NA HIPÓTESE H_0, A_0 FOI TRANSMITIDO
NA HIPÓTESE H_1, A_1 FOI TRANSMITIDO

H_0: $x(t) = -1 + n(t)$ $\quad 0 < t < T$
H_1: $x(t) = 1 + n(t)$ $\quad 0 < t < T$

CONSIDERANDO RUÍDO ADITIVO GAUSSIANO: $f_N(n) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(n-\mu)^2}{2\sigma^2}}$

MÉDIA $= 0$
VARIÂNCIA $= 1$

COMO A MÉDIA É NULA E A VARIÂNCIA UNITÁRIA $f_N(n) = \frac{1}{\sqrt{2\pi}} e^{-\frac{n^2}{2}}$

NA HIPÓTESE H_0: $n(t) = x(t) + 1$, LOGO $f(\underline{x} | H_0) = \frac{e^{-\frac{(n+1)^2}{2}}}{\sqrt{2\pi}}$

NA HIPÓTESE H_1: $n(t) = x(t) - 1$, LOGO $f(\underline{x} | H_1) = \frac{e^{-\frac{(n-1)^2}{2}}}{\sqrt{2\pi}}$

PARA MÁXIMA VEROSSIMILHANÇA (ML)

$$\Lambda_{ML} = \frac{f(\underline{x}|H_1)}{f(\underline{x}|H_0)} \underset{H_0}{\overset{H_1}{\gtrless}} 1 \quad \text{LOGO} \quad S_{ML} = \ln\left[\frac{f(\underline{x}|H_1)}{f(\underline{x}|H_0)}\right] \underset{H_0}{\overset{H_1}{\gtrless}} 0$$

$$\ln[f(\underline{x}|H_1)] - \ln[f(\underline{x}|H_0)] \underset{H_0}{\overset{H_1}{\gtrless}} 0$$

$$-\frac{(n-1)^2}{2} + \frac{(n+1)^2}{2} \underset{H_0}{\overset{H_1}{\gtrless}} 0 \qquad -n^2 + 2n - 1 + n^2 + 2n + 1 \underset{H_0}{\overset{H_1}{\gtrless}} 0 \qquad 4n \underset{H_0}{\overset{H_1}{\gtrless}} 0$$

LOGO
$$\boxed{\begin{array}{l} n > 0 \Rightarrow H_1 \\ n < 0 \Rightarrow H_0 \end{array}}$$

PROBABILIDADE DE ERRO:

$$\alpha = P_I = P(A_1|H_0) = \int_{R_1} f(\underline{x}|H_0)\, dx = \frac{1}{\sqrt{2\pi}} \int_0^{\infty} e^{-\frac{(x+1)^2}{2}} dx = \frac{1}{2} \operatorname{erfc}\left(\frac{1}{\sqrt{2}}\right) = 0{,}159$$

$$\beta = P_{II} = P(A_0|H_1) = \int_{R_0} f(\underline{x}|H_1)\, dx = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{0} e^{-\frac{(x-1)^2}{2}} dx = \frac{1}{2} \operatorname{erfc}\left(\frac{1}{\sqrt{2}}\right) = 0{,}159$$

COM NEYMAN PEARSON (NP)

CONSIDERANDO $\alpha = P_I = 0{,}2$

$$\Lambda_{NP} = \frac{f(\underline{x}|H_1)}{f(\underline{x}|H_0)} \underset{H_0}{\overset{H_1}{\gtrless}} \lambda \quad \text{LOGO} \quad \delta_{NP} = \ln\left[\frac{f(\underline{x}|H_1)}{f(\underline{x}|H_0)}\right] \underset{H_0}{\overset{H_1}{\gtrless}} \ln(\lambda)$$

LOGO $\frac{4x}{2} \underset{H_0}{\overset{H_1}{\gtrless}} \ln(\lambda) \Rightarrow x \underset{H_0}{\overset{H_1}{\gtrless}} \frac{\ln(\lambda)}{2}$

ACHANDO λ

$$\int_{R_1} f(\underline{x}|H_0)\,dx = \alpha = 0{,}2 \Rightarrow \frac{1}{\sqrt{2\pi}}\int_{\frac{\ln(\lambda)}{2}}^{\infty} e^{-\frac{(x+1)^2}{2}} = 0{,}2 \Rightarrow \frac{1}{2}\,\text{erfc}\left(\frac{\frac{\ln(\lambda)}{2}+1}{\sqrt{2}}\right) = 0{,}2$$

$$\frac{\ln(\lambda)}{2} = -0{,}15838 \Rightarrow \lambda = 0{,}7285$$

$$\delta_{NP} \Rightarrow x \underset{H_0}{\overset{H_1}{\gtrless}} -0{,}15838$$

$$\beta = P_{II} = P(\delta_0|H_1) = \int_{R_0} f(\underline{x}|H_1)\,dx = \frac{1}{\sqrt{2\pi}}\int_{-\infty}^{-0{,}158} e^{-\frac{(x-1)^2}{2}}dx = \frac{1}{2}\,\text{erfc}\left(\frac{1}{\sqrt{2}}\right) = 0{,}123$$

COM O TESTE DE BAYES

$$\Lambda_B = \frac{f(\underline{x}|H_1)}{f(\underline{x}|H_0)} \underset{H_0}{\overset{H_1}{\gtrless}} \frac{C_{10}-C_{00}}{C_{01}-C_{11}} \cdot \frac{P(H_0)}{P(H_1)} \qquad \delta_B = \ln(\Lambda_B)$$

$$\frac{C_{10}-C_{00}}{C_{01}-C_{11}} \cdot \frac{P(H_0)}{P(H_1)} = \frac{0{,}8}{0{,}5}\cdot\frac{0{,}25}{0{,}75} = 0{,}5333 \Rightarrow \ln(0{,}5333) = -0{,}63$$

$$2x \underset{H_0}{\overset{H_1}{\gtrless}} -0{,}63 \qquad x \underset{H_0}{\overset{H_1}{\gtrless}} -0{,}31$$

$$\alpha = P_I = P(\delta_1|H_0) = \int_{R_1} f(\underline{x}|H_0)\,dx = \frac{1}{\sqrt{2\pi}}\int_{-0{,}31}^{\infty} e^{-\frac{(x+1)^2}{2}}dx = \frac{1}{2}\,\text{erfc}\left(\frac{1}{\sqrt{2}}\right) = 0{,}245$$

$$\beta = P_{II} = P(\delta_0|H_1) = \int_{R_0} f(\underline{x}|H_1)\,dx = \frac{1}{\sqrt{2\pi}}\int_{-\infty}^{-0{,}31} e^{-\frac{(x-1)^2}{2}}dx = \frac{1}{2}\,\text{erfc}\left(\frac{1}{\sqrt{2}}\right) = 0{,}095$$