```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
sns.set_theme(color_codes=True)
```

```
df=pd.read_csv(r'/content/drive/MyDrive/Data sets/Medical Cost Personal Datasets/insurance.csv')
df.head()
```

	age	sex	bmi	children	smoker	region	charges
0	19	female	27.900	0	yes	southwest	16884.92400
1	18	male	33.770	1	no	southeast	1725.55230
2	28	male	33.000	3	no	southeast	4449.46200
3	33	male	22.705	0	no	northwest	21984.47061
4	32	male	28.880	0	no	northwest	3866.85520

Data Preprocessing Part

```
#Checking object data type with uninque value count
df.select_dtypes(include='object').nunique()
```

```
sex       2
smoker    2
region    4
dtype: int64
```

```
#Checking intger data type with uninque value count
df.select_dtypes(include=int).nunique()
```

```
age         47
children     6
dtype: int64
```

```
#Checking in data frame data type null value count and all columns
df.info()

     <class 'pandas.core.frame.DataFrame'>
     RangeIndex: 1338 entries, 0 to 1337
     Data columns (total 7 columns):
      #   Column    Non-Null Count  Dtype  
     ---  ------    --------------  -----  
      0   age       1338 non-null   int64  
      1   sex       1338 non-null   object 
      2   bmi       1338 non-null   float64
      3   children  1338 non-null   int64  
      4   smoker    1338 non-null   object 
      5   region    1338 non-null   object 
      6   charges   1338 non-null   float64
     dtypes: float64(2), int64(2), object(3)
     memory usage: 73.3+ KB
```

```
#Deleting rows form data frame if null value available in any row
df.dropna(inplace=True)
```

```
#Data frame information in rows and columns
df.shape

     (1338, 7)
```

```
#checking null values count in columns
df.isna().sum()

     age         0
     sex         0
     bmi         0
     children    0
     smoker      0
     region      0
     charges     0
     dtype: int64
```

```
# checking statical information
df.describe()
```

	age	bmi	children	charges
count	1338.000000	1338.000000	1338.000000	1338.000000
mean	39.207025	30.663397	1.094918	13270.422265
std	14.049960	6.098187	1.205493	12110.011237
min	18.000000	15.960000	0.000000	1121.873900
25%	27.000000	26.296250	0.000000	4740.287150
50%	39.000000	30.400000	1.000000	9382.033000
75%	51.000000	34.693750	2.000000	16639.912515

Removing Outlier using percentile

```
#from scipy import stats
```

```
#quartile
q1,q3=np.percentile(df['bmi'],q=(25,75))
```

```
iqr=q3-q1
lx=q1-1.5*iqr
ux=q3+1.5*iqr
```

```
df=df.loc[(df['bmi']>=lx) & (df['bmi']<=ux)]
```

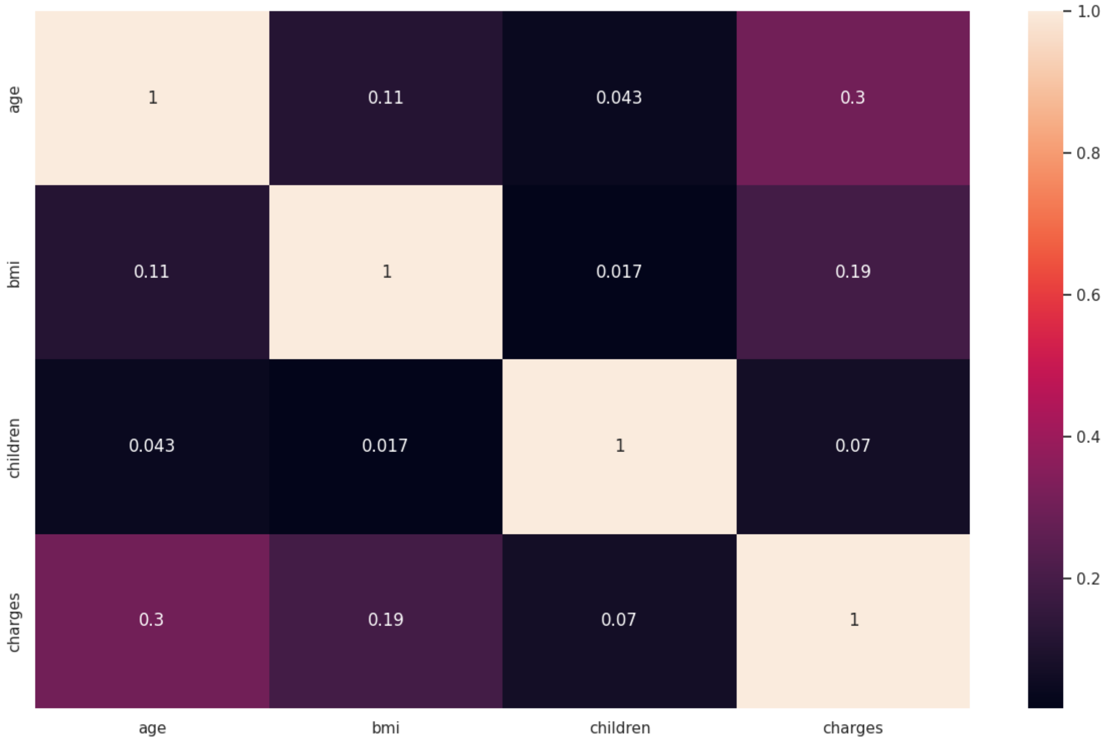
```
df.shape
```

```
     (1329, 7)
```

