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非均匀环境中的参量多通道目标检测

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Parametric Multichannel Target Detection in Heterogeneous Environment

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摘要 该文研究了非均匀环境中的参量多通道目标检测，其中，干扰信号用向量自回归(VAR)模型表示，且模型的空域协方差矩阵服从自由度为μ，均值为Q的复逆Wishart分布。当Q未知时，文章根据纽曼皮尔逊(NP)准则提出了NP参量自适应匹配滤波器(NP-PAMF)，贝叶斯PAMF(B-PAMF)和归一化形式B-NPAMF；当Q已知时，文章根据最大后验概率(MAP)准则提出了MAP-PAMF和归一化形式MAP-NPAMF。结果表明：NP-PAMF和B-PAMF均与μ有关，当$\mu\to\infty$时，B-PAMF趋于经典的PAMF；B-NPAMF与μ无关，和经典的NPAMF一致。在MAP-PAMF中，空域协方差矩阵的MAP估计由经典估计和先验知识构成，μ控制后者的权重。最后，文中分析了检测器的复杂度和检测性能。实验表明：贝叶斯的参量检测器具有很好的检测性能，且比归一化检测器的性能优越。

关键词： 目标检测 参量自适应匹配滤波 非均匀环境 向量自回归模型 逆Wishart分布

Abstract： Parametric multichannel target detection in heterogeneous environment is studied in this paper, where the disturbances are represented by Vector AutoregRessive (VAR) model with its spatial covariance matrix following complex inverse Wishart distribution with degrees of freedom μ and mean Q. When Q is unknown, the Neyman-Pearson Parametric Adaptive Matched Filter (NP-PAMF), Bayesian PAMF (B-PAMF) and its normalized version (B-NPAMF) are proposed based on NP detection rule. And when it is known, the maximum a-posteriori PAMF (MAP-PAMF) and its normalized version (MAP-NPAMF) are proposed followed MAP decision rule. It is shown that NP-PAMF and B-PAMF are both dependent onand B-PAMF is convergent to the PAMF when $\mu\to\infty$; B-NPAMF has no relation with μ and is consistent with the classic NPAMF. In MAP-PAMF, the MAP estimator of the spatial covariance matrix consists of the classic estimator and the prior knowledge, and the weigh of the later is controlled by μ. Finally, the complex issues and the detection performances are nalyzed, showing that: Bayesian parametric detectors possess good performances and they are better than their normalized counterparts.

Keywords： Target detection Parametric Adaptive Matched Filter (PAMF) Heterogeneous environments Vector AutoregRessive (VAR) model Inverse Wishart distribution

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