EDA Telco Customer Churn

March 24, 2024

[1]:

```
import numpy as np
import pandas as pd
import seaborn as sns
from collections import Counter
import matplotlib.pyplot as plt
import matplotlib.gridspec as gridspec
```

[2]:

```
df = pd.read_csv(r'Telco-Customer-Churn.csv')
```

[3]:

```
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 Preprocessing

[4]:
```
#drop column 'customerID'
df.drop('customerID', axis=1, inplace= True)
```

[5]:
```
print("nunique value ['TotalCharges']:", df['TotalCharges'].nunique())
```

```
nunique value ['TotalCharges']: 6531
```

[6]:
```
#There's Missing Value in column 'TotalCharges' so couldn't change the datatype␣
  ↪directly into float
df['TotalCharges'] = df['TotalCharges'].replace(' ', np.NaN)

#change the data type into float
df['TotalCharges'] = df['TotalCharges'].astype(float)

#fill the missing value with average value of 'TotalCharges'
df['TotalCharges'] = df['TotalCharges'].fillna(round(df['TotalCharges'].mean(),␣
  ↪4))
```

[7]:
```
object_type_data = {column: list(df[column].unique()) for column in df.
  ↪select_dtypes(object).columns}
for key, value in object_type_data.items():
    print(f'{key}: {value}')
```

```
gender: ['Female', 'Male']
Partner: ['Yes', 'No']
Dependents: ['No', 'Yes']
PhoneService: ['No', 'Yes']
MultipleLines: ['No phone service', 'No', 'Yes']
InternetService: ['DSL', 'Fiber optic', 'No']
OnlineSecurity: ['No', 'Yes', 'No internet service']
OnlineBackup: ['Yes', 'No', 'No internet service']
DeviceProtection: ['No', 'Yes', 'No internet service']
TechSupport: ['No', 'Yes', 'No internet service']
StreamingTV: ['No', 'Yes', 'No internet service']
StreamingMovies: ['No', 'Yes', 'No internet service']
Contract: ['Month-to-month', 'One year', 'Two year']
PaperlessBilling: ['Yes', 'No']
PaymentMethod: ['Electronic check', 'Mailed check', 'Bank transfer (automatic)',
'Credit card (automatic)']
Churn: ['No', 'Yes']
```

In 'MultipleLines' column there are value 'No' and 'No phone service' that essentially the same thing, so we should convert this value into 'No' to avoid double meaning in one column. list of column:

1. MultipleLines
2. OnlineSecurity
3. DeviceProtection
4. TechSupport
5. StreamingTV
6. StreamingMovies

[8]:

```
df['MultipleLines'] = df['MultipleLines'].replace('No phone service', 'No')
df[['OnlineSecurity',
    'OnlineBackup',
    'DeviceProtection',
    'TechSupport',
    'StreamingTV',
    'StreamingMovies']] = df[['OnlineSecurity',
                              'OnlineBackup',
                              'DeviceProtection',
                              'TechSupport',
                              'StreamingTV',
                              'StreamingMovies']].replace('No internet␣
 ↪service', 'No')
```

[9]:

```
#Check the result
object_type_data = {column: list(df[column].unique()) for column in df.
 ↪select_dtypes(object).columns}
for key, value in object_type_data.items():
    print(f'{key}: {value}')
```

```
gender: ['Female', 'Male']
Partner: ['Yes', 'No']
Dependents: ['No', 'Yes']
PhoneService: ['No', 'Yes']
MultipleLines: ['No', 'Yes']
InternetService: ['DSL', 'Fiber optic', 'No']
OnlineSecurity: ['No', 'Yes']
OnlineBackup: ['Yes', 'No']
DeviceProtection: ['No', 'Yes']
TechSupport: ['No', 'Yes']
StreamingTV: ['No', 'Yes']
StreamingMovies: ['No', 'Yes']
Contract: ['Month-to-month', 'One year', 'Two year']
PaperlessBilling: ['Yes', 'No']
PaymentMethod: ['Electronic check', 'Mailed check', 'Bank transfer (automatic)',
'Credit card (automatic)']
Churn: ['No', 'Yes']
```

```
After handling any missing value or any double meaning value in column that have
object datatype, time to handling missing value in other column
```

[10]:

```
#chacking if there's a missing value (0) in numerical columns
type_data = {column: list(df[column].where(df[column] == 0).value_counts()) for␣
 ↪column in df.select_dtypes('number').columns}
print('Sum of 0 value in each numeric column')
for key, value in type_data.items():
    print(f'{key}: {value}')
```

```
Sum of 0 value in each numeric column
SeniorCitizen: [5901]
tenure: [11]
MonthlyCharges: []
TotalCharges: []
```

[11]:

```
#Replace missing value it with average value
df['tenure'] = df['tenure'].replace(0, int(df['tenure'].mean()))
```

[12]:

```
#chacking if there's a missing value (0) in numerical columns
type_data = {column: list(df[column].where(df[column] == 0).value_counts()) for␣
 ↪column in df.select_dtypes('number').columns}
print('Sum of 0 value in each numeric column')
for key, value in type_data.items():
    print(f'{key}: {value}')
```

```
Sum of 0 value in each numeric column
SeniorCitizen: [5901]
tenure: []
MonthlyCharges: []
TotalCharges: []
```

Finally, there's no column that has missing value, in 'SeniorCitizens' column case 0 = No instead of missing value

2 EDA

[13]:

```
df_describe = df.describe()
df_describe
```

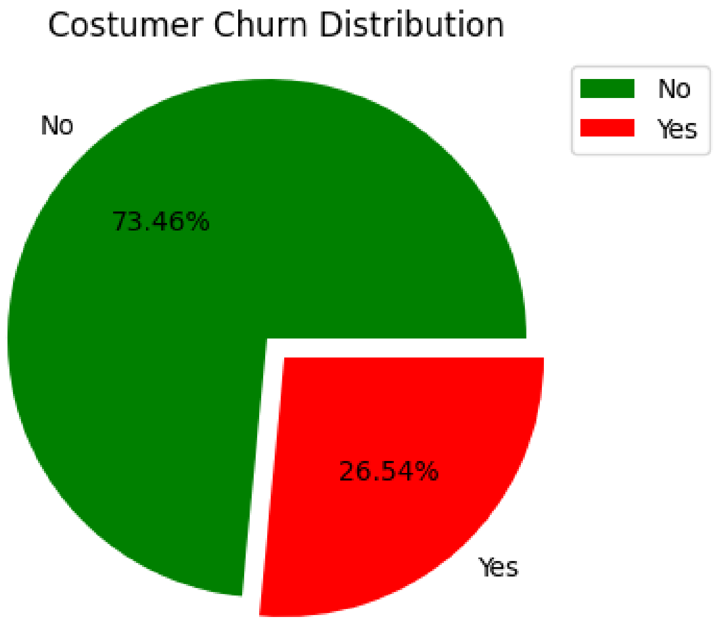
[13]:

```
       SeniorCitizen       tenure  MonthlyCharges  TotalCharges
count    7043.000000  7043.000000     7043.000000   7043.000000
mean        0.162147    32.421127       64.761692   2283.300441
std         0.368612    24.526087       30.090047   2265.000258
min         0.000000     1.000000       18.250000     18.800000
25%         0.000000     9.000000       35.500000    402.225000
50%         0.000000    29.000000       70.350000   1400.550000
75%         0.000000    55.000000       89.850000   3786.600000
max         1.000000    72.000000      118.750000   8684.800000
```

2.1 Churn Distribution

[14]:

```
value = Counter(df['Churn'])
labels = []
sizes = []
for x, y in value.items():
    labels.append(x)
    sizes.append(y)