Correlation Heatmap

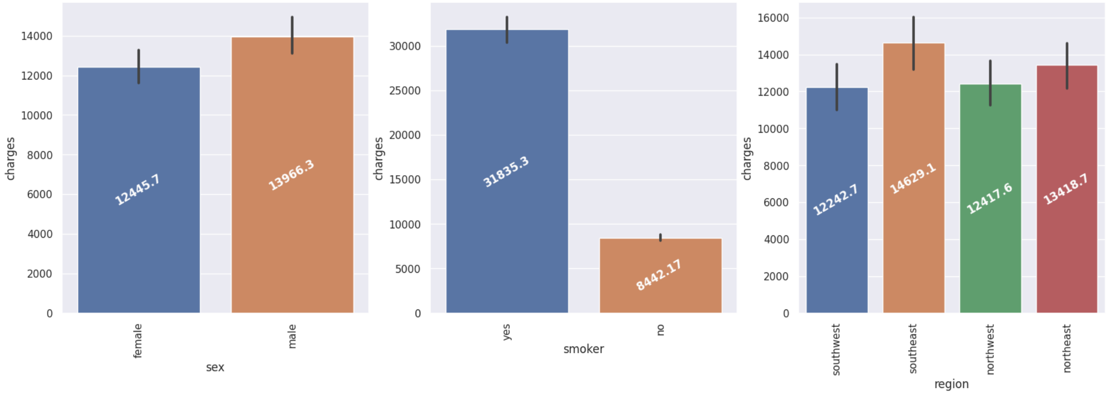
```
#Checking correlation by heatmap
plt.figure(figsize=(15, 9))
sns.heatmap(df.corr(),fmt='.2g',annot=True)
```

```
<ipython-input-15-3145246314e8>:3: FutureWarning: The default value of numeric_only in
  sns.heatmap(df.corr(),fmt='.2g',annot=True)
<Axes: >
```

