HINGE LOSS

$$L = \frac{1}{N}\sum_{i}^{\#examples} \sum_{j \neq i}^{\#class} \max(0, score - score\text{-}correct + \Delta)$$

score = $w_j x_i$ → i^{th} example score for j^{th} class

correct_score = $w_i x_i$ → correct class score.

$$L_i = \sum_{j \neq i}^{\#class} \max(0, \underbrace{w_j x_i - w_i x_i + \Delta}_{L_{ij}})$$

$$= \max(0, w_1 x_i - w_i x_i + \Delta) + \max(0, w_2 x_i - w_i x_i + \Delta) + \cdots \max(0, w_{class} x_i - w_i x_i + \Delta)$$

W is matrix ⇒ calculating Jacobian for $\nabla_w L_i$

$$\frac{\partial L_i}{\partial w_1} = \begin{cases} x_i & \text{if } w_1 x_i - w_i x_i + \Delta > 0 \\ 0 & \text{else} \end{cases}$$

$$\frac{\partial L_i}{\partial w_i} = -\left[\begin{array}{l} w_i \text{ appear in all} \\ \text{classes} \Rightarrow \text{It will be differenti} \\ \text{every time } L_{ij} > 0 \end{array}\right] x_i$$

$$= -\, n\, x_i$$

$$\frac{\sum_{i}^{\#examples} \nabla_w L_i}{N} = \nabla_w L$$