REGRESSION ASSIGNMENT

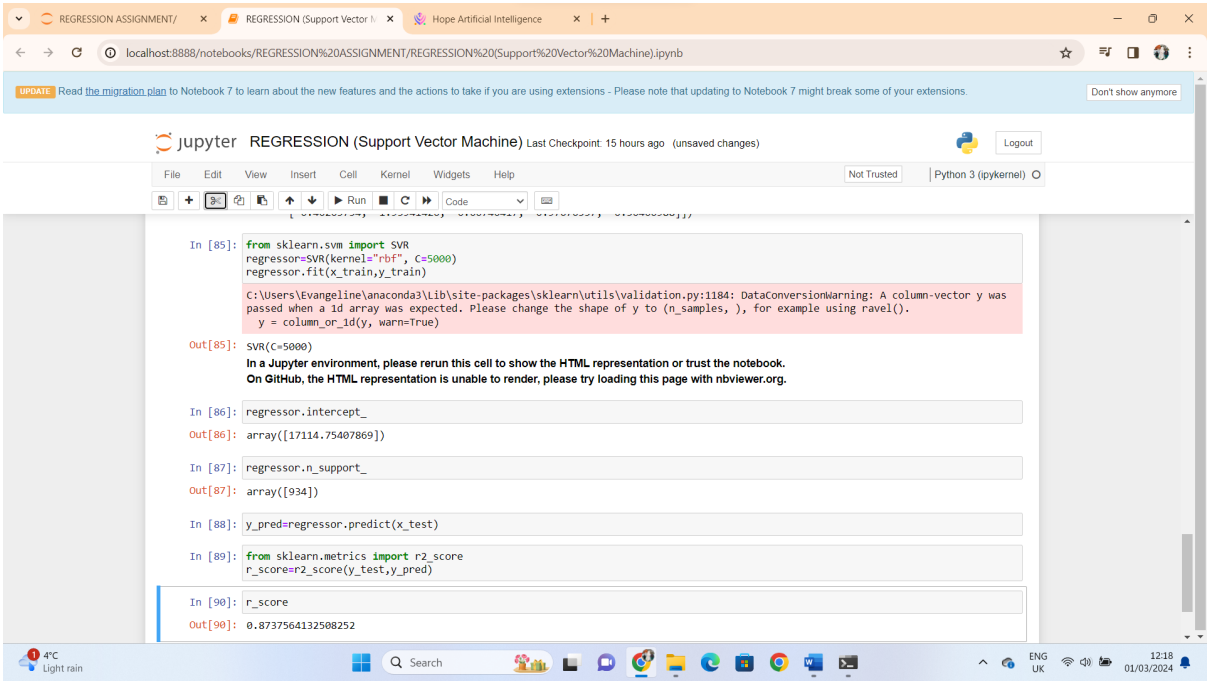
Problem Statement: To predict the insurance charges for clients

1) Identifying the problem statement:
   a) Stage 1: Machine Learning
   b) Stage 2: Supervised Learning
   c) Stage 3: Regression

2) Information about the Dataset:
   There are 1338 Rows and 6 Columns in the given Insurance Dataset. Inputs and Output present.