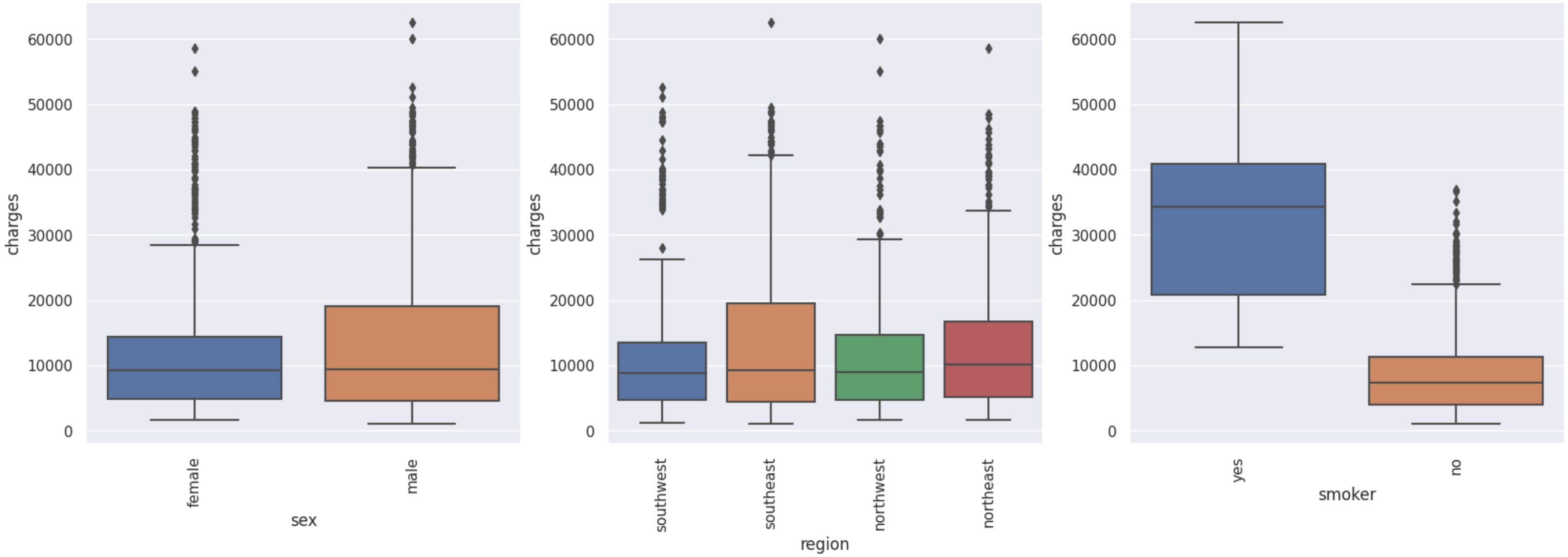


Exploratory data Analysis

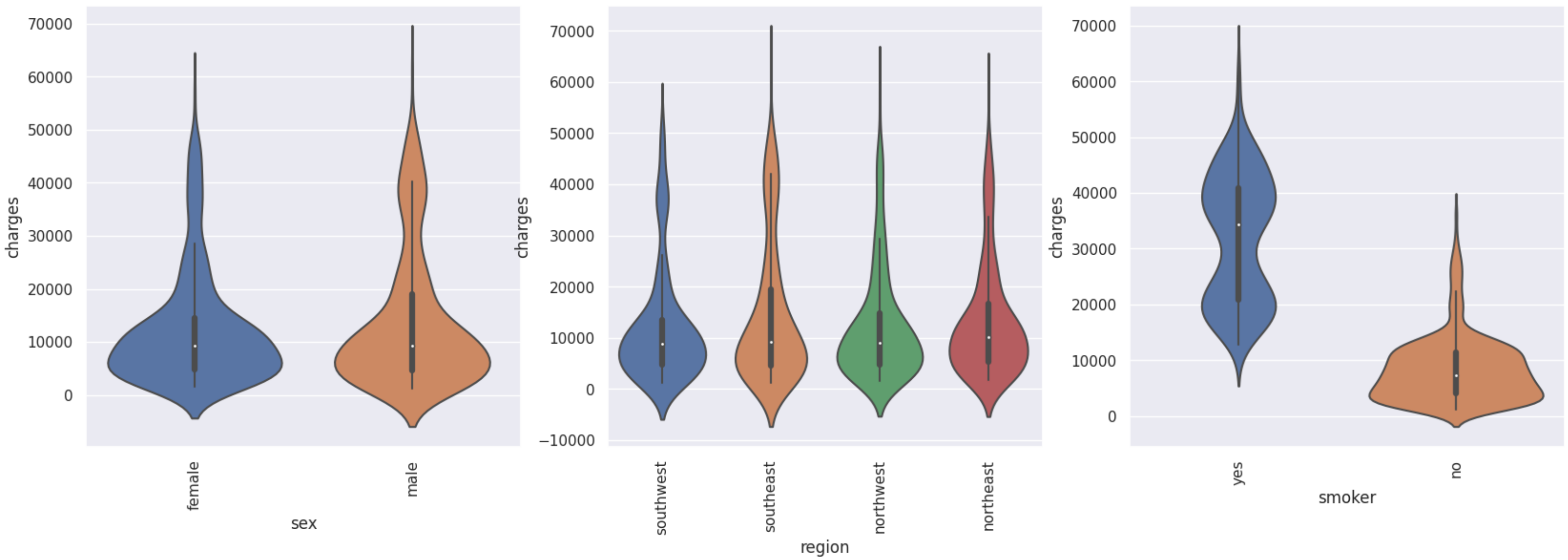
```
#list of categorical columns
cat_var=['sex', 'smoker', 'region']
#Create figure with subplot
fig, axs=plt.subplots(nrows=1,ncols=3, figsize=(20,6))
axs=axs.flatten()
#Create bar plot for each categorical column
for i,var in enumerate(cat_var):
  ax=sns.barplot(x=var,y='charges',data=df,ax=axs[i])
  axs[i].set_xticklabels(axs[i].get_xticklabels(),rotation=90)
  for container in ax.containers:
        container.datavalues
        ax.bar_label(container,color='white',weight='bold',rotation=30,label_type='center')
```



```
#list of categorical columns
cat_var=['sex', 'region', 'smoker']
#Create figure with subplot
fig, axs=plt.subplots(nrows=1,ncols=3, figsize=(20,6))
axs=axs.flatten()
#Create boxplot for each categorical column
for i,var in enumerate(cat_var):
  ax=sns.boxplot(x=var,y='charges',data=df,ax=axs[i])
  axs[i].set_xticklabels(axs[i].get_xticklabels(),rotation=90)
```

