x5crv5rco

January 28, 2025

[1]:
```
import pandas as pd
```

[3]:
```
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

[7]:
```
df=pd.read_csv(r"C:\Users\nageena shaik\OneDrive\Desktop\Churn_analysis.csv")
df
```

[7]:

	customerID	gender	SeniorCitizen	Partner	Dependents	tenure	\
0	7590-VHVEG	Female	0	Yes	No	1	
1	5575-GNVDE	Male	0	No	No	34	
2	3668-QPYBK	Male	0	No	No	2	
3	7795-CFOCW	Male	0	No	No	45	
4	9237-HQITU	Female	0	No	No	2	
…	…	…	…	…	…	…	…
7038	6840-RESVB	Male	0	Yes	Yes	24	
7039	2234-XADUH	Female	0	Yes	Yes	72	
7040	4801-JZAZL	Female	0	Yes	Yes	11	
7041	8361-LTMKD	Male	1	Yes	No	4	
7042	3186-AJIEK	Male	0	No	No	66	

	PhoneService	MultipleLines	InternetService	OnlineSecurity	…	\
0	No	No phone service	DSL	No	…	
1	Yes	No	DSL	Yes	…	
2	Yes	No	DSL	Yes	…	
3	No	No phone service	DSL	Yes	…	
4	Yes	No	Fiber optic	No	…	
…	…	…	…	…	…	
7038	Yes	Yes	DSL	Yes	…	
7039	Yes	Yes	Fiber optic	No	…	
7040	No	No phone service	DSL	Yes	…	
7041	Yes	Yes	Fiber optic	No	…	
7042	Yes	No	Fiber optic	Yes	…	

	DeviceProtection	TechSupport	StreamingTV	StreamingMovies	Contract	\
0	No	No	No	No	Month-to-month	

```
1                 Yes          No          No              No        One year
2                  No          No          No              No  Month-to-month
3                 Yes         Yes          No              No        One year
4                  No          No          No              No  Month-to-month
…                 …           …           …               …              …
7038              Yes         Yes         Yes             Yes        One year
7039              Yes          No         Yes             Yes        One year
7040               No          No          No              No  Month-to-month
7041               No          No          No              No  Month-to-month
7042              Yes         Yes         Yes             Yes        Two year

     PaperlessBilling              PaymentMethod MonthlyCharges  TotalCharges  \
0                 Yes           Electronic check          29.85         29.85
1                  No               Mailed check          56.95        1889.5
2                 Yes               Mailed check          53.85        108.15
3                  No  Bank transfer (automatic)          42.30       1840.75
4                 Yes           Electronic check          70.70        151.65
…                 …                         …             …           …
7038              Yes               Mailed check          84.80        1990.5
7039              Yes    Credit card (automatic)         103.20        7362.9
7040              Yes           Electronic check          29.60        346.45
7041              Yes               Mailed check          74.40         306.6
7042              Yes  Bank transfer (automatic)         105.65        6844.5

     Churn
0       No
1       No
2      Yes
3       No
4      Yes
…      …
7038    No
7039    No
7040    No
7041   Yes
7042    No

[7043 rows x 21 columns]
```

[8]:
```
df.head()
```

[8]:
```
   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]
```

[9]:
```
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 witho 0 as tensure 0 and no total charges are recorded

[10]:
```
df['TotalCharges']=df['TotalCharges'].replace(" ",0)
df['TotalCharges']=df['TotalCharges'].astype("float")
```

[11]:
```
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()
```

[12]:
```
      customerID  gender  SeniorCitizen  Partner  Dependents  tenure  \
0          False   False          False    False       False   False
```

```
1          False   False          False    False       False   False
2          False   False          False    False       False   False
3          False   False          False    False       False   False
4          False   False          False    False       False   False
…          …     …              …      …         …     …
7038       False   False          False    False       False   False
7039       False   False          False    False       False   False
7040       False   False          False    False       False   False
7041       False   False          False    False       False   False
7042       False   False          False    False       False   False

      PhoneService  MultipleLines  InternetService  OnlineSecurity  …  \
0            False          False            False           False  …
1            False          False            False           False  …
2            False          False            False           False  …
3            False          False            False           False  …
4            False          False            False           False  …
…            …            …                …             …  …
7038         False          False            False           False  …
7039         False          False            False           False  …
7040         False          False            False           False  …
7041         False          False            False           False  …
7042         False          False            False           False  …

      DeviceProtection  TechSupport  StreamingTV  StreamingMovies  Contract  \
0                False        False        False            False     False
1                False        False        False            False     False
2                False        False        False            False     False
3                False        False        False            False     False
4                False        False        False            False     False
…                …          …            …              …       …
7038             False        False        False            False     False
7039             False        False        False            False     False
7040             False        False        False            False     False
7041             False        False        False            False     False
7042             False        False        False            False     False

      PaperlessBilling  PaymentMethod  MonthlyCharges  TotalCharges  Churn
0                False          False           False         False  False
1                False          False           False         False  False
2                False          False           False         False  False
3                False          False           False         False  False
4                False          False           False         False  False
…                …            …             …     …
7038             False          False           False         False  False
7039             False          False           False         False  False
7040             False          False           False         False  False
```

```
7041             False          False           False         False  False
7042             False          False           False         False  False

[7043 rows x 21 columns]
```

