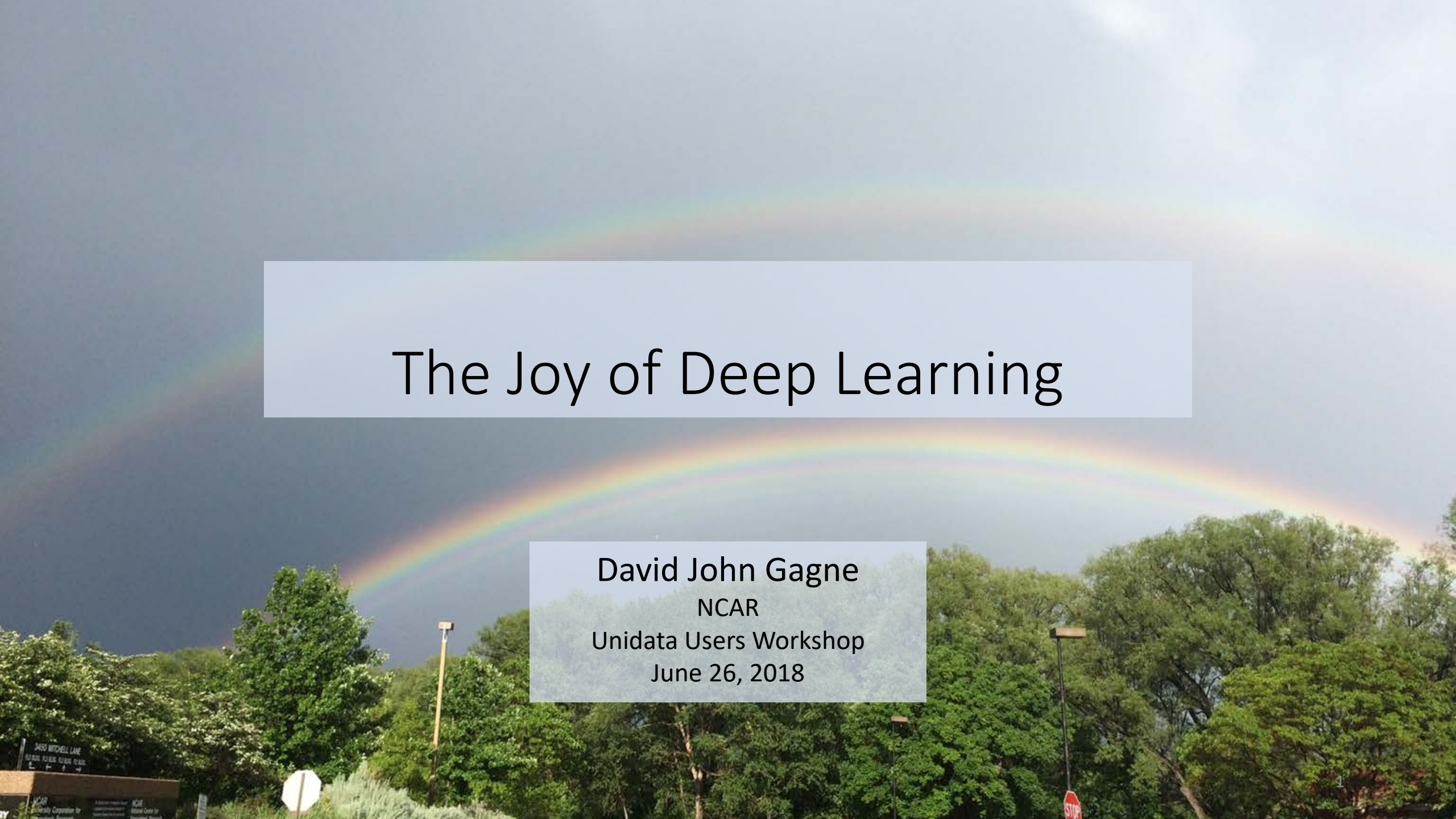
