Machine Learning SS2013

Ulrike von Luxburg
Assignment 05

Arne Schröder Falk Oswald Angel Bakardzhiev

May 11, 2013

Exercise 1

Task

Write the following linear program in the standard form by determining **A, b, c**.

Answer

Substitute x_3 with $x_3' = -x_3$:

$$\begin{aligned} &\text{Minimize} \quad x_1 - 2x_2 - 4x_3' \\ &\text{subject to} \\ &-x_1 + x_2 \geq 1 \\ &3x1 - 2x_3' \leq -1 \\ -2x_1 + &5x_3' + 4 \leq 0 \\ &x_1, x_2, x_3' \leq 0 \end{aligned}$$

Standard form:

Minimize $c^T x$
subject to $Ax \leq b$
and $x \leq 0$
with

$$A = \begin{bmatrix} -1 & 1 & 0 \\ 3 & 0 & -2 \\ -2 & 0 & 5 \end{bmatrix}, b = \begin{bmatrix} 1 \\ -1 \\ 4 \end{bmatrix}, c = \begin{bmatrix} 1 \\ -2 \\ -4 \end{bmatrix}$$

Exercise 4

Task

For any $\gamma > 0$ the solution of $\min_{w,b} \frac{1}{2}\|w\|^2$, subject to $y_i \cdot (\langle w, x_i \rangle - b) \geq 1$ is the same as the same one subject to $y_i \cdot (\langle w, x_i \rangle - b) \geq \gamma$.

Answer

$$
\begin{aligned}
&y_i \cdot (\langle w, x_i \rangle - b) \geq \gamma \\
\Leftrightarrow &\gamma^{-1} \cdot y_i \cdot (\langle w, x_i \rangle - b) \geq 1 \\
\Leftrightarrow &\gamma^{-1} \cdot y_i \cdot (\langle w, x_i \rangle - b) \geq 1
\end{aligned}
$$