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The Barankin bound and threshold behavior in frequency estimation

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Abstract

The Barankin bound is presented as a fundamental statistical tool for the understanding of the threshold effect associated with the estimation of the frequency of a sinusoid in additive white Gaussian noise. It is shown that the threshold effect takes hold whenever the Barankin bound departs significantly from the Cramer-Rao bound. In terms of the signal-to-noise ratio (SNR) and the data length $T$, the quantity $\text{SNR} \times T / \ln T$ is shown to be a good indicator for deciding whether the SNR is above threshold or not.