Neural Networks and Deep Learning

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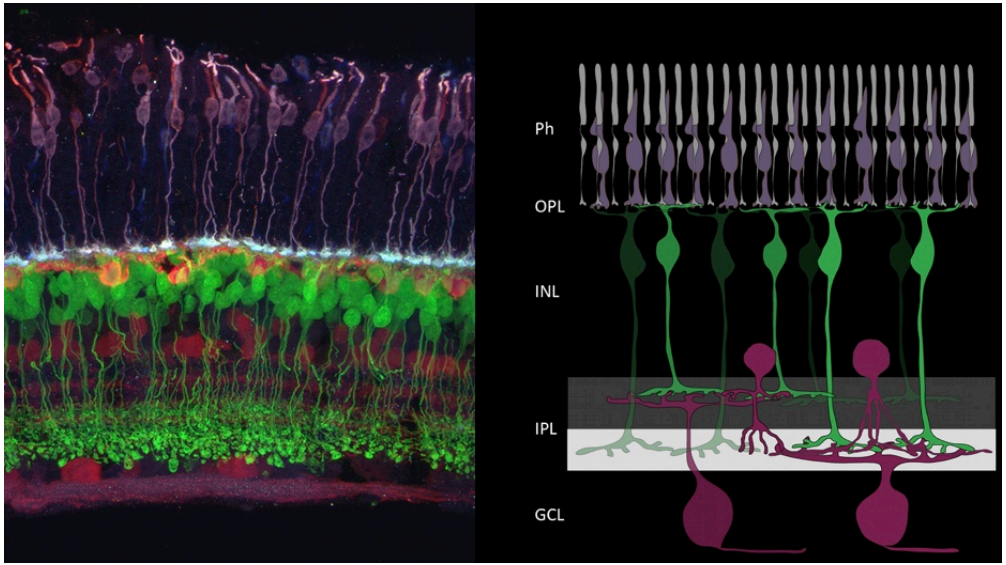
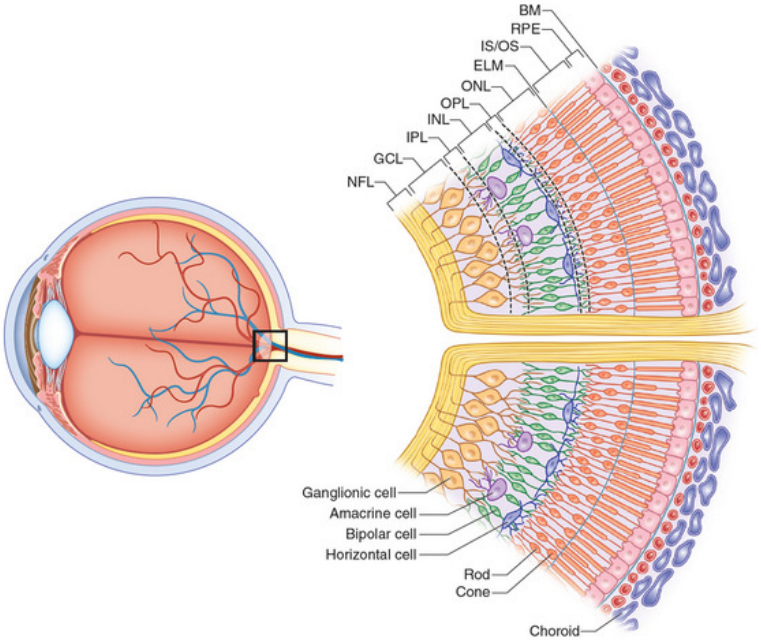
Neural Networks

