Starting of the project,Importing the required data analysis tasks in python which is used for the further project

Build machine Learning model(classification) for the insurance dataset listed below:

1) Do data ingestion (convert dataset into dataframe)

2) Do some pre-processing(if required), follow the steps for ML model creation.

3) Build multiple ML models(use different classification algorithms) and compare the accuracies.

4) Evaluate the model and write down the summarization of the process.

Importing the Dependencies

```
 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
```

Data Collection & Analysis

```
#Load the data from csv file to panda data frame
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

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

```
(1338, 7)
```

```
#need some info about the dataset
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
```

DATA ANALYSIS

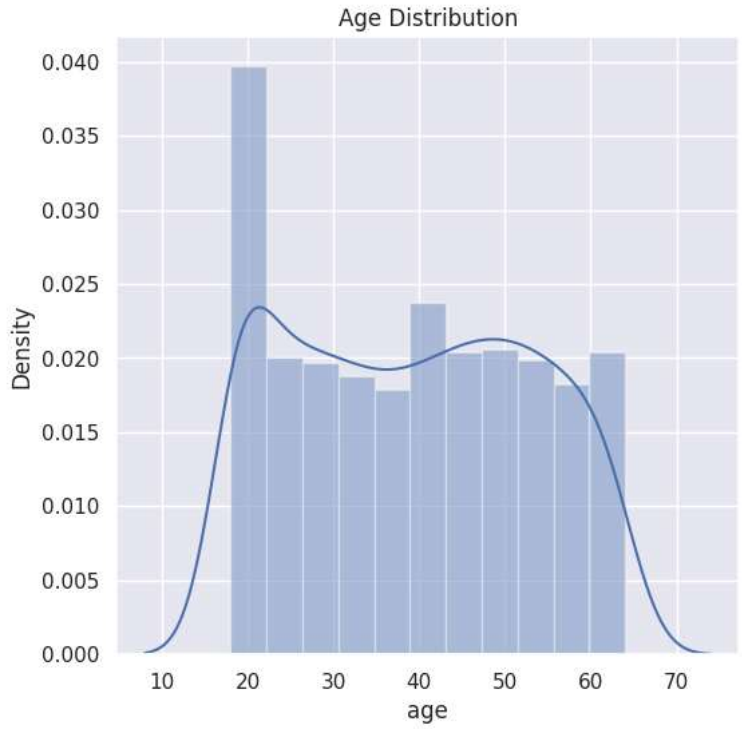
```
#Statistical Measures of dataset
insurance_dataset.describe()
```

	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
max	64.000000	53.130000	5.000000	63770.428010

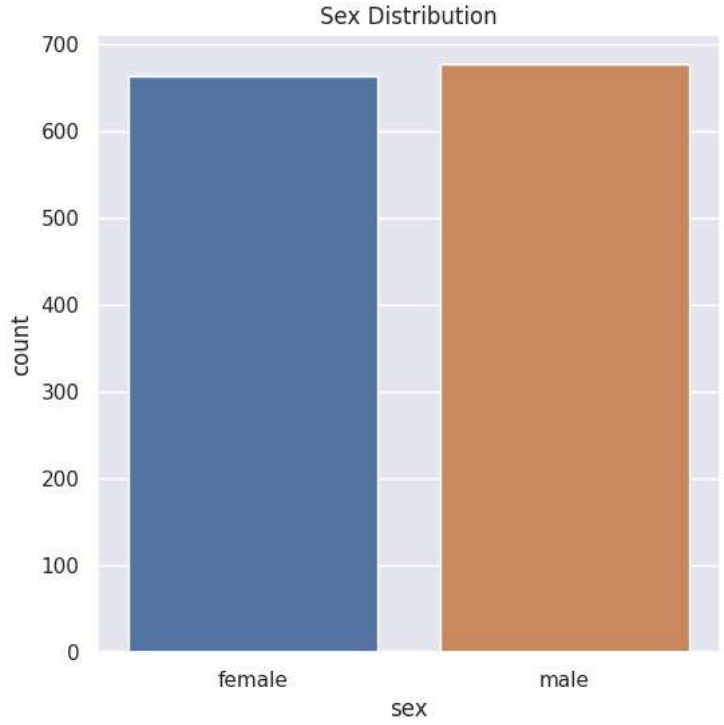
Group the data set by 'sex' , 'smoker' , 'region'

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