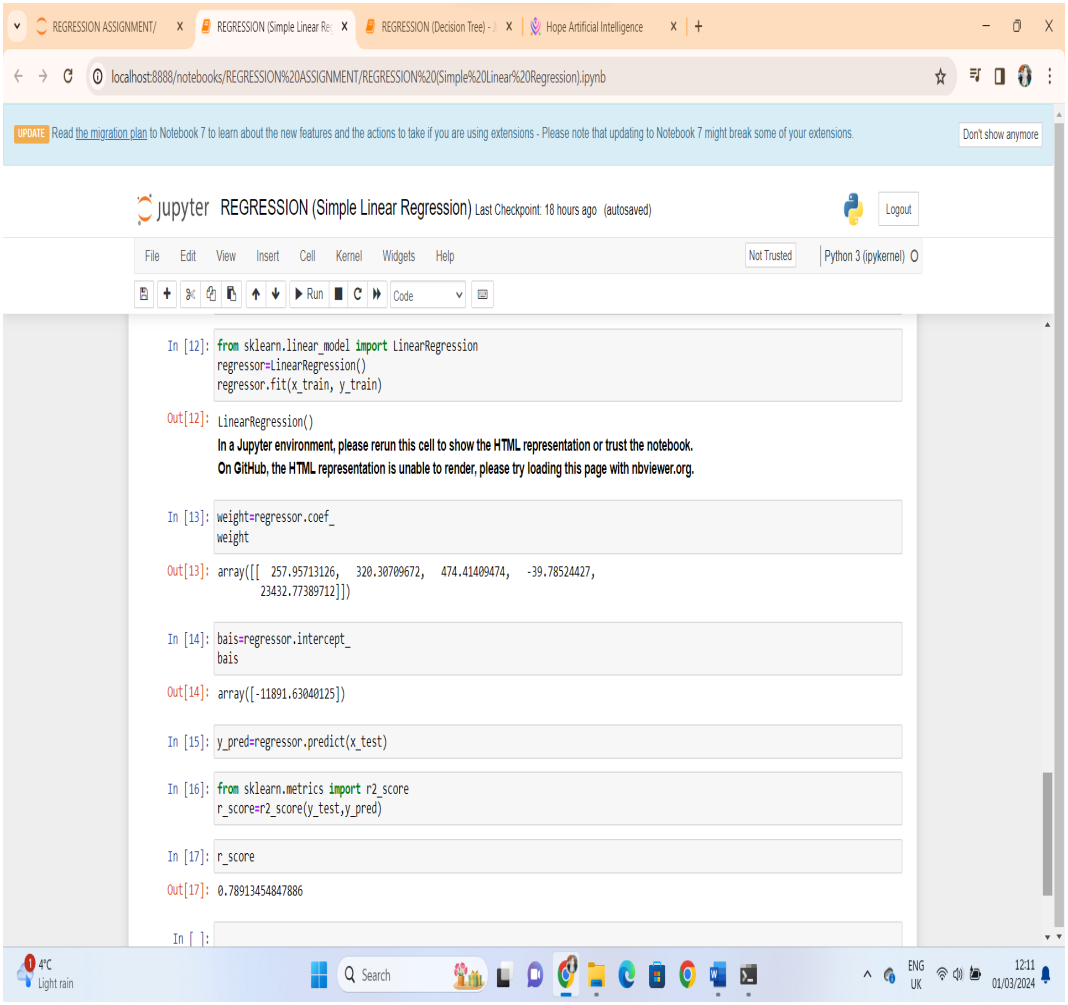
3) Mentioning the pre-processing method:
   I have used One-Hot-encoding to convert categorical data to numerical data, this is known as Nominal Data. A Nominal Data is used to label variables without providing any quantitative Value.

4) Developing a good model: Support Vector Machine has given me a r2 Value of 0.87375