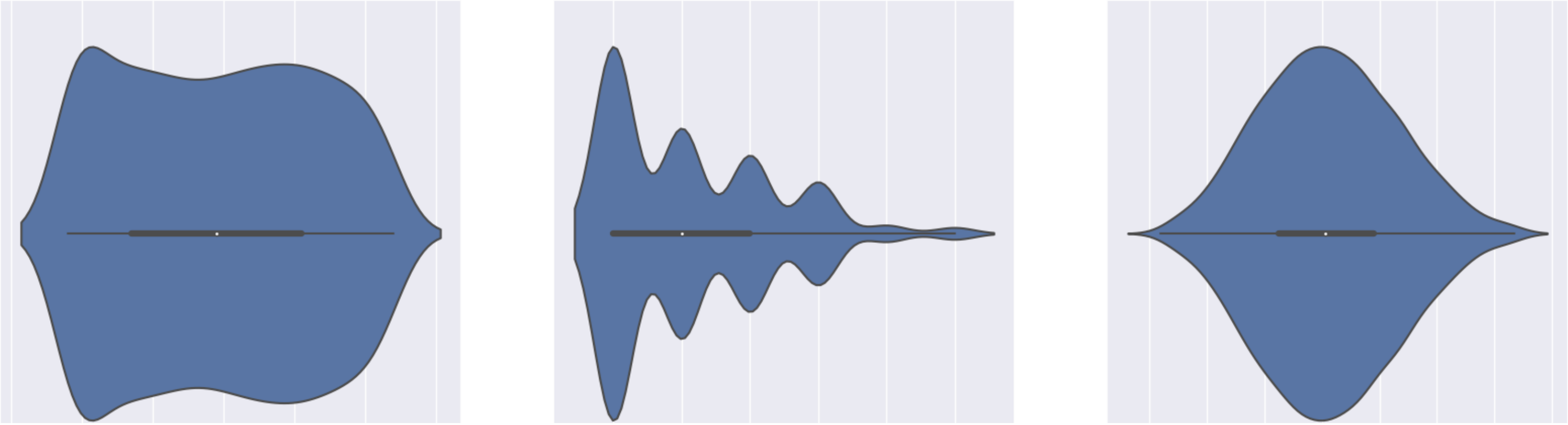


```
#list of categorical columns
cat_var=['sex', 'region', 'smoker']
#Create figure with subplot
fig, axs=plt.subplots(nrows=1,ncols=3, figsize=(20,6))
axs=axs.flatten()
#Create violinplot for each categorical column
for i,var in enumerate(cat_var):
  ax=sns.violinplot(x=var,y='charges',data=df,ax=axs[i])
  axs[i].set_xticklabels(axs[i].get_xticklabels(),rotation=90)
```



