# Multiple Features

**Note:** [7:25 - $\theta^T$ is a 1 by (n+1) matrix and not an (n+1) by 1 matrix]

Linear regression with multiple variables is also known as "multivariate linear regression".

We now introduce notation for equations where we can have any number of input variables.

$$\begin{align*}x_j^{(i)} &= \text{value of feature } j \text{ in the }i^{th}\text{ training example} \newline x^{(i)}& = \text{the input (features) of the }i^{th}\text{ training example} \newline m &= \text{the number of training examples} \newline n &= \text{the number of features} \end{align*}$$

The multivariable form of the hypothesis function accommodating these multiple features is as follows:

$$h_\theta (x) = \theta_0 + \theta_1 x_1 + \theta_2 x_2 + \theta_3 x_3 + \cdots + \theta_n x_n$$

In order to develop intuition about this function, we can think about $\theta_0$ as the basic price of a house, $\theta_1$ as the price per square meter, $\theta_2$ as the price per floor, etc. $x_1$ will be the number of square meters in the house, $x_2$ the number of floors, etc.

Using the definition of matrix multiplication, our multivariable hypothesis function can be concisely represented as:

$$\begin{align*}h_\theta(x) =\begin{bmatrix}\theta_0 \hspace{2em} \theta_1 \hspace{2em} ... \hspace{2em} \theta_n\end{bmatrix}\begin{bmatrix}x_0 \newline x_1 \newline \vdots \newline x_n\end{bmatrix}= \theta^T x\end{align*}$$

This is a vectorization of our hypothesis function for one training example; see the lessons on vectorization to learn more.

Remark: Note that for convenience reasons in this course we assume $x_{0}^{(i)} =1 \text{ for } (i\in \{ 1,\dots, m \} )$. This allows us to do matrix operations with theta and x. Hence making the two vectors '$\theta$' and $x^{(i)}$ match each other element-wise (that is, have the same number of elements: n+1).]