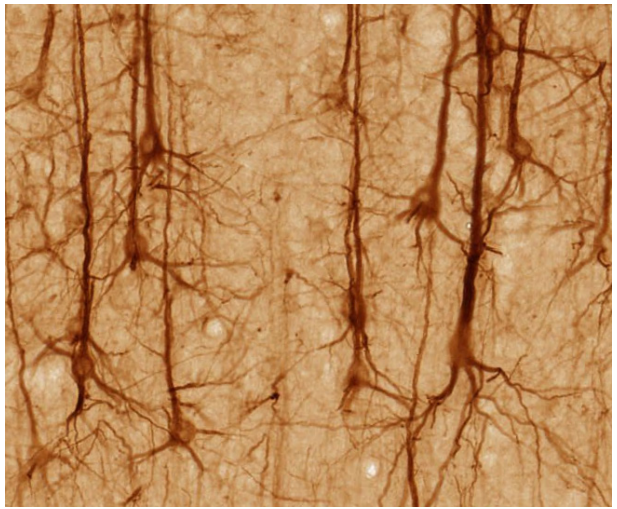
Neuron Networks



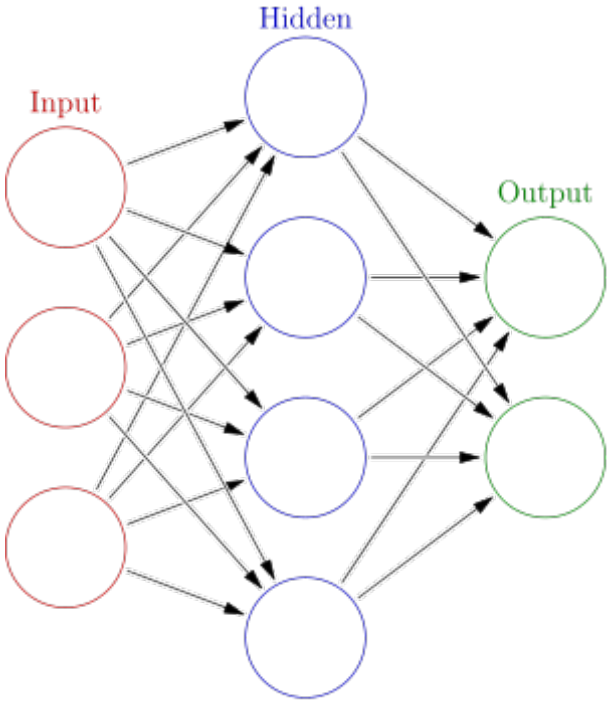


Bleckert A, Schwartz GW, Turner MH, Rieke F, Wong RO. Visual space is represented by nonmatching topographies of distinct mouse retinal ganglion cell types. Curr Biol. 2014 Feb 3;24(3):310-5.