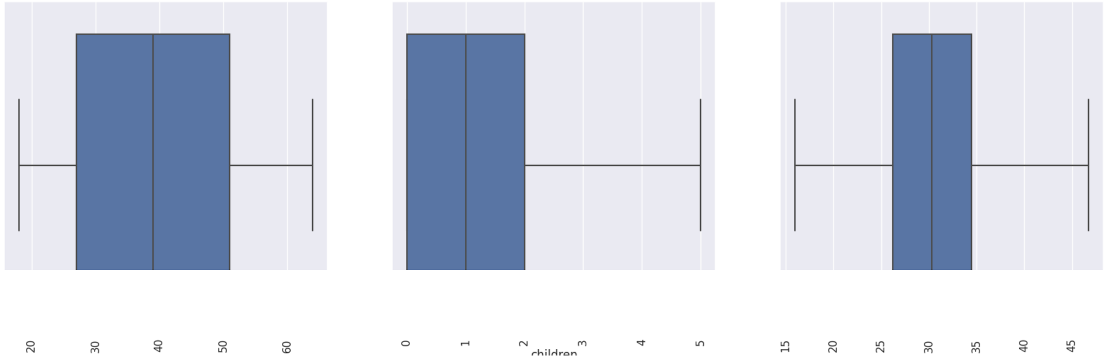
```
#list of categorical columns
cat_var=['age', 'children', 'bmi']
#Create figure with subplot
fig, axs=plt.subplots(nrows=1,ncols=3, figsize=(20,6))
axs=axs.flatten()
#Create violinplot for each categorical column
for i,var in enumerate(cat_var):
  ax=sns.violinplot(x=var,data=df,ax=axs[i])
  axs[i].set_xticklabels(axs[i].get_xticklabels(),rotation=90)
```

```
<ipython-input-19-6f54336a923b>:9: UserWarning: FixedFormatter should only be used together with FixedLocator
  axs[i].set_xticklabels(axs[i].get_xticklabels(),rotation=90)
<ipython-input-19-6f54336a923b>:9: UserWarning: FixedFormatter should only be used together with FixedLocator
  axs[i].set_xticklabels(axs[i].get_xticklabels(),rotation=90)
<ipython-input-19-6f54336a923b>:9: UserWarning: FixedFormatter should only be used together with FixedLocator
  axs[i].set_xticklabels(axs[i].get_xticklabels(),rotation=90)
```



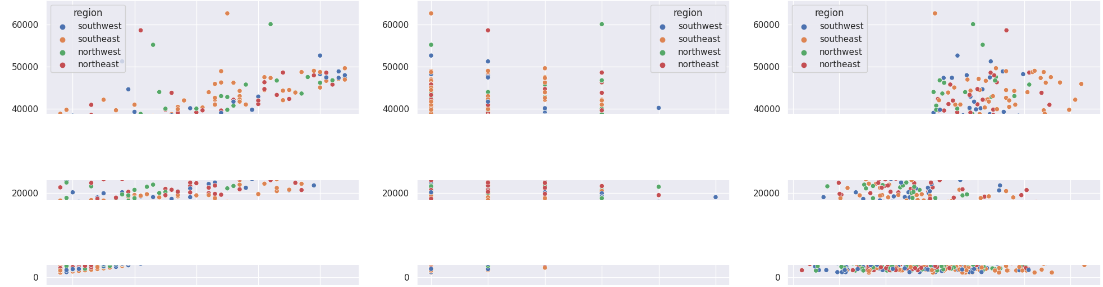
```
#list of categorical columns
cat_var=['age', 'children', 'bmi']
#Create figure with subplot
fig, axs=plt.subplots(nrows=1,ncols=3, figsize=(20,6))
axs=axs.flatten()
#Create boxplot for each categorical column
for i,var in enumerate(cat_var):
  ax=sns.boxplot(x=var,data=df,ax=axs[i])
  axs[i].set_xticklabels(axs[i].get_xticklabels(),rotation=90)
```

```
<ipython-input-20-4192c10c3cab>:9: UserWarning: FixedFormatter should only be used tog
  axs[i].set_xticklabels(axs[i].get_xticklabels(),rotation=90)
<ipython-input-20-4192c10c3cab>:9: UserWarning: FixedFormatter should only be used tog
  axs[i].set_xticklabels(axs[i].get_xticklabels(),rotation=90)
<ipython-input-20-4192c10c3cab>:9: UserWarning: FixedFormatter should only be used tog
  axs[i].set_xticklabels(axs[i].get_xticklabels(),rotation=90)
```



