ROBUST MATCHED FILTERING IN THE FEATURE SPACE
(MonPmPO2)

Author(s):
Ignacio Santamaria (University of Cantabria, Spain)
Deniz Erdogmus (Oregon Health and Science University, United States)
Rati Agrawal (University of Florida, United States)
Jose C. Principe (University of Florida, United States)

Abstract:
In this paper the problem of detecting a known waveform in noise is solved in a high dimensional transformed (feature) space. The proposed test statistic is the inner product between two hyperplanes constructed using the nonlinearly transformed template and observations, which becomes a simple quadratic form after applying the kernel trick. To obtain the optimal projections for the template and the observations we maximize the Fisher discriminant analysis (FDA) criterion in the feature space. Under the white Gaussian noise assumption, closed−form expressions for the means and the variances under each hypothesis are obtained, and an iterative procedure to get the optimal projections is proposed. Interestingly, the analysis of the results shows that the optimal projections preserve the information about the original waveform shape. This can be used to simplify the optimization procedure since one of the projectors can be fixed in advance. Some simulation results indicate that the proposed test statistic achieves the optimal performance of the linear matched filter under Gaussian noise, but shows an increased robustness against impulsive noise distributions.