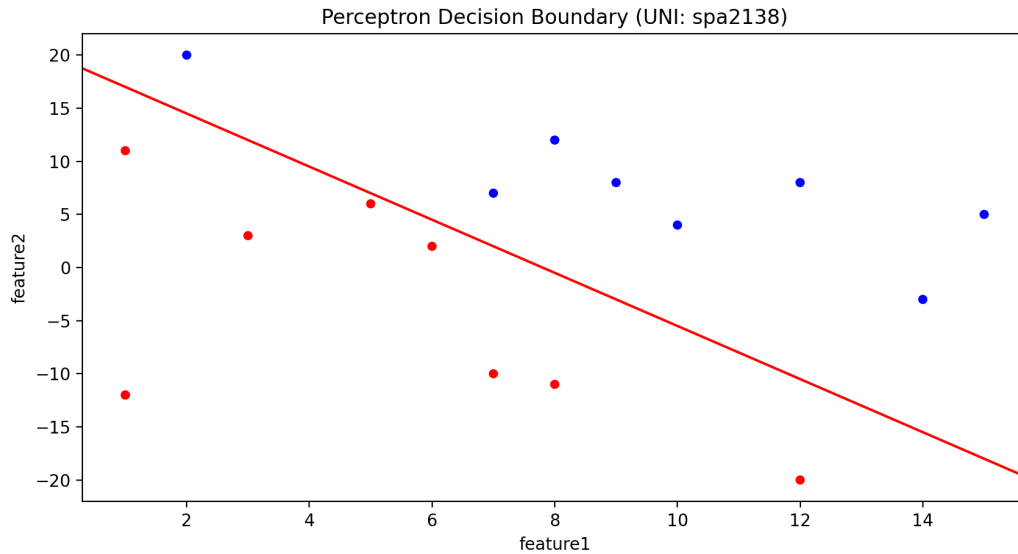


# Perceptron Learning Algorithm

The following is the decision boundary visualization of the perceptron learning algorithm on data1.csv



The Results table looks like the following:

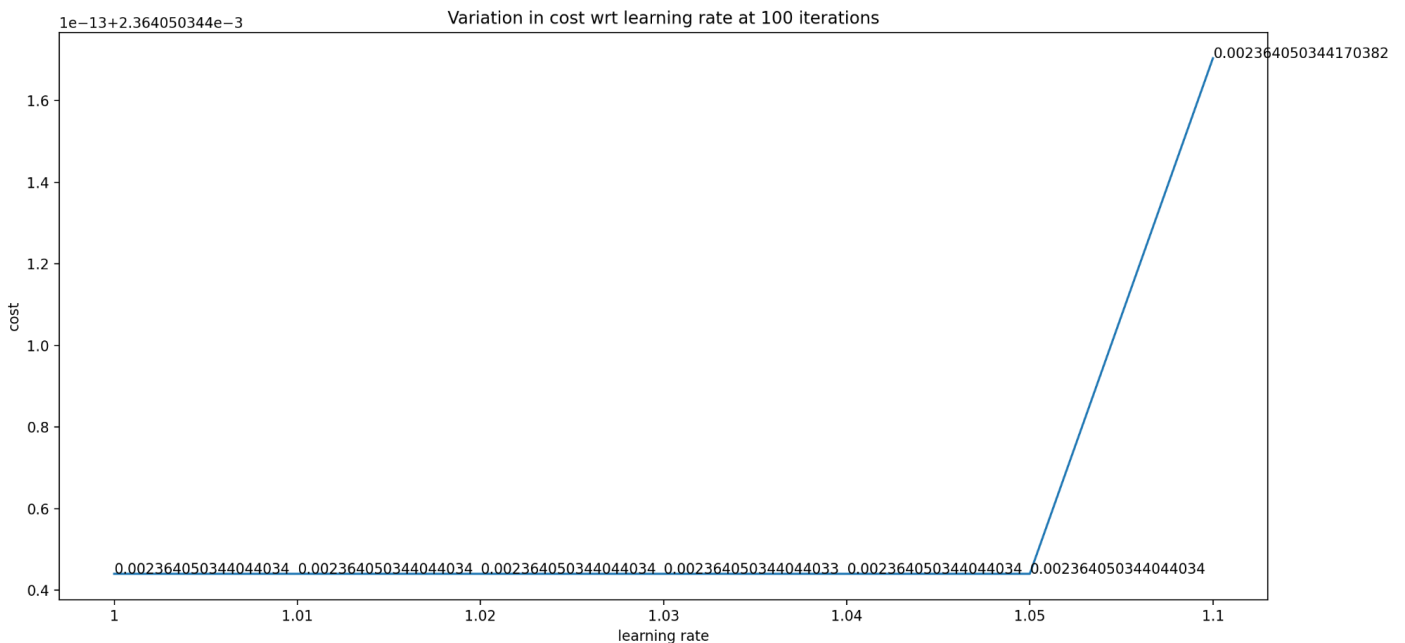
weight_1	weight_2	b
8	3	3
3	9	6
12	6	10
6	1	12
7	9	15
5	2	16
5	-1	18
6	7	21
3	8	23
-1	-2	24
2	7	26
3	3	28
3	6	30
0	7	32
1	3	34
1	6	36
2	2	38
2	5	40
-5	-2	39
-5	-2	39