[13]:
```
df.isnull().sum()
```

[13]:
```
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.isnull().sum().sum()
```

[15]:
```
0
```

[16]:
```
df.describe()
```

[16]:

	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

[18]:
```
df.duplicated().sum()
```

[18]:
```
0
```

#To check duplicates

[19]:
```
df['customerID'].duplicated().sum()
```

[19]:
```
0
```

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

[23]:
```
def conv(value):
    if value == 1:
        return "yes"
    else:
        return "no"

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

[26]:
```
df.head(30)
```

[26]:

	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	
2	3668-QPYBK	Male	no	No	No	2	Yes	
3	7795-CFOCW	Male	no	No	No	45	No	
4	9237-HQITU	Female	no	No	No	2	Yes	
5	9305-CDSKC	Female	no	No	No	8	Yes	
6	1452-KIOVK	Male	no	No	Yes	22	Yes	
7	6713-OKOMC	Female	no	No	No	10	No	
8	7892-POOKP	Female	no	Yes	No	28	Yes	
9	6388-TABGU	Male	no	No	Yes	62	Yes	
10	9763-GRSKD	Male	no	Yes	Yes	13	Yes	
11	7469-LKBCI	Male	no	No	No	16	Yes	
12	8091-TTVAX	Male	no	Yes	No	58	Yes	
13	0280-XJGEX	Male	no	No	No	49	Yes	
14	5129-JLPIS	Male	no	No	No	25	Yes	
15	3655-SNQYZ	Female	no	Yes	Yes	69	Yes	
16	8191-XWSZG	Female	no	No	No	52	Yes	
17	9959-WOFKT	Male	no	No	Yes	71	Yes	
18	4190-MFLUW	Female	no	Yes	Yes	10	Yes	
19	4183-MYFRB	Female	no	No	No	21	Yes	
20	8779-QRDMV	Male	yes	No	No	1	No	
21	1680-VDCWW	Male	no	Yes	No	12	Yes	
22	1066-JKSGK	Male	no	No	No	1	Yes	
23	3638-WEABW	Female	no	Yes	No	58	Yes	
24	6322-HRPFA	Male	no	Yes	Yes	49	Yes	
25	6865-JZNKO	Female	no	No	No	30	Yes	
26	6467-CHFZW	Male	no	Yes	Yes	47	Yes	

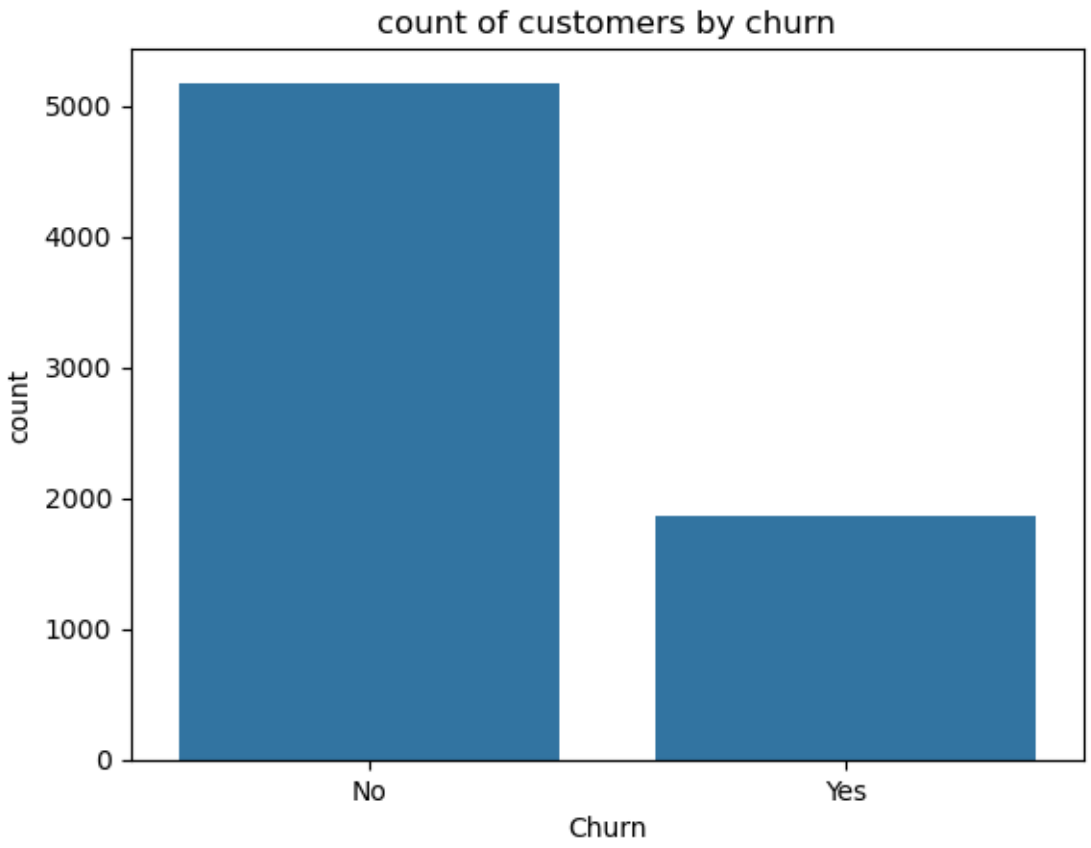
```
27  8665-UTDHZ    Male            no     Yes        Yes       1           No
28  5248-YGIJN    Male            no     Yes         No      72          Yes
29  8773-HHUOZ  Female            no      No        Yes      17          Yes

