Stat 271. Fall 2015. Homework 3

Prof. Alan Yuille

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Due on Tuesday 15/Dec 2015. Email pdf file to `qiuwch@gmail.com`

Question 1. Theory.

Discuss the main ideas of Bayes-Kalman filters. What is it optimal for? What are prediction and correction? What types of visual phenomena can it be used to model?

Briefly describe strong and weak coupling. Under which situations is the linear rule for combining cues optimal? How can cue coupling be modeled using causal models? Describe "explaining away" and model selection. What are "negative bias" effects? And how can causal models account for them? (e.g., for multi-sensory cues coupling).

Derive the backpropagation learning algorithm for two-layer perceptrons. Is the loss function (for learning) convex? In practice, what are the main factors which influence the convergence of the learning algorithm?

Discuss the similarity and differences between compositional models and deep networks. What are the advantages and disadvantages of each method? What is the difference between forward models, such as deep networks, and generative models? What is analysis by synthesis?

Question 2. Deep Neural Networks

The goal of this project is to train a deep neural network to recognize digits. Details are available on the website:

`http://nbviewer.ipython.org/github/qiuwch/Stat271HWFall15/blob/master/`
`HW3Intro.ipynb`

Note: contact Prof. Yuille by email if you want to attempt a more challenging deep network application.