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Definition

Let Z and X be sets, either of which may or may not be finite.

A *latent generation pair* from *latents* Z to *observations* X is an ordered pair $(p_z, p_{x|z})$ whose first coordinate is a distribution (density) on Z and whose second coordinate is a conditional distribution (density) on X from Z .

The *joint function* $p_{zx} : Z \times X \rightarrow \mathbf{R}$ of the pair is defined by $p_{zx}(\zeta, \xi) = p_z(\zeta)p_{x|z}(\xi, \zeta)$ for all $\xi \in X$ and $\zeta \in Z$. It is a distribution (density) if (not only if) both p_z and $p_{x|z}$ are distributions (densities). Regardless, we define the *marginal function* $p_x : X \rightarrow \mathbf{R}$ by $p_x(\xi) = \int_Z p_{zx}(\xi, \cdot)$. It too may be a distribution, density, or neither. In cases we construct, it is often one a distribution or a density, but it need not be either.

Interpretation as distribution graph

The latent generation pairs from Z to X are isomorphic to the graph distributions whose typed graph $(\{1, 2\}, \{(1, 2)\}), (Z, x)$.²

Parametrizations

By parameterizing either or both of the coordinates of the pair, we have *latent generation family*.

¹Future editions will include.

²Future editions will include a visualization.

Other terminology

Other terminology for latent generation pair includes *latent variable model*. Some authorities refer to the marginal function as the *generative model*, still others use this term to refer to the pair.

