 100)  # Set y-axis limit from 0 to 100%
plt.show()
```



[58]:
```
plt.figure(figsize=(3,4))
ax=sns.countplot(x ="SeniorCitizen", data = df)
ax.bar_label(ax.containers[0])
plt.title("Count of Customers by Senior citizen")
plt.show()
```



[38]:
```
plt.figure(figsize=(4,4))
sns.countplot(x ='SeniorCitizen', data = df, hue="Churn")
plt.title("Churn by SeniorCitizen")
plt.show()
```



[67]:
```
# Calculate percentage
percent_data = count_data.div(count_data.sum(axis=1), axis=0) * 100

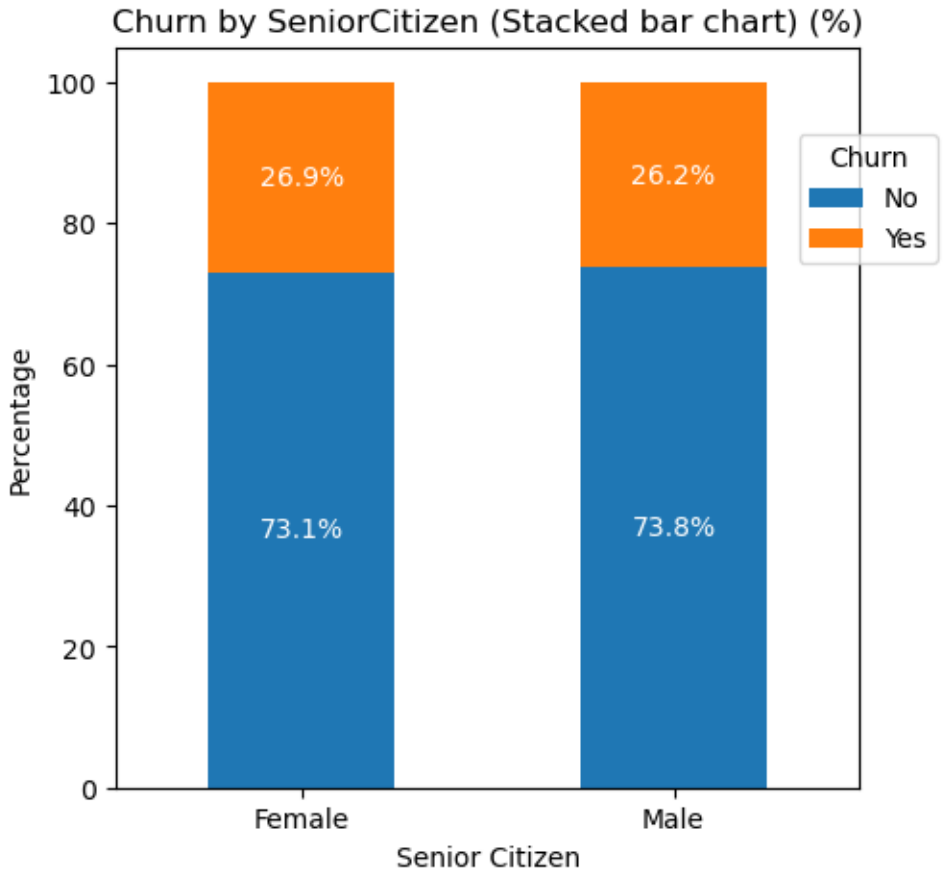
# Plotting
percent_data.plot(kind='bar', stacked=True, figsize=(5, 5))

# Adding percentage labels on top of the bars
for i in range(len(percent_data)):
    for j in range(len(percent_data.columns)):
        plt.text(i, percent_data.iloc[i].cumsum()[j] - percent_data.iloc[i][j] /
 ↪ 2,
                 f"{percent_data.iloc[i][j]:.1f}%",
                 ha='center', va='center', color='white', fontsize=10)

plt.title("Churn by SeniorCitizen (Stacked bar chart) (%)")
plt.xlabel("Senior Citizen")
plt.ylabel("Percentage")
plt.xticks(rotation=0)
plt.legend(title='Churn',bbox_to_anchor=(.9,.9))
plt.show()
```

