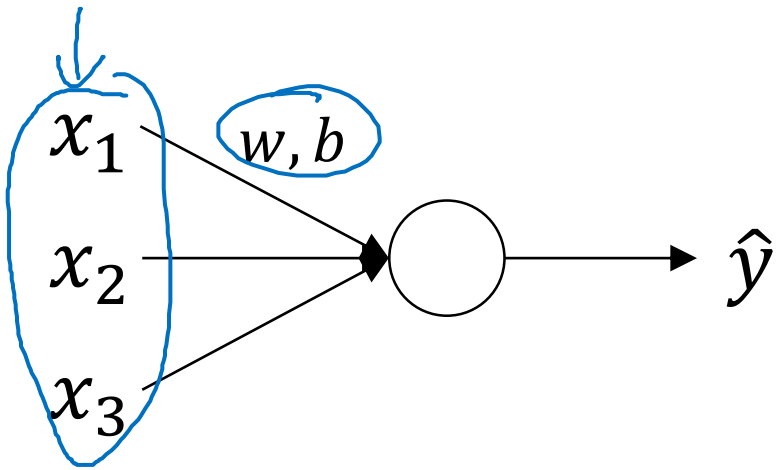
deeplearning.ai

Batch Normalization

Normalizing activations in a network

Normalizing inputs to speed up learning

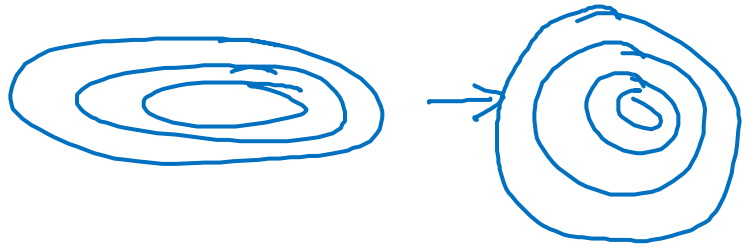


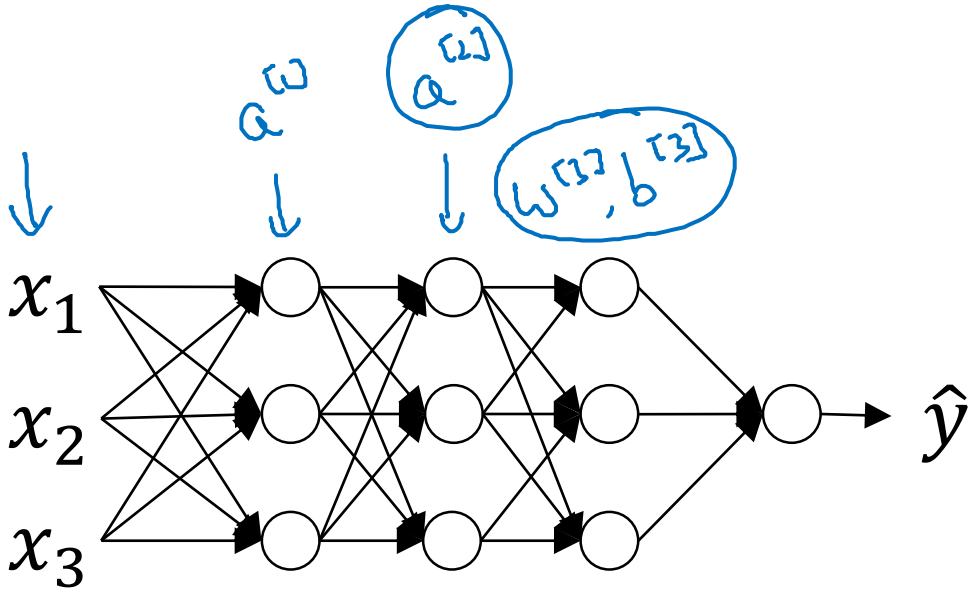
$$\mu = \frac{1}{m}\sum_i x^{(i)}$$

$$X = X - \mu \quad \text{← element-wise}$$

$$\sigma^2 = \frac{1}{m}\sum_i x^{(i)2}$$

$$X = X / \sigma^2$$





Can we normalize $a^{[2]}$ so as to train $w^{[3]}, b^{[3]}$ faster

Normalize $z^{[2]}$

Andrew Ng

Implementing Batch Norm

Given some intermediate values in NN $z^{(1)}, \ldots, z^{(m)}$

$z^{[l](i)}$

$$\mu = \frac{1}{m} \sum_i z^{(i)}$$

$$\sigma^2 = \frac{1}{m} \sum_i (z_i - \mu)^2$$

$$z^{(i)}_{norm} = \frac{z^{(i)} - \mu}{\sqrt{\sigma^2 + \varepsilon}}$$

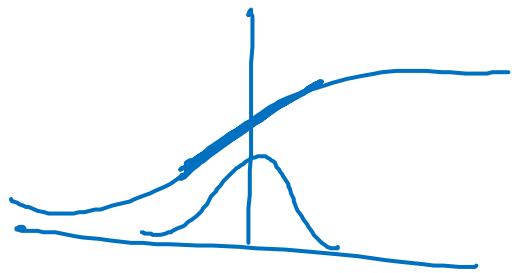
$$\tilde{z}^{(i)} = \gamma z^{(i)}_{norm} + \beta$$

learnable parameters of model.

If $\gamma = \sqrt{\sigma^2 + \varepsilon}$, $\beta = \mu$, then $\tilde{z}^{(i)} = z^{(i)}$

$X \leftarrow$

$z^{(i)} \leftarrow$



Use $\tilde{z}^{[l](i)}$ instead of $z^{[l](i)}$.