About suboptimal binary detection in $\alpha$-stable context

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\textbf{ABSTRACT}

In this paper, we revisit the problem of detecting a known signal corrupted by an independent identically distributed $\alpha$-stable noise. The implementation of the optimal receiver, \textit{i.e.} the log-likelihood ratio, requires the explicit expression of the probability density function of the noise. In the general $\alpha$-stable case, there exists no closed-form for the probability density function of the noise. To avoid the numerical evaluation of the probability density function of the noise, we propose to study a parametric suboptimal detector based on properties of $\alpha$-stable noise and on implementation considerations. We focus our attention on several optimization criteria of the parameters, showing that our choice allows the optimization without using the explicit expression of the noise probability density function. The chosen detector allows to retrieve the optimal Gaussian detector (matched filter) as well as the locally optimal detector in the Cauchy context. The performance of the detector is studied and compared to usual detectors and to the optimal detector. The robustness of the detector against the signal amplitude and the stability index of the noise is discussed.

\textbf{Keywords:} $\alpha$-stable noise, probability of error, suboptimal detection, parameter optimization

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