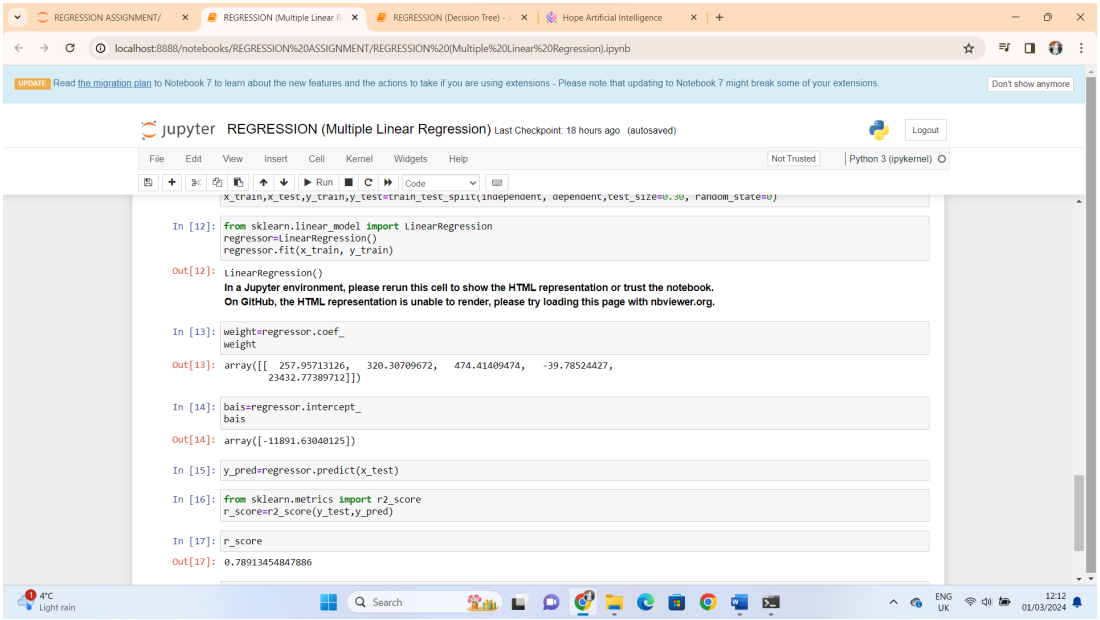


5)Regression Model research R2 Values:

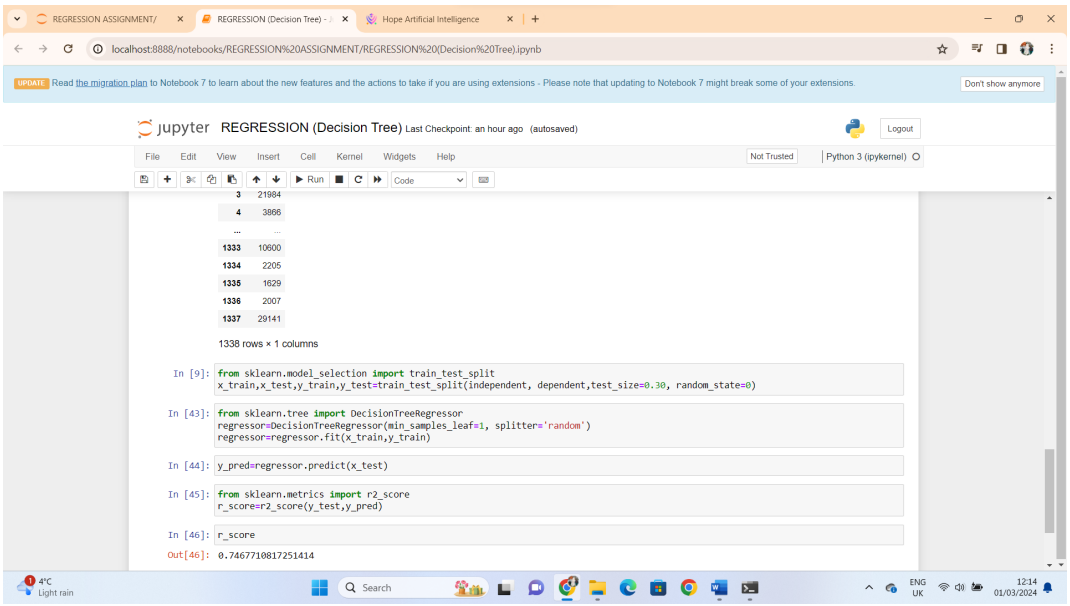
a) Simple Linear Regression **R2 Value=0.78913**



b) Multiple Linear Regression **R2 Value=0.78913**



c) Decision Tree **R2 Value = 0.7467710**



3) Decision Tree Regression

No	CRITERION	SPLITTER	R2 VALUE
1.	Squared_Error	Best	**0.6781754**
2.	Squared Error	Random	**0.6927514**
3.	Friedman_mse	Best	**0.6794144**
4.	Friedman_mse	Random	**0.6931777**
5.	Absolute_error	Best	**0.7345476**
6.	Absolute_error	Random	**0.6780406**
7.	Poisson	Best	**0.6836392**
8.	Poisson	Random	**0.7259208**
9.	min_samples_split=2	Random	**0.7361561**
10.	min_samples_split=2	Best	**0.6891230**
11.	min_samples_leaf=1	Best	**0.6859465**