       MultipleLines InternetService       OnlineSecurity  …  \
0   No phone service             DSL                   No  …
1                 No             DSL                  Yes  …
2                 No             DSL                  Yes  …
3   No phone service             DSL                  Yes  …
4                 No     Fiber optic                   No  …
5                Yes     Fiber optic                   No  …
6                Yes     Fiber optic                   No  …
7   No phone service             DSL                  Yes  …
8                Yes     Fiber optic                   No  …
9                 No             DSL                  Yes  …
10                No             DSL                  Yes  …
11                No              No  No internet service  …
12               Yes     Fiber optic                   No  …
13               Yes     Fiber optic                   No  …
14                No     Fiber optic                  Yes  …
15               Yes     Fiber optic                  Yes  …
16                No              No  No internet service  …
17               Yes     Fiber optic                  Yes  …
18                No             DSL                   No  …
19                No     Fiber optic                   No  …
20  No phone service             DSL                   No  …
21                No              No  No internet service  …
22                No              No  No internet service  …
23               Yes             DSL                   No  …
24                No             DSL                  Yes  …
25                No             DSL                  Yes  …
26               Yes     Fiber optic                   No  …
27  No phone service             DSL                   No  …
28               Yes             DSL                  Yes  …
29                No             DSL                   No  …

       DeviceProtection          TechSupport          StreamingTV  \
0                    No                   No                   No
1                   Yes                   No                   No
2                    No                   No                   No
3                   Yes                  Yes                   No
4                    No                   No                   No
5                   Yes                   No                  Yes
6                    No                   No                  Yes
7                    No                   No                   No
8                   Yes                  Yes                  Yes
9                    No                   No                   No
```

10	No	No	No
11	No internet service	No internet service	No internet service
12	Yes	No	Yes
13	Yes	No	Yes
14	Yes	Yes	Yes
15	Yes	Yes	Yes
16	No internet service	No internet service	No internet service
17	Yes	No	Yes
18	Yes	Yes	No
19	Yes	No	No
20	Yes	No	No
21	No internet service	No internet service	No internet service
22	No internet service	No internet service	No internet service
23	No	Yes	No
24	No	Yes	No
25	No	No	No
26	No	No	Yes
27	No	No	No
28	Yes	Yes	Yes
29	No	No	Yes

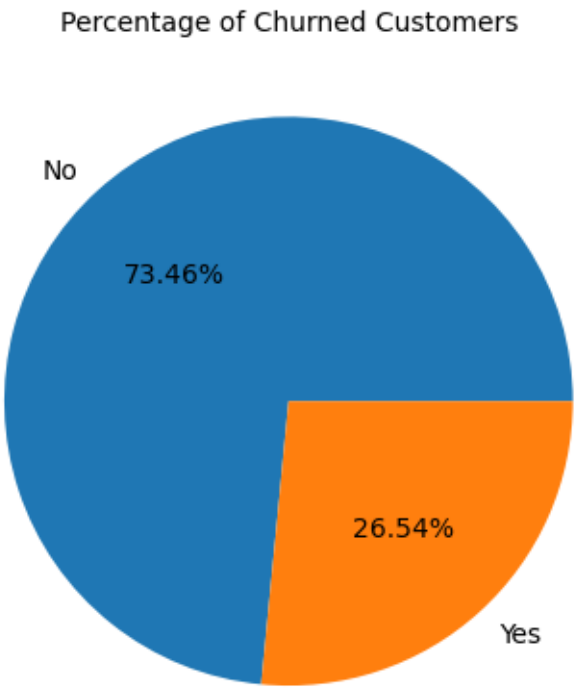
	StreamingMovies	Contract	PaperlessBilling	\
0	No	Month-to-month	Yes	
1	No	One year	No	
2	No	Month-to-month	Yes	
3	No	One year	No	
4	No	Month-to-month	Yes	
5	Yes	Month-to-month	Yes	
6	No	Month-to-month	Yes	
7	No	Month-to-month	No	
8	Yes	Month-to-month	Yes	
9	No	One year	No	
10	No	Month-to-month	Yes	
11	No internet service	Two year	No	
12	Yes	One year	No	
13	Yes	Month-to-month	Yes	
14	Yes	Month-to-month	Yes	
15	Yes	Two year	No	
16	No internet service	One year	No	
17	Yes	Two year	No	
18	No	Month-to-month	No	
19	Yes	Month-to-month	Yes	
20	Yes	Month-to-month	Yes	
21	No internet service	One year	No	
22	No internet service	Month-to-month	No	
23	No	Two year	Yes	
24	No	Month-to-month	No	