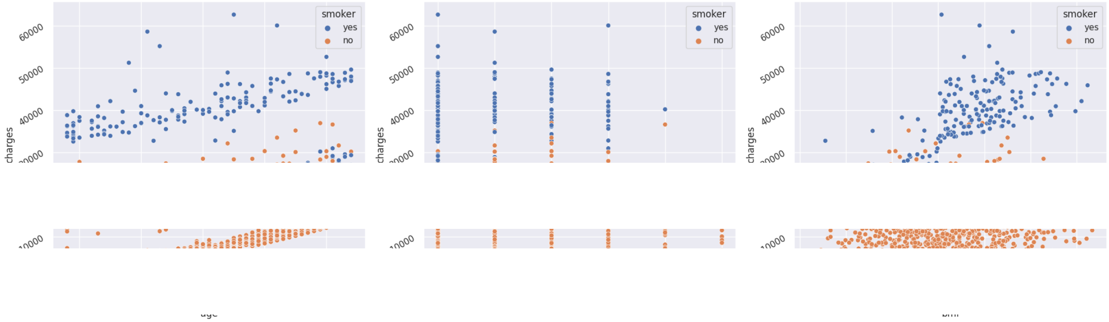
```
#list of categorical columns
cat_var=['age', 'children', 'bmi']
#Create figure with subplot
fig, axs=plt.subplots(nrows=1,ncols=3, figsize=(20,6))
axs=axs.flatten()
#Create scatterplot for each categorical column and region wise
for i,var in enumerate(cat_var):
  ax=sns.scatterplot(x=var,y='charges',hue='region',data=df,ax=axs[i])
  axs[i].set_xticklabels(axs[i].get_xticklabels(),rotation=90)
fig.tight_layout()
```

```
<ipython-input-21-85c2648b42bd>:9: UserWarning: FixedFormatter should only be used tog
  axs[i].set_xticklabels(axs[i].get_xticklabels(),rotation=90)
<ipython-input-21-85c2648b42bd>:9: UserWarning: FixedFormatter should only be used tog
  axs[i].set_xticklabels(axs[i].get_xticklabels(),rotation=90)
<ipython-input-21-85c2648b42bd>:9: UserWarning: FixedFormatter should only be used tog
  axs[i].set_xticklabels(axs[i].get_xticklabels(),rotation=90)
```



