# Hyperspectral Applications of Continuum Fusion

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## Abstract

Hyperspectral detection theory has spawned a new signal processing framework called *Continuum Fusion*, which integrates infinitely many optimal algorithms, in problems where a lack of prior knowledge precludes selecting the correct one. The methodology can generate several varieties of algorithm for any given model, depending on the constraints imposed during the fusion process. However, it offers no intrinsic guidance for choosing the constraints. This paper derives several flavors of detection algorithm based on what appear to be the most effective constraints to impose on constituent Fusion detectors. These are methods with: (1) Constant False Alarm Rate (CFAR), (2) Constant Probability of Detection (CPD), and (3) Constant Likelihood Ratio (CLR). Several CFAR methods are derived that compete with standard methods; CPD methods are revealed as converse forms of CFAR; and CLR methods are proven equivalent to generalized likelihood ratio tests. Practical methods of exploiting the new methodology are also devised, especially through the use of post facto distribution functions for which a given Fusion method can be proven optimal. These also serve to distinguish the Fusion approach from Bayesian methods: some Fusion solutions to a problem cannot be derived within any Bayesian framework.

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