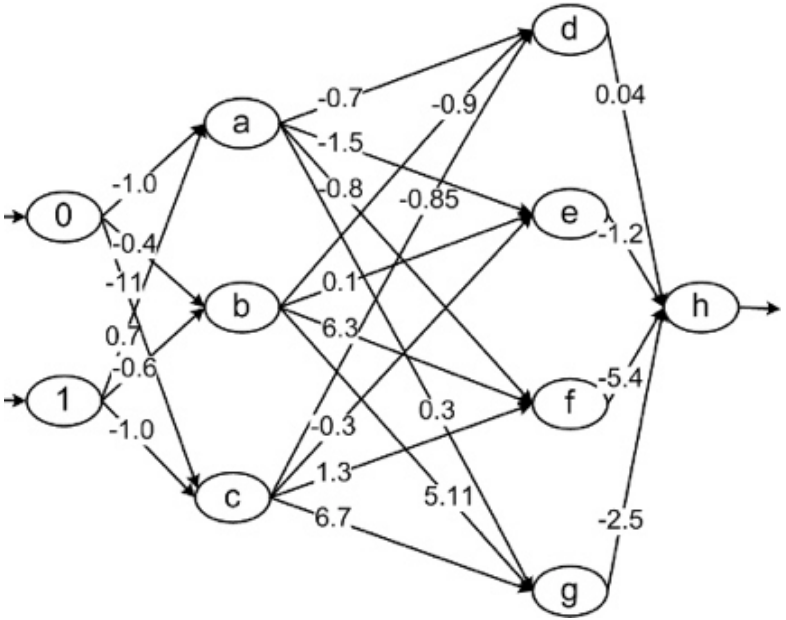
Neuron Network



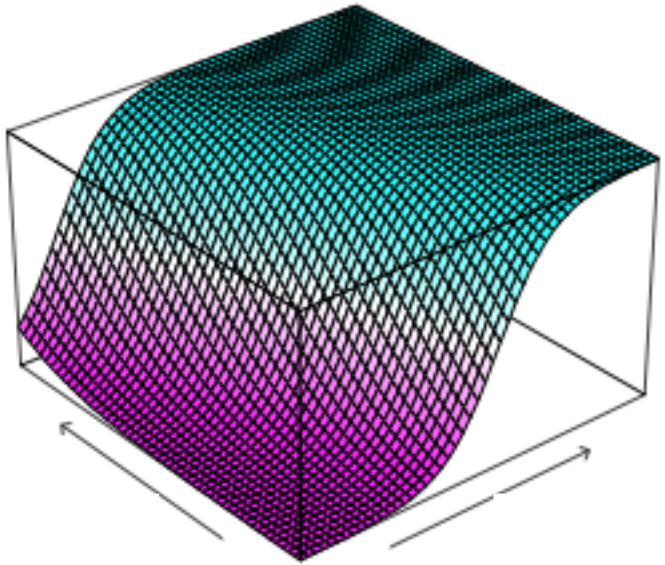
Neural Net



Weights

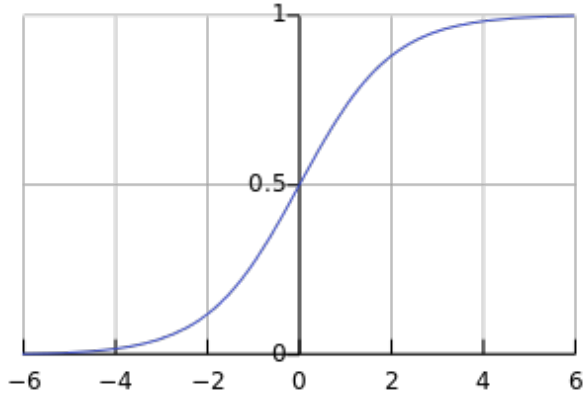

d
a
0.04
-0.7
-0.9
-1.5
-1.0
-0.8
-0.85
0
e
-1.2
-0.4
-11
0.1
b
h
6.3
0.7
-0.6
-5.4
1
f
0.3
-0.3
-1.0
1.3
5.11
c
-2.5
6.7
g

Ridge Function



Hastie, Trevor, et al. The elements of statistical learning. Vol. 2. No. 1. New York: Springer, 2009.

