Vision - removed material

This is an earlier, longer, but no less confusing version of the confusing aside.

Confusing aside - rate versus reconstruction

The slightly confusing thing here is that we are moving between the linear model and the reconstruction. We do this all the time with vectors:

$$\mathbf{v} = v_1\mathbf{i} + v_2\mathbf{j} + v_3\mathbf{k} \tag{1}$$

is the reconstruction where the corresponding project, for example

$$v_1 = \mathbf{v} \cdot \mathbf{i} \tag{2}$$

is like the linear model. In other words, in the construction we make the vector out of the components and the basis vectors, in the projection we work out the components using the basis vectors. The situation in this case is pretty striaght-forward, because the basis vectors are orthonormal

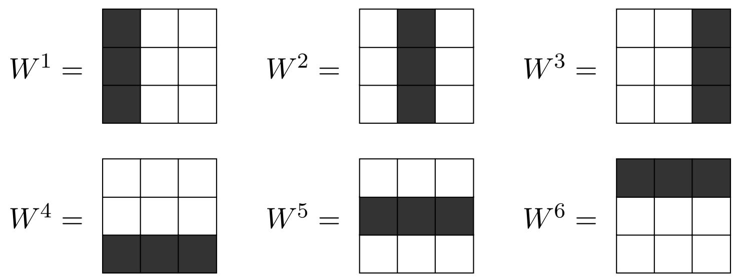
$$\mathbf{i} \cdot \mathbf{j} = \mathbf{j} \cdot \mathbf{k} = \mathbf{k} \cdot \mathbf{i} = 0 \tag{3}$$

and

$$\mathbf{i} \cdot \mathbf{i} = \mathbf{j} \cdot \mathbf{j} = \mathbf{k} \cdot \mathbf{k} = 1 \tag{4}$$

the same basis vector appears in the reconstruction and the projection: the coeffient v_1 of $\mathbf{i}$ in the reconstruction is the projection of $\mathbf{v}$ onto $\mathbf{i}$. However, in the case of vision the basis elements, the W^s_{ij} and w^s_{ij} are not orthonormal and therefore are not the same, working out the relationship between involves vectorizing the matrix indices i and j, so we won't go into it here, morally one is the inverse transpose of the other. In fact, here we will consider an example where the dimensions are different, where the image patches are 3×3 but there are only six features, so $s = 1 \ldots 6$. This means that the reconstructed image may not be equal the original image and will just be an approximation to it.

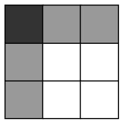
As an example, lets have



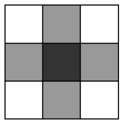
where the almost-black corresponds to one and white to zero, so put another way

$$[W^1_{ij}] = \begin{pmatrix} 1 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 0 & 0 \end{pmatrix} \tag{5}$$

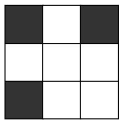
Now consider the example visual input

$I =$ 

This would correspond to $a = (0.5, 0, 0, 0, 0, 0.5)$ or

$I =$ 

corresponds to $a = (0, 0.5, 0, 0, 0.5, 0)$ whereas

$I =$ 

lies outside the six-dimensional subspace spanned by the features.