Assignment # 1
Group Assignment:
ISM2015501, IRM2015003, IRM2015001, IRM2015006, IHM2015005

Objective :- To run gradient descent and normal equation method on housing price dataset to obtain the weights of the hypothesis parameters.

Features taken:-

- lotsize
- number of bedrooms
- number of bathrooms
- number of stories

Hypothesis:-

$w_0 + w_1x_1 + w_2x_2 + w_3x_3 + w_4x_4 = 0$

where,

x_1 - lotsize

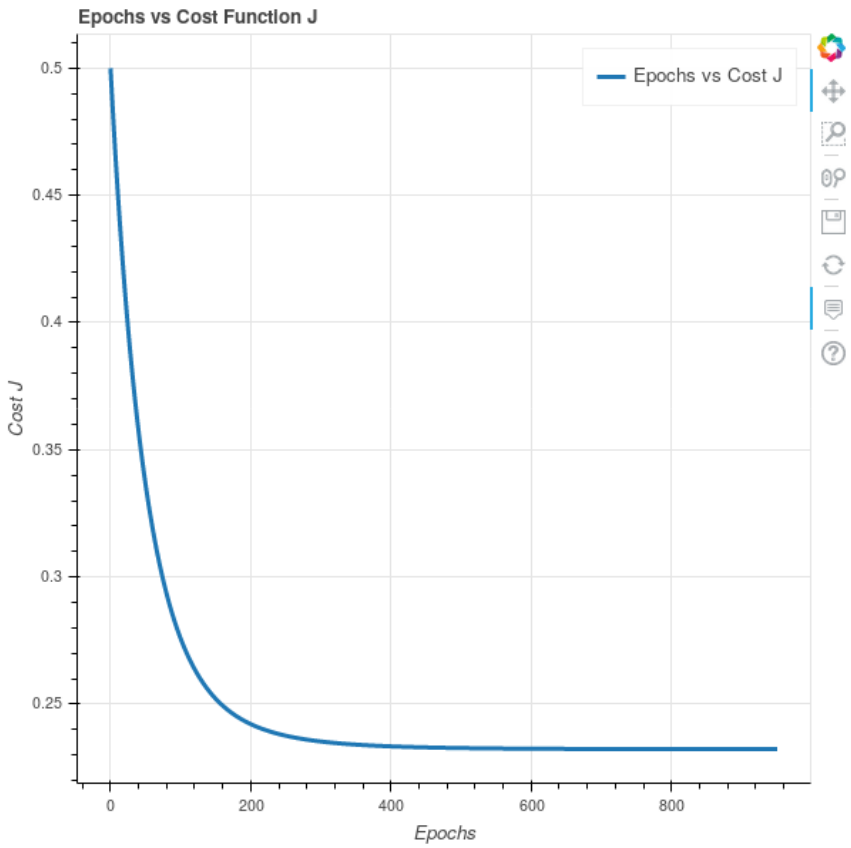
x_2 - number of bedrooms

x_3 - number of bathrooms

x_4 - number of stories

Results:-

1. Gradient Descent



learning rate = 0.006
number of iterations = 951

The hypothesis parameters obtained :-

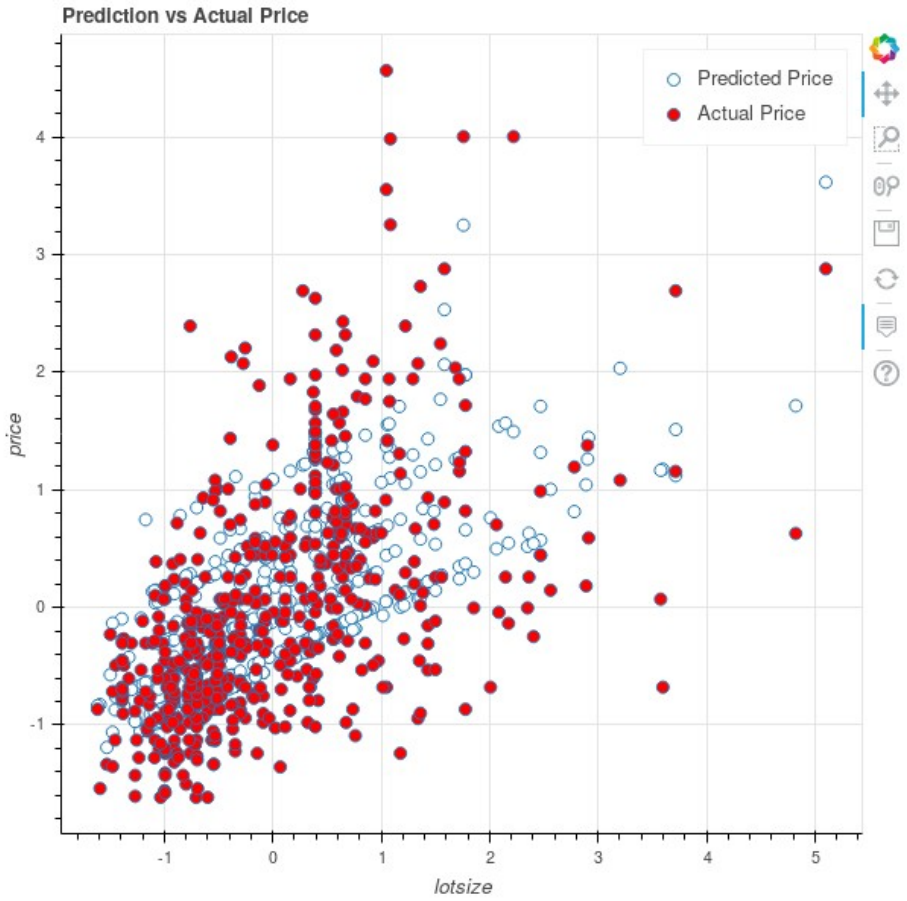
$$\text{weights} = \begin{bmatrix} -1.91235916\text{e-}16 \\ 4.39146607\text{e-}01 \\ 8.34327995\text{e-}02 \\ 3.20025453\text{e-}01 \\ 2.44987557\text{e-}01 \end{bmatrix}$$

Learning Rate	**Iterations**
6	Does not converge
0.6	14
0.06	126
0.006	951
0.0006	6573

2. Normal Equation

The hypothesis parameters obtained :-

$$\text{weights} = \begin{bmatrix} -5.20176035\text{e-}17 \\ 4.40828948\text{e-}01 \\ 7.80010411\text{e-}02 \\ 3.21671859\text{e-}01 \\ 2.48238713\text{e-}01 \end{bmatrix}$$



Observations :-

- The gradient descent and normal equation give approximately same weight values. The small difference is due to stopping the gradient descent when difference in change in cost goes below 0.0000001.
- Normal equation gives faster result than gradient descent. The result from normal equation method is the accurate result.
- The normal equation method does not work when the matrix (X^TX) is not invertible.
- The gradient descent algorithm may not converge if we take the learning rate to be very high.

Notes :-

- Batch Gradient Descent is used in the gradient descent algorithm.
- Data has been normalised before use using mean normalisation.
- Regularisation has not been performed.