

SVM exercise

We are given the formulation of SVM's optimization on the left side (see below) and the canonical form of a quadratic optimization on the right side.

Could you write the values of the matrixes/vectors \mathbf{u} , \mathbf{Q} , \mathbf{p} , \mathbf{A} and \mathbf{c} for the equivalent SVM optimization in canonical form?

$$\underset{b, \mathbf{w}}{\text{minimize}} \quad \frac{1}{2} \mathbf{w}^T \mathbf{w}$$

$$\text{subject to: } y_n(\mathbf{w}^T \mathbf{x}_n + b) \geq 1 \text{ for } n = 1, \dots, N.$$

$$\underset{\mathbf{u} \in \mathbb{R}^q}{\text{minimize}} \quad \frac{1}{2} \mathbf{u}^T \mathbf{Q} \mathbf{u} + \mathbf{p}^T \mathbf{u}$$

$$\text{subject to: } \mathbf{A} \mathbf{u} \geq \mathbf{c}$$

For the below defined examples input examples \mathbf{X} and output labels \mathbf{Y} , write down the \mathbf{u} , \mathbf{Q} , \mathbf{p} , \mathbf{A} and \mathbf{c} for the canonical form of the SVM's quadratic optimization formulation.

$$\mathbf{X} = \begin{bmatrix} 0 & 0 \\ 2 & 2 \\ 2 & 0 \\ 3 & 0 \end{bmatrix} \quad \mathbf{y} = \begin{bmatrix} -1 \\ -1 \\ +1 \\ +1 \end{bmatrix}$$