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Definition

A distribution family (density family) on X is a family of distributions (densities) $\{p^{(\theta)}\}_{\theta\in\Theta}$ on X. We call the index set Θ (see Families) the parameters. Frequently $\Theta\subset\mathbf{R}^p$.

Similarly, a conditional distribution family (conditional density family) on Z from X is a family $\{q^{(\theta)}\}_{\theta\in\Theta}$ whose terms $q^{(\theta)}:Z\times X\to \mathbf{R}$ are such that $q^{(\theta)}(\cdot,\xi):Z\to \mathbf{R}$ is a distribution (density) for every $\xi\in X$.

Examples

For example, let $\Theta = [0, 1]$ and consider the family of distributions $\{p^{(\theta)} : \{0, 1\} \to [0, 1]\}_{\theta \in [0, 1]}$ defined by, for each $\theta \in [0, 1]$,

$$p^{(\theta)}(1) = \theta \text{ and } p^{(\theta)}(0) = 1 - \theta.$$

This family is called the *Bernoulli family* and $p^{(\theta)}$ is called a *Bernoulli distribution* with parameter θ .

For a second example, let $\Theta = \mathbf{R} \times \mathbf{R}_+$ and consider the family of densities $\{f^{(\theta)}: \mathbf{R} \to \mathbf{R}\}_{\theta \in \Theta}$ defined by, for each $\theta = (\mu, \sigma) \in \Theta$,

$$f^{(\theta)}(x) = (1/\sqrt{2\pi}\sigma) \exp((x-\mu)/\sigma^2).$$

This family is called the *normal family* and $f^{(\theta)}$ with $\theta = (\mu, \sigma)$ is called a *normal density* with mean μ and variance σ^2 .

¹Future editions will include.

