

# Implementation Note: Unrolling Parameters

With neural networks, we are working with sets of matrices:

$$\Theta^{(1)}, \Theta^{(2)}, \Theta^{(3)}, \dots$$

$$D^{(1)}, D^{(2)}, D^{(3)}, \dots$$

In order to use optimizing functions such as "fminunc()", we will want to "unroll" all the elements and put them into one long vector:

```
1 thetaVector = [ Theta1(:); Theta2(:); Theta3(:); ]  
2 deltaVector = [ D1(:); D2(:); D3(:) ]
```

If the dimensions of Theta1 is 10x11, Theta2 is 10x11 and Theta3 is 1x11, then we can get back our original matrices from the "unrolled" versions as follows:

```
1 Theta1 = reshape(thetaVector(1:110),10,11)  
2 Theta2 = reshape(thetaVector(111:220),10,11)  
3 Theta3 = reshape(thetaVector(221:231),1,11)  
4
```

To summarize:

## Learning Algorithm

- Have initial parameters  $\Theta^{(1)}, \Theta^{(2)}, \Theta^{(3)}$ .
- Unroll to get `initialTheta` to pass to
- `fminunc(@costFunction, initialTheta, options)`

```
function [jval, gradientVec] = costFunction(thetaVec)
```

From `thetaVec`, get  $\Theta^{(1)}, \Theta^{(2)}, \Theta^{(3)}$ .

Use forward prop/back prop to compute  $D^{(1)}, D^{(2)}, D^{(3)}$  and  $J(\Theta)$ .

Unroll  $D^{(1)}, D^{(2)}, D^{(3)}$  to get `gradientVec`.