Recall the logistic function



Sigmoidal Function

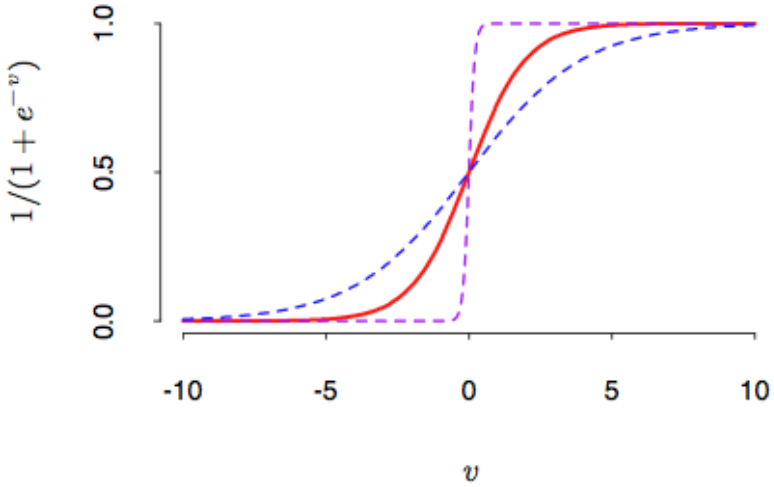


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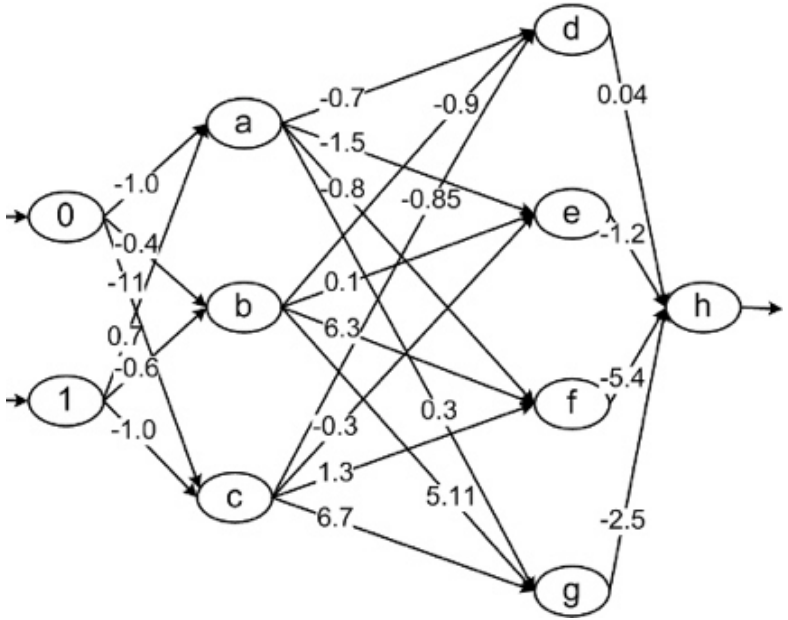
FIGURE 11.3. *Plot of the sigmoid function* $\sigma(v) = 1/(1+\exp(-v))$ *(red curve), commonly used in the hidden layer of a neural network. Included are* $\sigma(sv)$ *for* $s = \frac{1}{2}$ *(blue curve) and* $s = 10$ *(purple curve). The scale parameter* s *controls the activation rate, and we can see that large* s *amounts to a hard activation at* $v = 0$*. Note that* $\sigma(s(v - v_0))$ *shifts the activation threshold from* 0 *to* v_0*.*

Optimization



Too Many Weights

- Each layer has U*V weights, where U are the number of neurons in the previous layer and V the number in the current

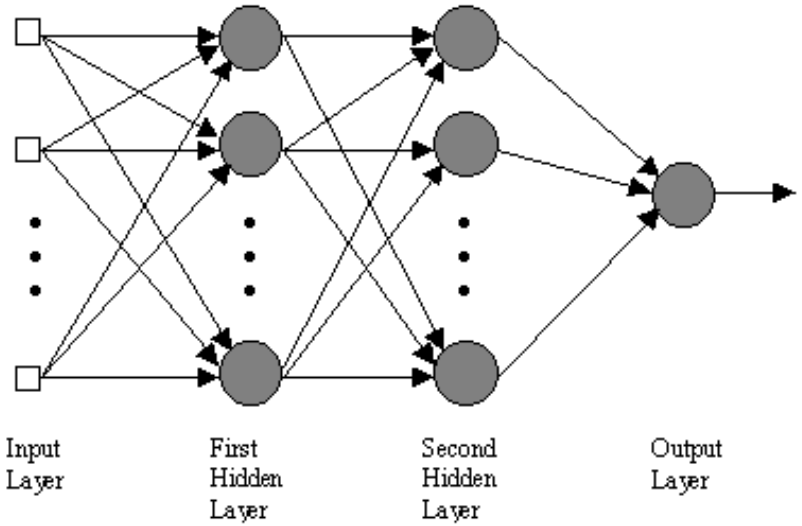
- Regularization via early stopping

- Regularization via **Weight Decay**

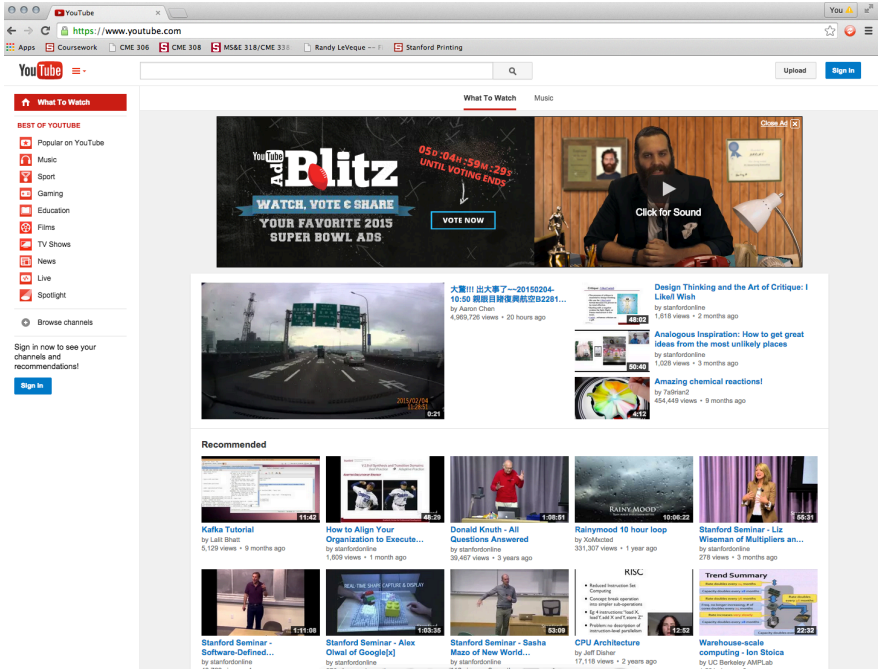
Questions?

