Step - 1 : Business Problem Understanding

In [1]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
```

Step - 2 : Data Understanding

Load Data & Understand every variable

In [2]:

```
df = pd.read_excel("insurance.xlsx")
df.head()
```

Out[2]:

	age	sex	bmi	children	smoker	region	expenses
0	19	female	27.9	0	yes	southwest	16884.92
1	18	male	33.8	1	no	southeast	1725.55
2	28	male	33.0	3	no	southeast	4449.46
3	33	male	22.7	0	no	northwest	21984.47
4	32	male	28.9	0	no	northwest	3866.86

Dataset Understanding

In [3]:

```
df.shape
```

Out[3]:

```
(1338, 7)
```

In [4]:

```
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   expenses  1338 non-null   float64
dtypes: float64(2), int64(2), object(3)
memory usage: 73.3+ KB
```

Exploratory Data Analysis

In [5]:

```
categorical=[]
continous=[]
check =[]

d_types = dict(df.dtypes)
for name , type in d_types.items():
    if str(type) == 'object':
        categorical.append(name)
    elif str(type) == 'float64':
        continous.append(name)
    else:
        check.append(name)

print("categorical features:",categorical)
print("continous features:",continous)
print("features to be checked:",check)
```

```
categorical features: ['sex', 'smoker', 'region']
continous features: ['bmi', 'expenses']
features to be checked: ['age', 'children']
```

In [6]:

```
d_types = dict(df.dtypes)
for name , type_ in d_types.items():
    if str(type_) == 'object':
        print(f"<======== {name} ===========>")
        print(df[name].value_counts())
```

```
<======== sex ===========>
male      676
female    662
Name: sex, dtype: int64
<======== smoker ===========>
no     1064
yes     274
Name: smoker, dtype: int64
<======== region ===========>
southeast    364
southwest    325
northwest    325
northeast    324
Name: region, dtype: int64
```

In [7]:

```
df.describe()
```

Out[7]:

	age	bmi	children	expenses
count	1338.000000	1338.000000	1338.000000	1338.000000
mean	39.207025	30.665471	1.094918	13270.422414
std	14.049960	6.098382	1.205493	12110.011240
min	18.000000	16.000000	0.000000	1121.870000
25%	27.000000	26.300000	0.000000	4740.287500
50%	39.000000	30.400000	1.000000	9382.030000
75%	51.000000	34.700000	2.000000	16639.915000
max	64.000000	53.100000	5.000000	63770.430000

In [8]:

```
df.corr()
```

Out[8]:

	age	bmi	children	expenses
age	1.000000	0.109341	0.042469	0.299008
bmi	0.109341	1.000000	0.012645	0.198576
children	0.042469	0.012645	1.000000	0.067998
expenses	0.299008	0.198576	0.067998	1.000000

Step - 3 : Data Preprocessing

In [9]:

```
df.isnull().sum()
```

Out[9]:

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

In [10]:

```
#drop the region column
df.drop('region', axis=1,inplace=True)
```

In [11]:

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

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

In [12]:

```
X = df.drop('expenses', axis=1)
y = df['expenses']
```

In [13]:

```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,random_state=9)
```

Step - 4 : Modelling & Evaluation

Lasso Regression with default parameters

In [15]:

```
# Modelling
from sklearn.linear_model import ElasticNet
enr_base = ElasticNet()
enr_base.fit(X_train,y_train)

#predictions
train_predictions = enr_base.predict(X_train)
test_predictions = enr_base.predict(X_test)

#evaluation
print("Train R2:",enr_base.score(X_train,y_train))
print("Test R2:",enr_base.score(X_test,y_test))
from sklearn.model_selection import cross_val_score
print("Cross Validation Score:",cross_val_score(enr_base,X,y,cv=5).mean())
```

```
Train R2: 0.39155822533558715
Test R2: 0.39702776413473506
Cross Validation Score: 0.3889250431216654
```

Applying Hyperparameter tuning for Lasso Regression

In [16]:

```
from sklearn.model_selection import GridSearchCV

# model
estimator = ElasticNet()

# parameters & values
param_grid = {"alpha":[0.1,0.2,1,2,3,5,10],"l1_ratio":[0.1,0.5,0.75,0.9,0.95,1]}

#Identifying the best value of the parameter within given values for the given data
model_hp = GridSearchCV(estimator,param_grid,cv=5,scoring='neg_mean_squared_error')
model_hp.fit(X_train,y_train)
model_hp.best_params_
```

Out[16]:

```
{'alpha': 10, 'l1_ratio': 1}
```

Rebuilt Lasso Model using best hyperparameters

In [17]:

```
#Modelling
enr_best = ElasticNet(alpha=10,l1_ratio=1)
enr_best.fit(X_train,y_train)

print("Intercept:",enr_best.intercept_)
print("coefficients:",enr_best.coef_)

#predictions
train_predictions = enr_best.predict(X_train)
test_predictions = enr_best.predict(X_test)

#Evaluation
print("Train R2:",enr_best.score(X_train,y_train))
print("Test R2:",enr_best.score(X_test,y_test))
print("Cross Validation Score:",cross_val_score(enr_best,X,y,cv=5).mean())
```

```
Intercept: -11449.28756082979
coefficients: [ 2.56838444e+02 -6.43158858e-01  3.04860929e+02  4.34656692e+02
  2.35631810e+04]
Train R2: 0.7433083585849637
Test R2: 0.7755411716841649
Cross Validation Score: 0.7467299170217538
```

Prediction on New Data

Data

In [18]:

```
input_data ={"age":31,
             "sex":"female",
             "bmi":25.74,
             "children":0,
             "smoker":"no",
             "region":"northeast"}
```

preprocessing the data

In [19]:

```
df_test = pd.DataFrame(input_data,index=[0])

df_test.drop('region',axis=1, inplace=True)
df_test['sex'].replace({'female':0,'male':1}, inplace=True)
df_test['smoker'].replace({'no':0,'yes':1}, inplace=True)

transormed_data = df_test
```

predict

In [20]:

```
enr_best.predict(transormed_data)
```

Out[20]:

```
array([4359.82451623])
```