# Plot
fig = plt.figure(figsize = (6, 4))
plt.pie(sizes, labels=labels, explode=[0.1, 0], autopct="%1.2f%%", colors=['g',␣
  ↪'r'])
plt.title("Costumer Churn Distribution")
plt.legend()
plt.axis('equal')
plt.show()
```



Out of all the customers, `73.46% of costumers won't churn.`

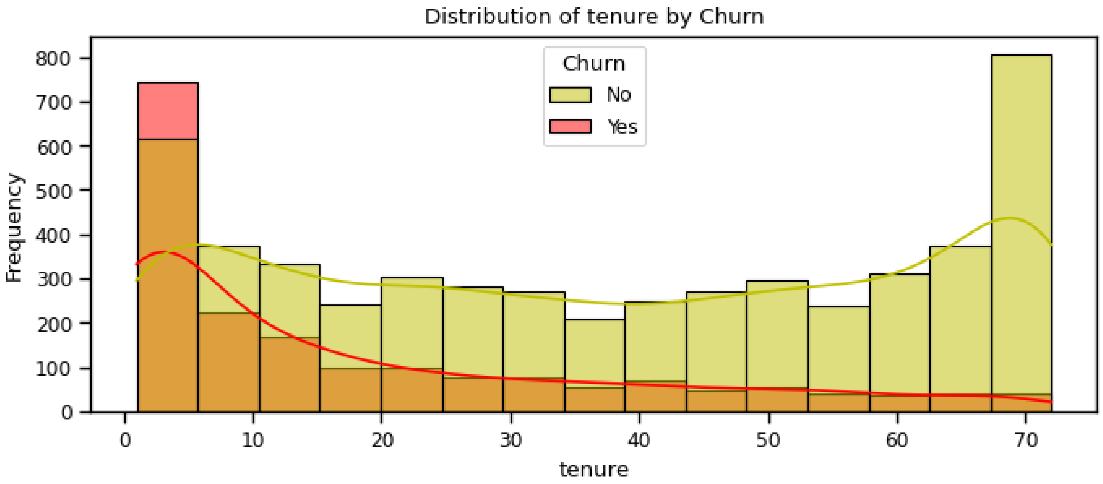
2.2 Distribution of various numric features by Churn

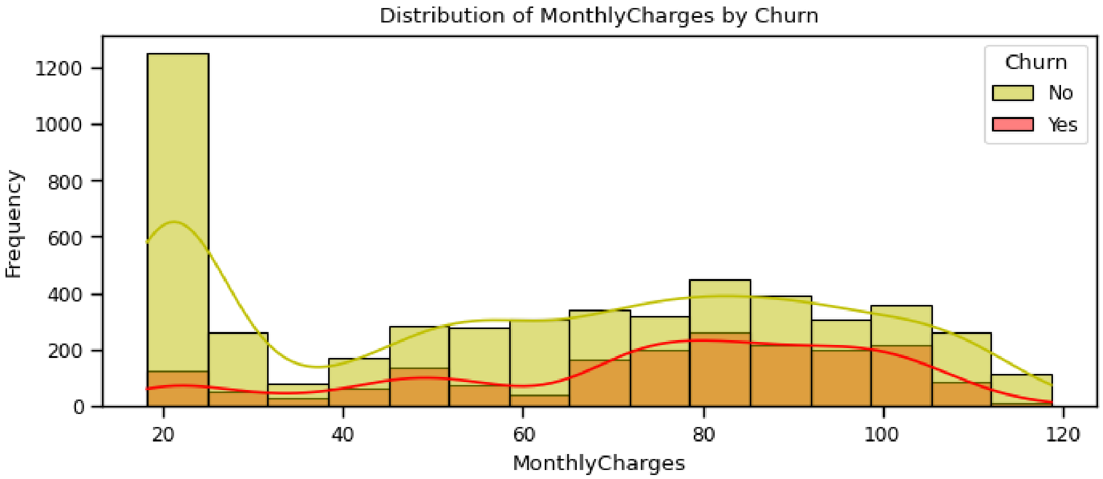
[15]:

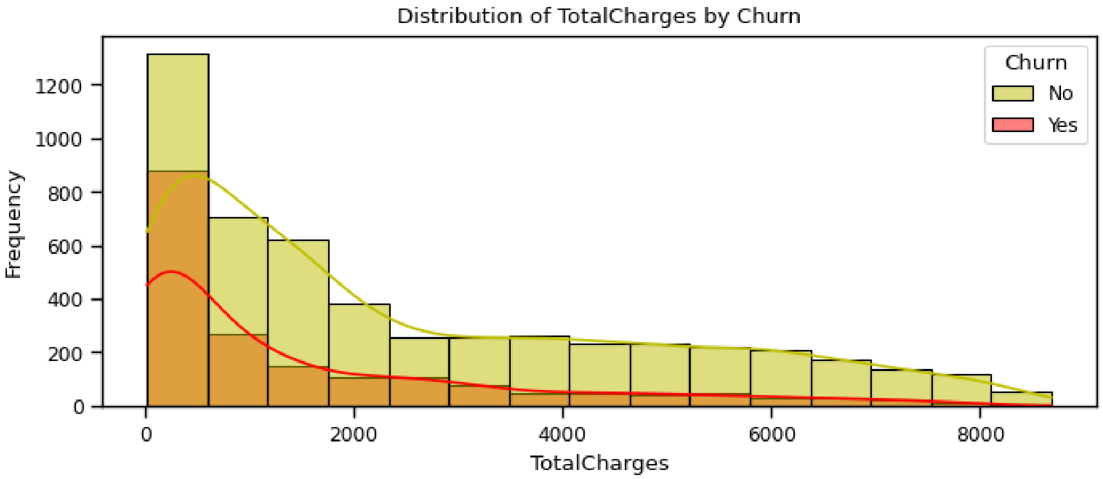
```
def distribution_byChurn(feature, frame):
    fig = plt.figure(figsize = (8, 3))
    sns.histplot(x= df[feature], hue= df['Churn'], bins=15, kde=True,␣
  ↪palette=['y', 'r'])
```

