PairwiseRankloss(for MultiLabelLearning)

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1 introduction

1.1 History

PairwiseRankloss(for MultiLabelLearning) is proposed by Min-Ling Zhang, Zhi-Hua Zhou in 2006, named BP-MLL(Back Propagation for Multi-Label Learning). At that time, neural network is not popular as now, this paper is the first one applying neural network on multi-label learning.

1.2 Thought

Target label should be ranked higher than others.

2 feed forward

$$Loss = \sum_{i}^{dataset} Loss_i = \sum_{i}^{dataset} \frac{1}{|Y_i||\bar{Y}_i|} \sum_{(k,l)\in Y_i \times \bar{Y}_i} \exp(-(x_{ik} - x_{il})) \quad (1)$$

i is the index of a sample in dataset.

Y stands for the ground-truth set, Y_i is the target label(ground-truth) set of i-th sample, $\bar{Y}_i$ is the rest label of i-th sample, $|Y_i|$ and $|\bar{Y}_i|$ is the label number of Y_i and $\bar{Y}_i$.

x is the input of pairwise-rank loss, the output of prior layer, x_{ik} is the i sample's k category.

3 back propegatation

For i-th sample:

$$\frac{\alpha(Loss)}{\alpha x_k} = \begin{cases} \frac{1}{|Y||\bar{Y}|} \sum_{l \in \bar{Y}} \exp(-(x_k - x_l)) * (-1) & k \in Y \\ \frac{1}{|Y||\bar{Y}|} \sum_{k \in Y} \exp(-(x_k - x_l)) & l \in \bar{Y} \end{cases} \tag{2}$$