Advanced Machine Learning

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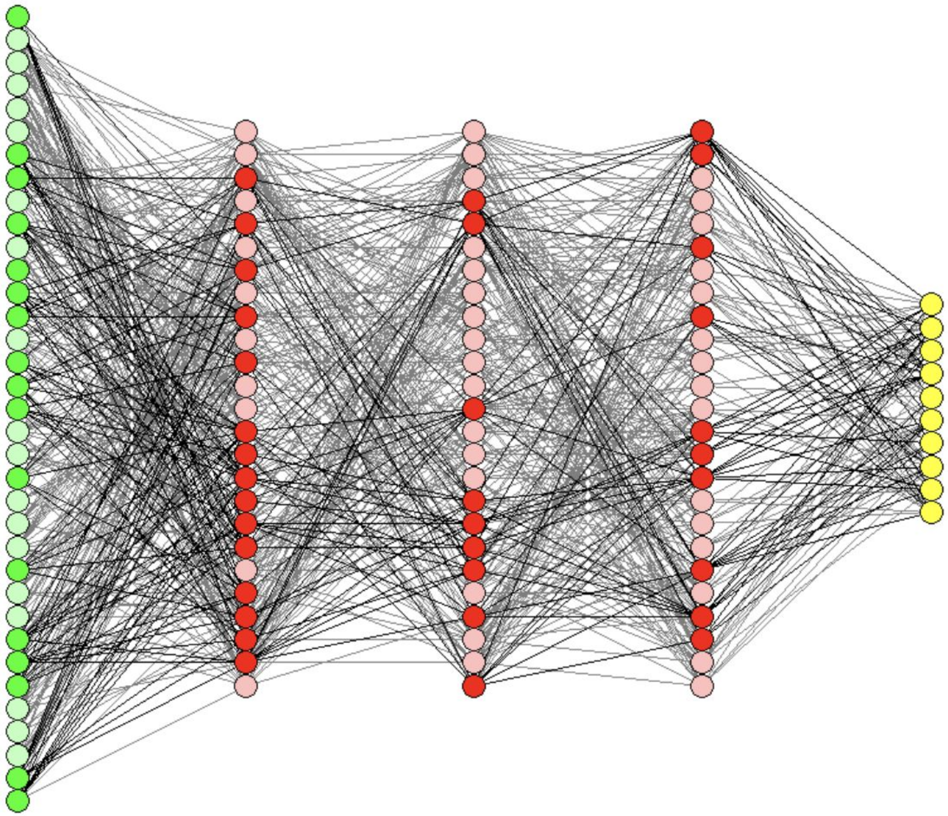
Co-adaptation of neural networks

During training a neural network, some neurons become highly dependent on others - resulting in “stronger” and “weaker” connections

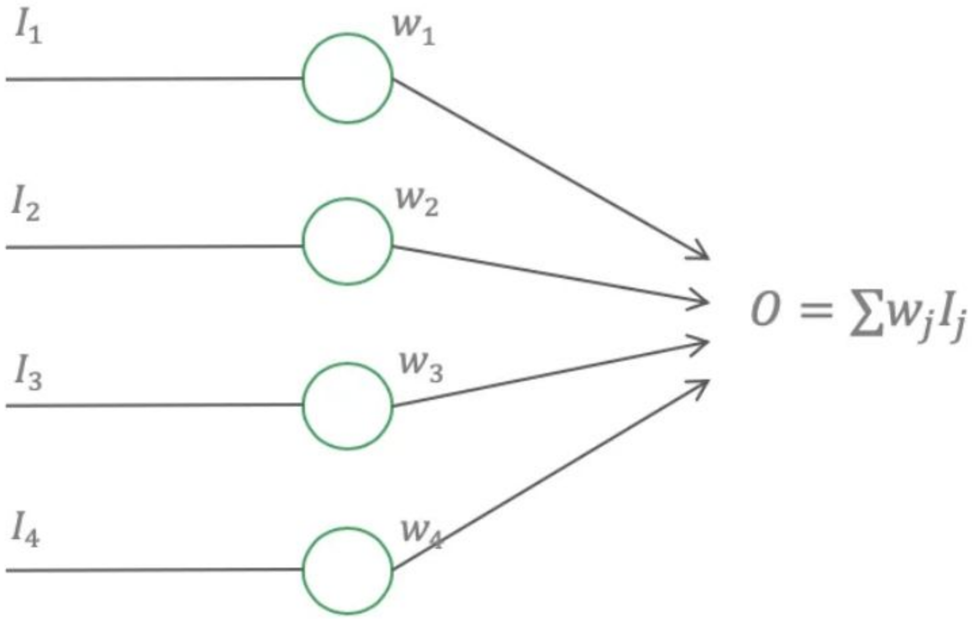
- If the “stronger” connections receive “bad” inputs, then it can significantly affect the neural network’s performance, which is what might happen with overfitting
- This can not be prevented with the traditional regularization, like the L1 and L2

Co-adaptation of deep networks



Dropout as solution to co-adaptation

Let us consider a single linear unit of a neural network:



Other papers on Dropout

- Fast dropout

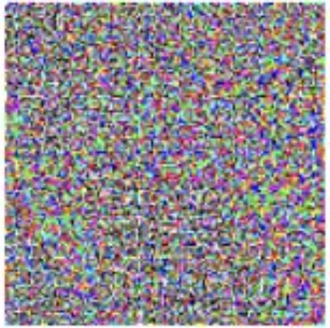
Wang, Sida, and Christopher Manning. "Fast dropout training." international conference on machine learning. PMLR, 2013.

- Dropout boosting

Warde-Farley, David, et al. "An empirical analysis of dropout in piecewise linear networks." arXiv preprint arXiv:1312.6197 (2013).

Adversarial Training

$+ .007 \times$



$=$

$\boldsymbol{x}$

$y =$"panda"
w/ 57.7%
confidence

$\text{sign}(\nabla_{\boldsymbol{x}} J(\boldsymbol{\theta}, \boldsymbol{x}, y))$

"nematode"
w/ 8.2%
confidence

$\boldsymbol{x} + \epsilon\, \text{sign}(\nabla_{\boldsymbol{x}} J(\boldsymbol{\theta}, \boldsymbol{x}, y))$

"gibbon"
w/ 99.3%
confidence