

Computational Cognitive Science, Tutorial 06

Wai Keen Vong (waikeen.vong@adelaide.edu.au)
University of Adelaide, School of Psychology

April 8, 2014

In this week's tutorial, we'll be covering three different kinds of models that can learn abstract, or higher-level knowledge. Since most of these models are too difficult to give code examples for, the aim of this tutorial will be to get a solid conceptual understanding of how these things work.

1 Learning overhypotheses about the variability of categories

- What are overhypotheses and hyperparameters? How are overhypotheses different from the usual kinds of hypotheses we have seen before?
- The first model we introduced in this lecture learns an overhypothesis for a single kind. What are the model parameters that learn the abstract knowledge in this situation?
- The second model extends the model to account for the fact that people can learn overhypotheses about multiple kinds, not just a single kind. What modifications do we make to the model to allow for this?
- The third model then allows the model to learn the category assignments of each of the observations (as well as learning overhypotheses over multiple kinds). What modifications do we make to the model to allow for this?
- Finally, comparing the model's performance to human data shows that while the model could learn many of the tasks, humans could not. What are some explanations for this discrepancy?

2 Learning overhypotheses about the distribution of categories

- In this lecture, we covered the process of how to design an experiment to study a novel question. In the experiment, what is the purpose of the last trial where participants in both conditions see the same example?
- The key measure in the experiments was to examine whether people extrapolated the number of types seen. How did we operationalize the concept of extrapolation in this task?
- How does this model differ from the overhypothesis models in the previous lectures? Which differences allows it to make inferences about the number of types in each bag?
- Why do all of the previous category learning models we have seen fail to capture this?

3 Learning about category structure

- In this lecture we presented a model can that learn the structure of concepts from only object-feature (or similarity) data. What are the three levels of this hierarchical model that lets us learn conceptual structure?
- The goal of the model is to maximize the equation $p(S, F|D) \propto p(D|S)p(S|F)p(F)$. What does $p(S, F|D)$ mean?
- What does the term $p(D|S)$ refer to? How is this calculated?
- What does the term $p(S|F)$ refer to? How is it calculated?
- How does the model generate different forms?