The Model 2.0 and Friends: An Interim Report

Last year, I reported on preliminary results of an anatomically-inspired deep learning model of the visual system and its role in explaining the face inversion effect. This year, I will report on new results and some variations on network architectures that we have explored, mainly as a way to generate discussion and get feedback. This is by no means a polished, final presentation!

One architecture we've been working on uses divisive normalization. The goal here is to see if using sparse activations has any utility in neural networks. So far, we have preliminary results where the model is somewhat better than a baseline model with the same number of parameters on MNIST. The model has 6 divisive normalization convolutional "pools" of five features each, using the Carandini and Heeger formula for divisive normalization, followed by a fully connected network. Using Simoncelli's version, or using a simple pool of softmax units has not worked as well so far. Encouraged by this result, we are now experimenting with multiple layers of divisive normalization pools.

Another architecture we've been playing with is a mixture model where gating networks can switch different modules in hidden layers, with the goal of developing "pathways" that lead to a simulated FFA, VWFA, LOC, etc. Here, we want to see if previous results with a shallower network (The Model 1.0) generalizes to deep networks. Our previous result showed that a network trained on fine-grained categorization of homogeneous categories (e.g., faces, cups, cans, etc.) would learn greebles faster than a network that just did basic-level categorization ([Tong, M.H., Joyce, C.A., and Cottrell, G.W. (2008) Why is the fusiform face area recruited for novel categories of expertise? A neurocomputational investigation](#) *Brain Research* 1202:14-24). This work suggested that a reason why the FFA is recruited for other domains of expertise is not because it is a face area per se. Rather, it is what we do with them – fine level discrimination – that matters. Hence there is nothing special about faces. The takeaway message of that work was that if our parents were cans, the Fusiform Can Area would be recruited for Greebles. We are now investigating whether our deep, semi-modular model, will show the same effects.

We look forward to the group's suggestions for these projects.