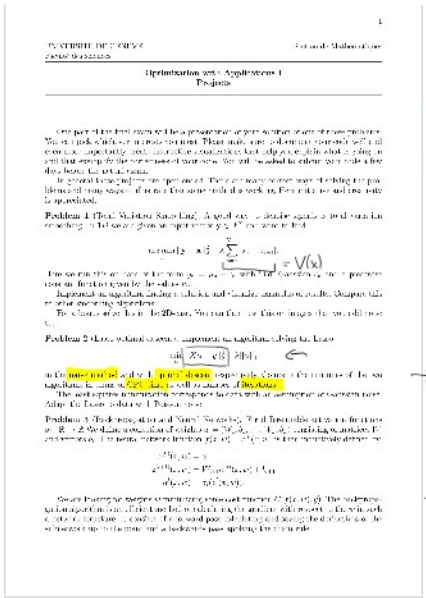
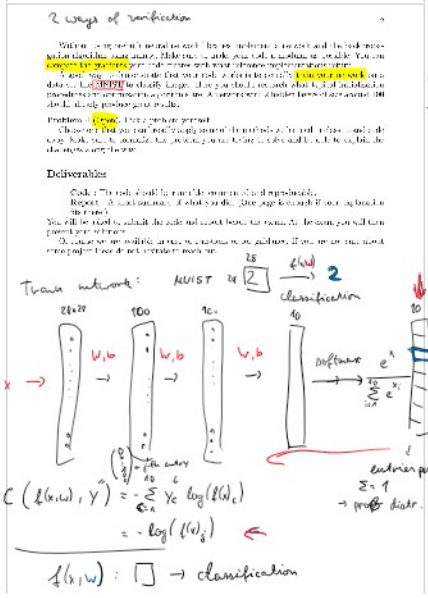
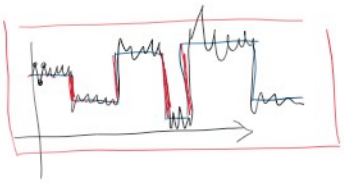
Projects

Thursday, November 19, 2020 8:08 PM







$y \rightsquigarrow$ measurements

$$V(x) = Dx \quad , D = \begin{pmatrix} 1 & -1 & & & \\ & 1 & -1 & & C \\ & & 1 & -1 & \\ 0 & & & \ddots & \end{pmatrix}$$

$$\rightarrow \boxed{\|y - x\|_2^2 + \lambda \underbrace{\|Dx\|_1}_{\text{induces sparsity}}}$$

↳ only a few non-zero entries

→ do some calculations to transform this into Lasso → then solve.

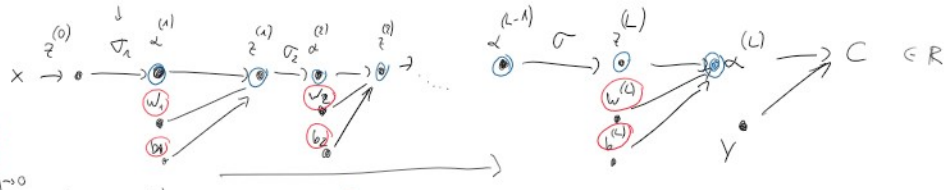
P2: Poisson: $A \in \mathbb{R}_+^{n \times p}$

$$Y \sim \mathcal{P}(Ax^*) \quad , Y \in \mathbb{R}_+^n \ , x^* \in \mathbb{R}_+^p$$

$\rightsquigarrow$ recover x^* from y, A.

$$C(x,y) = \|x - y\|_2^2$$

P3:



$$z^1 = W_1 \alpha^{(1)} + b_1$$

$w = (W_i, b_i)_i \rightarrow$ parameters.

→ want to minimize $C(f(x, w), y)$

data

$$\boxed{\nabla_w C(f(x,w), y)}$$

$\mathbb{R}$ parameters

Train network: MNIST $\ni \boxed{2} \xrightarrow{f(x,w)} 2$ classification

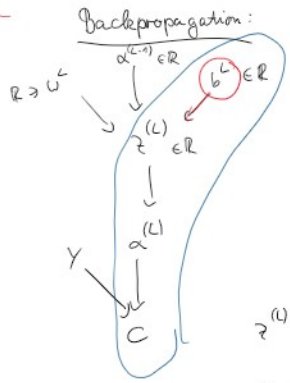
$$C(f(x,w), y) = -\sum_{c \in A} y_c \log(f(w)_c) = -\log(f(w)_j)$$

$y = \begin{pmatrix} 0 \\ 0 \\ 1 \\ 0 \\ \vdots \\ 0 \end{pmatrix}$ → 1 hot vector

entries pos. $\Sigma = 1$ → prob distr.

$f(x,w)$: $\square$ → classification

Backpropagation:



$$\boxed{\frac{\partial C}{\partial b^L} = \frac{\partial z^{(L)}}{\partial b^{(L)}} \frac{\partial \alpha^{(L)}}{\partial z^{(L)}} \frac{\partial C}{\partial \alpha^{(L)}}}$$

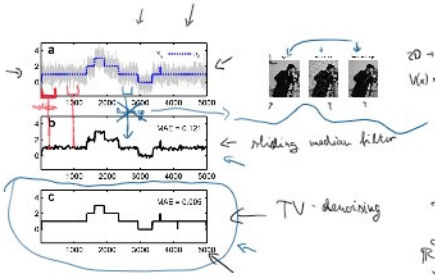
$$= 1 \cdot \sigma'(z^{(L)}) \, 2(\alpha^{(L)} - y)$$

$$\frac{\partial C}{\partial w^L} = \alpha^{(L-1)} \cdot \sigma'(z^{(L)}) \cdot 2(\alpha^{(L)} - y)$$

$$z^{(L)} = w^L \alpha^{(L-1)} + b^{(L)}$$

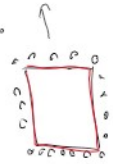
$$c = (\alpha^{(L)} - y)^2$$

$$\alpha^{(L)} = \sigma_L(z^{(L)})$$



2D →

$$V(x) = \sum_{ij} (|x_{ij} - x_{i+1,j}| + |x_{ij} - x_{i,j+1}|)^{\frac{1}{2}}$$



$\mathbb{R}^{n \times p}$

$\downarrow$

$\mathbb{R}^{c \times n \times p}$

$\rightsquigarrow$ apply channelwise

Forward pass → save values, evaluate error

Backwards pass → Apply chain rule

$\rightsquigarrow$ in higher dimensions → get matrix multiplications