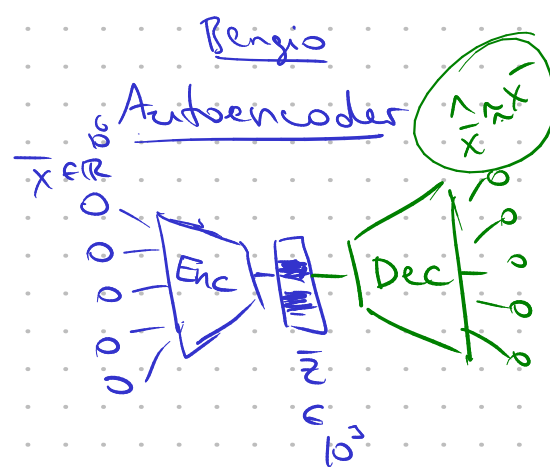
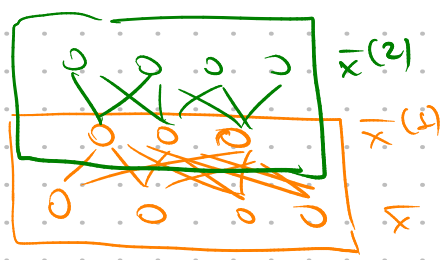
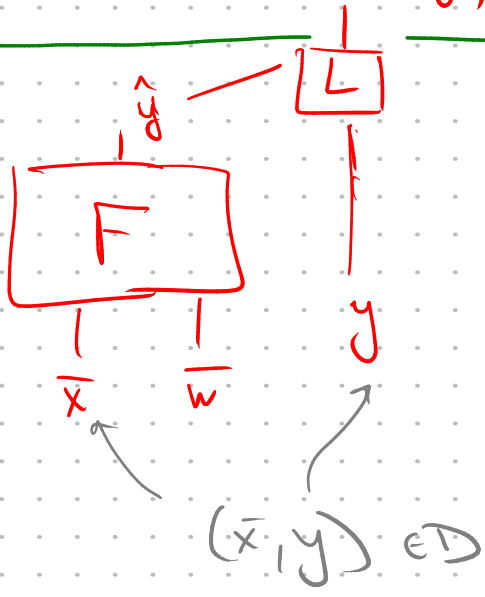


Unsupervised
pretraining
Restricted
Boltzmann
Machines



$$l(y, \hat{y}) \xrightarrow{\bar{w}} \min$$



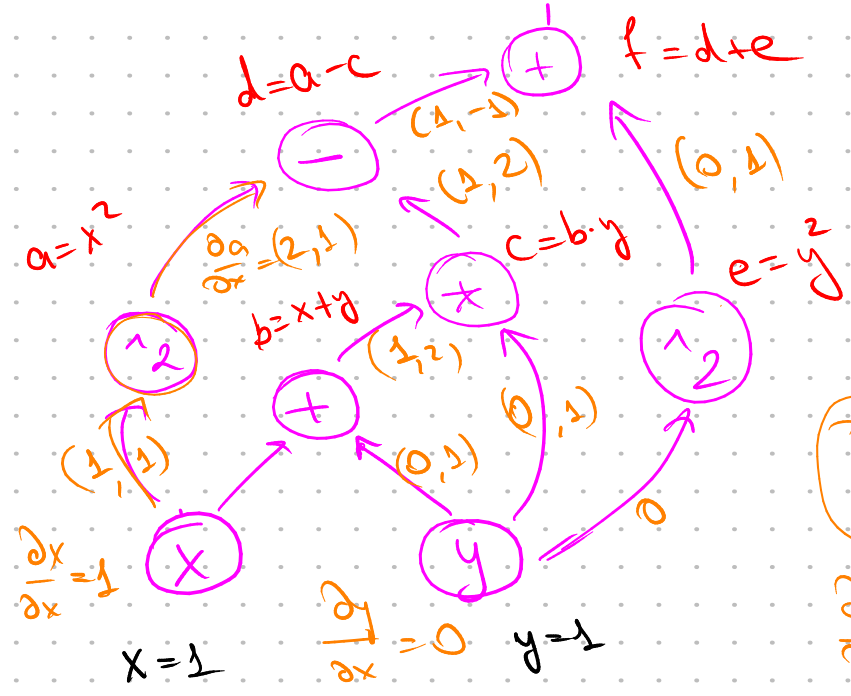
$$L(\bar{w}) = \frac{1}{N} \sum_{(x_n, y_n)} l(y_n, F(x_n, \bar{w}))$$

