Linear Regression with one variable

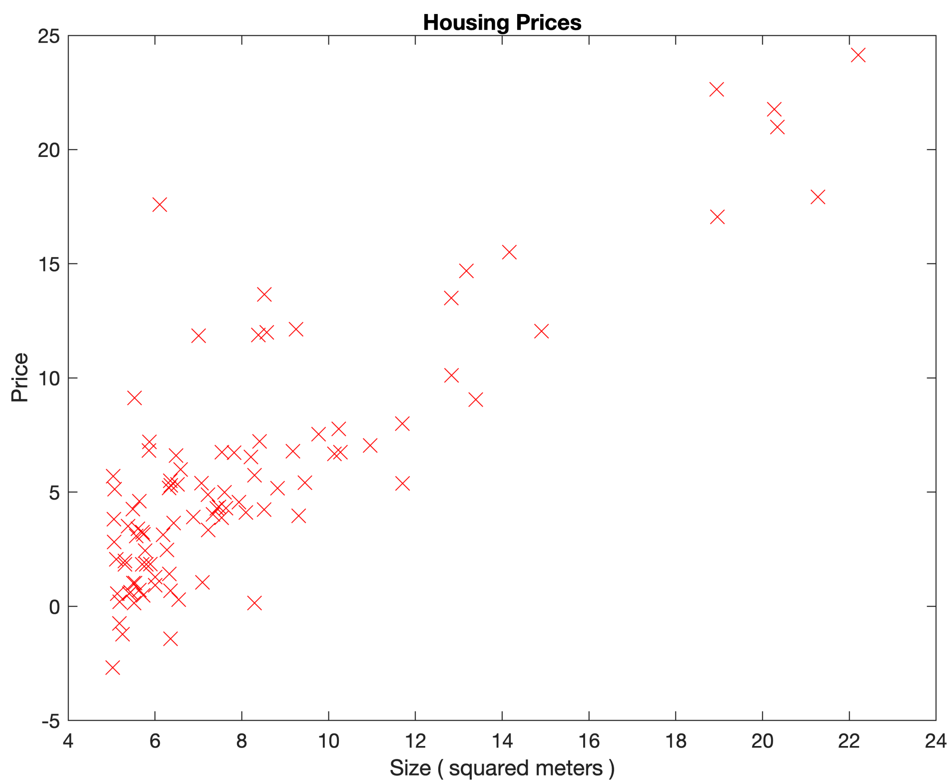
Loading the dataset

```
% Loading the dataset
dataSet = load('ex1data1.txt');
% Storing the values in seperate vectors
x = dataSet(:, 1);
y = dataSet(:, 2);
m = length(x)
```

```
m = 97
```

Plotting the data

```
figure;
plot(x, y, 'rx', 'MarkerSize', 10);
xlabel('Size ( squared meters )');
ylabel('Price');
title('Housing Prices');
```



Computing the Cost

```
theta = [0;0];
x=[ones(m,1),x]
```

```
x = 97×2
    1.0000    6.1101
    1.0000    5.5277
    1.0000    8.5186
    1.0000    7.0032
    1.0000    5.8598
    1.0000    8.3829
    1.0000    7.4764
    1.0000    8.5781
    1.0000    6.4862
    1.0000    5.0546
      ⋮
```

```
% Compute and display initial cost with theta all zeros
computeCost(x, y, theta)
```

```
ans = 32.0727
```

```
% Compute and display initial cost with non-zero theta
computeCost(x, y,[-1;2])
```

```
ans = 54.2425
```

Gradient Descent

```
alpha = 0.01;
num_iters = 1500;
% Run gradient descent:
% Compute theta
[theta,J_history]=gradientDescent(x,y,theta,alpha,num_iters)
```

```
theta = 2×1
   -3.6303
    1.1664
J_history = 1500×1
    6.7372
    5.9316
    5.9012
    5.8952
    5.8901
    5.8850
    5.8799
    5.8749
    5.8698
    5.8648
      ⋮
```

```
fprintf('Minimum cost computed from gradient descent:\n%f',min(J_history))
```

