

$$h:\mathcal{X}\rightarrow\mathcal{Y}$$

$$\begin{array}{l} \mathcal{X} \\ \mathcal{Y} \\ f: \\ \mathcal{X} \times \\ \mathcal{Y} \rightarrow \\ \mathcal{R} \\ \mathcal{Y} \\ f \\ \mathcal{Y} \in \end{array}$$

$$\begin{array}{l} h_{\mathbf{w}}(x)=_{y\in\mathcal{Y}} \\ f_{\mathbf{w}}(x,y) \\ f_{\mathbf{w}} \end{array}$$

$$f_{\mathbf{w}} = \mathbf{w}^T \Phi(x,y)$$

$$\begin{array}{l} \mathbf{w} \\ \Phi(x,y) \\ \mathcal{Y} \\ \Phi: \\ \mathcal{Y} \times \\ \mathcal{Y} \rightarrow \\ R \end{array}$$

$$\Delta(y,y')\geq for y\neq y'$$

$$\Delta(y,y)=0$$

$$(x,y)$$

$$R_p^\Delta=\int_{\mathcal{X}\times\mathcal{Y}}\Delta(\mathbf{y},f(\mathbf{x}))dP(\mathbf{x},\mathbf{y})$$

$$\begin{array}{l} P \\ (x_i,y_i) \\ R_s^\Delta(f)=\frac{1}{n}\sum_{i=1}^n\Delta(\mathbf{y}_i,f(\mathbf{x}_i)) \end{array}$$

$$\begin{array}{l} \forall i\in\{1,\cdots,n\},\forall \mathbf{y}\in\mathcal{Y}\backslash \mathbf{y}_i:\langle \mathbf{w},\Phi(\mathbf{x}_i,\mathbf{y}_i)-\Phi(\mathbf{x}_i,\mathbf{y})\rangle\leq 0 \\ \max_{\gamma,\mathbf{w}:\|\mathbf{w}\|=1}\gamma s.t\ \forall i\in\{1,\cdots,n\},\forall \mathbf{y}\in\mathcal{Y}\backslash \mathbf{y}_i:\langle \mathbf{w},\delta\Phi(\mathbf{y})\rangle\leq \gamma \end{array}$$

$$\min_{\mathbf{w}}\frac{1}{2}\|\mathbf{w}\|^2 s.t\ \forall i\in\{1,\cdots,n\},\forall \mathbf{y}\in\mathcal{Y}\backslash \mathbf{y}_i:\langle \mathbf{w},\delta\Phi(\mathbf{y})\rangle\leq 1$$

$$\min_{\mathbf{w},\xi}\frac{1}{2}\|\mathbf{w}\|^2+\frac{C}{n}\sum_{i=1}^n\xi_i s.t\ \forall i\in\{1,\cdots,n\},\forall \mathbf{y}\in\mathcal{Y}\backslash \mathbf{y}_i:\langle \mathbf{w},\delta\Phi(\mathbf{y})\rangle\leq 1-\xi_i,\xi_i\leq 0$$

$$\begin{array}{l} C \\ C \\ ? \end{array}$$

$$\min_{\mathbf{w},\xi}\frac{1}{2}\|\mathbf{w}\|^2+\frac{C}{n}\sum_{i=1}^n\xi_i s.t\ \forall i\in\{1,\cdots,n\},\forall \mathbf{y}\in\mathcal{Y}\backslash \mathbf{y}_i:\langle \mathbf{w},\delta\Phi(\mathbf{y})\rangle\leq 1-\frac{\xi_i}{\Delta(\mathbf{y}_i,\mathbf{y})}$$

$$\min_{\mathbf{w},\xi}\frac{1}{2}\|\mathbf{w}\|^2+\frac{C}{n}\sum_{i=1}^n\xi_i s.t\ \forall i\in\{1,\cdots,n\},\forall \mathbf{y}\in\mathcal{Y}\backslash \mathbf{y}_i:\langle \mathbf{w},\delta\Phi(\mathbf{y})\rangle\leq \Delta(\mathbf{y}_i,\mathbf{y})-\xi_i$$

$$\begin{array}{l} O(n|\mathcal{Y}|) \\ ? \\ \hat{h} \end{array}$$

$$\min_{\mathbf{w},\xi_i\geq 0}\frac{1}{2}\mathbf{w}^T\mathbf{w}+C\xi$$

$$\begin{array}{l} \forall i\in \\ \{1,\cdots,n\},\hat{y}_i\in \\ \mathcal{Y}: \\ \mathbf{w}^T[\Psi(x_i,y_i)- \\ \Psi(x_i,\hat{y}_i)]\geq \\ \Delta(y_i,\hat{y}_i)- \\ \xi_i \end{array}$$

$$\begin{array}{l} \min_{\mathbf{w},\xi_i\geq 0}\frac{1}{2}\mathbf{w}^T\mathbf{w}+ \\ \frac{C}{n}\sum_{i=1}^n\xi_i s.t.for \end{array}$$