```
25                  No  Month-to-month              Yes
26                 Yes  Month-to-month              Yes
27                  No  Month-to-month               No
28                 Yes        Two year              Yes
29                 Yes  Month-to-month              Yes

                PaymentMethod MonthlyCharges  TotalCharges  Churn
0            Electronic check          29.85         29.85     No
1                Mailed check          56.95       1889.50     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            Electronic check          99.65        820.50    Yes
6     Credit card (automatic)          89.10       1949.40     No
7                Mailed check          29.75        301.90     No
8            Electronic check         104.80       3046.05    Yes
9   Bank transfer (automatic)          56.15       3487.95     No
10               Mailed check          49.95        587.45     No
11    Credit card (automatic)          18.95        326.80     No
12    Credit card (automatic)         100.35       5681.10     No
13  Bank transfer (automatic)         103.70       5036.30    Yes
14           Electronic check         105.50       2686.05     No
15    Credit card (automatic)         113.25       7895.15     No
16               Mailed check          20.65       1022.95     No
17  Bank transfer (automatic)         106.70       7382.25     No
18    Credit card (automatic)          55.20        528.35    Yes
19           Electronic check          90.05       1862.90     No
20           Electronic check          39.65         39.65    Yes
21  Bank transfer (automatic)          19.80        202.25     No
22               Mailed check          20.15         20.15    Yes
23    Credit card (automatic)          59.90       3505.10     No
24    Credit card (automatic)          59.60       2970.30     No
25  Bank transfer (automatic)          55.30       1530.60     No
26           Electronic check          99.35       4749.15    Yes
27           Electronic check          30.20         30.20    Yes
28    Credit card (automatic)          90.25       6369.45     No
29               Mailed check          64.70       1093.10    Yes

