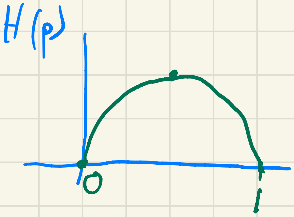
28.4.2020 Cross entropy:

$$H(P,Q) = -\sum_{y \in \mathcal{Y}} P(y) \log_2 Q(y)$$

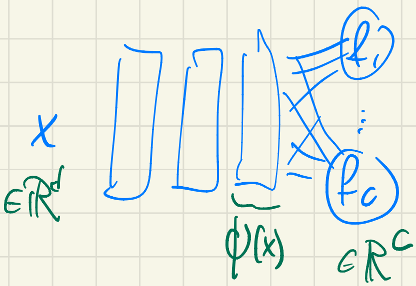
for $P=Q$: $H(P,P) = H(P) = -\sum_y P(y) \log_2 P(y)$



E.g. $P(Y=y) = \begin{cases} p & \text{if } y=+1 \\ 1-p & \text{if } y=-1 \end{cases}$

More gen. $H(\mathrm{Unif}\{1..c\}) = \log_2 c$

$$H(P,Q) = H(P) + \underbrace{KL(P \,\|\, Q)}_{\geq 0}$$



$f_i = w_i^T \phi(x)$

$\rightarrow P(y|x,w) = \dfrac{\exp(f_y)}{\sum_{y'} \exp(f_{y'})}$

for $y \in \{1..c\}$

$\equiv \underbrace{e_y = [0..0,1,0..0]}_{z}$ ↙ y-th coord

$$\log(y|x,w) = \log \underbrace{\frac{\exp(\overbrace{w_y^T \phi(x)}^{f_y})}{\sum_{y'} \exp(w_{y'}^T \phi(x))}}_{\hat{p}_y} = \underbrace{\sum_{y'} z_{y'} \log \hat{p}_{y'}}_{H(z,\hat{p})}$$