```
    plt.title(f"Distribution of {feature} by Churn")
    plt.xlabel(feature)
    plt.ylabel('Frequency')
    plt.show()
```

[16]:
```
sns.set_context("paper",font_scale=1)
num_cols = ["tenure", 'MonthlyCharges', 'TotalCharges']
for colmn in num_cols: distribution_byChurn(colmn, df)
```





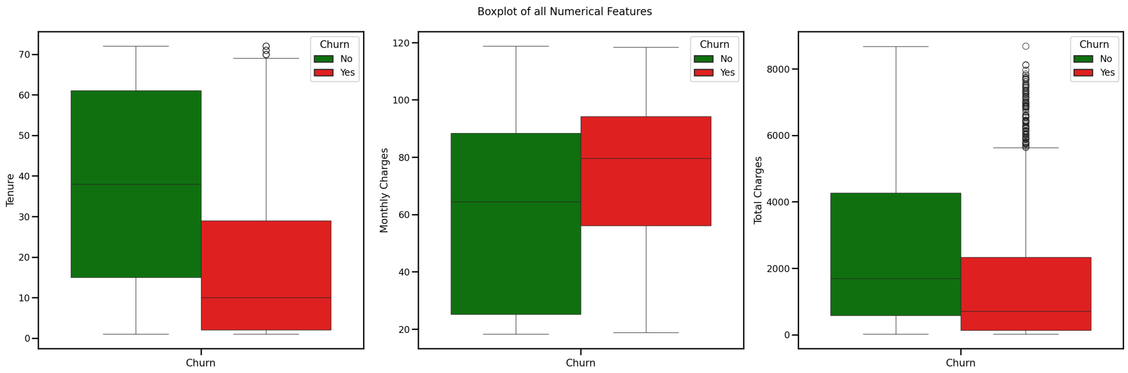


The more months the customer stays with the company, **the less likely that costumer will churn**. The total charges column is clearly skewed

2.3 Find Outlier for Various Features distinguised by Churn

[17]:

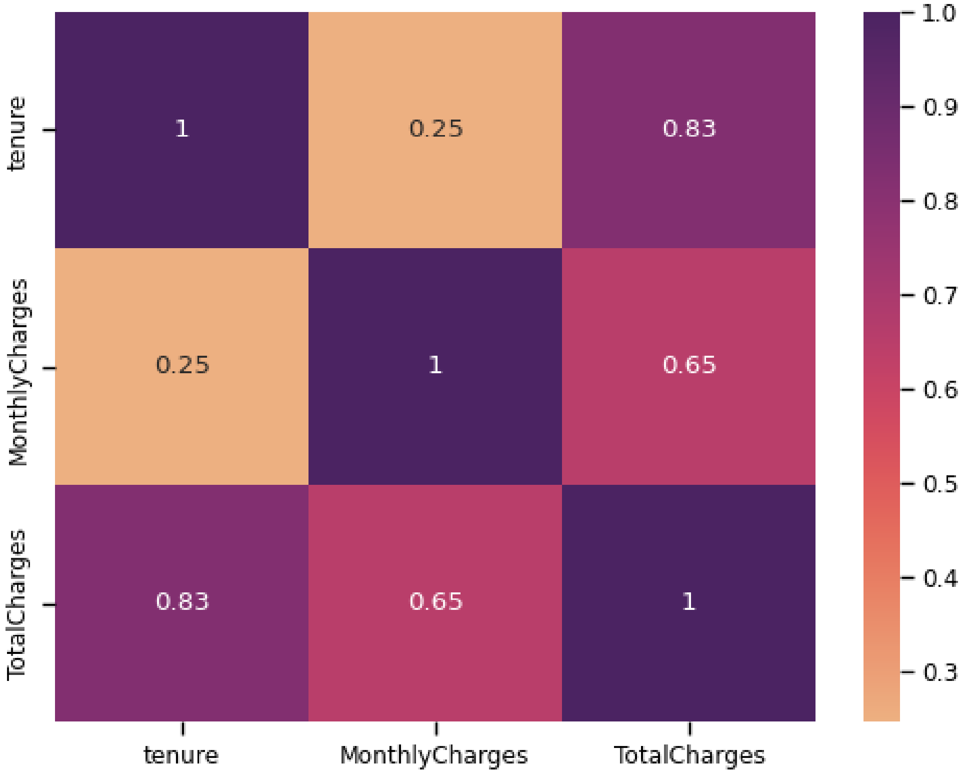
```
sns.set_context('poster', font_scale= 0.8)
fig, ax  = plt.subplots(1, 3, figsize=(30, 10))