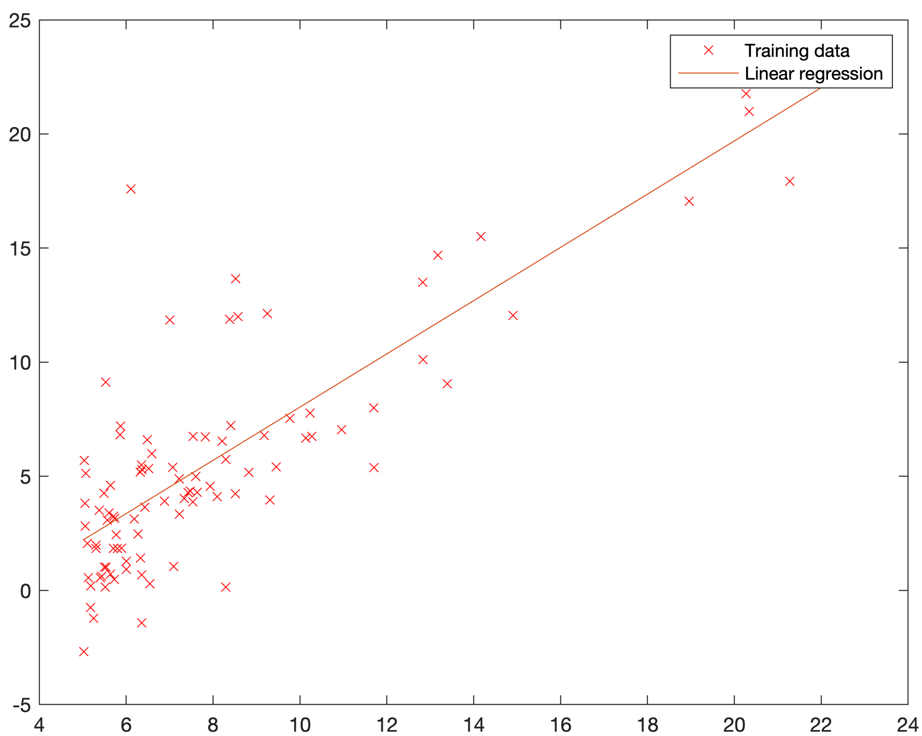
```
Minimum cost computed from gradient descent:
4.483388
```

```
% Print theta to screen
```

```
% Display gradient descent's result
fprintf('Theta computed from gradient descent:\n%f,\n%f',theta(1),theta(2))
```

```
Theta computed from gradient descent:
-3.630291,
1.166362
```

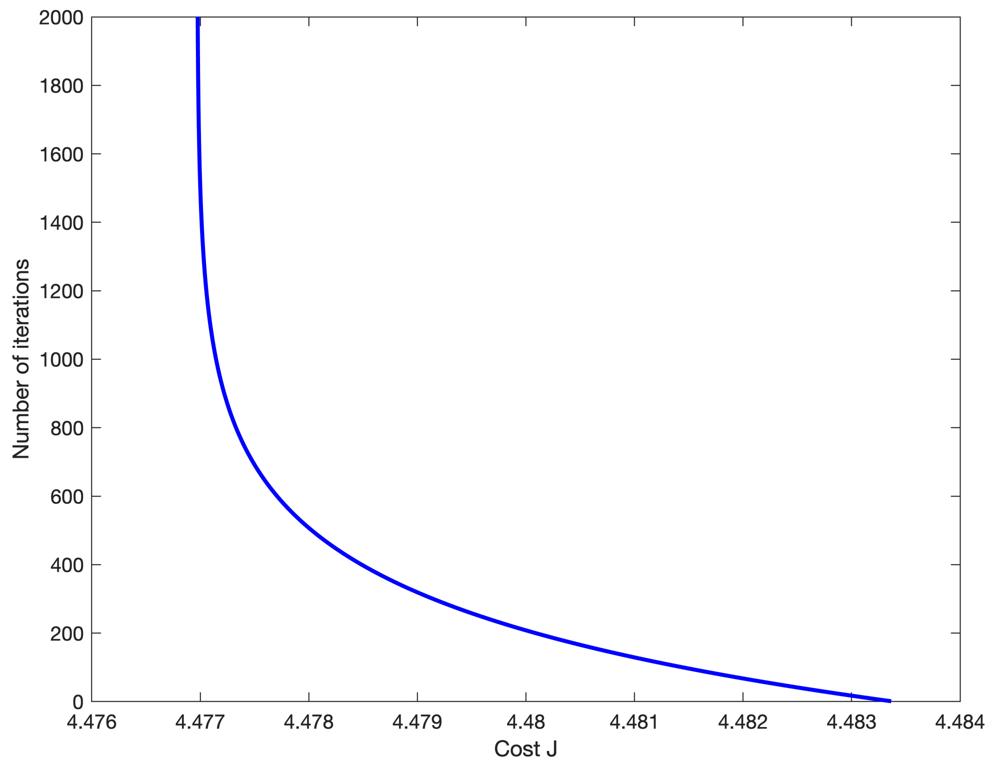
```
% Plot the linear fit
plot(x(:,2),y,'rx')
hold on
plot(x(:,2),x*theta)
legend('Training data', 'Linear regression')
hold off
```