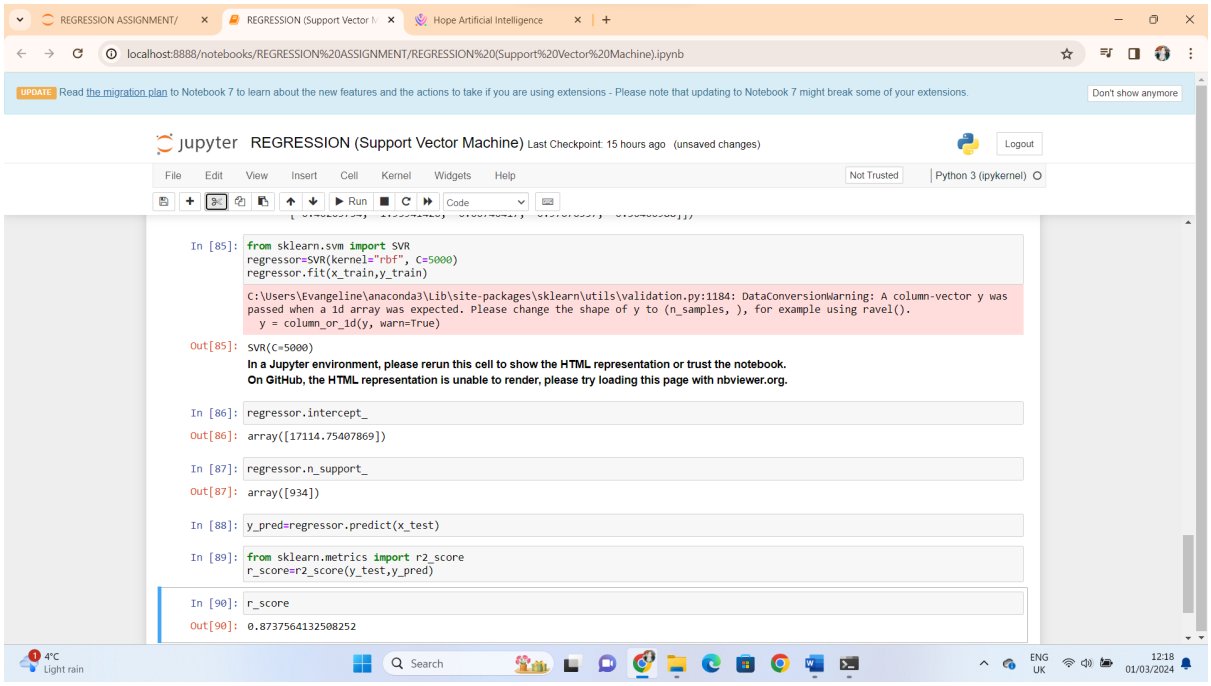
12.	min_samples_leaf=1	Random	**0.7467710**
13.	*random_state=None*	Random	**0.7128355**
14.	*random_state=None*	Best	**0.6571168**
15.	*max_leaf_nodes=None*	Best	**0.6637487**
16.	*max_leaf_nodes=None*	Random	**0.7185674**

The best R2 Value for Decision Tree Regression is min_samples_leaf=1 and Random hyper tuning Parameter = 0.7467710

SUPPORT VECTOR MACHINE:

a) Support Vector Machine **R2 Value (Kernel ='RBF', C=5000) = 0.8737564**

No	Hyper Parameter	Linear (r value)	Poly (r value)	RBF (Non-Linear) (r value)	Sigmoid (r value)
1.	C=10	0.46242633	0.0386251	-0.0323806	-0.098553
2.	C=100	0.6289632	0.6164698	0.3196645	0.5268415
3.	C=1000	0.7648394	0.8546515	0.8107195	0.212045
4.	C=2000	0.743935	0.8583433	0.85407306	-0.621621
5.	C=3000	0.7413370	0.8580853	0.8646256	-2.143154
6	C=5000	0.7413297	0.8587213	0.8737564	-8.160605