plt.suptitle('Boxplot of all Numerical Features', fontsize = 20)

ax1 = sns.boxplot(y = df['tenure'], ax= ax[0], hue=df['Churn'], palette= ['g',␣
 ↪'r'])
ax1.set(xlabel= 'Churn', ylabel= 'Tenure')

ax2 = sns.boxplot(y = df['MonthlyCharges'], ax= ax[1], hue=df['Churn'],␣
 ↪palette= ['g', 'r'])
ax2.set(xlabel= 'Churn', ylabel= 'Monthly Charges')

ax3 = sns.boxplot(y = df['TotalCharges'], ax= ax[2], hue=df['Churn'], palette=␣
 ↪['g', 'r'])
ax3.set(xlabel= 'Churn', ylabel= 'Total Charges')

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



2.4 Correlation

```
[18]: df_corr = df[['tenure', 'MonthlyCharges', 'TotalCharges']]
```

```
[19]: sns.set_context("paper",font_scale=1)
      sns.heatmap(df_corr.corr(numeric_only=1), cmap = 'flare', annot = True)
      plt.show()
```



There is some correlation between tenure and total charges

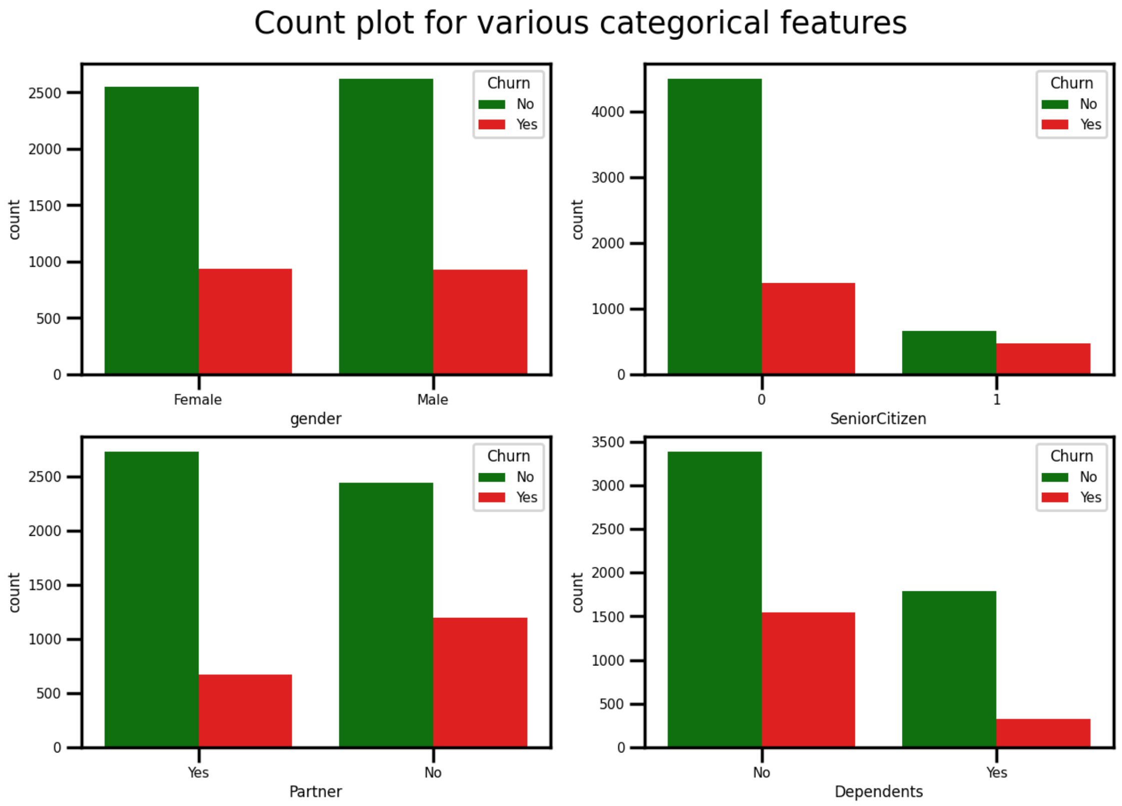
2.5 Count Plot for various categorical features