```
<ipython-input-72-30bd7651d2c1>:4: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(insurance_dataset['age'])
```

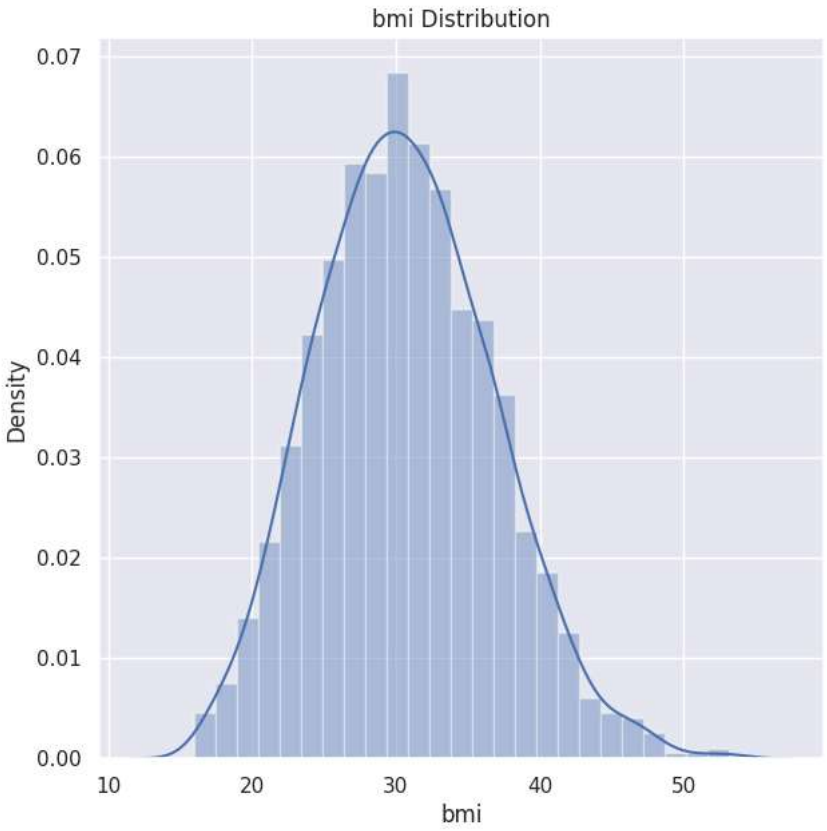



```
#Gender column
plt.figure(figsize=(6,6))
sns.countplot(x='sex', data=insurance_dataset)
plt.title('Sex Distribution')
plt.show()
```



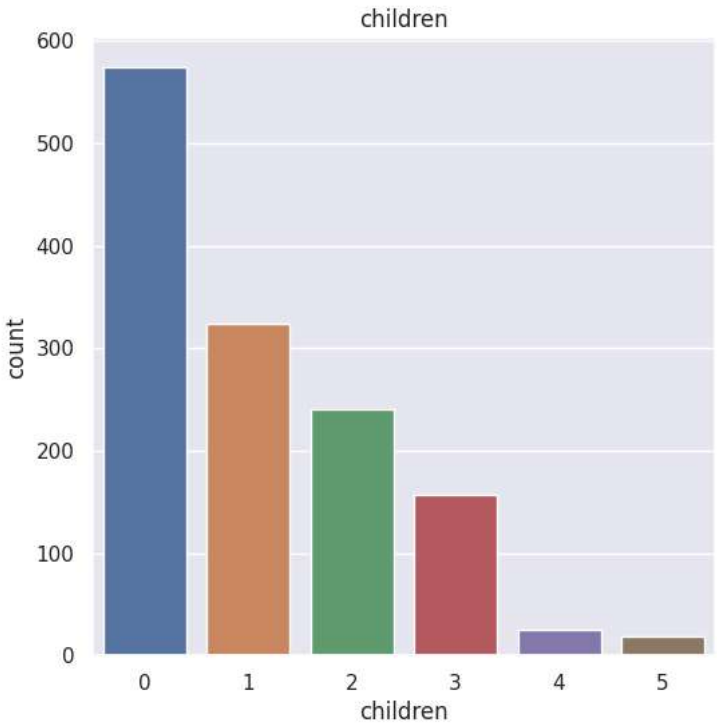
```
#bmi distribution
plt.figure(figsize=(7,7))
sns.distplot(insurance_dataset['bmi'])
plt.title('bmi Distribution')
plt.show()
```

