James Herring

Optimization Schemes for Phase Recovery in Bispectral Imaging

Department of Mathematics and Computer Science
Emory University
400 Dowman Dr
W401
Atlanta
GA
30322
jlherri@emory.edu
James Nagy

Bispectral imaging is one class of methods used for the recovery of images in ground-based astronomical imaging. The problem is a familiar one: retrieve a clear, high-resolution image of an object in space given a sequence of telescopic images of an object and a star (acting as the point spread function or blurring operator) through an atmosphere-telescope system. Bispectral methods approach this problem by separating the image recovery into two subproblems: recovery of the objects intensity (also known as its Fourier modulus or power spectrum) and recovery of the objects Fourier phase. To recover the objects phase, we exploit the relationship between the objects phase and the bispectrum phase of the collected image frames, where the bispectrum is a statistical quantity which is calculable given a sufficient number of frames. Mathematically, this is formulated as a large-scale, non-linear inverse problem. In this talk, we describe two previously proposed alternative formulations of the objective function (Haniff and Glindemann, Dainty) and discuss efficient approaches to solving these optimization problems.

1.) A. Glindemann and J.C. Dainty, Object fitting to the bispectral phase by using least squares, JOSA A 10.5 (1993): 1056-1063.

2.) C.A. Haniff, Least-squares Fourier phase estimation from the modulo 2-pi bispectrum phase, JOSA A 8.1 (1991): 134-140.