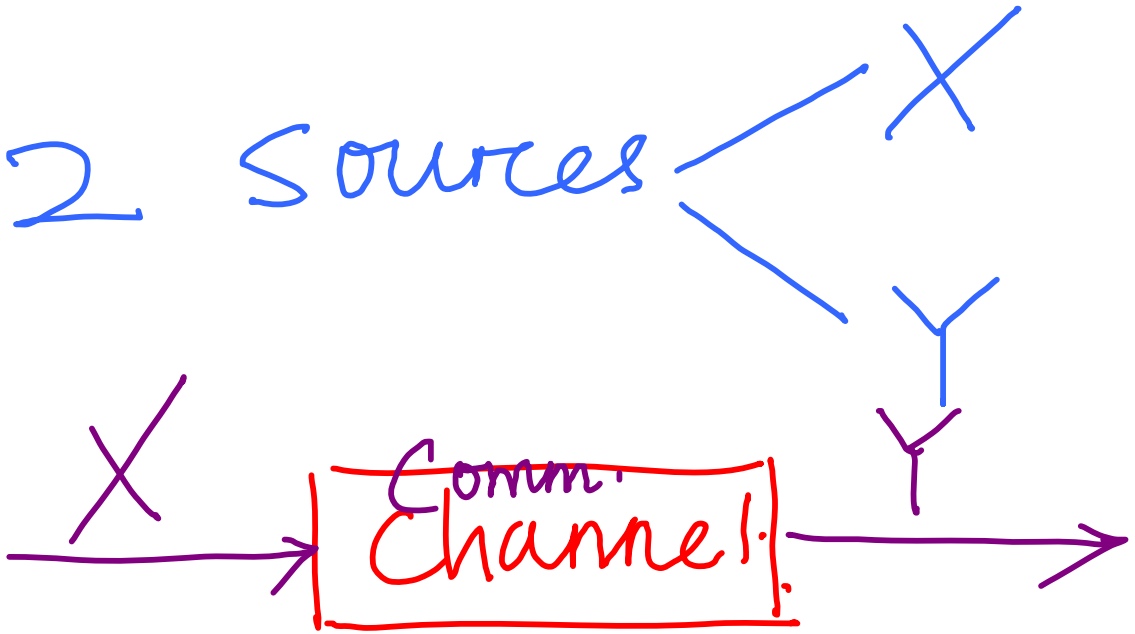
* JOINT/CONDITIONAL DIFFERENTIAL ENTROPIES

For continuous sources.

Definitions are similar to those of Joint/Conditional Entropies of discrete sources.



$f_Y(y)$, $f_X(x)$

Marginal PDFs of X, Y.

$$f_{X,Y}(x,y) = \text{Joint PDF of } X, Y.$$

$$h(X,Y) = \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} f_{X,Y}(x,y)\log_2\left(\frac{1}{f_{X,Y}(x,y)}\right) dx\,dy$$

Joint Entropy

$$h(X|Y) = \int_{-\infty}^{\infty} f_Y(y)\, h(X|Y=y)\, dy$$

Marginal Density

For Discrete case

$$\sum_{j=0}^{N-1} P_r(Y=r_j)\, H(X|Y=r_j)$$

Differential Entropy.

conditional Probability density function

$$= \int_{-\infty}^{\infty} f_Y(y) \int_{-\infty}^{\infty} f_{X|Y}(x|Y=y) \log_2\left(\frac{1}{f_{X|Y}(x|Y=y)}\right) dx \; dy$$

$h(X|Y=y)$

$$f_{X|Y}(x|Y=y) = \frac{f_{X,Y}(x,y)}{f_Y(y)}.$$

$$f_{X|Y}(x|y) f_Y(y) = f_{X,Y}(x,y).$$

$$h(X|Y) = \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} f_{X,Y}(x,y) \log_2\left(\frac{1}{f_{X|Y}(x|y)}\right) dx\,dy.$$

Conditional Differential Entropy.

MUTUAL INFORMATION

$$I(X;Y) = H(X) - H(X|Y)$$
$$= H(Y) - H(Y|X)$$

Mutual Information