```
<ipython-input-74-54fccb8c48d2>:3: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(insurance_dataset['bmi'])
```



Normal BMI Range --- 18.50 to 24.90

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



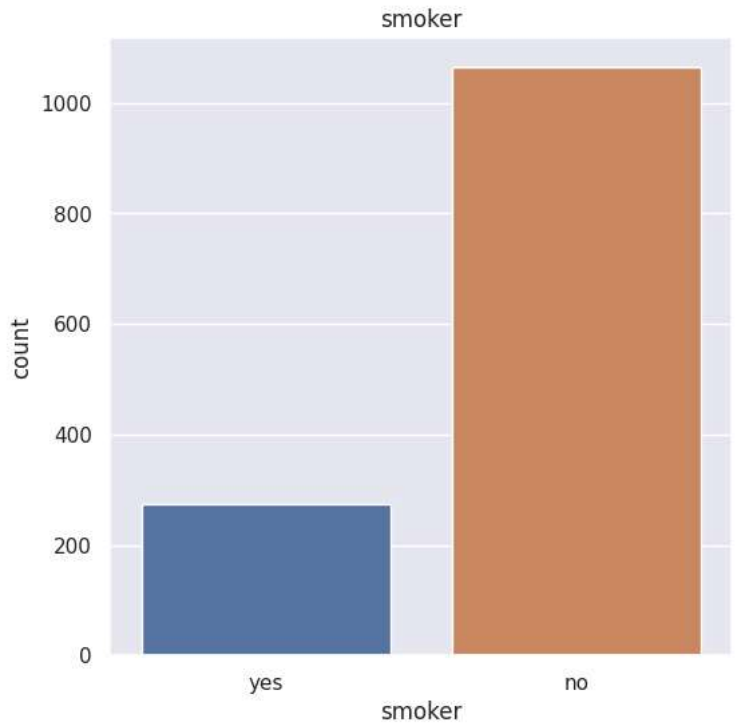
CHILDREN column for the the particular people.

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

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

Smoker Column

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

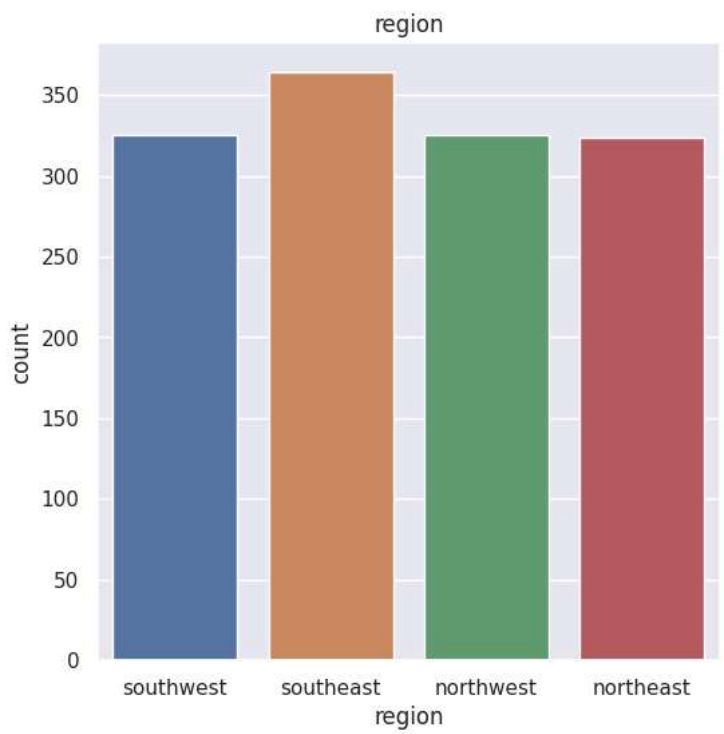



