ber_sbceo.m

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Abstract

The function ber_sbceo() represent the formulation of Bit Error Rate (BER) in the symmetric binary CEO problem.

1 Introduction

The function ber_sbceo() in the m-file ber_sbceo.m is defined as:

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E = ber_sbceo(Ps,M);
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This function represent the formulation of BER in the symmetric binary CEO problem.

$$BER = \begin{cases} \sum\limits_{k=\lfloor \frac{M}{2} \rfloor +1}^{M} \binom{M}{k} (1-P_s)^{M-k} P_s^k & \text{if } M \text{ } odd \\ \\ \sum\limits_{k=\lfloor \frac{M}{2} \rfloor +1}^{M} \binom{M}{k} (1-P_s)^{M-k} P_s^k & \text{if } M \text{ } even \\ \quad + 0.5 \binom{M}{\frac{M}{2}} (1-P_s)^{\frac{M}{2}} P_s^{\frac{M}{2}} & \end{cases} \tag{1}$$

This form is showed in [1], a similar form is presented in [2, 3].

1.1 Working with the probability $BER = P(\hat{U}_0 \neq U_0)$

In [2, 3] is considered a maximum a posteriori (MAP) fusion rule $f(\Omega_M)$, where the output value $\hat{u}_0$ of $\hat{U}_0$ is obtained as

$$\begin{aligned} \hat{u}_0 &= \arg_{u_0} \max P(U_0|\Omega_M) \\ &\equiv \arg_{u_0} \max P(\Omega_M|U_0) \end{aligned} \tag{2}$$

Thus, considering that m_0 is the number of zeros in Ω_M, the decision is simplify to

$$m_0 \underset{\hat{u}_0 = 0}{\overset{\hat{u}_0 = 1}{\gtrless}} \lfloor \frac{M}{2} \rfloor \tag{3}$$

In this expression is considered that if M is even and $m_0 = M/2$, the decision is arbitrarily assume that $\hat{u}_0 = 1$, so that $P(\hat{U}_0 \neq U_0)$ is $BER = 0.5\ [P(\hat{u}_0 =$

$0|u_0 = 1) + P(\hat{u}_0 = 1|u_0 = 0)],$

$$BER = 0.5 \sum_{k=0}^{\lfloor \frac{M}{2} \rfloor - 1} \binom{M}{k} (1 - P_s)^k {P_s}^{M-k} + 0.5 \sum_{k=\lfloor \frac{M}{2} \rfloor}^{M} \binom{M}{k} (1 - P_s)^{M-k} {P_s}^k \tag{4}$$

where, $\lfloor . \rfloor$ is the floor function and the value BER only is valid for values of $P_s \leq 1/2$ [1]. The Equation (4) can be sort as (1).

References

[1] Haghighat, J.; Behroozi, Hamid; Plant, D.V., "Iterative joint decoding for sensor networks with binary CEO model," Signal Processing Advances in Wireless Communications, 2008. SPAWC 2008. IEEE 9th Workshop on , vol., no., pp.41,45, 6-9 July 2008. doi: 10.1109/SPAWC.2008.4641566

[2] Abrardo, A.; Ferrari, G.; Martalò, M.; Perna, F. Feedback Power Control Strategies in Wireless Sensor Networks with Joint Channel Decoding. Sensors 2009, 9, 8776-8809. doi:10.3390/s91108776

[3] Ferrari, G.; Martalo, M.; Abrardo, A.; Raheli, R., "Orthogonal multiple access and information fusion: How many observations are needed?," Information Theory and Applications Workshop (ITA), 2012 , vol., no., pp.311,320, 5-10 Feb. 2012. doi: 10.1109/ITA.2012.6181783

[1] Here is important note that in [2, 3] your value ρ is equal to $1 - P_s$ here, and your result is for $\rho > 0.5$