Importing the Dependncies

Data Collection & Analysis

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn import metrics
```

```
import pandas as pd
# loading the data from csv file to a pandas DataFrame
insurance_dataset = pd.read_csv("/content/insurance.csv")
```

```
# first 5 rows of the dataframe
insurance_dataset.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

```
# numbers of rows and columns
insurance_dataset.shape
```

```
(1338, 7)
```

```
# getting some information about the datset
insurance_dataset.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
```

Categorical Features:

- sex
- Smoker
- Region

```
# checking for missing values
insurance_dataset.isnull().sum()
```

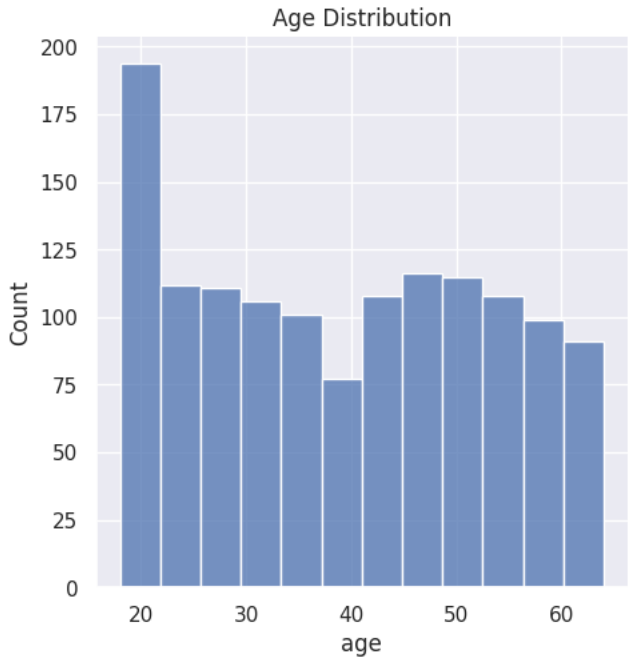
```
age         0
sex         0
bmi         0
children    0
smoker      0
region      0
charges     0
dtype: int64
```

```
# statistical Measures of the dataset
insurance_dataset.describe()
```

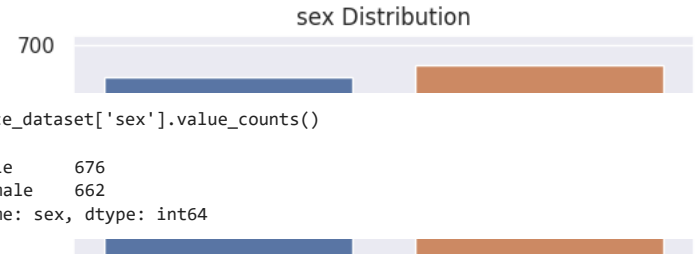
	age	bmi	children	charges
count	1338.000000	1338.000000	1338.000000	1338.000000
mean	39.207025	30.663397	1.094918	13270.422265
std	14.049960	6.098187	1.205493	12110.011237
min	18.000000	15.960000	0.000000	1121.873900
25%	27.000000	26.296250	0.000000	4740.287150
50%	39.000000	30.400000	1.000000	9382.033000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

```
# distribution of age value
sns.set()
plt.figure(figsize=(6,6))
sns.displot(insurance_dataset['age'])
plt.title('Age Distribution')
plt.show()
```

```
<Figure size 600x600 with 0 Axes>
```




```
# Gender column
plt.figure(figsize=(6,6))
sns.countplot(x='sex', data=insurance_dataset)
plt.title('sex Distribution')
plt.show()
```



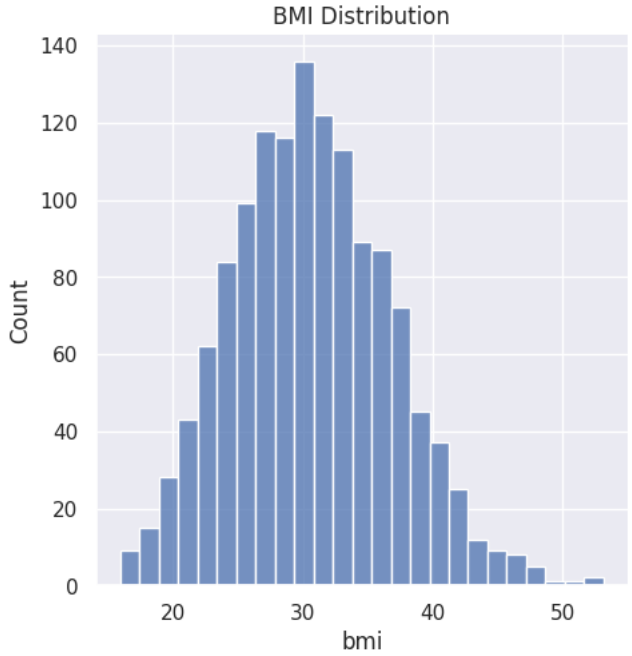

```
insurance_dataset['sex'].value_counts()
```

```
male      676
female    662
Name: sex, dtype: int64
```



```
# bmi distribution
plt.figure(figsize=(6,6))
sns.displot(insurance_dataset['bmi'])
plt.title('BMI Distribution')
plt.show()
```

```
<Figure size 600x600 with 0 Axes>
```




```
# children column
plt.figure(figsize=(6,6))
sns.countplot(x='children', data=insurance_dataset)
plt.title('children')
plt.show
```