```
insurance_dataset['smoker'].value_counts()
```

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

REGION COLUMN

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



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

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

```
insurance_dataset.isnull().values.any()
```

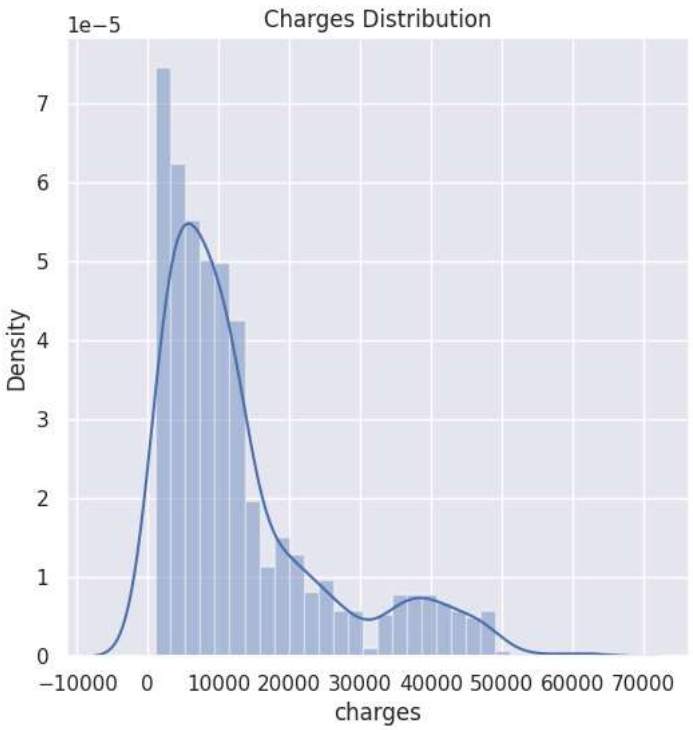
```
False
```

```
insurance_dataset.isnull().values.sum()
```

```
0
```

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

```
<ipython-input-83-366b06851ae4>:4: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(insurance_dataset['charges'])
```



DATA PRE-PROCESSING

ENCODING CATEGORICAL FEATURES

```
#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' : {'southeast':0, 'southwest':1, 'northeast':2, 'northwest':3}}, inplace=True)
```

Splitting the Features and Targets

```
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       1
1      18    0  33.770         1       1       0
2      28    0  33.000         3       1       0
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       0
1336   21    1  25.800         0       1       1
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 Reggression model
regressor = LinearRegression()
```

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

```
▾ LinearRegression
LinearRegression()
```

Model Evaluation

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

#R squared value (lies between 0 to 1`)
r2_train = metrics.r2_score(Y_train, training_data_prediction)
print('R squared value :' , r2_train)
```

```
R squared value : 0.751505643411174
```

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


#R squared value (lies between 0 to 1`)
r2_test = metrics.r2_score(Y_test, test_data_prediction)
print('R squared value :' , r2_test)
```

```
R squared value : 0.7447273869684076
```

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_reshaped = input_data_as_numpy_array.reshape(1,-1)

prediction = regressor.predict(input_data_reshaped)
print(prediction)
```