

Homework 5 - SMAI 20171213

3.

20171213

HW5, Q3)

Covariance matrix $\Sigma = E\{(x - \bar{x})(x - \bar{x})^T\}$

now, taking any vector u ,

$$\begin{aligned} u^T \Sigma u &= u^T E\{(x - \bar{x})(x - \bar{x})^T\} u \\ &= E\{u^T (x - \bar{x})(x - \bar{x})^T u\} \\ &= E\{\xi^2\} \\ &= \sigma_\xi^2 \end{aligned}$$

where σ_ξ is variance of the random variable (3).

$$\Delta \sigma_\xi = u^T (x - \bar{x}) = (x - \bar{x})^T u$$

\therefore also, $\sigma_\xi^2 \geq 0$ (as it is a square)

$$\therefore u^T \Sigma u = \sigma_\xi^2 \geq 0$$

\hookrightarrow since PSD Covariance Matrix (Σ) is a



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