论文与技术报告

改进的杂波协方差矩阵结构估计方法

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摘要：

在球不变随机向量建模的非高斯杂波背景下，针对现有协方差矩阵估结构计方法对杂波不具备完全自适应性以及计算复杂度高等问题，本文利用经验信息，提出了基于经验的自适应估计方法(E-AE)，并将其作为初始化矩阵，再次利用经验信息进行迭代估计，得到了基于经验的自适应迭代估计方法(E-ARE)。E-AE和E-ARE只需要进行实数运算，减小了计算复杂度。从理论上证明了所提方法对应的ANMF对杂波纹理分量和协方差矩阵结构都具有CFAR特性，并通过仿真实验对其有效性进行了验证。最后，利用匹配滤波器的输出信杂比损失及相应的ANMF检测性能，对所提方法和已有方法进行效果评估，结果表明，本文方法具有收敛速度快、所需的辅助单元数少、信杂比损失小和对应的ANMF检测性能优等特点。

关键词： 非高斯杂波；协方差矩阵结构；恒虚警率；归一化匹配滤波器

Improved Estimation Method of Clutter Covariance Matrix Structure

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Abstract:

In the non-Gaussian clutter modeled as spherically invariant random vectors, for the problems that existing methods of covariance matrix estimation are not fully adaptive and higher computational complexity, an adaptive estimator is devised based on experience (E-AR). Moreover, with E-AR as the initialization matrix for the recursive, the E-ARE is proposed. The E-AR and the E-ARE are only need to implement real number operation, and have lower computational complexity. The constant false alarm rate property to both of the clutter texture components and the normalized clutter covariance matrix of corresponding adaptive normalized matched filters (ANMFs) are proved theoretically, and are also validated by simulation. Finally, the effectiveness of proposed methods are evaluated and compared with the exiting method for the signal to clutter ratio (SCR) loss and the performance of corresponding ANMFs. The results show that proposed methods have the characteristic of faster convergence rate, fewer second data, smaller SCR loss and better performance of corresponding ANMFs.

Keywords: non-Gaussian clutter　covariance matrix structure　constant false alarm rate　normalized matched filter

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