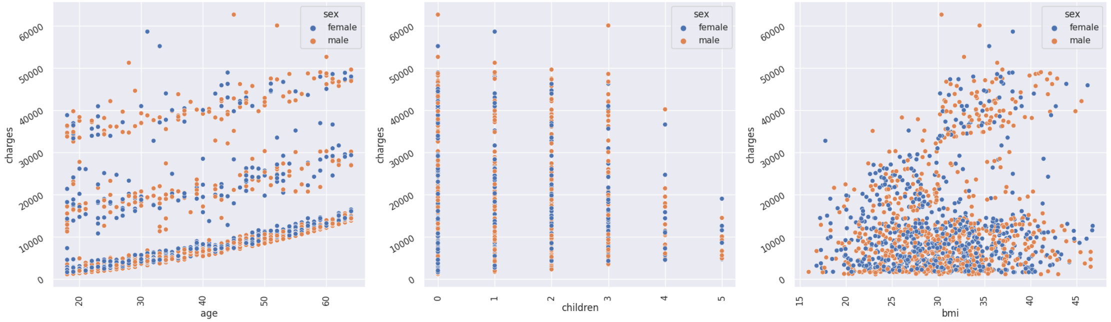
```
#list of categorical columns
cat_var=['age', 'children', 'bmi']
#Create figure with subplot
fig, axs=plt.subplots(nrows=1,ncols=3, figsize=(20,6))
axs=axs.flatten()
#Create boxplot for each categorical column snd smoker wise
for i,var in enumerate(cat_var):
  ax=sns.scatterplot(x=var,y='charges',hue='smoker',data=df,ax=axs[i])
  axs[i].set_yticklabels(axs[i].get_yticklabels(),rotation=30)
  axs[i].set_xticklabels(axs[i].get_xticklabels(),rotation=90)
fig.tight_layout()
```

```
<ipython-input-22-f003f089cfff>:9: UserWarning: FixedFormatter should only be used toge
  axs[i].set_yticklabels(axs[i].get_yticklabels(),rotation=30)
<ipython-input-22-f003f089cfff>:10: UserWarning: FixedFormatter should only be used tog
  axs[i].set_xticklabels(axs[i].get_xticklabels(),rotation=90)
<ipython-input-22-f003f089cfff>:9: UserWarning: FixedFormatter should only be used toge
  axs[i].set_yticklabels(axs[i].get_yticklabels(),rotation=30)
<ipython-input-22-f003f089cfff>:10: UserWarning: FixedFormatter should only be used tog
  axs[i].set_xticklabels(axs[i].get_xticklabels(),rotation=90)
<ipython-input-22-f003f089cfff>:9: UserWarning: FixedFormatter should only be used toge
  axs[i].set_yticklabels(axs[i].get_yticklabels(),rotation=30)
<ipython-input-22-f003f089cfff>:10: UserWarning: FixedFormatter should only be used tog
  axs[i].set_xticklabels(axs[i].get_xticklabels(),rotation=90)
```



```
#list of categorical columns
cat_var=['age', 'children', 'bmi']
#Create figure with subplot
fig, axs=plt.subplots(nrows=1,ncols=3, figsize=(20,6))
axs=axs.flatten()
#Create boxplot for each categorical column and sex wise
for i,var in enumerate(cat_var):
  ax=sns.scatterplot(x=var,y='charges',hue='sex',data=df,ax=axs[i])
  axs[i].set_yticklabels(axs[i].get_yticklabels(),rotation=30)
  axs[i].set_xticklabels(axs[i].get_xticklabels(),rotation=90)
fig.tight_layout()
```

