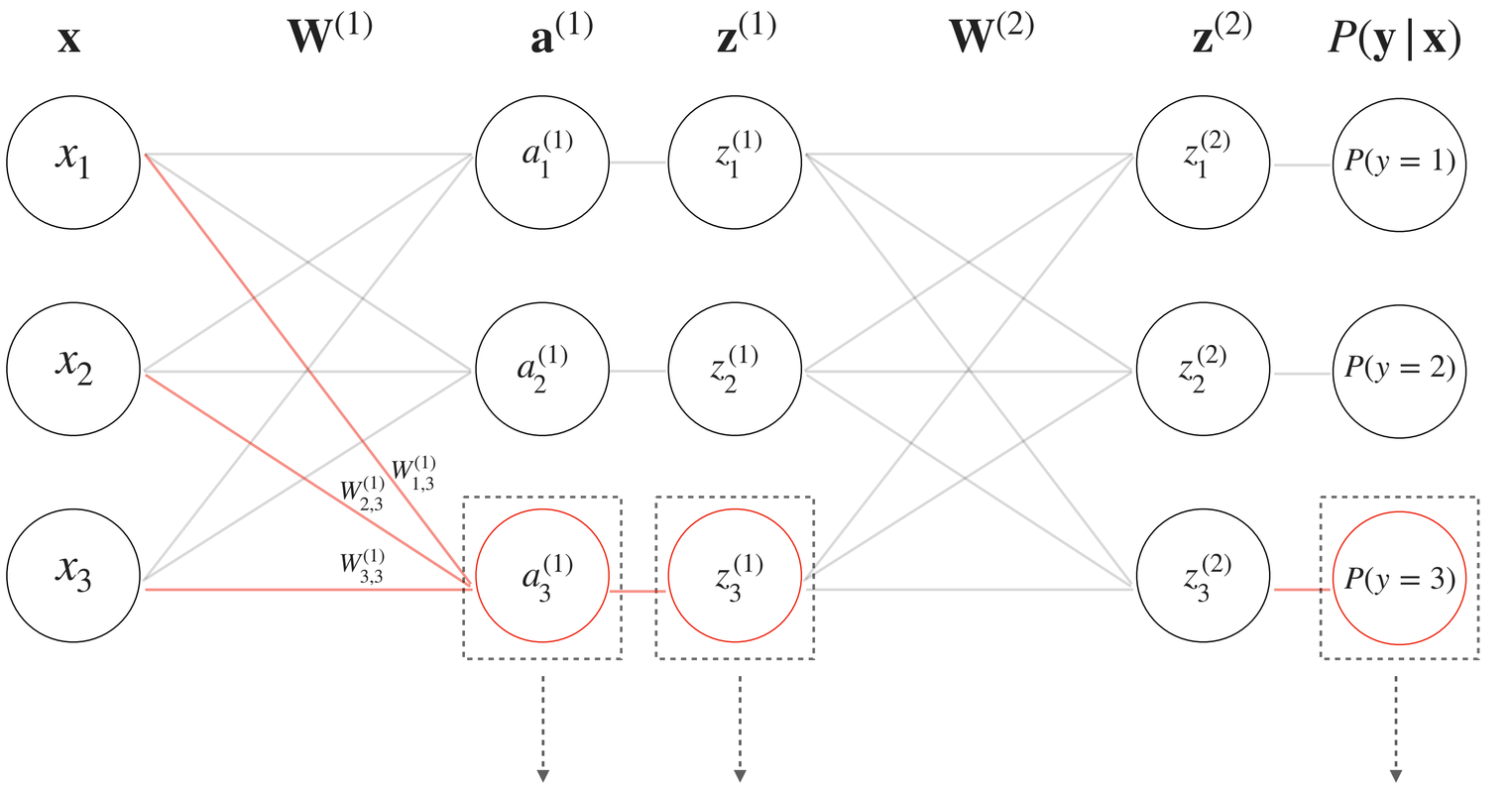
Feed forward neural network

$\mathbf{x}$ — $f(\mathbf{x};\boldsymbol{\theta})$ — $\mathbf{z}$ — $\sigma_{softmax}(\mathbf{z})$



$$a_3^{(1)} = \sum_{j=1}^{3} W_{3,j}^{(1)} x_j + b^{(1)}$$

$$z_3^{(1)} = \sigma_{activation}\left(a_3^{(1)}\right)$$

$$P(y=3) = \sigma_{softmax}(\mathbf{z}_3^{(2)})$$

Common activation functions

$\sigma_{activation}$

$$\sigma_{sigmoid}(z_k) = \frac{1}{1+e^{-z_k}}$$

$$ReLU(z_k) = \max(0, z_k)$$

$$LReLU(z_k) = \max(\alpha z_k, z_k) \quad (0 < \alpha < 1)$$

$$\tanh(z_k) = \frac{2}{1+e^{-2z_k}} - 1$$

Softmax output

$$\sigma_{softmax}(z_k) = \frac{e^{z_k}}{\sum_{k'=1}^{K} e^{z_{k'}}}$$

Gradient backpropagation