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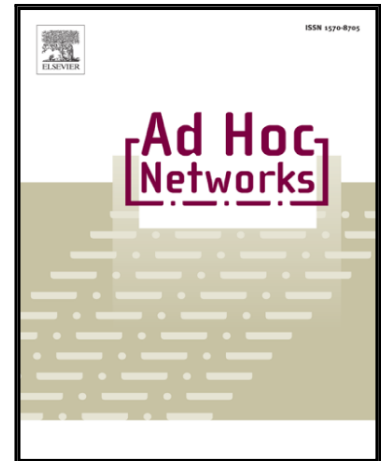
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## Fuzzy Clustering in Radar Sensor Networks for Target Detection

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### Abstract

Fuzzy clustering has been an efficient tool for data science. In this paper, we present two fuzzy clustering schemes in radar sensor networks (RSN) data processing for target detection. We design cluster-head (CH) election for both intra-cluster single-hop and multi-hop data transmission on a basis of constant false alarm rate (CFAR) under fading environment. Small scale fading is considered in our fuzzy logic system (FLS) design (FLS with three-antecedents, F3) to compute the likelihood to be a CH for each radar sensor (RS) at the first stage. In case of single-hop routing, fuzzy c-means with singular value decomposition-QR (FCMSVDQR) approach is proposed to decide the final CH. As for multi-hop routing, firstly the RS with the highest FLS likelihood will be elected a CH. Secondly a graphical optimal routing selection (GORS) algorithm is applied for multi-hop data transmission. We also propose CFAR fusion approaches for both single-hop and multi-hop transmission at low SNR channel regime. Performances of our designs are compared with CHEF, a commonly adopted scheme, in terms of target detection and the lifetime of RSN. Numerical results show that F3&FCMSVDQR provides superior detection performances and the longest lifetime at large amount of residual alive RSs, while F3&GORS takes the second place in improving the detection performances at moderate-to-high SNRs, and has the same lowest power loss as CHEF&GORS at small amount of residual alive RSs.

*Keywords:* radar sensor networks, clustering, fuzzy logic, routing

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