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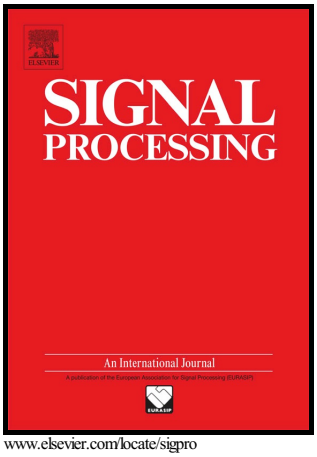
Kamlesh Gupta, S.N. Merchant, U.B. Desai



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A Multistage Approach to Decision Fusion using A Distributed Network of Non-identical Nodes

Kamlesh Gupta[a,*], S. N. Merchant[a], U. B. Desai[b]

[a] *SPANN Laboratory, Electrical Engineering Department, IIT Bombay, Powai, Mumbai 400076 (MH) INDIA*
[b] *IIT Hyderabad, Ordnance Factory Estate, Yeddumailaram 502205 (AP) INDIA*

Abstract

A distributed sensor network deployed to detect a binary event using a hard decision fusion scheme is considered. Earlier works show that the K-out-of-N counting rule is optimum in minimizing the total error rate when the sensor nodes participating in the event detection have identical performance indexes (detection and false-alarm probability pairs). In most scenarios, this optimum rule turns out to be the half-voting or majority rule. However, when the sensor nodes have non-identical performance indexes, the optimum value of K that gives the maximum correct decision probability may be anything from 1 to N and no general expression for it is available. Trying all possibilities before choosing the best value of K is computationally very demanding and the complexity grows rapidly as the number of sensor nodes increases, making it an impractical approach for a large sensor network. We propose a multistage decision fusion scheme for such networks using unanimity fusion rules and show that it gives an improved performance over unanimity, half-voting, majority, **and some soft fusion rules** and a comparable performance to the best K-out-of-N fusion rule in many cases with considerably reduced computational complexity in determining the global detection and false-alarm probabilities.

Keywords: AND, OR, K-out-of-N, multistage decision fusion, correct

*Corresponding author, Phone +919826076863
Email addresses: kamlesh@ee.iitb.ac.in (Kamlesh Gupta), merchant@ee.iitb.ac.in (S. N. Merchant), ubdesai@iith.ac.in (U. B. Desai)