Problem Statement or Requirement:

A client's requirement is, he wants to predict the insurance charges based on the several parameters. The Client has provided the dataset of the same. As a data scientist, you have to develop a model which will predict the insurance charges.

In [5]:
```
import pandas as pd
```

In [6]:
```
data=pd.read_csv('insurance.csv')
```

First 5 Rows

In [7]:
```
data.head()
```

Out[7]:

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

Last 5 Rows

In [8]:
```
data.tail()
```

Out[8]:

	age	sex	bmi	children	smoker	charges
1333	50	male	30.97	3	no	10600.5483
1334	18	female	31.92	0	no	2205.9808
1335	18	female	36.85	0	no	1629.8335
1336	21	female	25.80	0	no	2007.9450
1337	61	female	29.07	0	yes	29141.3603

Total Rows and Columns

In [9]:
```
data.shape
```

Out[9]:
```
(1338, 6)
```

Info about the dataset

In [10]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1338 entries, 0 to 1337
Data columns (total 6 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   charges   1338 non-null   float64
dtypes: float64(2), int64(2), object(2)
memory usage: 62.8+ KB
```

Check any null value

In [11]:
```
data.isnull().sum()
```

Out[11]:
```
age         0
sex         0
bmi         0
children    0
smoker      0
charges     0
dtype: int64
```

Describe about data

In [12]:
```
data.describe()
```

Out[12]:

	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

Convert String to Number

In [13]:
```
data['sex'].unique()
```

Out[13]:
```
array(['female', 'male'], dtype=object)
```

In [14]:
```
data['sex']=data['sex'].map({'female':0,'male':1})
```

In [15]:
```
data.head()
```

Out[15]:

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

In [16]:
```
data['smoker']=data['smoker'].map({'yes':1,'no':0})
```

In [17]:
```
data.head()
```

Out[17]:

	age	sex	bmi	children	smoker	charges
0	19	0	27.900	0	1	16884.92400
1	18	1	33.770	1	0	1725.55230
2	28	1	33.000	3	0	4449.46200
3	33	1	22.705	0	0	21984.47061
4	32	1	28.880	0	0	3866.85520

Store Matrix in X and Response in Vector y

In [18]:
```
data.columns
```

Out[18]:
```
Index(['age', 'sex', 'bmi', 'children', 'smoker', 'charges'], dtype='object')
```

In [19]:
```
X=data.drop(['charges'],axis=1)
```

In [20]:
```
X
```

Out[20]:

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

1338 rows × 5 columns

In [21]:
```
y=data['charges']
```

In [22]:
```
y
```

Out[22]:
```
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
```

Train or Test Split

In [23]:
```
from sklearn.model_selection import train_test_split
```

In [24]:
```
X_train,X_test,y_train,y_test=train_test_split(X,y,test_size=0.2,random_state=42)
```

In [25]:
```
X_train
```

Out[25]:

	age	sex	bmi	children	smoker
560	46	0	19.950	2	0
1285	47	0	24.320	0	0
1142	52	0	24.860	0	0
969	39	0	34.320	5	0
486	54	0	21.470	3	0
...	...	...	...	...	...
1095	18	0	31.350	4	0
1130	39	0	23.870	5	0
1294	58	1	25.175	0	0
860	37	0	47.600	2	1
1126	55	1	29.900	0	0

1070 rows × 5 columns

In [26]:
```
y_train
```

Out[26]:
```
560      9193.83850
1285     8534.67180
1142    27117.99378
969      8596.82780
486     12475.35130
           ...
1095     4561.18850
1130     8582.30230
1294    11931.12525
860     46113.51100
1126    10214.63600
Name: charges, Length: 1070, dtype: float64
```

Import the Models

In [27]:
```
from sklearn.linear_model import LinearRegression
from sklearn.svm import SVR
from sklearn.ensemble import RandomForestRegressor
from sklearn.ensemble import GradientBoostingRegressor
```

Model Training

In [28]:
```
lr= LinearRegression()
lr.fit(X_train,y_train)
svm= SVR()
svm .fit(X_train,y_train)
rf=RandomForestRegressor()
rf.fit(X_train,y_train)
gr= GradientBoostingRegressor()
gr.fit(X_train,y_train)
```

Out[28]:
```
GradientBoostingRegressor()
```

Prediction on Test Data

In [29]:
```
y_pred1=lr.predict(X_test)
y_pred2=svm.predict(X_test)
y_pred3=rf.predict(X_test)
y_pred4=gr.predict(X_test)