Varying alpha and number of iterations

```
% Run gradient descent:
% Choose some alpha value
alpha = 0.01;
num_iters = 2000;

% Init Theta and Run Gradient Descent

[~, J_history] = gradientDescent(x, y, theta, alpha, num_iters);

% Plot the convergence graph
plot(J_history,1:num_iters, '-b', 'LineWidth', 2);
ylabel('Number of iterations');
```

```
xlabel('Cost J');
```




```
% Predict values for population sizes of 35,000 and 70,000
predict1 = [1, 3.5] *theta;
fprintf('For population = 35,000, we predict a profit of %f\n', predict1*10000);
```

```
For population = 35,000, we predict a profit of 4519.767868
```

```
predict2 = [1, 7] * theta;
fprintf('For population = 70,000, we predict a profit of %f\n', predict2*10000);
```

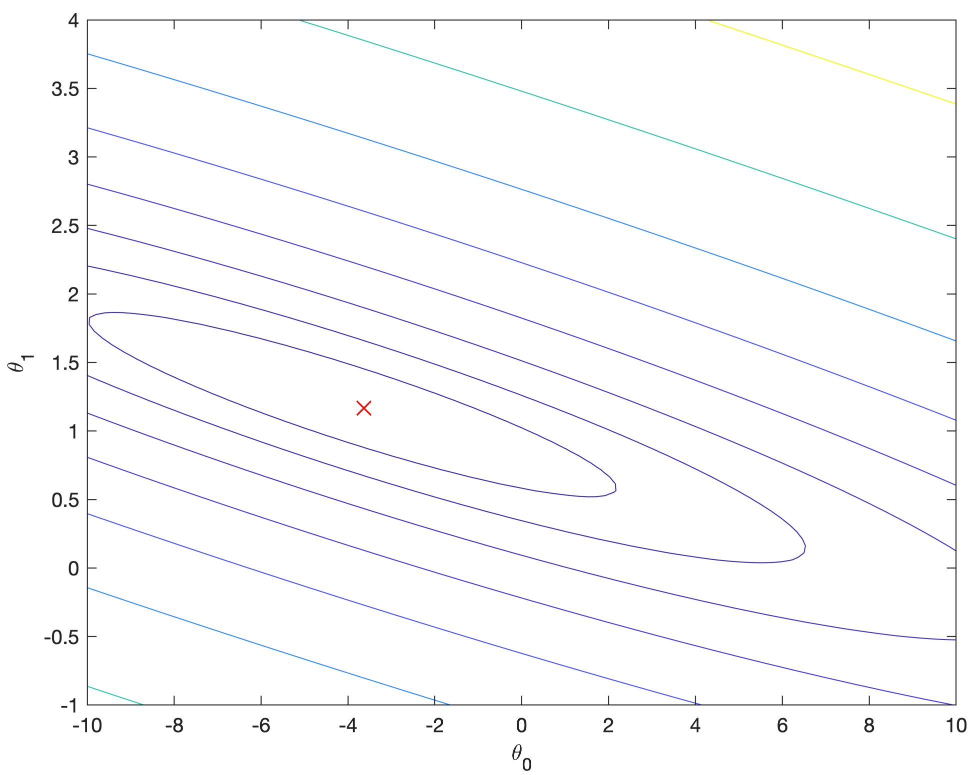
```
For population = 70,000, we predict a profit of 45342.450129
```

