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Trabajo T4

Ejercicio 1

Función objetivo original

Minimizar $\frac{1}{2}\theta^t\theta + \ C\sum_{n=1}^{N}\zeta_n$ sujeto a $c_n(\theta^t\, x_n + \theta_0) \geq 1 - \zeta_n, \zeta_n \geq 0, 1\leq n \leq N$

Función primal de Lagrange

$$\Lambda(\theta, \theta_0, \zeta, \alpha, \beta) = \frac{1}{2}\theta^t\theta + \ C\sum_{n=1}^{N}\zeta_n - \sum_{n=1}^{N}\alpha_n\left(c_n(\theta^t\, x_n + \theta_0) - 1 + \zeta_n\right) - \sum_{n=1}^{N}\beta_n\zeta_n$$

Sujeto a: $\alpha_n \geq 0, \beta_n \geq 0, \zeta_n \geq 0, , 1\leq n \leq N$

Resolver $\nabla_{\theta,\theta_0,\zeta}\Lambda(\theta, \theta_0, \zeta, \alpha, \beta) = 0$

$$\frac{\partial\Lambda(\theta, \theta_0, \zeta, \alpha, \beta)}{\partial\theta} \Rightarrow \ \theta = \sum_{n=1}^{N} c_n\alpha_n x_n$$

$$\frac{\partial\Lambda(\theta, \theta_0, \zeta, \alpha, \beta)}{\partial\theta_0} \Rightarrow \ 0 = \sum_{n=1}^{N} c_n\alpha_n$$

$$\frac{\partial\Lambda(\theta, \theta_0, \zeta, \alpha, \beta)}{\partial\zeta} \Rightarrow \ \zeta = C - \sum_{n=1}^{N}\alpha_n - \sum_{n=1}^{N}\beta_n$$

Función dual de Lagrange

$\Lambda(\alpha, \beta) = \frac{1}{2}\sum_{n,n'=1}^{N} c_n c_{n'}\alpha_n\alpha_{n'}x_n x_{n'} + \ C\sum_{n=1}^{N}(C - \sum_{n=1}^{N}\alpha_n - \sum_{n=1}^{N}\beta_n) - \sum_{n=1}^{N}\alpha_n\left(c_n\left(\sum_{n=1}^{N} c_{n'}\alpha_{n'}x_{n'}{}^t\ x_n + \theta_0\right) - 1 + C - \sum_{n=1}^{N}\alpha_n - \sum_{n=1}^{N}\beta_n\right) - \sum_{n=1}^{N}(\beta_n C - \sum_{n=1}^{N}\alpha_n - \sum_{n=1}^{N}\beta_n)$

$\Lambda(\alpha, \beta) = -\frac{1}{2}\sum_{n,n'=1}^{N} c_n c_{n'}\alpha_n\alpha_{n'}x_n x_{n'} - \theta_0\sum_{n=1}^{N}\alpha_n c_n + \sum_{n=1}^{N}\alpha_n + \ C\sum_{n=1}^{N}(C - \sum_{n=1}^{N}\alpha_n - \sum_{n=1}^{N}\beta_n) - \ \sum_{n=1}^{N}\alpha_n(C - \sum_{n=1}^{N}\alpha_n - \sum_{n=1}^{N}\beta_n) - \ \sum_{n=1}^{N}\beta_n(C - \sum_{n=1}^{N}\alpha_n - \sum_{n=1}^{N}\beta_n)$

$$\Lambda(\alpha,\beta) = -\frac{1}{2}\sum_{n,n'=1}^{N} c_n c_{n'} \alpha_n \alpha_{n'} x_n x_{n'} - \theta_0 \sum_{n=1}^{N} \alpha_n c_n + \sum_{n=1}^{N} \alpha_n + \mathrm{C} \sum_{n=1}^{N} (\mathrm{C} - \sum_{n=1}^{N} \alpha_n - \sum_{n=1}^{N} \beta_n) - \alpha_n \sum_{n=1}^{N} (\mathrm{C} - \sum_{n=1}^{N} \alpha_n - \sum_{n=1}^{N} \beta_n) - \beta_n \sum_{n=1}^{N} (\mathrm{C} - \sum_{n=1}^{N} \alpha_n - \sum_{n=1}^{N} \beta_n)$$