## Linear Regression

If we plot the variation of cost as learning rate, we get the following:

Note: to visualize the variation, I have added plots for learning rate  $\epsilon$  [1, 1.01, 1.02, 1.03, 1.04, 1.05, 1.1]

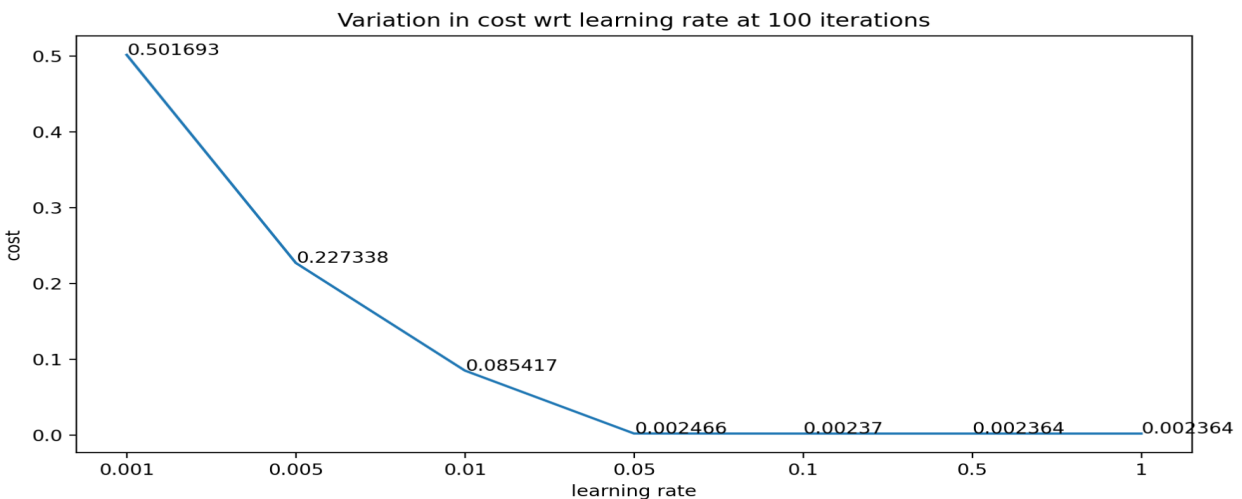
For other learning rates, cost shoots to very high number and difficult to visualize subtle variation in the cost.



Observations:

- We can see that there is not much variation in learning rate from 1 to 1.05, but at 1.1, cost increases.
- Hence choosing 1.05 as the 10th learning rate.
- Increasing number of iterations to 10000 to further minimize the cost
- At learning rate 5 and 10, cost overshoots to infinity

For the reference, variation of the cost for learning rate [0.001, 0.005, 0.01, 0.05, 0.1, 0.5, 1]