[30 rows x 21 columns]
```

[38]:
```
sns.countplot(x='Churn',data=df)
plt.title("count of customers by churn")
plt.show()
```



[39]:
```
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()
```

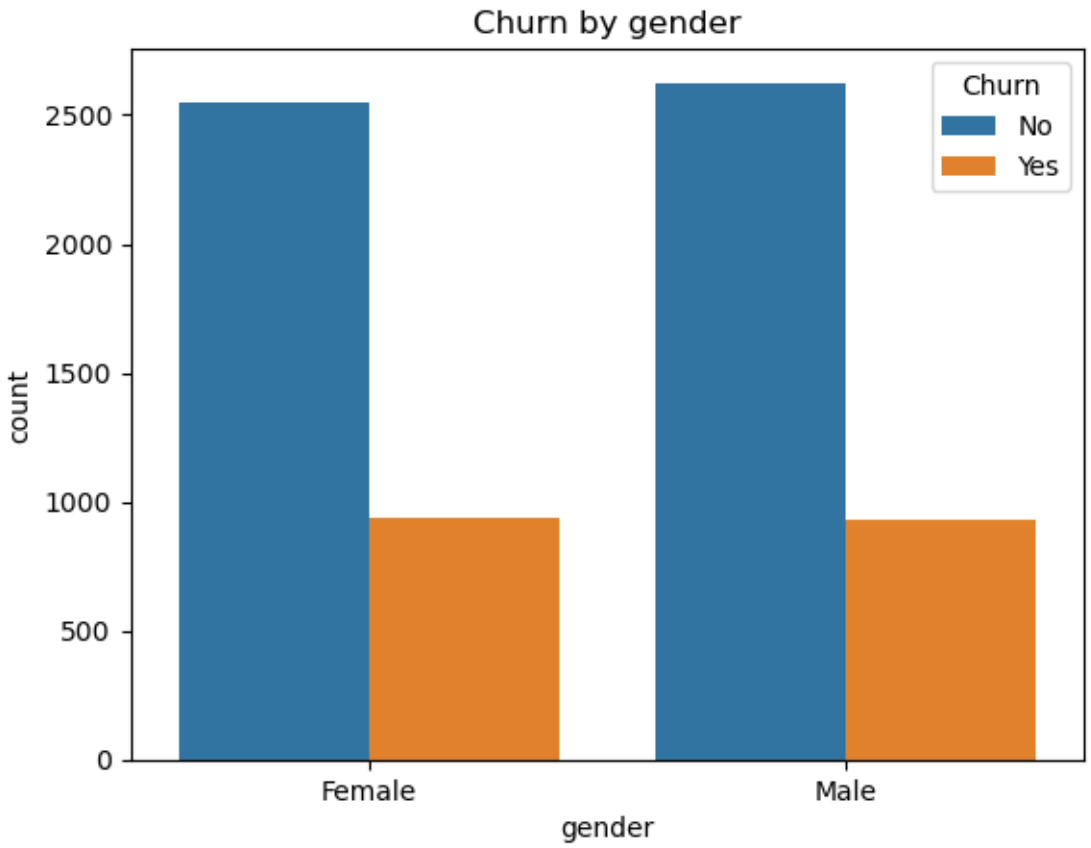


from the given pie chart we can conclude that 26.54% our customers have churned out .

now lets explore the reason behind it

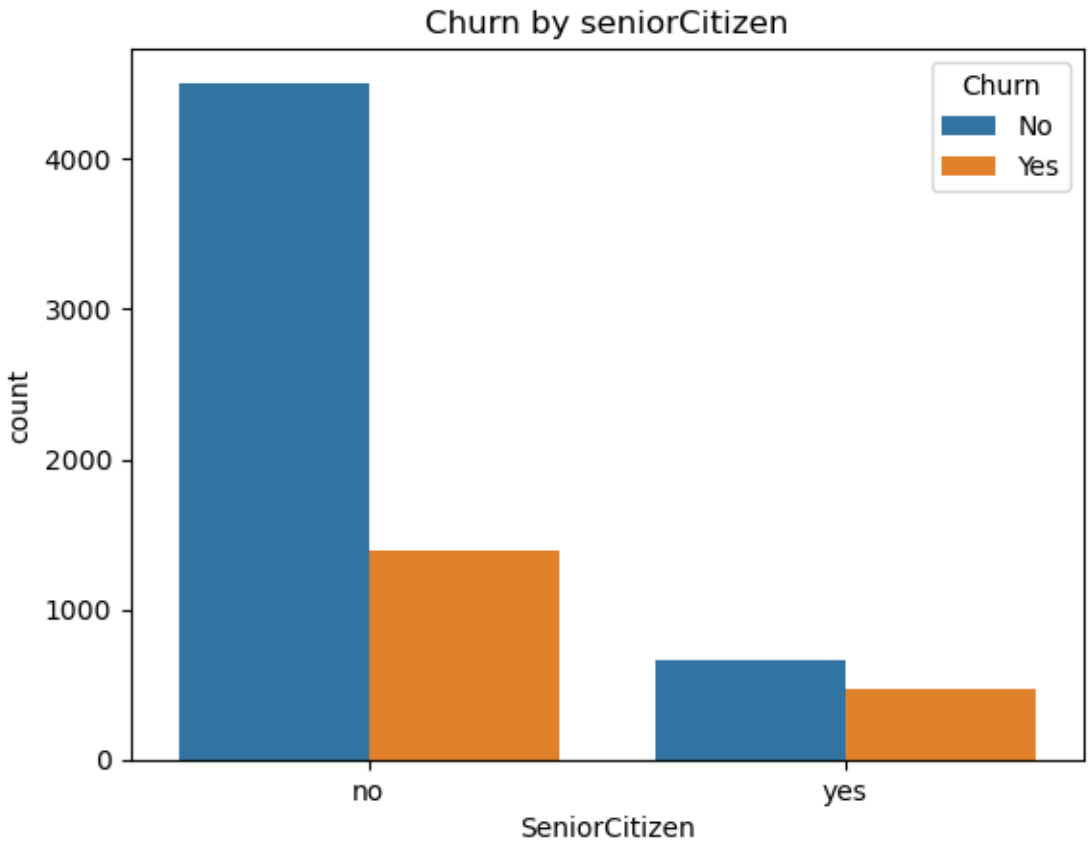
[41]:
```
sns.countplot(x='gender',data=df,hue="Churn")
plt.title("Churn by gender")
plt.show
```

[41]:
```
<function matplotlib.pyplot.show(close=None, block=None)>
```



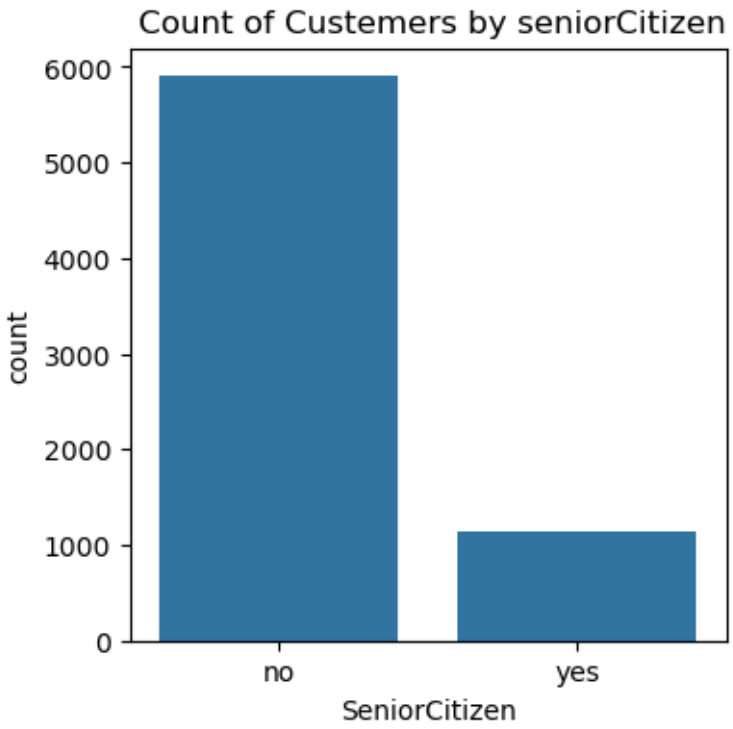
[42]:
```
sns.countplot(x='SeniorCitizen',data=df,hue="Churn")
plt.title("Churn by seniorCitizen")
plt.show
```

[42]:
```
<function matplotlib.pyplot.show(close=None, block=None)>
