1. Multiple Features

August 6, 2021

1 Introduction

Previously, we only considered linear regression with a single feature/variable x, now however we will consider more than 1 feature that can be used to predict something. As an example we can have features such as the size of a house, the number of bedrooms, the age of the house and the number of floors to predict the price of the house

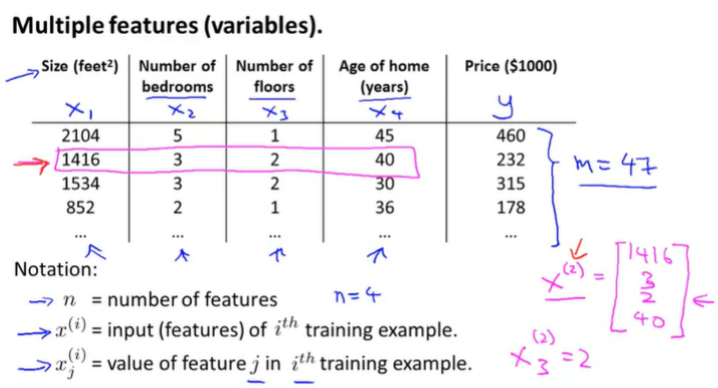

Figure 1: Notation of multiple variables

2 Hypothesis Function with Multiple Features

Our hypothesis function now changes from a function of 1 variable to a function of multiple

$$h_\theta(x) = \theta_0 + \theta_1 x_1 + \theta_2 x_2 + ... + \theta_n x_n \tag{1}$$

for convenience lets define a 0 feature x_0 which will always have the value 1, then our hypothesis function becomes

$$h_\theta(x) = \theta_0 x_0 + \theta_1 x_1 + \theta_2 x_2 + ... + \theta_n x_n \tag{2}$$

Lets define a feature vector X given as

$$X = \begin{bmatrix} x_0 \\ x_1 \\ . \\ . \\ . \\ x_n \end{bmatrix} \in \Re^{n+1} \tag{3}$$

And a parameter vector defined as

$$\Theta = \begin{bmatrix} \theta_0 \\ \theta_1 \\ . \\ . \\ . \\ \theta_n \end{bmatrix} \in \Re^{n+1} \tag{4}$$

Our hypothesis function can then be written in matrix form as

$$\begin{aligned} h_\theta(x) &= \Theta^T \times X \\ &= \begin{bmatrix} \theta_0 & \theta_1 & . & . & . & \theta_n \end{bmatrix} \times \begin{bmatrix} x_0 \\ x_1 \\ . \\ . \\ . \\ x_n \end{bmatrix} \end{aligned} \tag{5}$$