$$\Lambda(\alpha,\beta) = -\frac{1}{2}\sum_{n,n'=1}^{N} c_n c_{n'} \alpha_n \alpha_{n'} x_n x_{n'} - \theta_0 \sum_{n=1}^{N} \alpha_n c_n + \sum_{n=1}^{N} \alpha_n + \mathrm{C} \sum_{n=1}^{N} (\mathrm{C} - \sum_{n=1}^{N} \alpha_n - \sum_{n=1}^{N} \beta_n) - C \sum_{n=1}^{N} (\mathrm{C} - \sum_{n=1}^{N} \alpha_n - \sum_{n=1}^{N} \beta_n)$$

$$\Lambda(\alpha,\beta) = -\frac{1}{2}\sum_{n,n'=1}^{N} c_n c_{n'} \alpha_n \alpha_{n'} x_n x_{n'} - \theta_0 \sum_{n=1}^{N} \alpha_n c_n + \sum_{n=1}^{N} \alpha_n$$

$$\Lambda(\alpha,\beta) = \sum_{n=1}^{N} \alpha_n - \frac{1}{2}\sum_{n,n'=1}^{N} c_n c_{n'} \alpha_n \alpha_{n'} x_n x_{n'}$$

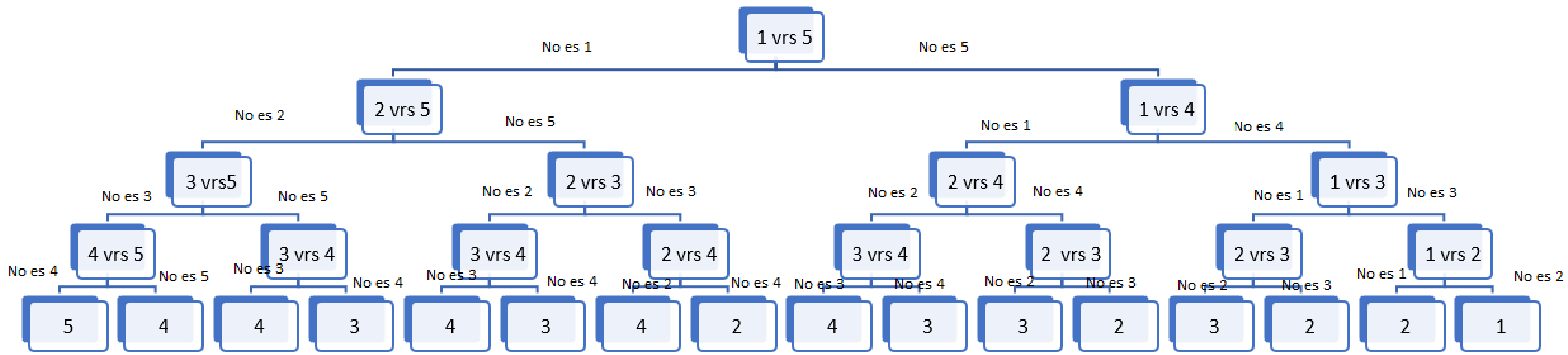
Sujeto a: $0 = \sum_{n=1}^{N} c_n \alpha_n$, $\mathrm{C} - \sum_{n=1}^{N} \alpha_n - \sum_{n=1}^{N} \beta_n$, $\alpha_n \geq 0, 1 \leq n \leq N$

Por tanto, hay que maximizar:

$$\Lambda(\alpha) = \sum_{n=1}^{N} \alpha_n - \frac{1}{2}\sum_{n,n'=1}^{N} c_n c_{n'} \alpha_n \alpha_{n'} x_n x_{n'}$$

Sujeto a: $0 = \sum_{n=1}^{N} c_n \alpha_n$, $\mathrm{C} - \sum_{n=1}^{N} \alpha_n - \sum_{n=1}^{N} \beta_n$, $\alpha_n \geq 0, 1 \leq n \leq N$

Ejercicio 2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