

Project Summaries

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a)

The goal of our project is to visualize and compare the feature maps that a CNN learns after training to early biological features. We plan to find the similarities and dissimilarities between the features learned by convnets and the brain. Additionally, we also plan on finding parallels between ConvNets and the visual system regarding visual processing such as local response normalization in CNN and lateral inhibition in the brain. By comparing the visual processing in the brain and CNN, we aim to find out the reason why CNN performs so well and try to improve it further.

b)

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1363130/> is one of the papers we'll be referencing. It shows that certain neurons in cats respond to certain lines or contours.

<https://arxiv.org/pdf/1311.2901.pdf> is another paper we'll be referencing. It discusses projecting neuron activation back to the pixel space, so that we can see what patterns activate the neurons in the CNN filters. It also discusses how changing things like filter size or the depth of the model can have big effects on the model, so we will try to do similar things for our project, to see if these can make our model more brain-like.

c)

We expect to find that there are many similarities between the early biological features and ConvNet features, which explain why CNN is performing well. For example, Zeiler and Fergus (2014) reported that early layers of CNN responded to certain lines and contours, which were learnt by cats too (Hubel & Wiesel, 1959). Also, certain techniques used in improving the performance of CNN actually have reference in the brain such as pooling. In addition, there are also lots of dissimilarities between CNN and the brain. Except the difference in features learnt, there are also differences in the way of visual processing such as the absence of lateral connections, adaption, and normalization in CNN. We want to explore more on the differences and have some improvement on CNN.

(d)

So far we've looked into finding and reading some papers that will help us for our project. We've also begun writing the code for our feature visualization model.

e)

Since the majority of the literature search has already been completed, we plan to continue onwards with finishing the code and the training of the feature visualization models by April 12th. The rest of the time will then be used to write the report while fine-tuning any bugs in our programs.