Visualizing $J(\theta)$

```
% Grid over which we will calculate J
theta0_vals = linspace(-10, 10, 100);
theta1_vals = linspace(-1, 4, 100);
% initialize J_vals to a matrix of 0's
J_vals = zeros(length(theta0_vals), length(theta1_vals));

% Fill out J_vals
for i = 1:length(theta0_vals)
    for j = 1:length(theta1_vals)
   t = [theta0_vals(i); theta1_vals(j)];
```

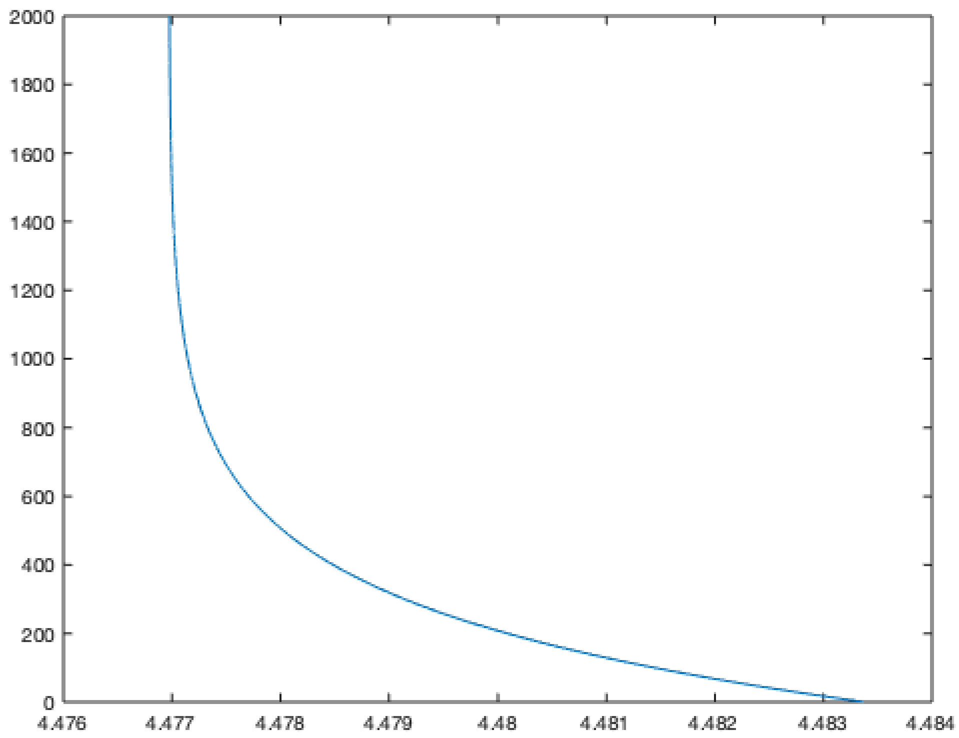
```
   J_vals(i,j) = computeCost(x, y, t);
    end
end


% Because of the way meshgrids work in the surf command, we need to
% transpose J_vals before calling surf, or else the axes will be flipped
J_vals = J_vals';

% Surface plot
figure;
surf(theta0_vals, theta1_vals, J_vals)
xlabel('\theta_0'); ylabel('\theta_1');
```

```
% Contour plot
figure;
% Plot J_vals as 15 contours spaced logarithmically between 0.01 and 100
contour(theta0_vals, theta1_vals, J_vals, logspace(-2, 3, 20))
xlabel('\theta_0'); ylabel('\theta_1');
hold on;
plot(theta(1), theta(2), 'rx', 'MarkerSize', 10, 'LineWidth', 2);
hold off;
```




```
figure;
```

```
plot(J_history, 1:num_iters);
```



Linear Regression with multiple variables

Loading the dataset

```
Housing_Price=importfile('ex1data2.txt');
x1=(Housing_Price.Size_of_House);
x2=(Housing_Price.No_of_bedrooms);
y=Housing_Price.Price;
m = length(y);
```

Feature Normalization

```
[x1,mu1,sigma1]=featureNormalize(x1);
[x2,mu2,sigma2]=featureNormalize(x2);
x0=ones(size(x1,1),1);
X=[x0 x1 x2];
```

Computing Cost

```
theta=zeros(3,1);
computeCostMulti(X,y,theta)
```

```
ans = 6.5592e+10
```