Deep Learning

Many layers, means many parameters



Huge Datasets only



Building High-level Features Using Large Scale Unsupervised Learning

Quoc V. Le, Marc Aurelio Ranzato, Rajat Monga, Matthieu Devin, Kai Chen, Greg S. Corrado, Jeffrey Dean, and Andrew Y. Ng

Unsupervised Neural Net Learning

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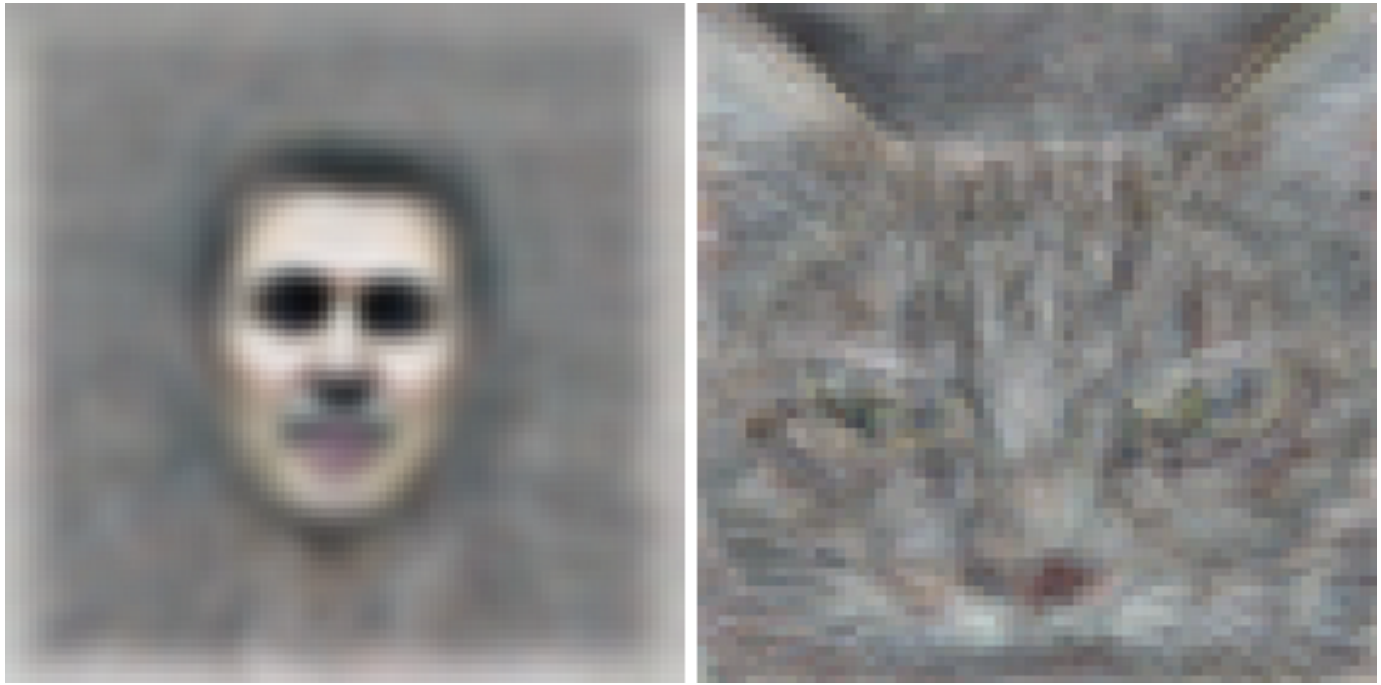

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