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

Hard targets

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

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

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

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

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

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

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Intuition

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

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

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

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

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

Intuition

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

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

| $\frac{\varepsilon}{9}$ | $\frac{\varepsilon}{9}$ | $1-\varepsilon$ | $\frac{\varepsilon}{9}$ | $\frac{\varepsilon}{9}$ | $\frac{\varepsilon}{9}$ | $\frac{\varepsilon}{9}$ | $\frac{\varepsilon}{9}$ | $\frac{\varepsilon}{9}$ | $\frac{\varepsilon}{9}$ | Soft targets |

$\varepsilon = $ small positive constant

| $\frac{\varepsilon}{9}$ | $\frac{\varepsilon}{9}$ | $1-\varepsilon$ | $\frac{\varepsilon}{9}$ | $\frac{\varepsilon}{9}$ | $\frac{\varepsilon}{9}$ | $\frac{\varepsilon}{9}$ | $\frac{\varepsilon}{9}$ | $\frac{\varepsilon}{9}$ | $\frac{\varepsilon}{9}$ | Soft targets |

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

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

| $\frac{\varepsilon}{9}$ | $\frac{\varepsilon}{9}$ | $1-\varepsilon$ | $\frac{\varepsilon}{9}$ | $\frac{\varepsilon}{9}$ | $\frac{\varepsilon}{9}$ | $\frac{\varepsilon}{9}$ | $\frac{\varepsilon}{9}$ | $\frac{\varepsilon}{9}$ | $\frac{\varepsilon}{9}$ | Soft targets |

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

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

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

| $\frac{\varepsilon}{9}$ | $\frac{\varepsilon}{9}$ | $1-\varepsilon$ | $\frac{\varepsilon}{9}$ | $\frac{\varepsilon}{9}$ | $\frac{\varepsilon}{9}$ | $\frac{\varepsilon}{9}$ | $\frac{\varepsilon}{9}$ | $\frac{\varepsilon}{9}$ | $\frac{\varepsilon}{9}$ | Soft targets |

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

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

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

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

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