[20]:

```
def plot_various_categorial(frame, list_feature, hue_col_name, nrows, ncols,␣
 ↪figsize):
    fig, axs = plt.subplots(nrows, ncols, figsize = figsize)
    fig.suptitle('\nCount plot for various categorical features', fontsize = 25)

    for feature, ax in zip(list_feature, axs.ravel()):

        sns.countplot(x =feature, data= frame, ax= ax, hue= hue_col_name,␣
 ↪palette= ['g', 'r'])
        ax.set_xlabel(feature)

    plt.show()
```

[21]:

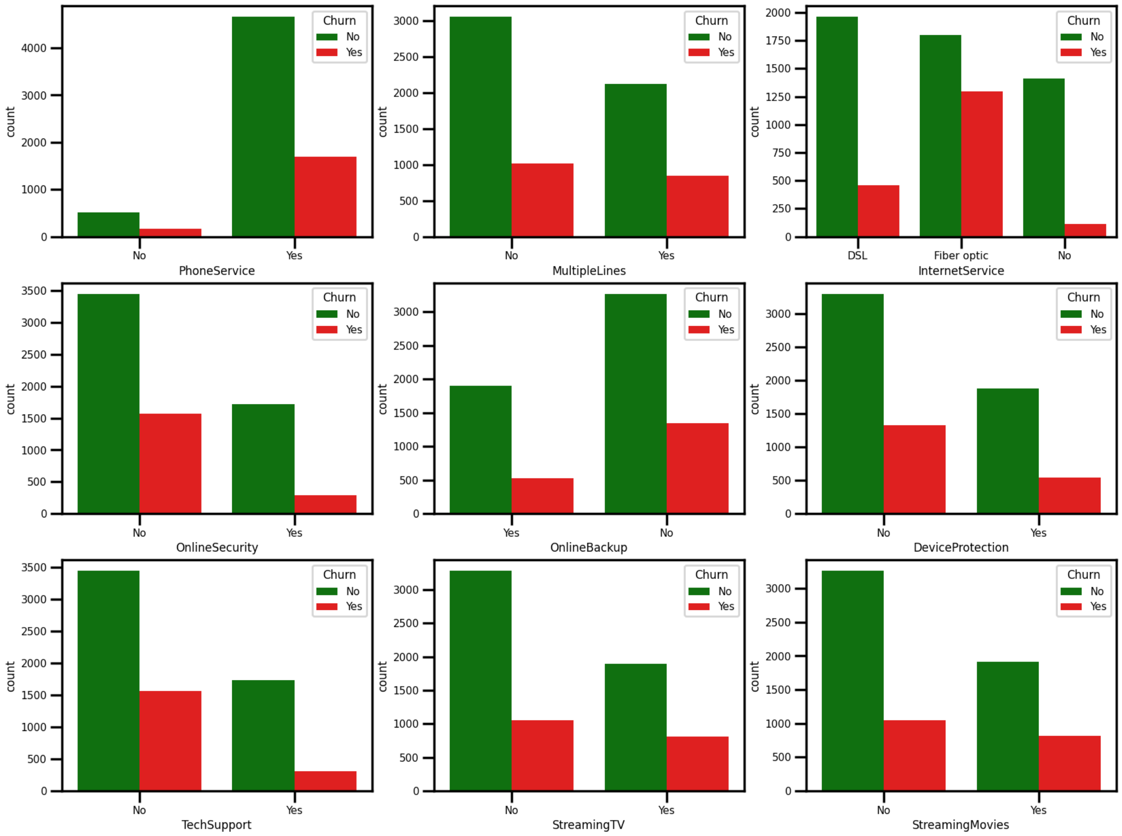
```
sns.set_context('poster', font_scale= 0.5)
list_feature = ['gender', 'SeniorCitizen', 'Partner', 'Dependents']
plot_various_categorial(df, list_feature, 'Churn', 2, 2, (15, 10))
```