df1=pd.DataFrame({'Actual':y_test,'lr':y_pred1,'svm':y_pred2,'rf':y_pred3,'gr':y_pred4})
```

In [30]:
```
df1
```

Out[30]:

	Actual	lr	svm	rf	gr
764	9095.06825	8554.817116	9546.725504	10492.741186	10427.990349
887	5272.17580	6973.587467	9487.935664	5416.352560	5878.929609
890	29330.98315	36798.604161	9651.574870	28415.417275	27846.773368
1293	9301.89355	9417.882823	9553.932765	9308.945277	9613.279761
259	33750.29180	26871.680311	9413.992629	34442.074134	33859.024038
...	...	...	...	...	...
109	47055.53210	39220.995889	9651.905055	46900.855674	45476.088187
575	12222.89830	11695.634124	9627.798040	12704.200380	12407.271814
535	6067.12675	7253.598675	9500.111686	5714.552949	6417.948132
543	63770.42801	40950.539904	9605.947203	47039.289256	48274.630065
846	9872.70100	12625.966419	9592.025720	9943.473498	10778.381460

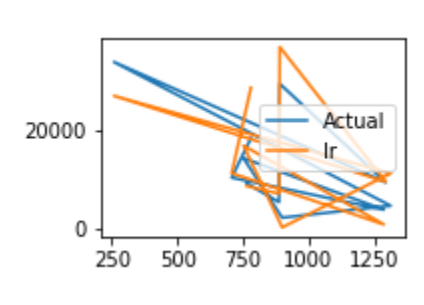
268 rows × 5 columns

Compare the performance visually

In [31]:
```
import matplotlib.pyplot as plt
```

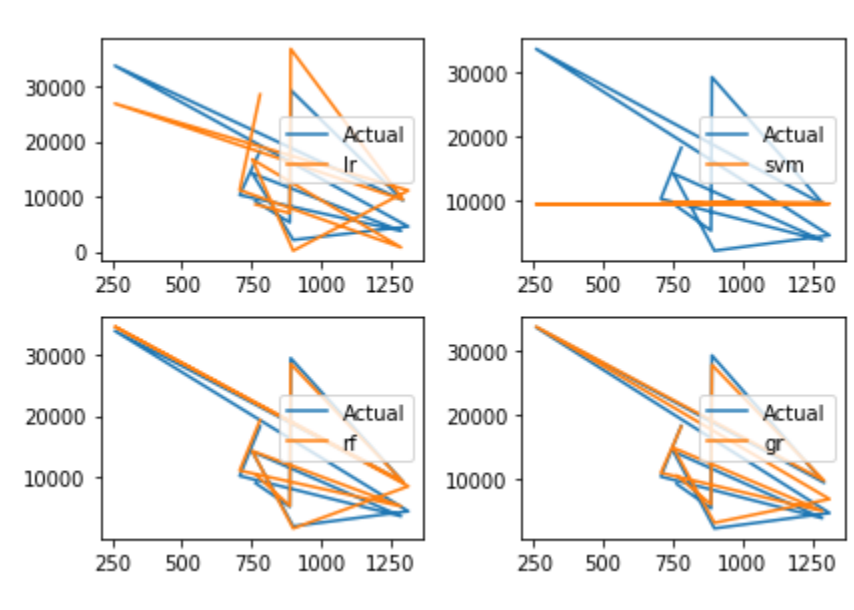
In [32]:
```
plt.subplot(221)
plt.plot(df1['Actual'].iloc[0:11],label='Actual')
plt.plot(df1['lr'].iloc[0:11],label='lr')
plt.legend()
```

Out[32]:
```
<matplotlib.legend.Legend at 0x21c52222440>
```



In [33]:
```
plt.subplot(221)
plt.plot(df1['Actual'].iloc[0:11],label='Actual')
plt.plot(df1['lr'].iloc[0:11],label='lr')
plt.legend()