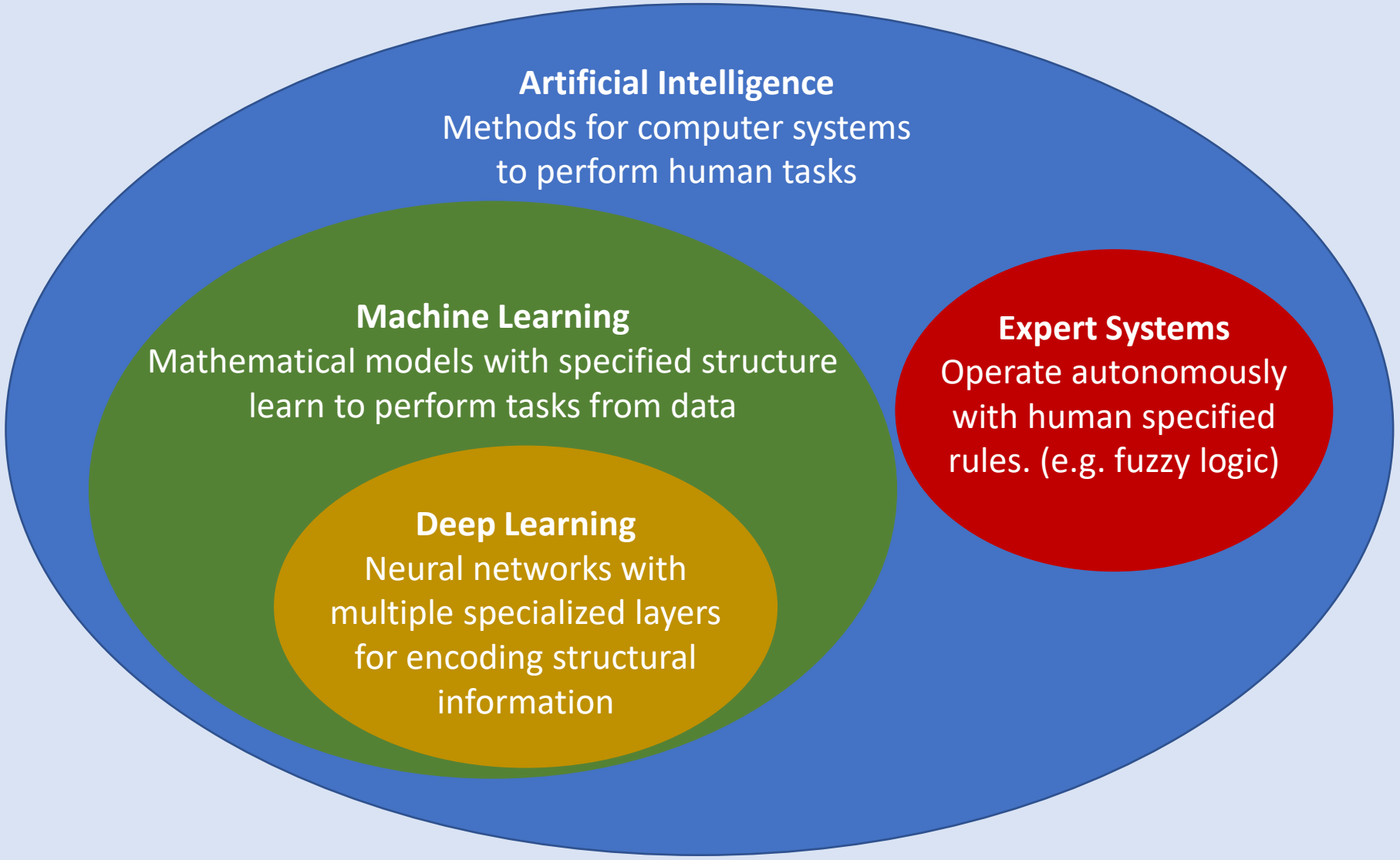