```



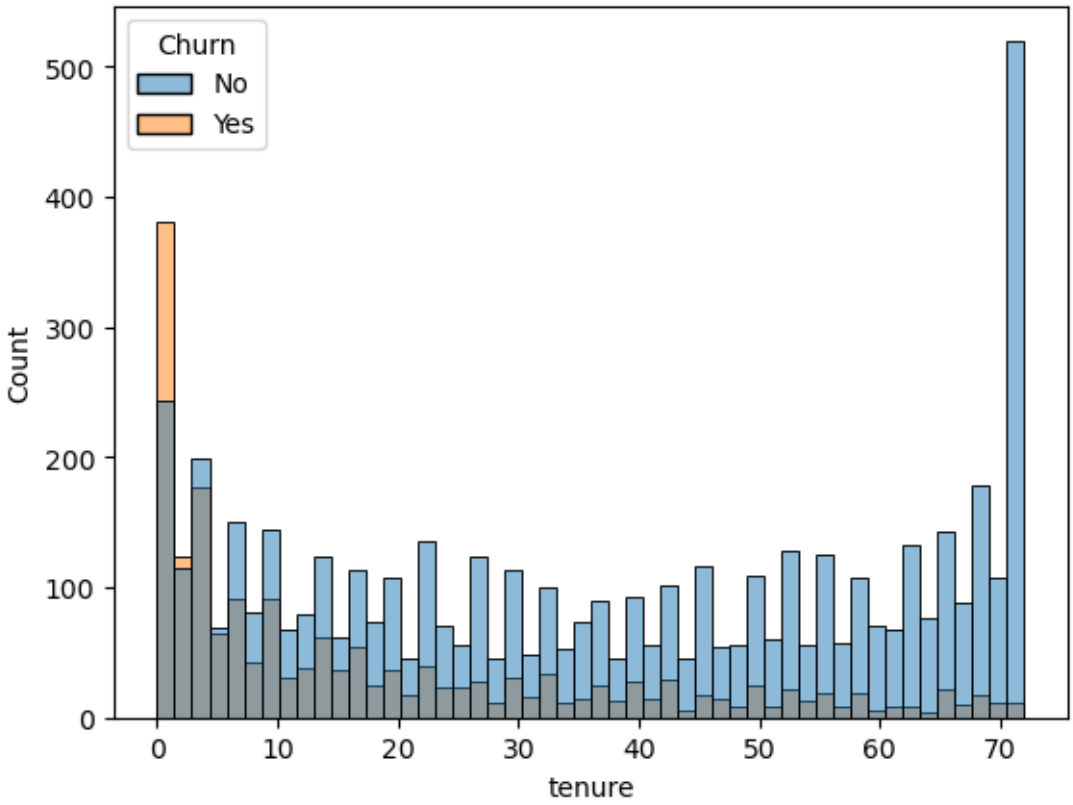
[45]:
```
plt.figure(figsize=(4,4))
sns.countplot(x='SeniorCitizen',data=df)
plt.title(" Count of Custemers by seniorCitizen")
plt.show
```

[45]:
```
<function matplotlib.pyplot.show(close=None, block=None)>
```



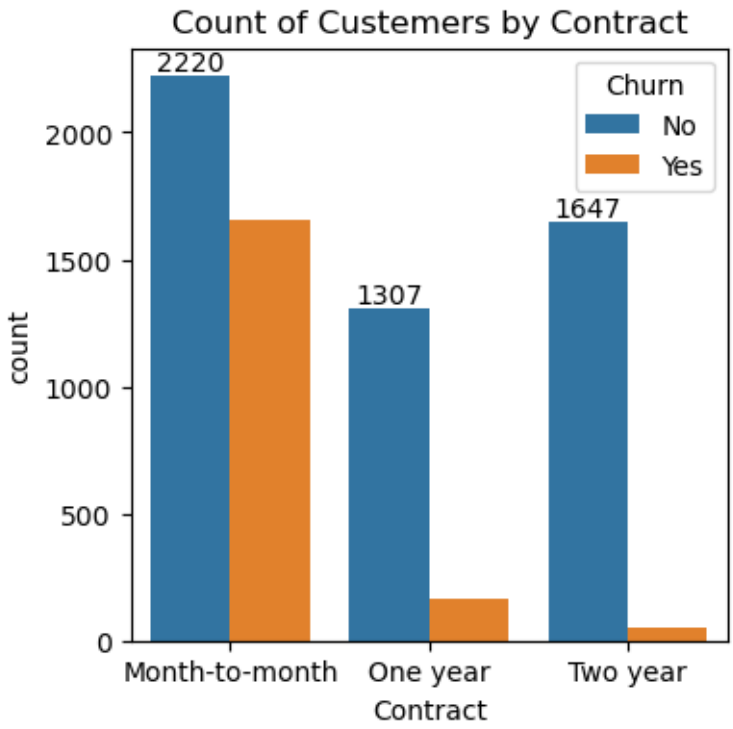
comparive greater percentage of people in senior citizen catogery have churned

[49]:
```
sns.histplot(x="tenure",data=df,bins=50,hue="Churn")
plt.show()
```



people who have used our services for a long time have stayed and people who have used our services one or two months have churned.

[55]:
```
plt.figure(figsize=(4,4))
ax=sns.countplot(x="Contract",data=df,hue="Churn")
ax.bar_label(ax.containers[0])
plt.title("Count of Custemers by Contract")
plt.show()
```