Based on the `demographic information`, it is clear that Senior Citizens are much more likely to churn, also, customers not having a partner have higher chances of churning as compared to customers who do have a partner

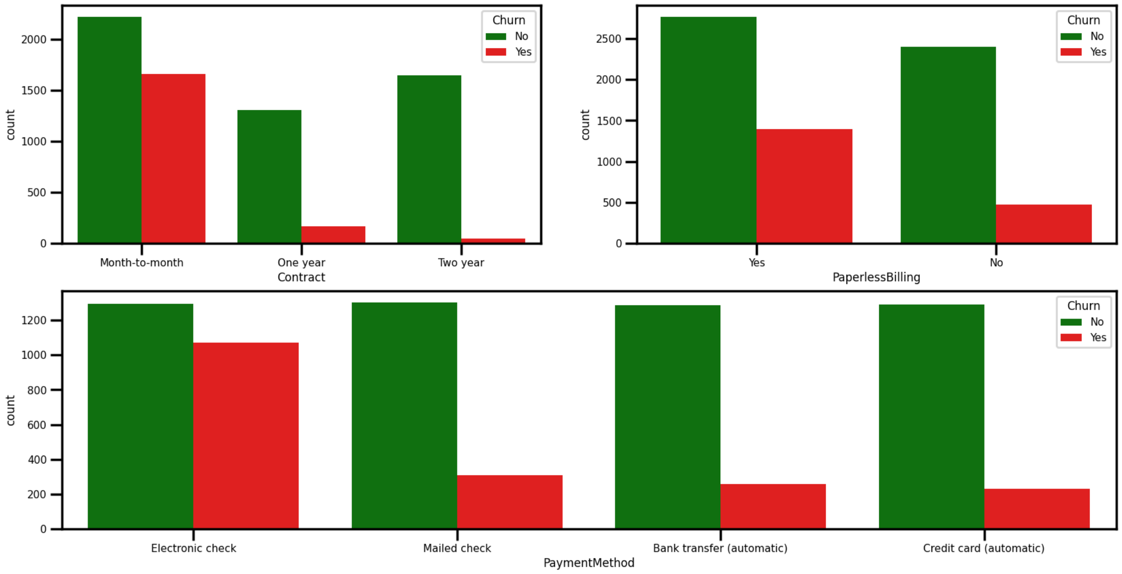
[22]:
```python
sns.set_context('poster', font_scale= 0.5)
list_feature = ['PhoneService', 'MultipleLines', 'InternetService',
                'OnlineSecurity', 'OnlineBackup', 'DeviceProtection',
                'TechSupport', 'StreamingTV', 'StreamingMovies']
plot_various_categorial(df, list_feature, 'Churn', 3, 3, (20, 15))
```

Count plot for various categorical features



Customers having **Fiber optic internet service are more likely to churn** compared to other existing categories

[23]:
```python
sns.set_context('poster', font_scale= 0.5)
# Create 2x2 sub plots
gs = gridspec.GridSpec(2, 2)
fig = plt.figure(figsize = (20, 10))

ax = plt.subplot(gs[0, 0])
ax = sns.countplot(x ='Contract', data= df, hue= 'Churn', palette= ['g', 'r'])
ax = plt.subplot(gs[0, 1])
ax = sns.countplot(x ='PaperlessBilling', data= df, hue= 'Churn', palette=␣
 ↪['g', 'r'])

ax = plt.subplot(gs[1, :])
ax = sns.countplot(x ='PaymentMethod', data= df, hue= 'Churn', palette= ['g',␣
 ↪'r'])
```



Based on the Account information, **customers having longer contracts are less likely to churn**. While, **customers who use Electronic Check as a payment method have higher chances of churning** then customers who use other methods