Deep Learning Wrap-Up

Andrea Danyluk
April 24, 2017

Parts of this, as well as parts of the earlier neural net slides, were adapted from Tom Mitchell. Other parts draw from Deep Learning by Goodfellow, Bengio, and Courville.

Announcements

• AI/Ethics discussion on Wednesday

Today’s Lecture

• Deep Learning Wrap-up
• Discussion: Do deep convolutional nets need to be deep and convolutional?

What is Deep Learning?

• Represents the world as a nested hierarchy of concepts
  – Each concept defined in relation to simpler concepts
  – More abstract representations computed in terms of less abstract ones
• An artificial neural network with many layers
• Success generally not due to simply to the fact that they have many layers
  – Autoencoding
  – Convolution
  – Recurrence

Autoencoders

• Trained to copy their input to their output
  – Typically not interested in the decoding piece
• Traditionally used for dimensionality reduction or feature learning

Autoencoders

But more typically, we reduce dimensionality at each level.
Deep Belief Networks

- Autoencoder networks learn low dimensional encodings
- With more layers, can learn better encodings
- After each individual encoding layer has been learned, put them together and backpropagate to tune the entire encoder-decoder network

Very Large Scale DBNs

[Quoc Le et al., ICML 2012]

- Data: 10 million 200x200 unlabeled images, sampled from YouTube
- Training: 1000 machines (16000 cores) for one week
- Learned network: 3 multi-stage layers, 1.15 billion parameters
- Achieves 15.8% accuracy classifying 1 of 22K ImageNet items (sota at the time was 9.5%)

One Layer

- Local Contrast Normalization
- L2 pooling
- Local Receptive Fields = not convolutional

Examining Specific Learned Features

Real images that most excite the feature:

Image synthesized to most excite the feature: