The Generalized Area Theorem in Signal Detection Theory

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In the context of standard signal detection theory, the data from the infinite sequence of forced-choice tasks that involve a single realization of a signal and k independent realizations of a noise source, $k = 1, 2...$, are shown to be sufficient to reconstruct the receiver operating characteristic (ROC) for the corresponding yes-no detection task. This follows from a novel interpretation of forced-choice probabilities as the moments of a random variable whose distribution function determines the yes-no ROC; the first moment is just the area suggested by the ROC. We further develop the standard theory of the forced-choice paradigm, and obtain conditions allowing that theory to be verified in empirical data.