```
C:\Users\Jyoti\AppData\Local\Temp\ipykernel_9204\3280702958.py:10:
FutureWarning: Series.__getitem__ treating keys as positions is deprecated. In a
```

```
future version, integer keys will always be treated as labels (consistent with
DataFrame behavior). To access a value by position, use `ser.iloc[pos]`
  plt.text(i, percent_data.iloc[i].cumsum()[j] - percent_data.iloc[i][j] / 2,
C:\Users\Jyoti\AppData\Local\Temp\ipykernel_9204\3280702958.py:11:
FutureWarning: Series.__getitem__ treating keys as positions is deprecated. In a
future version, integer keys will always be treated as labels (consistent with
DataFrame behavior). To access a value by position, use `ser.iloc[pos]`
  f"{percent_data.iloc[i][j]:.1f}%",
```



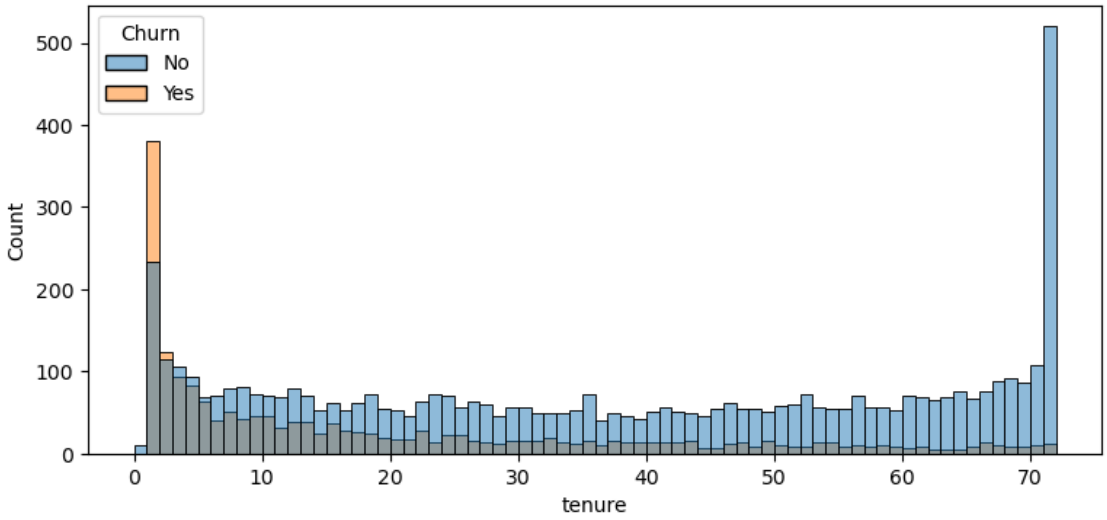
7 Comparative a greater percentage of people in senior citizen category have churned

[69]:
```
df.columns
```

[69]:
```
Index(['customerID', 'gender', 'SeniorCitizen', 'Partner', 'Dependents',
       'tenure', 'PhoneService', 'MultipleLines', 'InternetService',
       'OnlineSecurity', 'OnlineBackup', 'DeviceProtection', 'TechSupport',
       'StreamingTV', 'StreamingMovies', 'Contract', 'PaperlessBilling',
```

