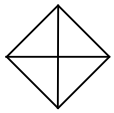

Multivariate Normals

1 Why

We generalize the normal density to d-dimensional space.

2 Definition

Let $f : \mathbf{R}^d \to \mathbf{R}$ be a density. If there exists $\mu \in \mathbf{R}^d$ and $\Sigma \in \mathbf{S}^d$ with $\Sigma \succ 0$ such that for all $x \in \mathbf{R}^d$

$$f(x) = \frac{1}{\sqrt{(2\pi)^d \det \Sigma}} \exp\left(-\frac{1}{2}(x-\mu)^\top \Sigma^{-1}(x-\mu)\right)$$

then f is a *multivariate normal density*. Since this definition generalizes the normal density, we also refer to these as *normal densities*.

2.1 Notation