

. How do I produce a neural network that behaves like this?

What is deep learning?

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Uses **layers** of "neurons", output from each layer connects to the next



What is deep learning?

- Many ways layers can be connected (*fully-connected, max-pooling, convolutions...*), which forms the model **architecture**
 - Key point: certain architectures are now known to work for specific applications
- Convolutional network are very (very) good for working with images
 - What are they: Combine *layers* of *convolutions* which have a finite *stencil width*, i.e. span only a finite number of points



- Each layer contracts information from a finite part of image into a single value
 - These are composited over multiple layers to produce more complex features

Visualizing and Understanding Convolutional Networks

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How do you train a neural network?

- Model needs a goal, measure how close model is to goal with loss function, L
- Use chain rule to calculate what changes to weights in network will reduce loss for a given (set of) training example(s)

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Backpropagation



Learning Deep Learning (Sonse Shimaoka)

What can neural networks predict?

Anything you want!

• As long as you can formulate a loss function for your problem

Examples

- Predicting location of something:
 - Need bounding box, four scalars y=[x0, y0, x1, y1]
- Predicting class between a predefined set (e.g. is it a cat, dog or fish)
 - Use "one-hot-encoding", probability for each class is element of a vector, e.g. 3 scalars, y=[p_{cat}, p_{dog}, p_{fish}]
- Predicting temperature, concentration change:
 - Output is vector of increments, should probably normalize to ensure conservation, e.g. y=[dT₀, dT₁, dT₂, ...]