

Definition 10.23 Let X and Y be jointly distributed random variables where Y is continuous and is related to X through a conditional pdf $f(y|x)$ defined for all x . The conditional differential entropy of Y given $\{X = \textcolor{red}{x}\}$ is defined as

$$h(Y|X = \textcolor{red}{x}) = - \int_{\mathcal{S}_Y(\textcolor{red}{x})} f(y|\textcolor{red}{x}) \log f(y|\textcolor{red}{x}) dy$$

and the conditional differential entropy of Y given X is defined as

$$h(Y|X) = - \int_{\mathcal{S}_X} h(Y|X = \textcolor{red}{x}) dF(\textcolor{red}{x}) = -E \log f(Y|X)$$