Gradient Descent

```
% Run gradient descent
% Choose some alpha value
alpha = 0.6;
num_iters = 400;
theta = zeros(3, 1);

% Init Theta and Run Gradient Descent

[theta, J_history] = gradientDescentMulti(X, y, theta, alpha, num_iters);
J_history
```

```
J_history = 400×1
10^10 ×
    1.2157
    0.3975
    0.2527
    0.2217
    0.2124
    0.2085
    0.2066
    0.2056
    0.2050
    0.2047
      ⋮
```

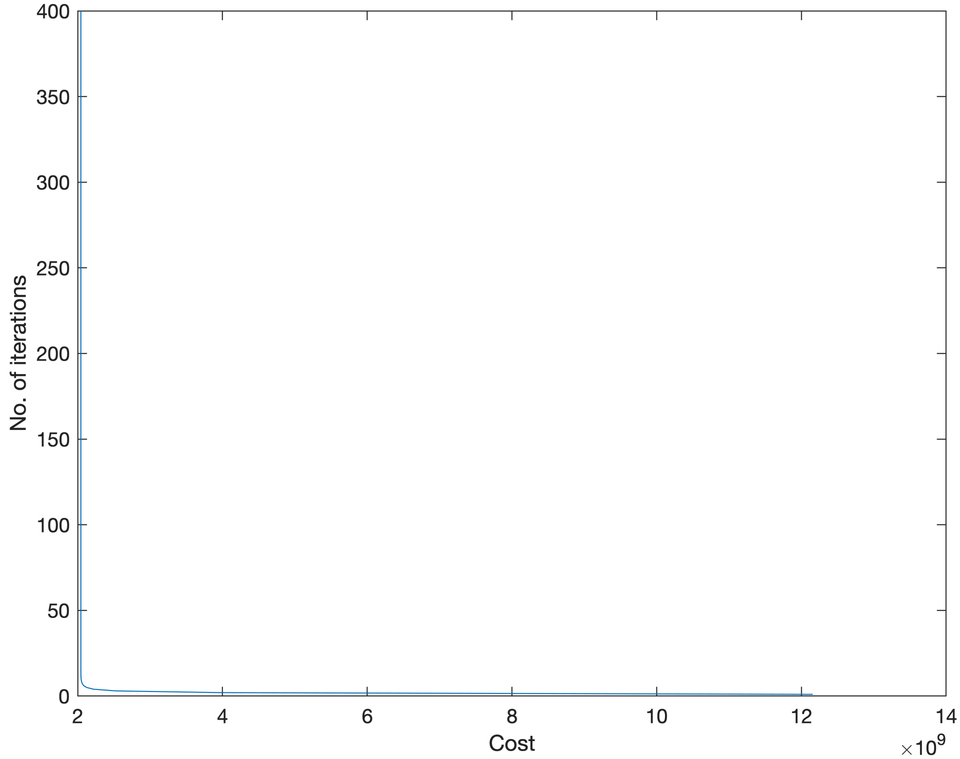
```
fprintf('Minimum cost computed from gradient descent:\n%f',min(J_history))
```

```
Minimum cost computed from gradient descent:
2043280050.602827
```

```
% Display gradient descent's result
fprintf('Theta computed from gradient descent:\n%f,\n%f',theta(1),theta(2))
```

```
Theta computed from gradient descent:
340412.659574,
110631.050279
```

```
figure;
plot(J_history, 1:num_iters);
ylabel("No. of iterations")
xlabel("Cost")
```




```
val=(1650-mu1)/sigma1;
price = [theta(1)+theta(2)*val];

fprintf('Predicted price of a 1650 sq-ft, 3 br house (using gradient descent):\n $%f',
```

```
Predicted price of a 1650 sq-ft, 3 br house (using gradient descent):
 $291594.141933
```

Normal Equation

```
X_normal=X;
theta_normal=normalEqn(X_normal,y);
```

```
fprintf('Theta computed from the normal equations:\n%f\n%f\n%f', theta_normal(1),theta_
```

```
Theta computed from the normal equations:
340412.659574
110631.050279
-6649.474271
```

```
J=computeCostMulti(X,y,theta_normal)
```

```
J = 2.0433e+09
```