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

forward
propagation

$$\frac{df}{dx} = 2x - y$$

$$(1, 0) \uparrow f(x, y) = x^2 - (x+y)y + y^2$$

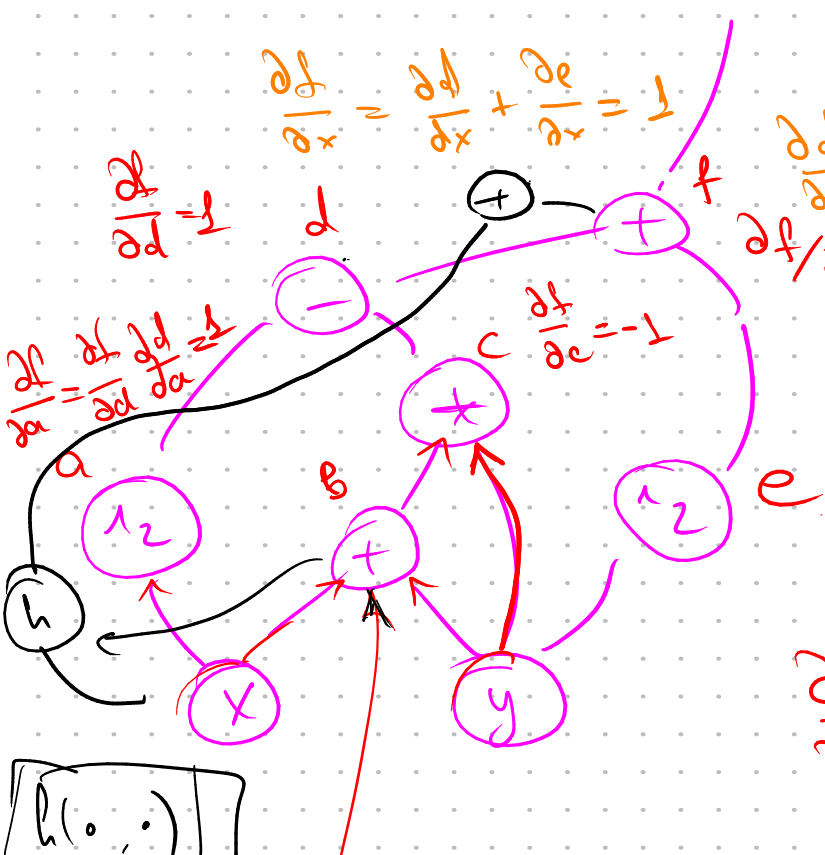


$\frac{\partial f}{\partial x} = ?$
 $\frac{\partial f}{\partial y} = ?$

$\frac{\partial a}{\partial x} = 2x \cdot \frac{\partial x}{\partial x} = 2 \cdot 1 \cdot 1 = 2$

$\frac{\partial b}{\partial x} = 1 \cdot \frac{\partial x}{\partial x} + 0 = 1$

$\frac{\partial c}{\partial x} = \frac{\partial b}{\partial x} \cdot y + \frac{\partial y}{\partial x} \cdot b = 1$



$\frac{\partial d}{\partial x} = \frac{\partial a}{\partial x} - \frac{\partial c}{\partial x} = 2$

backward propagation (backprop)

$\frac{\partial f}{\partial e} = 1$

$\frac{\partial f}{\partial x} = \frac{\partial f}{\partial a} \frac{\partial a}{\partial x} + \frac{\partial f}{\partial b} \frac{\partial b}{\partial x} = 2x - y$

$\frac{\partial f}{\partial b} = \frac{\partial f}{\partial c} \frac{\partial c}{\partial b} = -y$

$\frac{\partial f}{\partial y} = \frac{\partial f}{\partial c} \frac{\partial c}{\partial y} + \frac{\partial f}{\partial e} \frac{\partial e}{\partial y} = -b - y + 2y = y - b = y - (x + y) = -x$

$h(a, b, c, d, e)$
 $\frac{\partial h}{\partial a}, \frac{\partial h}{\partial b}, \frac{\partial h}{\partial c}, \frac{\partial h}{\partial d}, \frac{\partial h}{\partial e}$

PyTorch
 TensorFlow
 Theano

automatic differentiation libraries