

**Definition 11.1 (Continuous Channel I)** 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  $f(y|x)$ .

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