

# Features and Polynomial Regression

We can improve our features and the form of our hypothesis function in a couple different ways.

We can **combine** multiple features into one. For example, we can combine  $x_1$  and  $x_2$  into a new feature  $x_3$  by taking  $x_1 \cdot x_2$ .

## Polynomial Regression

Our hypothesis function need not be linear (a straight line) if that does not fit the data well.

We can **change the behavior or curve** of our hypothesis function by making it a quadratic, cubic or square root function (or any other form).

For example, if our hypothesis function is  $h_{\theta}(x) = \theta_0 + \theta_1 x_1$  then we can create additional features based on  $x_1$ , to get the quadratic function

$$h_{\theta}(x) = \theta_0 + \theta_1 x_1 + \theta_2 x_1^2 \text{ or the cubic function } h_{\theta}(x) = \theta_0 + \theta_1 x_1 + \theta_2 x_1^2 + \theta_3 x_1^3$$

In the cubic version, we have created new features  $x_2$  and  $x_3$  where  $x_2 = x_1^2$  and  $x_3 = x_1^3$ .

To make it a square root function, we could do:  $h_{\theta}(x) = \theta_0 + \theta_1 x_1 + \theta_2 \sqrt{x_1}$

One important thing to keep in mind is, if you choose your features this way then feature scaling becomes very important.

eg. if  $x_1$  has range 1 - 1000 then range of  $x_1^2$  becomes 1 - 1000000 and that of  $x_1^3$  becomes 1 - 1000000000

✓ Complete