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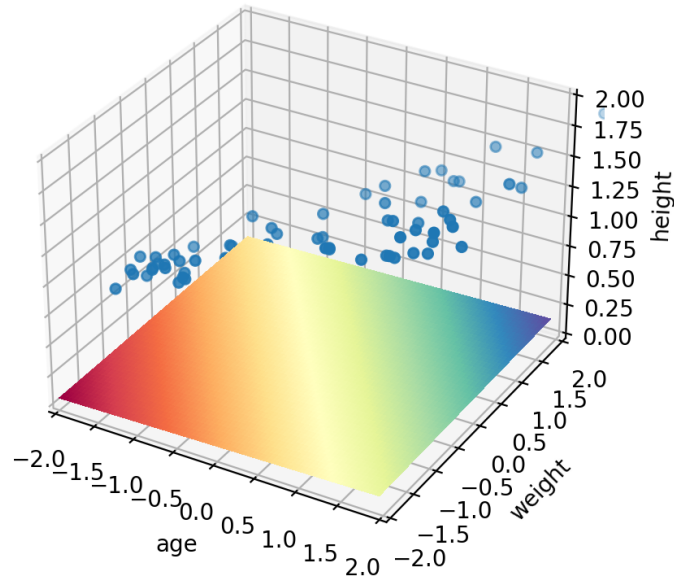
The results2 table looks like this:

Note the learning rate 1.05 is the learning rate of choice and number of iterations was changed to 10000

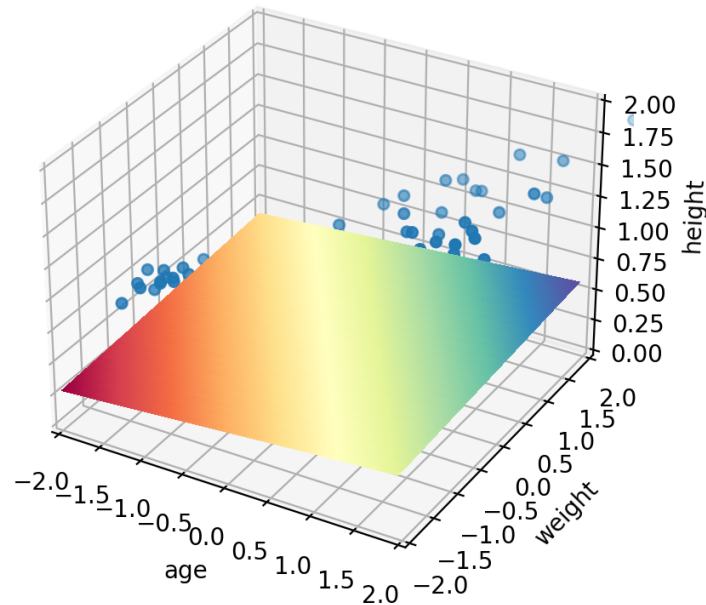
	Q (Learning Rate)	No of Iterations	Bias	b_age	b_weight
	0.001	100	0.1043916796	0.01196296719	0.008633595556
	0.005	100	0.4322572671	0.04562576717	0.02981469392
	0.01	100	0.6951206935	0.06862363808	0.03893700612
	0.05	100	1.089969183	0.1124331714	0.01840028008
	0.1	100	1.096431688	0.1250055377	0.005844982938
	0.5	100	1.096460811	0.1294390291	0.001411492516
	1	100	1.096460811	0.129439076	0.001411445546
	5	100	4.38E+71	-4.42E+86	-4.42E+86
	10	100	3.07E+104	-3.40E+119	-3.40E+119
<b>The learning rate of choice</b>	<b>1.05</b>	<b>10000</b>	<b>1.096460811</b>	<b>0.129439076</b>	<b>0.001411445546</b>

