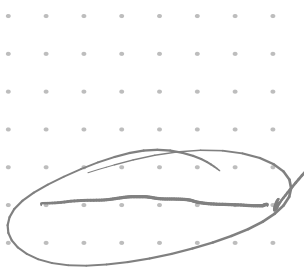
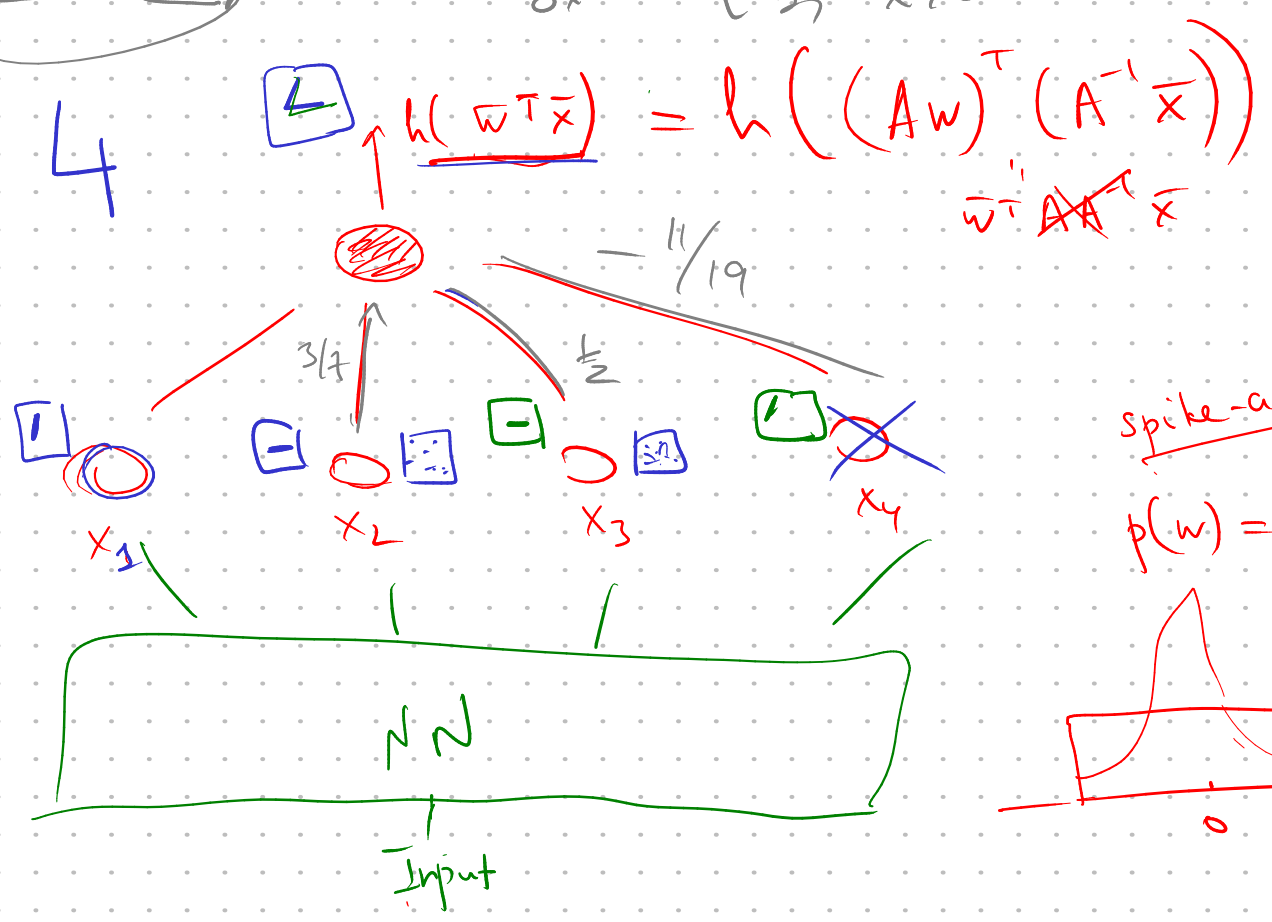


$$\bar{x} \rightarrow \Sigma \rightarrow \bar{w}^T \bar{x} \rightarrow h \rightarrow h(\bar{w}^T \bar{x})$$