```
       'PaymentMethod', 'MonthlyCharges', 'TotalCharges', 'Churn'],
      dtype='object')
```

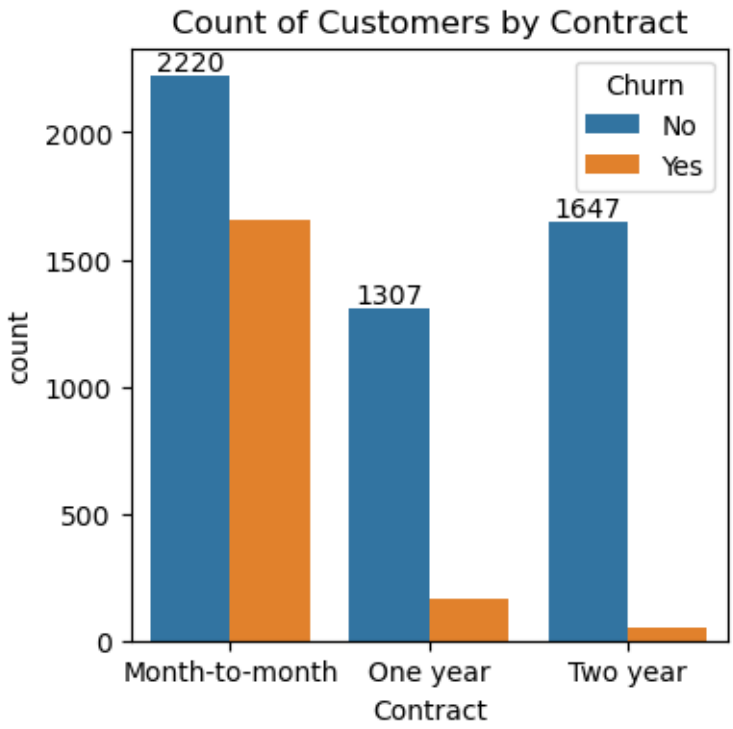
[74]:
```
plt.figure(figsize=(9,4))
sns.histplot(x="tenure",data=df,bins=72,hue="Churn")
plt.show()
```



8 people who used our services for a long time have stayed and

people who used our services for #1 or 2 months have churned out

[77]:
```
plt.figure(figsize=(4,4))
ax=sns.countplot(x ="Contract", data = df,hue)
ax.bar_label(ax.containers[0])
plt.title("Count of Customers by Contract")
plt.show()
```



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

[91]:
```
df.columns.values
```

[91]:
```
array(['customerID', 'gender', 'SeniorCitizen', 'Partner', 'Dependents',
       'tenure', 'PhoneService', 'MultipleLines', 'InternetService',
       'OnlineSecurity', 'OnlineBackup', 'DeviceProtection',
       'TechSupport', 'StreamingTV', 'StreamingMovies', 'Contract',
       'PaperlessBilling', 'PaymentMethod', 'MonthlyCharges',
       'TotalCharges', 'Churn'], dtype=object)
```

[97]:
```
# Set up the subplot grid
num_columns = len(columns_to_plot)
fig, axes = plt.subplots(nrows=(num_columns + 2) // 3, ncols=3, figsize=(15, 4␣
 ↪* ((num_columns + 2) // 3)))
axes = axes.flatten()  # Flatten to easily iterate

# Create a countplot for each column
for ax, column in zip(axes, columns_to_plot):
    sns.countplot(x=column, data=df, ax=ax,hue="Churn")
    ax.set_title(f'Count of {column}', fontsize=10)  # Decrease title font size
```

```
    ax.set_ylabel('Count', fontsize=9)  # Decrease y-axis label font size
    ax.set_xlabel(column, fontsize=9)  # Decrease x-axis label font size
    ax.set_xticklabels(ax.get_xticklabels(),  fontsize=9)  # Decrease x-tick␣
  ↪label font size
    ax.set_yticklabels(ax.get_yticks(), fontsize=9)  # Decrease y-tick label␣
  ↪font size
    # Hide any unused subplots
for i in range(len(columns_to_plot), len(axes)):
    fig.delaxes(axes[i])