### 3D Visualize the Result of Each Linear Regression Model:

learning rate: 0.001, Iterations:100, UNI: spa2138

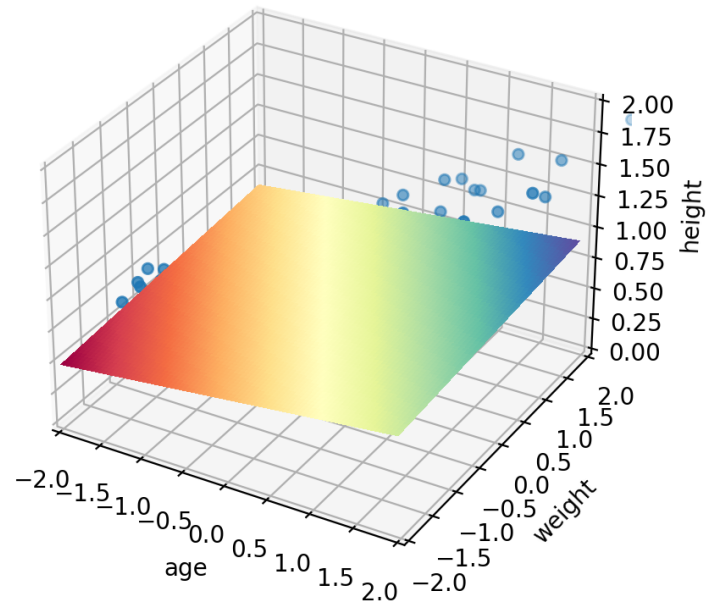


learning rate: 0.005, Iterations:100, UNI: spa2138

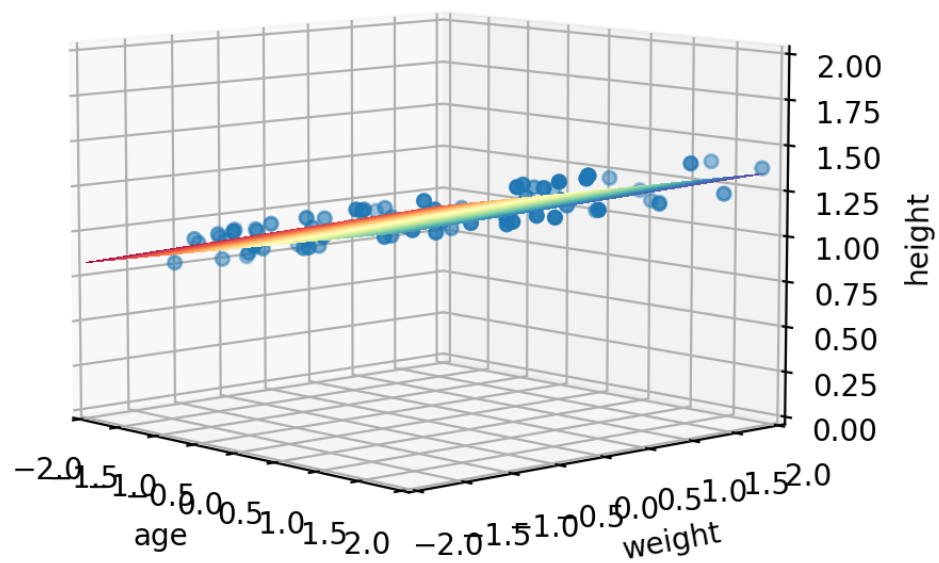


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learning rate: 0.01, Iterations:100, UNI: spa2138

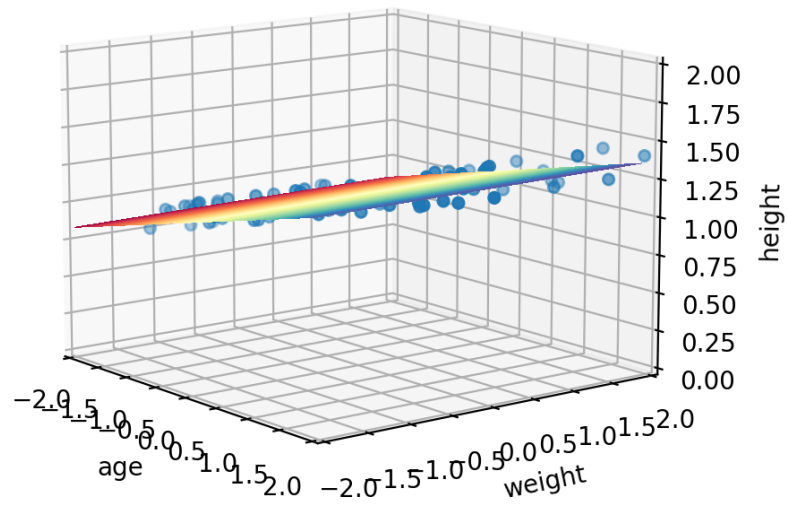


learning rate: 0.05, Iterations:100, UNI: spa2138

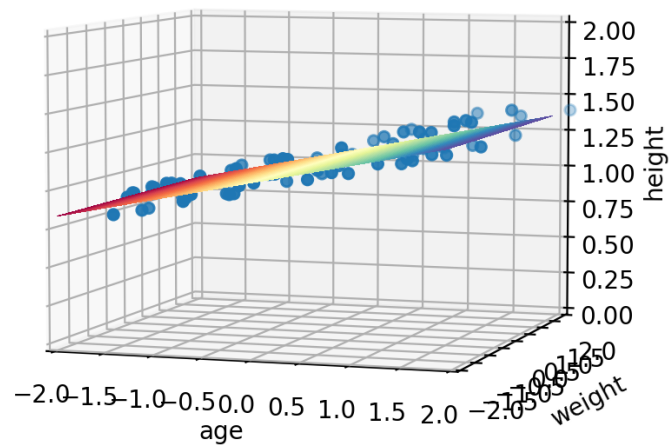


COMS 4701 Artificial Intelligence  
Homework 4 Coding  
Name: Sankalp Apharande, UNI: spa2138