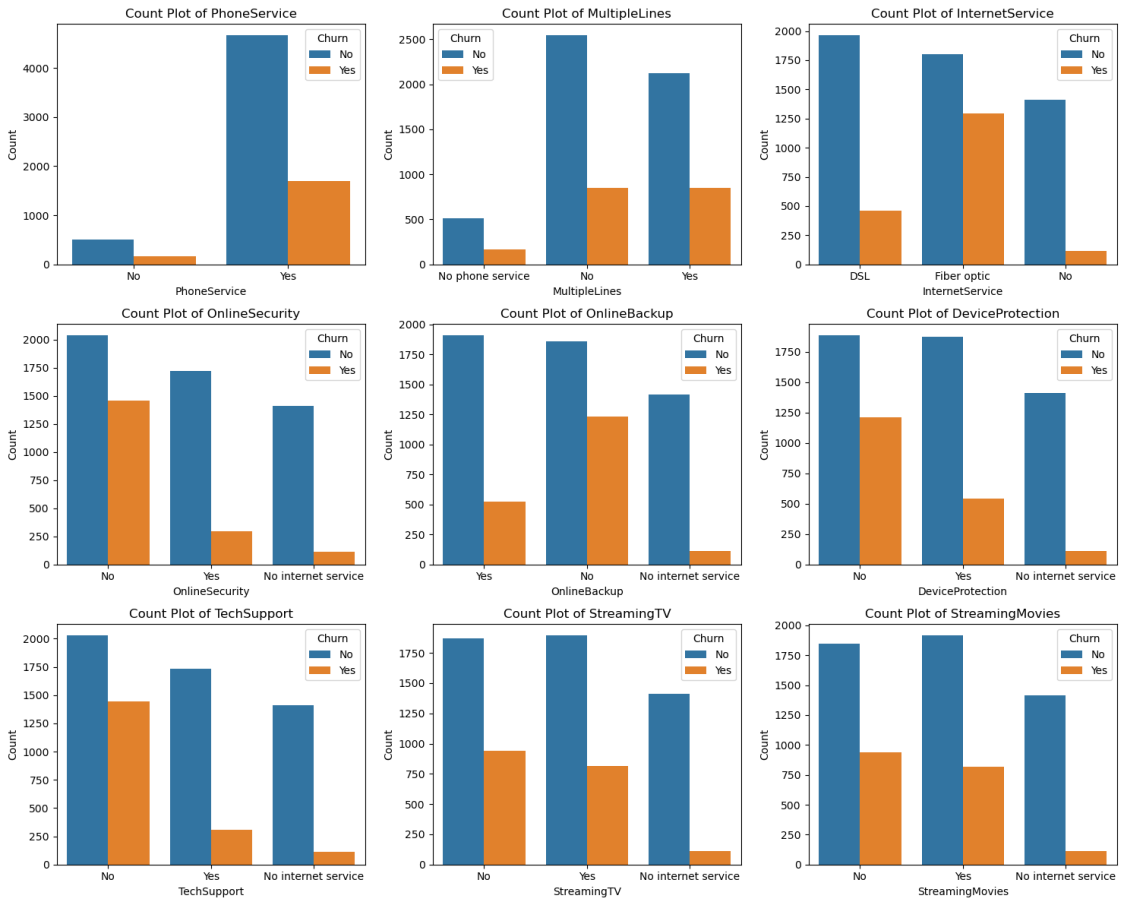
people who have month to month contract are likely to churn then from those who have 1 or 2 years of contract

[56]:
```
df.columns.values
```

[56]:
```
array(['customerID', 'gender', 'SeniorCitizen', 'Partner', 'Dependents',
       'tenure', 'PhoneService', 'MultipleLines', 'InternetService',
       'OnlineSecurity', 'OnlineBackup', 'DeviceProtection',
       'TechSupport', 'StreamingTV', 'StreamingMovies', 'Contract',
       'PaperlessBilling', 'PaymentMethod', 'MonthlyCharges',
       'TotalCharges', 'Churn'], dtype=object)
```

[60]:
```
# List of columns to plot
columns = ['PhoneService', 'MultipleLines', 'InternetService',
           'OnlineSecurity', 'OnlineBackup', 'DeviceProtection',
           'TechSupport', 'StreamingTV', 'StreamingMovies']