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

```
C:\Users\Jyoti\AppData\Local\Temp\ipykernel_9204\149378275.py:12: UserWarning:
set_ticklabels() should only be used with a fixed number of ticks, i.e. after
set_ticks() or using a FixedLocator.
  ax.set_xticklabels(ax.get_xticklabels(),  fontsize=9)  # Decrease x-tick label
font size
C:\Users\Jyoti\AppData\Local\Temp\ipykernel_9204\149378275.py:13: UserWarning:
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```

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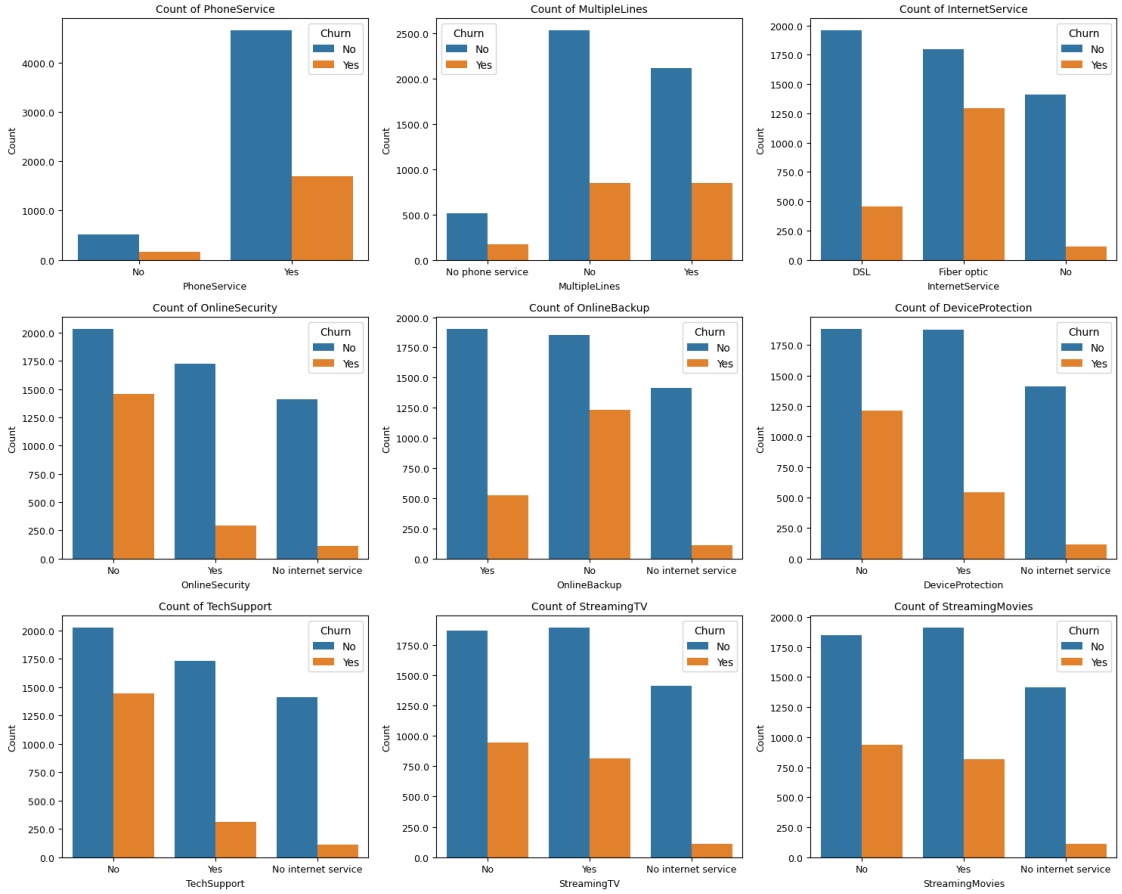
size
```

