

# Type-Based Random Access for Distributed Detection over Multiaccess Fading Channels

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## Abstract

The problem of distributed detection in a sensor network over multiaccess fading channels is considered. A random access transmission scheme referred to as the Type-Based Random Access (TBRA) is proposed and analyzed. Error exponents of TBRA are characterized with respect to the mean transmission rate and the channel coherence index. For the zero-mean multiaccess fading channel, it is shown that there exists an optimal mean transmission rate that maximizes detection error exponents. The optimal mean transmission rate can be calculated numerically or estimated using the Gaussian approximation, and it gives a sensor activation strategy that achieves the optimal allocation of transmission energy in spatial and temporal domains. Numerical examples and simulations are used to compare TBRA with the conventional centralized Time-Division Multiple Access (TDMA) schemes. It is shown that for zero-mean multiaccess fading channels, TBRA gives substantial improvement in the low receiver Signal-to-Noise Ratio (SNR) regime whereas, in the high SNR regime, TDMA provides better detection performance.

*Index Terms*—**Signal Processing for Communications, distributed detection, multisensor systems, performance analysis.**

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