NLNL: Negative Learning for Noisy Labels Appendix

1 Gradient after NL

Eq. 1 shows detailed outline of computing gradient after training CNN with NL.

$$
\begin{aligned}
\frac{\partial \mathcal{L}(f, \overline{y})}{\partial f_i} &= -\sum_{k=1}^{C} \overline{\boldsymbol{y}}_k \frac{\partial \log(1-\boldsymbol{p}_k)}{\partial f_i} = -\sum_{k=1}^{C} \overline{\boldsymbol{y}}_k \frac{\partial \log(1-\boldsymbol{p}_k)}{\partial \boldsymbol{p}_k} \frac{\partial \boldsymbol{p}_k}{\partial f_i} \\
&= \sum_{k=1}^{C} \frac{\overline{\boldsymbol{y}}_k}{(1-\boldsymbol{p}_k)} \boldsymbol{p}_k (1\{k=i\} - \boldsymbol{p}_i) = \overline{\boldsymbol{y}}_i \boldsymbol{p}_i - \sum_{k \neq i} \frac{\overline{\boldsymbol{y}}_k \boldsymbol{p}_k}{1-\boldsymbol{p}_k} \boldsymbol{p}_i \qquad (1) \\
&= \begin{cases} \boldsymbol{p}_i \approx \frac{1}{c} & \text{if } i = \overline{y} \\ -\frac{\boldsymbol{p}_{\overline{y}}}{1-\boldsymbol{p}_{\overline{y}}} \boldsymbol{p}_i \approx -\frac{1}{c(c-1)} & \text{if } i \neq \overline{y} \end{cases}
\end{aligned}
$$