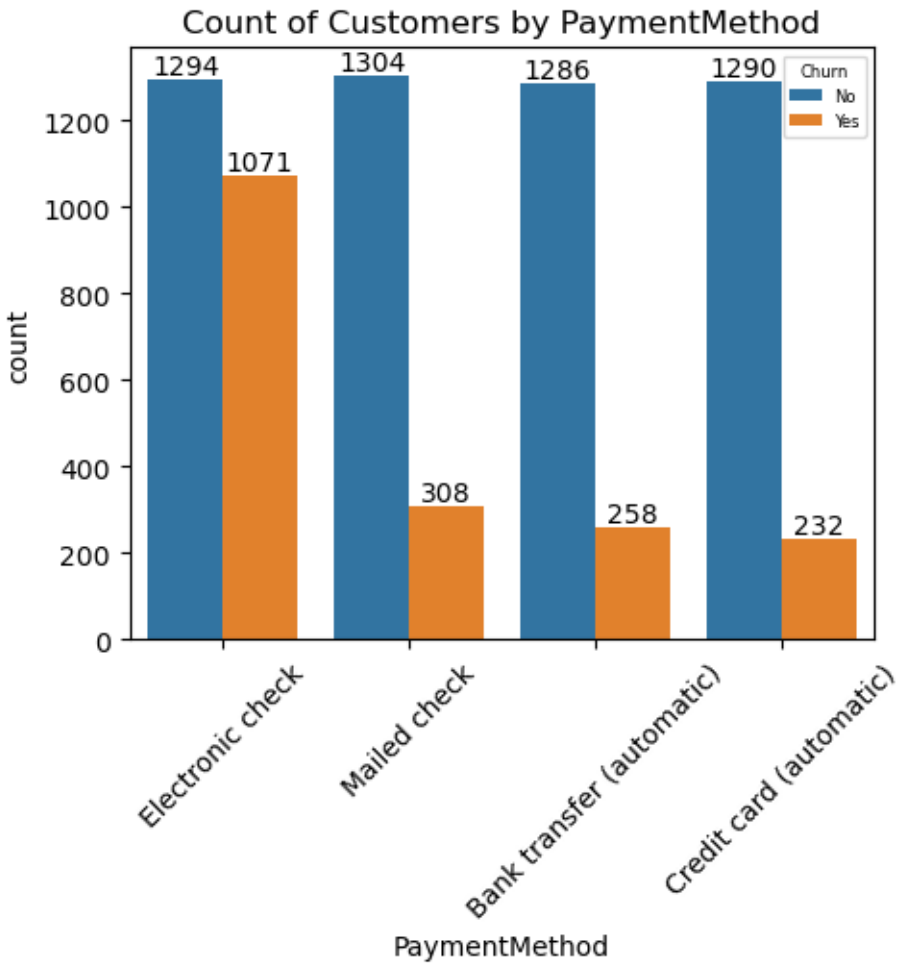


10 The data visualizations reveal that customers who lack additional services such as phone service, online security, or tech support are more likely to churn. Fiber optic internet users show less churn compared to DSL users. Similarly, the absence of streaming services (TV or movies) correlates with higher churn, highlighting that value-added services can play a crucial role in customer retention.

[99]:
```
df.columns.values
```

[99]:
```
array(['customerID', 'gender', 'SeniorCitizen', 'Partner', 'Dependents',
       'tenure', 'PhoneService', 'MultipleLines', 'InternetService',
       'OnlineSecurity', 'OnlineBackup', 'DeviceProtection',
       'TechSupport', 'StreamingTV', 'StreamingMovies', 'Contract',
       'PaperlessBilling', 'PaymentMethod', 'MonthlyCharges',
       'TotalCharges', 'Churn'], dtype=object)
```

[110]:
```
plt.figure(figsize=(5,4))
ax=sns.countplot(x ='PaymentMethod', data = df,hue="Churn")
ax.bar_label(ax.containers[0])
ax.bar_label(ax.containers[1])
plt.xticks(rotation=45)
plt.legend(title='Churn',title_fontsize=6,fontsize=6)
plt.title("Count of Customers by PaymentMethod")
plt.show()
```



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

[ ]: