

Module 8.8 : Adding Noise to the outputs

Other forms of regularization

- l_2 regularization
- Dataset augmentation
- Parameter Sharing and tying
- Adding Noise to the inputs
- Adding Noise to the outputs
- Early stopping
- Ensemble methods
- Dropout



0	0	1	0	0	0	0	0	0	0
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Hard targets



0	0	1	0	0	0	0	0	0	0
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Hard targets

$$\text{minimize : } \sum_{i=0}^9 p_i \log q_i$$



0	0	1	0	0	0	0	0	0	0
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Hard targets

$$\text{minimize : } \sum_{i=0}^9 p_i \log q_i$$

true distribution : $p = \{0, 0, 1, 0, 0, 0, 0, 0, 0, 0\}$



0	0	1	0	0	0	0	0	0	0
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Hard targets

$$\text{minimize : } \sum_{i=0}^9 p_i \log q_i$$

true distribution : $p = \{0, 0, 1, 0, 0, 0, 0, 0, 0, 0\}$

estimated distribution : q



0	0	1	0	0	0	0	0	0	0
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Hard targets

$$\text{minimize : } \sum_{i=0}^9 p_i \log q_i$$

true distribution : $p = \{0, 0, 1, 0, 0, 0, 0, 0, 0, 0\}$

estimated distribution : q

Intuition

- Do not trust the true labels, they may be noisy



0	0	1	0	0	0	0	0	0	0
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Hard targets

$$\text{minimize : } \sum_{i=0}^9 p_i \log q_i$$

true distribution : $p = \{0, 0, 1, 0, 0, 0, 0, 0, 0, 0\}$

estimated distribution : q

Intuition

- Do not trust the true labels, they may be noisy
- Instead, use soft targets



$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$	$1 - \epsilon$	$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$
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Soft targets



$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$	$1 - \epsilon$	$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$
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Soft targets

$\epsilon = \text{small positive constant}$



$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$	$1 - \epsilon$	$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$
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Soft targets

$\epsilon = \text{small positive constant}$

$$\text{minimize : } \sum_{i=0}^9 p_i \log q_i$$



$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$	$1 - \epsilon$	$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$
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Soft targets

$\epsilon =$ small positive constant

$$\text{minimize : } \sum_{i=0}^9 p_i \log q_i$$

$$\text{true distribution + noise : } p = \left\{ \frac{\epsilon}{9}, \frac{\epsilon}{9}, 1 - \epsilon, \frac{\epsilon}{9}, \dots \right\}$$



$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$	$1 - \epsilon$	$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$	$\frac{\epsilon}{9}$
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Soft targets

$\epsilon = \text{small positive constant}$

$$\text{minimize : } \sum_{i=0}^9 p_i \log q_i$$

$$\text{true distribution + noise : } p = \left\{ \frac{\epsilon}{9}, \frac{\epsilon}{9}, 1 - \epsilon, \frac{\epsilon}{9}, \dots \right\}$$

$$\text{estimated distribution : } q$$