$\frac{\partial h}{\partial \cdot}$

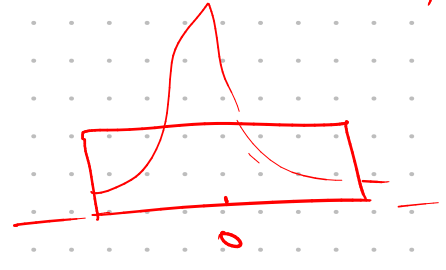


$$\frac{\partial \text{ReLU}}{\partial x} = \begin{cases} 0 & x \leq 0 \\ 1 & x > 0 \end{cases}$$



Spike-and-slab

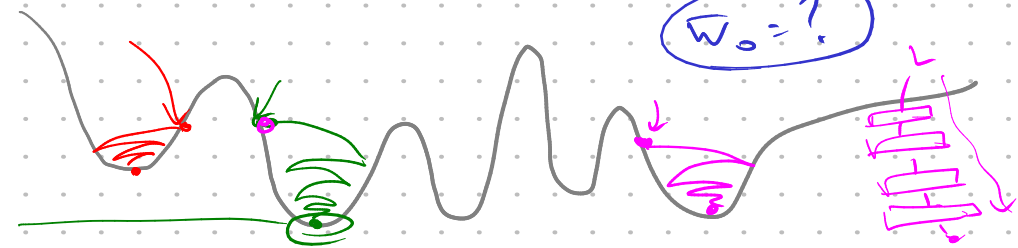
$$p(w) = \begin{cases} \mathcal{N}, & \frac{1}{2} \\ 0, & \frac{1}{2} \end{cases}$$



Weight initialization

$$\bar{w} := \bar{w} - \alpha \nabla_{\bar{w}} L$$

$\bar{w}_0 = ?$



2006-07
Unsupervised pretraining

$$y = w^T x = \sum_{i=1}^n w_i x_i = y_i$$

$$y = \sum y_i = \sum w_i x_i$$

Var[y] = ?

$$\text{Var}[y_i] = \text{Var}[w_i x_i] = \mathbb{E}[w_i^2 x_i^2] - (\mathbb{E}[w_i x_i])^2 =$$



$$= \mathbb{E}[x_i^2] \cdot \text{Var}[w_i] + \mathbb{E}[w_i^2] \cdot \text{Var}[x_i] + \text{Var}[x_i] \cdot \text{Var}[w_i]$$

$$\text{Var}[y_i] = \text{Var}[x_i] \text{Var}[w_i]$$

$$\text{Var}[y] = \sum \text{Var}[y_i] = \sum \text{Var}[x_i w_i]$$

Unit(a,b)
 $\frac{(b-a)^2}{12}$

$$\text{Var}[y] = n \cdot \text{Var}[w_i] \cdot \text{Var}[x_i]$$

$$\text{Var}[w_i] = O\left(\frac{1}{n}\right)$$

$$w_i \sim \text{Unif}\left(-\frac{\sqrt{\beta}}{\sqrt{n}}, \frac{\sqrt{\beta}}{\sqrt{n}}\right)$$

$$\text{Var}[w_i] = \frac{(b-a)^2}{12} = \frac{(2/\sqrt{n})^2}{12} = \frac{1}{3n}$$

$(n \cdot \text{Var}[w_i] = \frac{1}{3})$

Heating He

He init

Glorot, Bengio, 2010

Xavier init

$$\text{Var}[y_i] = (\mathbb{E}[x_i])^2 \text{Var}(w_i) + \text{Var}w_i \text{Var}x_i =$$

$$= \mathbb{E}[x_i^2] \cdot \text{Var}w_i$$

$$\text{Var}[y^{(l)}] = n \cdot \text{Var}[w_i] \cdot \mathbb{E}[x_i^{(l-1)^2}] =$$

$$\left(\frac{1}{2}\right) \text{Var}[w_i] \cdot \text{Var}[y_i^{(l-1)}]$$