# Number of columns and rows for the subplots grid
n_rows = 3
n_cols = 3

# Create a figure and axes
fig, axes = plt.subplots(n_rows, n_cols, figsize=(15, 12))
```

```
# Flatten the axes array for easy indexing
axes = axes.flatten()

# Loop through each column and create a countplot
for i, col in enumerate(columns):
    sns.countplot(x=col, data=df, ax=axes[i],hue=df["Churn"])
    axes[i].set_title(f'Count Plot of {col}')
    axes[i].set_xlabel(col)
    axes[i].set_ylabel('Count')

# Adjust layout to avoid overlap
plt.tight_layout()

# Display the plots
plt.show()
```



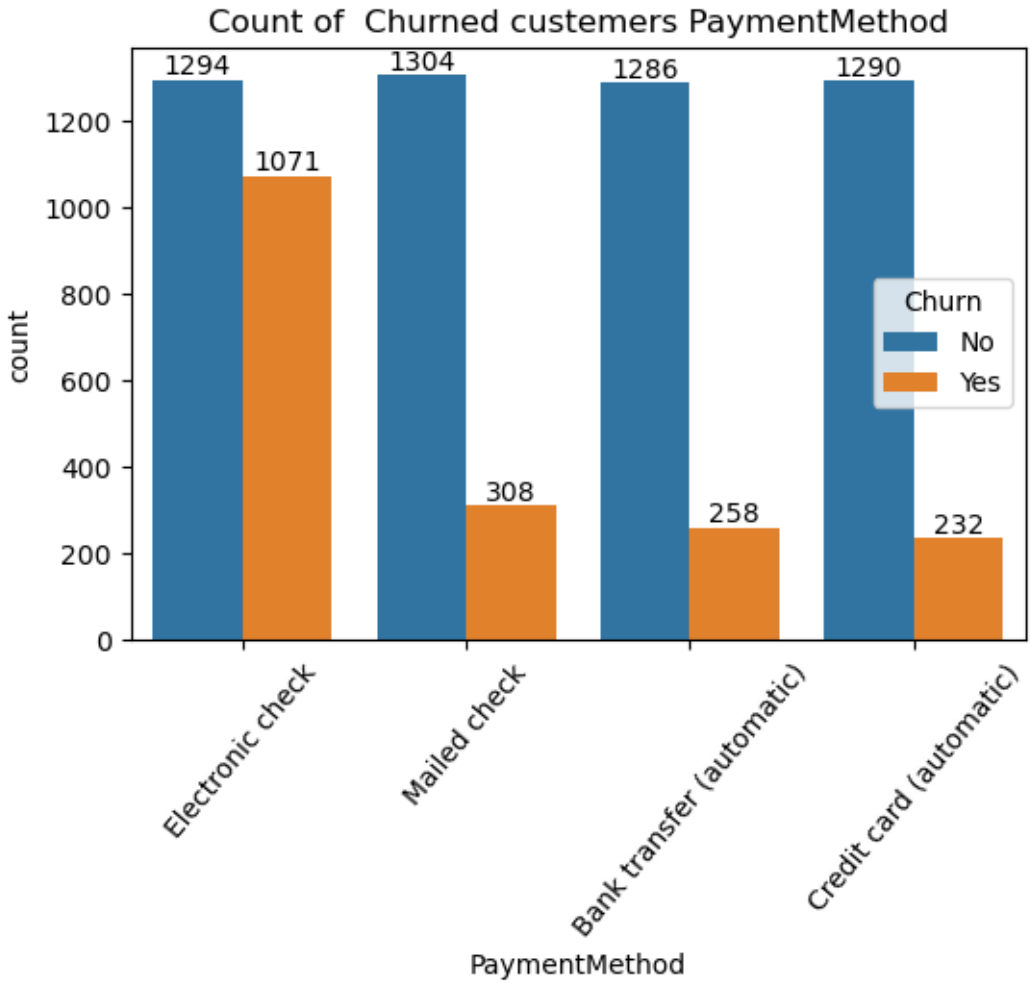
Based on the count plots: The majority of customers have PhoneService and MultipleLines, while fewer customers opted out of these services.

Internet services like Fiber Optic are more popular, but they also show a higher churn rate compared to DSL or no internet.

Security-related services like OnlineSecurity, OnlineBackup, and TechSupport show significant churn differences, with customers lacking these services having higher churn.

Entertainment services like StreamingTV and StreamingMovies have balanced participation but slightly elevated churn for users without these services.

[64]:
```
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("Count of  Churned custemers PaymentMethod")
plt.xticks(rotation=50)
plt.show()
```



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