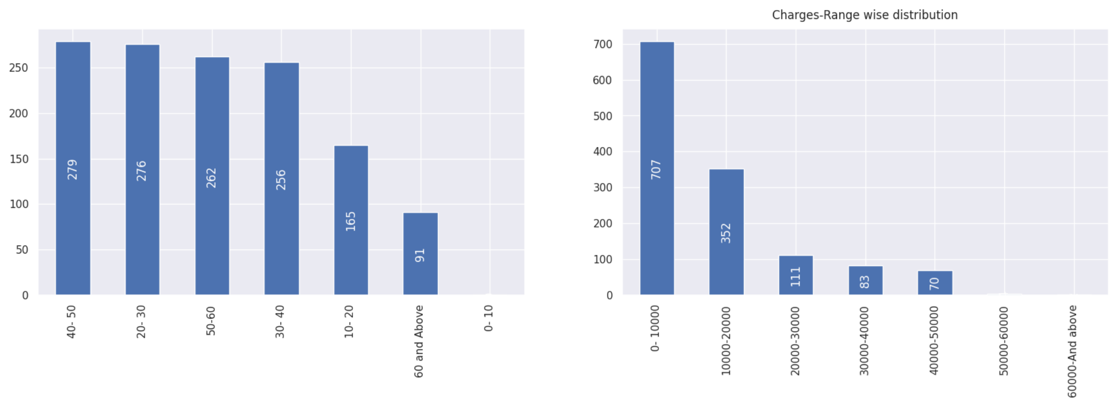
```
<ipython-input-23-7812beb2fa04>:9: UserWarning: FixedFormatter should only be used toge
  axs[i].set_yticklabels(axs[i].get_yticklabels(),rotation=30)
<ipython-input-23-7812beb2fa04>:10: UserWarning: FixedFormatter should only be used tog
  axs[i].set_xticklabels(axs[i].get_xticklabels(),rotation=90)
<ipython-input-23-7812beb2fa04>:9: UserWarning: FixedFormatter should only be used toge
  axs[i].set_yticklabels(axs[i].get_yticklabels(),rotation=30)
<ipython-input-23-7812beb2fa04>:10: UserWarning: FixedFormatter should only be used tog
  axs[i].set_xticklabels(axs[i].get_xticklabels(),rotation=90)
<ipython-input-23-7812beb2fa04>:9: UserWarning: FixedFormatter should only be used toge
  axs[i].set_yticklabels(axs[i].get_yticklabels(),rotation=30)
<ipython-input-23-7812beb2fa04>:10: UserWarning: FixedFormatter should only be used tog
  axs[i].set_xticklabels(axs[i].get_xticklabels(),rotation=90)
```



```
bins_age=np.arange(0,df['age'].max()+10,10)
slot_age=['0- 10','10- 20','20- 30','30- 40','40- 50','50-60','60 and Above']
df['Age_Range']=pd.cut(df['age'],bins=bins_age,labels=slot_age)
```

```
bins_charges=np.arange(0,round(df['charges'].max())+10000,10000)
slot_charges=['0- 10000','10000-20000','20000-30000','30000-40000','40000-50000','50000-60000','60000-And above']
df['Charges-Range']=pd.cut(df['charges'],bins=bins_charges,labels=slot_charges)
```

```
cat_var_b=['Age_Range', 'Charges-Range']
fig,axs=plt.subplots(nrows=1,ncols=2,figsize=(20,5))
axs=axs.flatten()
for i,var in enumerate(cat_var_b):
  plt.title(f"{var} wise distribution",loc='center',pad=10)
  ax=df[f'{var}'].value_counts().plot(kind='bar',ax=axs[i])
  for container in ax.containers:
    container.datavalues
    ax.bar_label(container,color='white',rotation=90,label_type='center')
```



```
#list of categorical columns
cat_var=['age', 'children', 'bmi']
#Create figure with subplot
fig, axs=plt.subplots(nrows=1,ncols=3, figsize=(20,6))
axs=axs.flatten()
#Create boxplot for each categorical column snd smoker wise
for i,var in enumerate(cat_var):
  ax=sns.scatterplot(y=var,x='Charges-Range',hue='smoker',data=df,ax=axs[i])
  axs[i].set_yticklabels(axs[i].get_yticklabels(),rotation=30)
  axs[i].set_xticklabels(axs[i].get_xticklabels(),rotation=90)
fig.tight_layout()
```

```
<ipython-input-27-5469d2e9957d>:9: UserWarning: FixedFormatter should only be used tog
  axs[i].set_yticklabels(axs[i].get_yticklabels(),rotation=30)
<ipython-input-27-5469d2e9957d>:10: UserWarning: FixedFormatter should only be used to
  axs[i].set_xticklabels(axs[i].get_xticklabels(),rotation=90)
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  axs[i].set_yticklabels(axs[i].get_yticklabels(),rotation=30)
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<ipython-input-27-5469d2e9957d>:9: UserWarning: FixedFormatter should only be used tog
  axs[i].set_yticklabels(axs[i].get_yticklabels(),rotation=30)
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  axs[i].set_xticklabels(axs[i].get_xticklabels(),rotation=90)
```

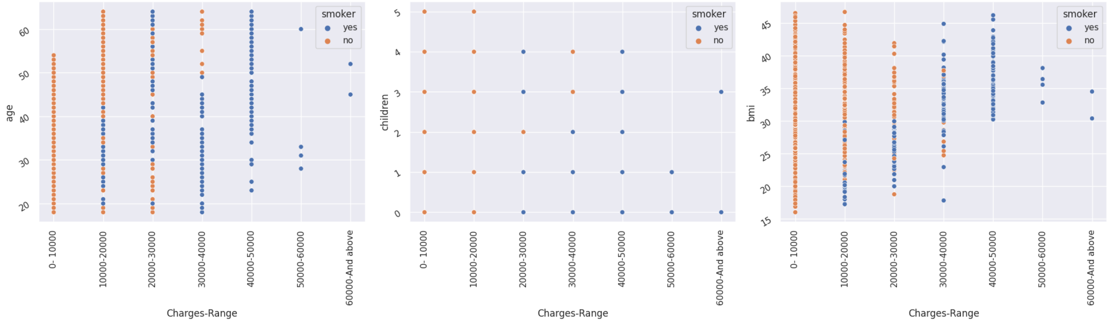

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