plt.subplot(222)
plt.plot(df1['Actual'].iloc[0:11],label='Actual')
plt.plot(df1['svm'].iloc[0:11],label='svm')
plt.legend()

plt.subplot(223)
plt.plot(df1['Actual'].iloc[0:11],label='Actual')
plt.plot(df1['rf'].iloc[0:11],label='rf')
plt.legend()


plt.subplot(224)
plt.plot(df1['Actual'].iloc[0:11],label='Actual')
plt.plot(df1['gr'].iloc[0:11],label='gr')

plt.tight_layout()
plt.legend()
```

Out[33]:
```
<matplotlib.legend.Legend at 0x21c523e1f90>
```



Evaluating the algorithm

In [34]:
```
from sklearn import metrics
```

In [35]:
```
score1=metrics.r2_score(y_test,y_pred1)
score2=metrics.r2_score(y_test,y_pred2)
score3=metrics.r2_score(y_test,y_pred3)
score4=metrics.r2_score(y_test,y_pred4)
```

In [36]:
```
print(score1,score2,score3,score4)
```

```
0.7811302113434095 -0.07222971234901521 0.8622412597595595 0.8784490034234667
```

In [37]:
```
s1=metrics.mean_absolute_error(y_test,y_pred1)
s2=metrics.mean_absolute_error(y_test,y_pred2)
s3=metrics.mean_absolute_error(y_test,y_pred3)
s4=metrics.mean_absolute_error(y_test,y_pred4)
```

In [38]:
```
print(s1,s2,s3,s4)
```

```
4213.484797807137 8590.133628716292 2532.4570626588425 2428.5816910879207
```

Predict for new customer

In [39]:
```
data={'age':40,
      'sex':1,
    'bmi':40.30,
     'children':4,
     'smoker':1
     }
df=pd.DataFrame(data,index=[0])
df
```

Out[39]:

	age	sex	bmi	children	smoker
0	40	1	40.3	4	1

In [40]:
```
new_pred=gr.predict(df)
print(new_pred)
```

```
[43731.38207886]
```

In [41]:
```
gr= GradientBoostingRegressor()
gr.fit(X,y)
```

Out[41]:
```
GradientBoostingRegressor()
```

Save model using Joblib

In [42]:
```
import joblib
```

In [43]:
```
joblib.dump(gr,'model_joblib_gr')
```

Out[43]:
```
['model_joblib_gr']
```

In [44]:
```
model=joblib.load('model_joblib_gr')
```

In [45]:
```
model.predict(df)
```

Out[45]:
```
array([43257.52633764])
```

GUI

In [46]:
```
from tkinter import*
```

In [47]:
```
import joblib
```

In [49]:
```
def show_entry():
    p1=float(e1.get())
    p2=float(e2.get())
    p3=float(e3.get())
    p4=float(e4.get())
    p5=float(e5.get())

    model=joblib.load('model_joblib_gr')
    result=model.predict([[p1,p2,p3,p4,p5]])
    Label(master,text="Insurance Cost").grid(row=6)
    Label(master,text=result).grid(row=7)

master=Tk()
master.title("Insurance Cost Prediction")
label=Label(master,text="Insurance Cost Prediction",bg="black",fg="white").grid(row=0,columnspan=2)
Label(master,text="Enter Your age").grid(row=1)
Label(master,text="Male or Female [1/0]").grid(row=2)
Label(master,text="Enter Your BMI value").grid(row=3)
Label(master,text="Enter Number of children").grid(row=4)
Label(master,text="Smoker Yes/No [1/0]").grid(row=5)

e1=Entry(master)
e2=Entry(master)
e3=Entry(master)
e4=Entry(master)
e5=Entry(master)

e1.grid(row=1,column=1)
e2.grid(row=2,column=1)
e3.grid(row=3,column=1)
e4.grid(row=4,column=1)
e5.grid(row=5,column=1)

Button(master,text="Predict",command=show_entry).grid()

mainloop()
```

In [ ]:

In [ ]: