

Definition 11.1 Let $f(y|x)$ be a conditional pdf defined for all x , where

$$-\int_{\mathcal{S}_Y(x)} f(y|x) \log f(y|x) dy < \infty$$

for all x . A discrete-time continuous channel $f(y|x)$ is a system with input random variable X and output random variable Y such that Y is related to X through $f(y|x)$ (cf. Definition 10.22).

Remark The integral in Definition 11.1 is precisely the conditional differential entropy $h(Y|X = x)$, which is required to be finite.

Definition 11.2 Let $\alpha : \mathfrak{R} \times \mathfrak{R} \rightarrow \mathfrak{R}$, and Z be a real random variable, called the noise variable. A discrete-time continuous channel (α, Z) is a system with a real input and a real output. For any input random variable X , the noise random variable Z is independent of X , and the output random variable Y is given by

$$Y = \alpha(X, Z).$$