Let $(\Omega, \mathcal{A}, P)$ be a latent (sample) space and $(\mathbb{R}^n, \mathcal{B}(\mathbb{R}^n))$, $(\mathbb{R}^m, \mathcal{B}(\mathbb{R}^m))$ measurable spaces, for random vectors, $\mathbf{z}$ and $\mathbf{x}$, respectively, where:

(1) $\mathbf{z}$ is a continuous latent feature variable with distribution $P \circ \mathbf{z}^{-1}$ and for some $\hat{\theta} \in \Theta$ $P(\mathbf{z}; \hat{\theta})$ is its parametrization. Then $p_{\hat{\theta}}(\mathbf{z})$ is its probability density function (pdf).

(2) $\mathbb{X} = \{\mathbf{x}^i\}_{i=1}^N$ are N iid. copies of $\mathbf{x}$ representing our dataset, a random sample.

A generator should then approximate $p_{\hat{\theta}}(\mathbf{x}, \mathbf{z})$, the joint pdf of $\mathbf{x}$ and $\mathbf{z}$.