The Joy of Deep Learning

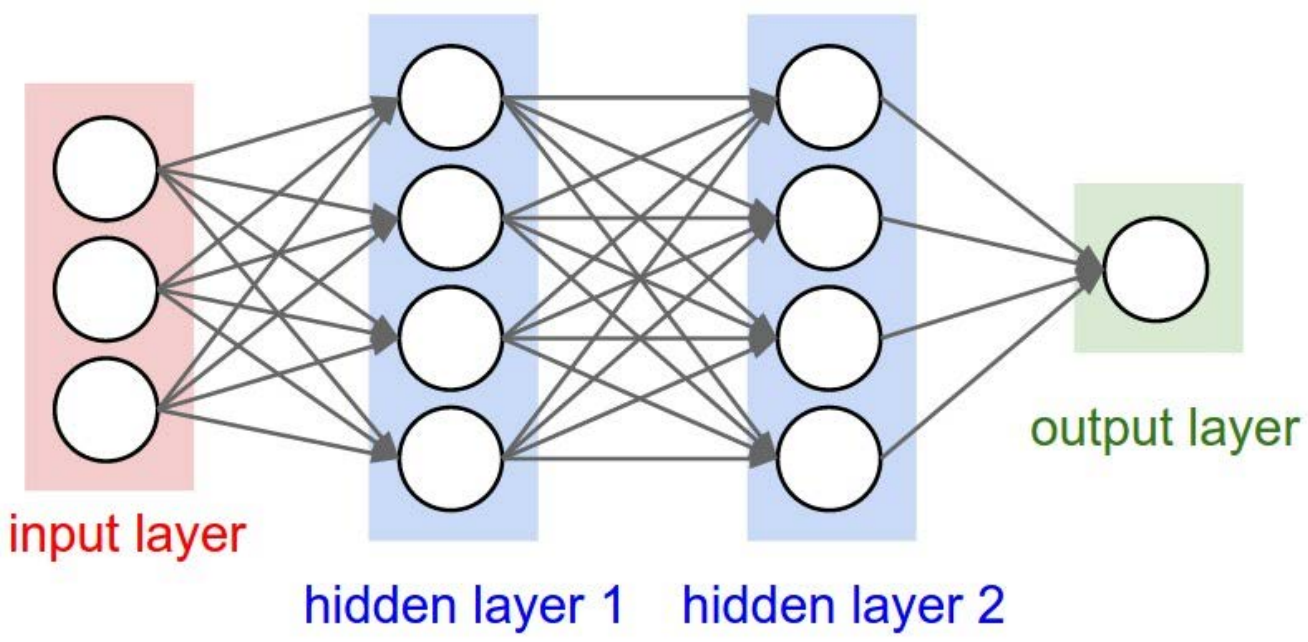
David John Gagne
NCAR
Unidata Users Workshop
June 26, 2018

What Is Deep Learning?

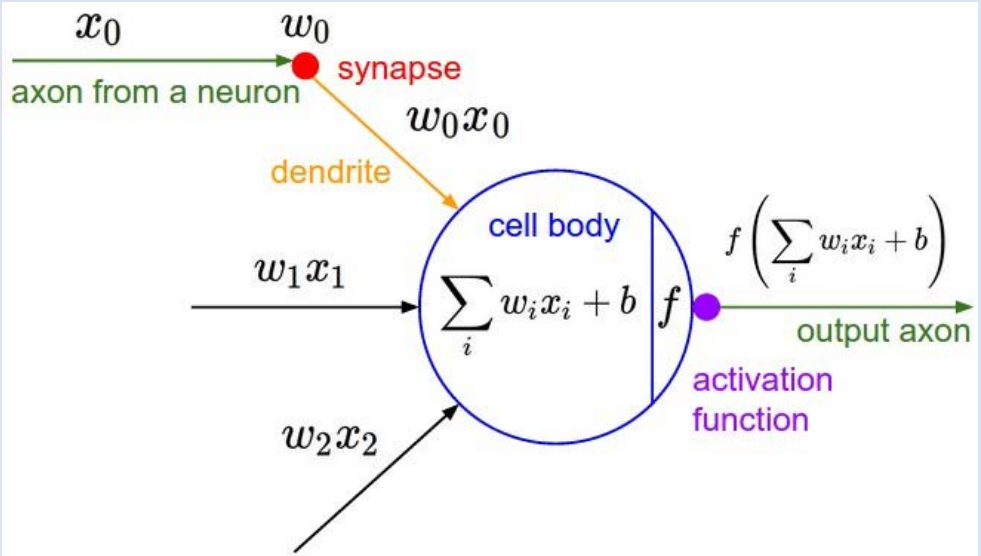


Neural Network Basics

Artificial Neural Network Structure



Perceptron (artificial neuron)



