Formulário de
Teoria da Informação

Teoria de Shannon

$$H(X) = -\sum_{i=1}^{M} P(x_i)\log_2 P(x_i) \qquad H(X,Y) = \sum_{i=1}^{M}\sum_{j=1}^{N} P(x_i, y_j)\log_2 \frac{1}{P(x_i, y_j)} \qquad H(Y|X) = \sum_{i=1}^{M} P(x_i) H(Y \mid x_i)$$

$$H(Y|x_i) = -\sum_{j=1}^{N} P(y_j \mid x_i)\log P(y_j \mid x_i) = H\left[P(Y|x_i)\right] \qquad I(X;Y) = \sum_{i=1}^{M}\sum_{j=1}^{N} P(x_i, y_j)\underbrace{\log_2 \frac{P(x_i, y_j)}{P(x_i)P(y_j)}}_{I(x_i;y_j)}$$

$$h(X) = \int_{-\infty}^{\infty} p(x)\log_2 \frac{1}{p(x)}\, dx \qquad \max_{p_X(X)} h(X) = \frac{1}{2}\log_2 2\pi e S \qquad h(X|Y) = \int\int_{-\infty}^{\infty} p_{XY}(x,y)\log_2 \frac{1}{p_X(x|y)} dx\, dy$$

$$I(X;Y) = \int\int_{-\infty}^{\infty} p_{XY}(x,y)\log_2 \frac{p_X(x|y)}{p_X(x)} dx\, dy \qquad C_s = 1 + p\log_2 p + (1-p)\log_2(1-p) \qquad R_c \le C_s \qquad \sum_{k=1}^{M} D^{-n_k} \le 1$$

Codificação para controlo de erros

$$R_c' = \frac{k}{n}\frac{1-p_R}{1+\dfrac{D}{T_w}} \le \frac{k}{n}\frac{1-p_R}{1+\dfrac{2t_d r_b}{k}} \qquad R_c' = \frac{k}{n}\frac{1-p_R}{1-p_R+Np_R} \le \frac{k}{n}\frac{1-p_R}{1-p_R+\dfrac{2t_d r_b}{k}p_R} \qquad R_c' = \frac{k}{n}(1-p_R)$$

$$d_{\min} \ge 2t+1 \qquad d_{\min} \ge l+1 \qquad d_{\min} \ge t+l+1 \qquad d_{\min} \le n-k+1 \qquad d_{\min} \le n\frac{2^{k-1}}{2^k-1} \qquad n-k \ge \log_2 \sum_{i=0}^{t}\binom{n}{i}$$

$$d_f \le \min_{l\ge 1}\left[\frac{2^{l-1}}{2^l-1}(l+N-1)n\right] \qquad P(i,n) = \binom{n}{i}p^i(1-p)^{n-i} \approx \binom{n}{i}p^i \quad p << 1 \qquad P_{end} = \sum_{i=1}^{n} A_i p^i (1-p)^{n-i}$$

$$P_{enc} = 1 - \sum_{i=0}^{n}\alpha_i p^i (1-p)^{n-i} \qquad M \ge n \qquad N \ge \frac{d_b}{t} \qquad A(z) = \frac{1}{n+1}\left[(1+z)^n + n(1+z)^{\frac{n-1}{2}}(1-z)^{\frac{n+1}{2}}\right]$$

$$A(z) = \frac{1}{2n}\left[(1+z)^n + (1-z)^n + 2(n-1)(1-z^2)^{\frac{n}{2}}\right] \qquad A_i = \binom{n}{i}\sum_{j=0}^{i-2t-1}(-1)^j\binom{i}{j}\left[(n+1)^{i-2t-j} - 1\right]$$

$$L_c = 4a\frac{R_c E_b}{N_0} \qquad L(u_k|\mathbf{y}) = L(u_k) + L_c y_{k1} + L_e(u_k) \qquad p(y_i|x_i = +1) = \frac{1}{1+\exp\left(-2y_i/\sigma^2\right)} \qquad L(p_i) = \frac{2y_i}{\sigma^2} = L_c y_i$$

$$q_{ij} = \frac{p_i \prod_{j'\ne j} r_{j'i}}{p_i \prod_{j'\ne j} r_{j'i} + (1-p_i)\prod_{j'\ne j}(1-r_{j'i})} \qquad 1 - 2r_{ji} = \prod_{i'\ne i}(1-2q_{i'j})$$

$$L(q_{ij}) = L(p_i) + \sum_{j'\ne j} L(r_{j'i}) \qquad L(r_{ji}) = 2\tanh^{-1}\left[-\prod_{i'\ne i}\tanh\left(-L(q_{i'j})/2\right)\right] = \Phi^{-1}\left[\prod_{i'\ne i}\Phi\left(L(q_{i'j})\right)\right]$$

$$\Phi(x) = \tanh(-x/2) \qquad L(r_{ji}) = (-1)^{d_j}\left(\prod_{i'\ne i}\mathrm{sgn}\left[L(q_{i'j})\right]\right)\min_{i'\ne i}\left(\left|L(q_{i'j})\right|\right)$$