



Dual-Blind Deconvolution Techniques for Joint Radar-Communications

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Recent interest in integrated sensing and communications (ISAC) has led to the design of novel signal processing techniques to recover information from an overlaid radar-communications signal [1]. We present a general spectral coexistence scenario, wherein the channels and transmit signals of both radar and communications systems are unknown at the receiver. In this dual-blind deconvolution (DBD) problem [2, 3], a common receiver admits a multi-carrier wireless communications signal that is overlaid with the radar signal reflected off multiple targets. The communications and radar channels are represented by continuous-valued range-time and Doppler velocities of multiple transmission paths and multiple targets. We exploit the sparsity of both channels to solve the highly ill-posed DBD problem by casting it into a sum of multivariate atomic norms (SoMAN) minimization.

We devise a semidefinite program to estimate the unknown target and communications parameters using the theories of positive-hyperoctant trigonometric polynomials (PhTP). Our theoretical analyses show that the minimum number of samples required for perfect recovery scale logarithmically with the maximum of the radar targets and communications paths rather than their sum. We show that our SoMAN method and PhTP formulations are also applicable to more general scenarios such as unsynchronized transmission, the presence of noise, multiple antennas, and multiple emitters [4]. We also examine this problem using extremal functions from the Beurling-Selberg interpolation theory [5].

References

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