Training Procedure

1. Send batch of training examples through network
2. Calculate prediction error
3. Calculate error gradients back through layers and update weights
4. Repeat over all training examples until errors are satisfactory

Definitions

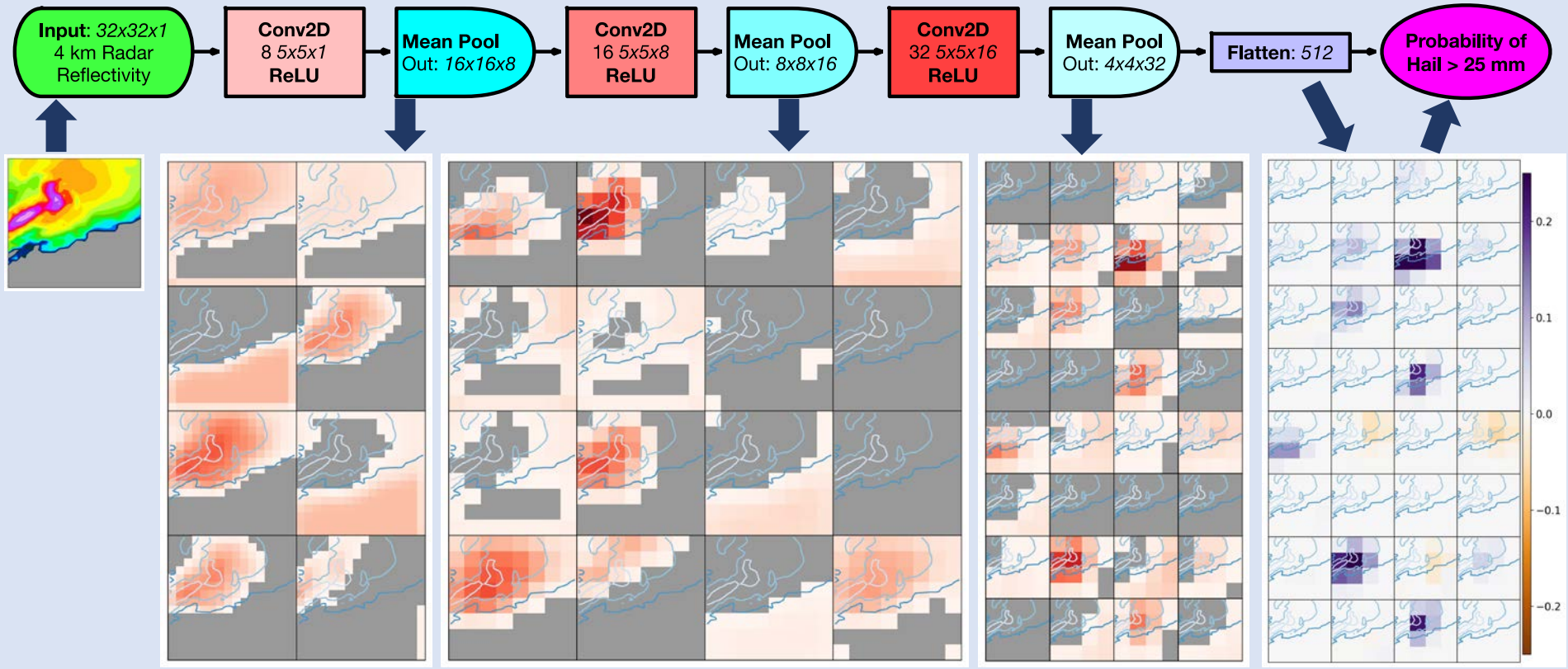
Batch: subset of training examples used to update weights