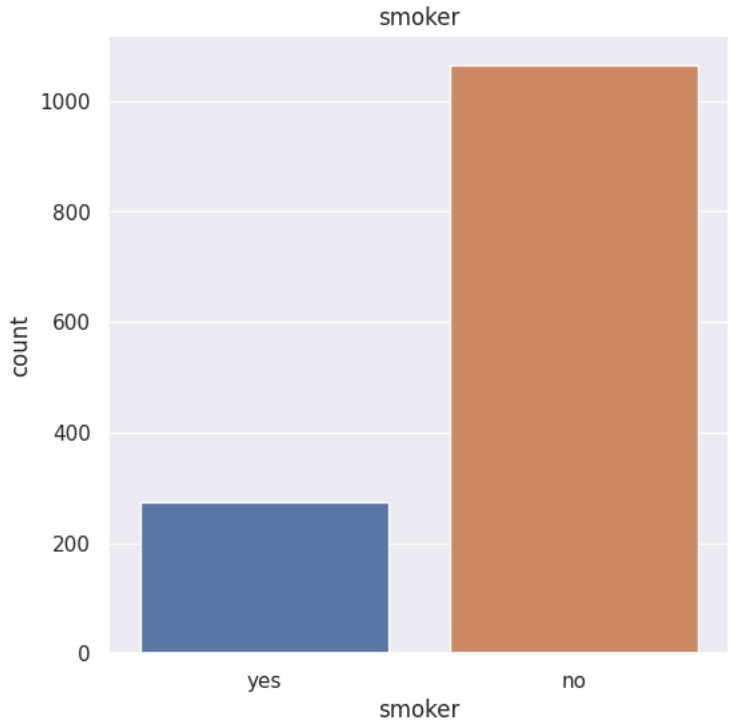
```
<function matplotlib.pyplot.show(close=None, block=None)>
```

```
insurance_dataset['children'].value_counts()
```

```
0    574
1    324
2    240
3    157
4     25
5     18
Name: children, dtype: int64
```

```
# smoker column
plt.figure(figsize=(6,6))
sns.countplot(x='smoker', data=insurance_dataset)
plt.title('smoker')
plt.show
```

```
<function matplotlib.pyplot.show(close=None, block=None)>
```

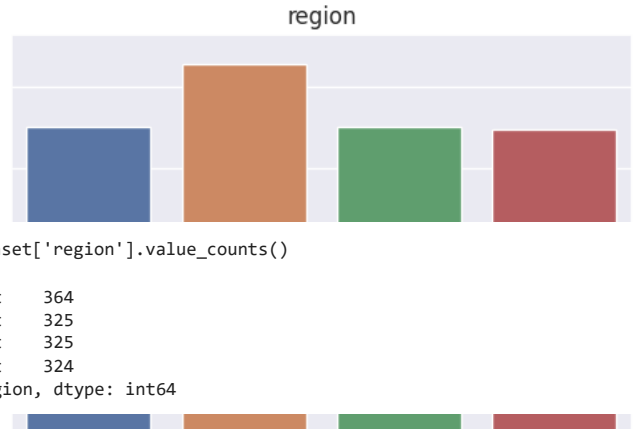



```
insurance_dataset['smoker'].value_counts()
```

```
no     1064
yes     274
Name: smoker, dtype: int64
```

```
# region column
plt.figure(figsize=(6,6))
sns.countplot(x='region', data=insurance_dataset)
plt.title('region')
plt.show
```

```
<function matplotlib.pyplot.show(close=None, block=None)>
```

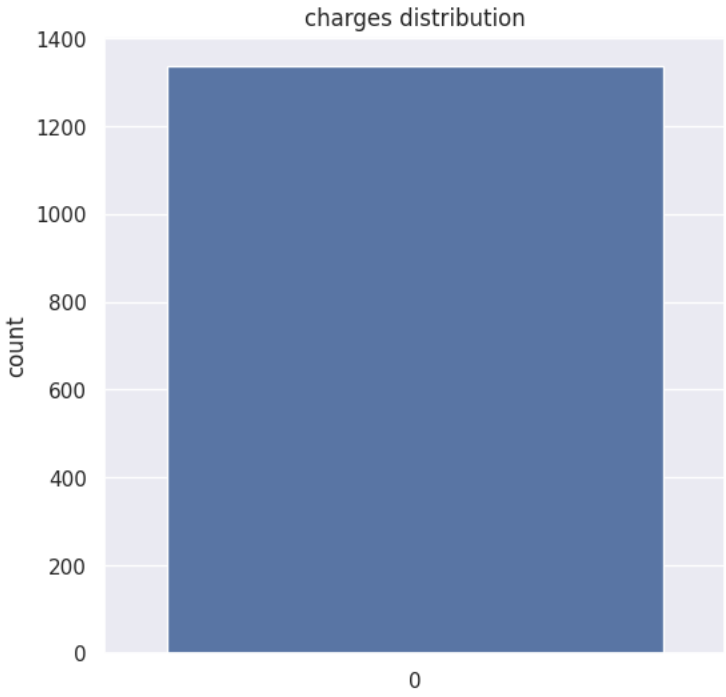



```
insurance_dataset['region'].value_counts()
```

```
southeast    364
southwest    325
northwest    325
northeast    324
Name: region, dtype: int64
```

```
# distribution of charges value
plt.figure(figsize=(6,6))
sns.countplot(insurance_dataset['charges'])
plt.title('charges distribution')
plt.show
```

```
<function matplotlib.pyplot.show(close=None, block=None)>
```




```
# encoding sex column
insurance_dataset.replace({'sex':{'male':0, 'female':1}},inplace=True)

# encoding 'smoker' column
insurance_dataset.replace({'smoker':{'yes':0, 'no':1}},inplace=True)

# encoding 'region' column
insurance_dataset.replace({'region':{'southwest':0, 'southeast':1, 'northeast':2, 'northwest':3}},inplace=True)
```

	age	sex	bmi	children	smoker	region	charges
0	19	1	27.900	0	0	0	16884.92400
1	18	0	33.770	1	1	1	1725.55230
3	33	0	22.705	0	1	3	21984.47061

splitting the Features and Target

```
X = insurance_dataset.drop(columns='charges', axis=1)
Y = insurance_dataset['charges']
```

```
print(X)
```

```
      age  sex     bmi  children  smoker  region
0      19    1  27.900         0       0       0
1      18    0  33.770         1       1       1
2      28    0  33.000         3       1       1
3      33    0  22.705         0       1       3
4      32    0  28.880         0       1       3
...   ...  ...     ...       ...     ...     ...
1333   50    0  30.970         3       1       3
1334   18    1  31.920         0       1       2
1335   18    1  36.850         0       1       1
1336   21    1  25.800         0       1       0
1337   61    1  29.070         0       0       3

[1338 rows x 6 columns]
```

```
print(Y)
```

```
0       16884.92400
1        1725.55230
2        4449.46200
3       21984.47061
4        3866.85520
           ...
1333    10600.54830
1334     2205.98080
1335     1629.83350
1336     2007.94500
1337    29141.36030
Name: charges, Length: 1338, dtype: float64
```

Splitting the data into Training data & Testing Data

```
X_train, X_test, Y_train, Y_test = train_test_split(X,Y, test_size=0.2, random_state=2)
```

```
print(X.shape, X_train.shape, X_test.shape)
```

```
(1338, 6) (1070, 6) (268, 6)
```

Model Training

Linear Regression

```
# loading the Linear Regression model
regressor = LinearRegression()
```

```
regressor.fit(X_train, Y_train)
```

```
LinearRegression()
```

Model Evluation

```
# prediction of training data
training_data_prediction =regressor.predict(X_train)
```

```
# R squared value
r2_train = metrics.r2_score(Y_train, training_data_prediction)
print('R squared vale :', r2_train)
```

```
R squared vale : 0.7516346664929344
```

```
# prediction on test data
test_data_prediction =regressor.predict(X_test)


# R squared value
r2_test = metrics.r2_score(Y_test, test_data_prediction)
print('R squared value :', r2_test)
```

```
R squared value : 0.744103253976007
```

Building a Predictive System

```
input_data = (31,1,25.74,0,1,0)

# changing input_data to a numpy array
input_data_as_numpy_array = np.asarray(input_data)

# reshape the array
input_data_reshape = input_data_as_numpy_array.reshape(1,-1)

prediction = regressor.predict(input_data_reshape)
print(prediction)

print('The insurance cost is USD', prediction[0])
```

```
[3713.09435422]
The insurance cost is USD 3713.0943542195328
/usr/local/lib/python3.10/dist-packages/sklearn/base.py:439: UserWarning: X does not have valid feature names, but LinearRegression
  warnings.warn(
```