learning rate: 0.1, Iterations:100, UNI: spa2138

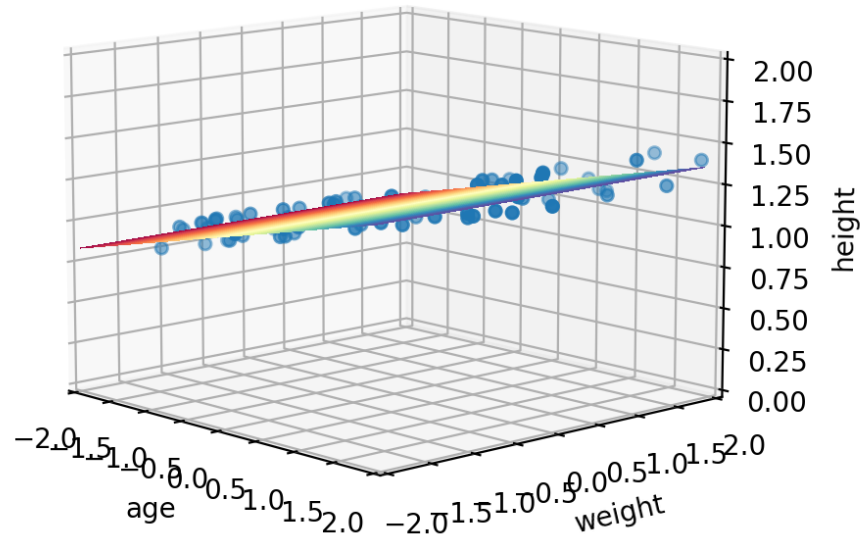


learning rate: 0.5, Iterations:100, UNI: spa2138



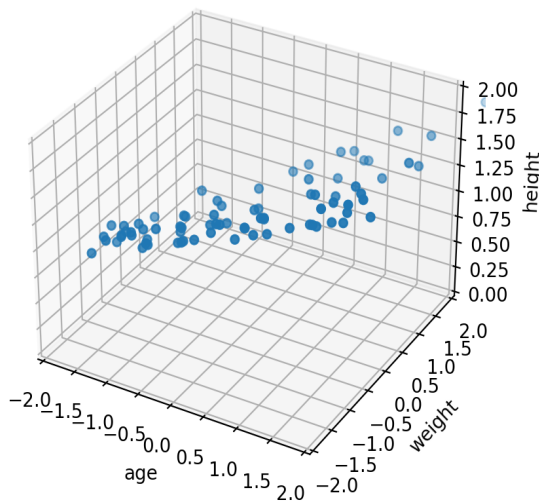
COMS 4701 Artificial Intelligence  
Homework 4 Coding  
Name: Sankalp Apherande, UNI: spa2138

learning rate: 1, Iterations:100, UNI: spa2138

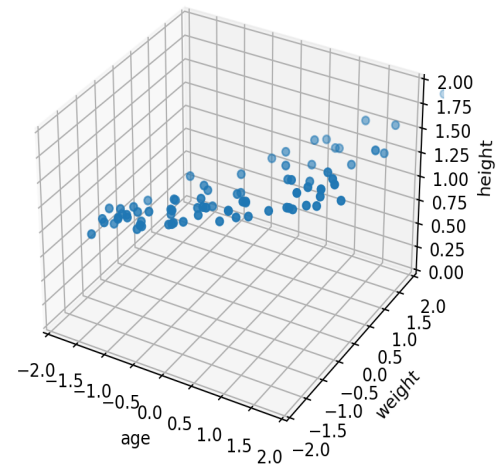


When the learning rate is 5 and 10, the values of weights are too high, and the cost overshoots to a very high number. Hence we are not able to visualize the boundary for learning rate = 5 and 10.

learning rate: 5, Iterations:100, UNI: spa2138



learning rate: 10, Iterations:100, UNI: spa2138



Learning rate of choice:  $\alpha = 1.05$

learning rate: 1.05, Iterations:10000, UNI: spa2138