Epoch: One pass through all examples in training set

Images from http://cs231n.github.io/convolutional-networks/

Convolutional Neural Network

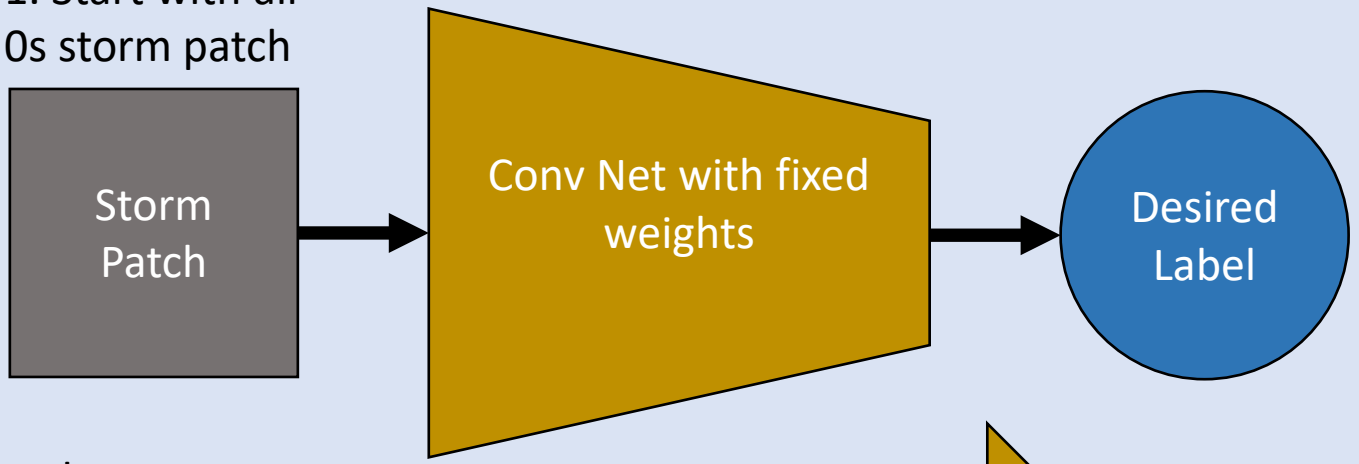
Deep neural network that encodes spatial information with learned convolutional filters



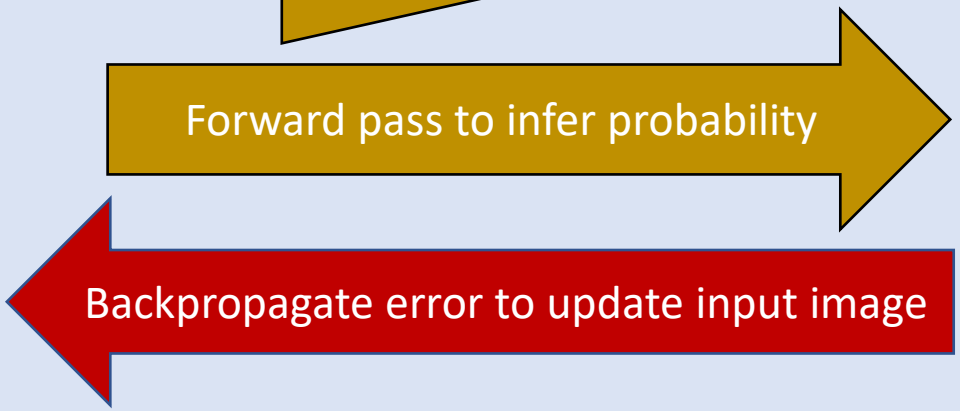
Convolution filter weights tuned through iterative optimization

Feature Visualization by Optimization

1. Start with all 0s storm patch



2. Send input forward through net to get error
3. Pass error back through net to get change in input
4. Update input by subtracting error derivative



Repeat steps 2-4 until prediction matches desired output

How do I get started?

- Software
  - Anaconda Python Distribution
  - Tensorflow and Keras (available in Python and R)
  - PyTorch
- Books
  - Deep Learning by Ian Goodfellow et al.
  - Deep Learning with Python by Francois Chollet
- Tutorials
  - Swirlnet: https://github.com/djgagne/swirlnet
    - Predict mesocyclones with deep learning
  - Stanford CS231n: http://cs231n.github.io/
    - Great notes and visuals explaining convolutional neural networks