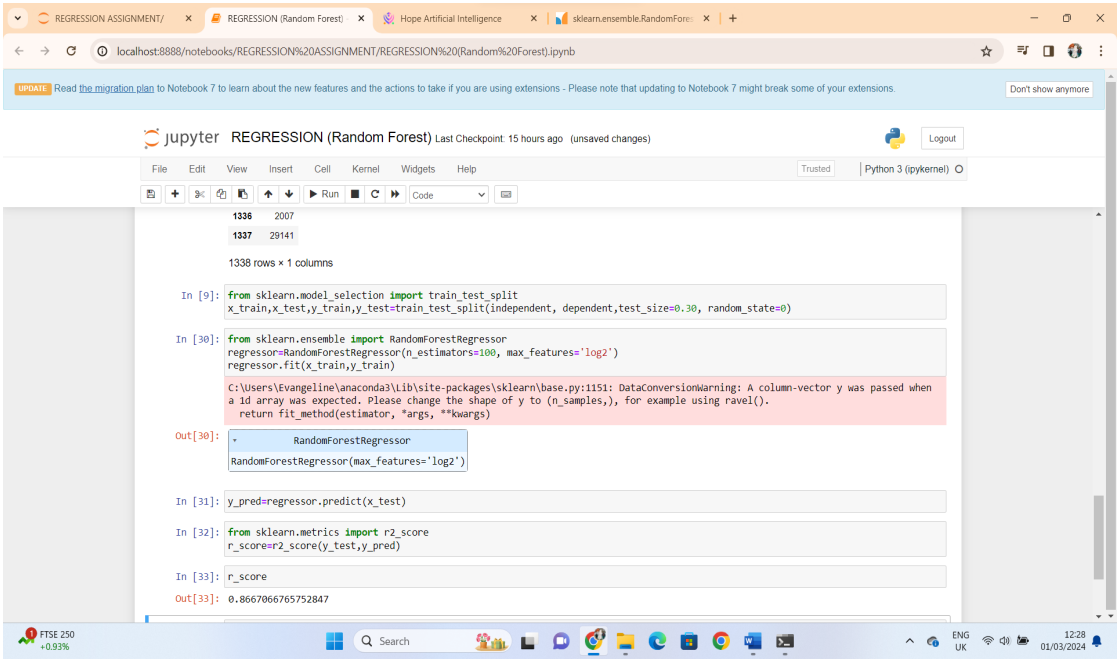


RANDOM FOREST

Random Forest **(n_estimators=100, Max_Feature='log2') R2 Value = 0.866709**

NO	PARAMETER n_estimators	Hyper Tuning Parameters	R2 Value
1.	50	criterion='squared_error	0.849944
2.	100	criterion='squared_error	0.851487
3.	50	Absolute_error	0.851068
4.	100	Absolute_error	0.857766
5.	50	Friedman_mse	0.847555
6.	100	Friedman_mse	0.852700
7.	50	Poisson	0.854152
8.	100	Poisson	0.854285
9.	50	Max_Features=sqrt	0.858814
10.	100	Max_Features=sqrt	0.864422

11.	50	Max_Features=Log2	0.864218
12.	100	Max_Features=Log2	0.866709
13.	50	Max_depth=None	0.848391
14.	100	Max_depth=None	0.849288
15.	50	Min_Samples_Split=2	0.847695
16.	100	Min_Samples_Split=2	0.851336
17.	50	Max_Features=1.0	0.848633
18.	100	Max_leaf_Nodes=None	0.850710



6) I have chosen **<u>Support Vector Machine</u>** as my final model because SVM algorithm has given me the best **R2 Value (Kernel ='RBF', C=5000) = 0.8737564** compared to the other regression algorithm.