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Combined Dimensionality Reduction in Search and Detection Spaces via Diffusion Mapping DMITRI ROMANOV, Dept. of Physics and Center for Advanced Photonics Research, Temple University, Philadelphia, PA 19122, STANLEY SMITH, JOHN BRADY, Dept. of Chemistry and Center for Advanced Photonics Research, Temple University, Philadelphia, PA 19122, RONALD COIFMAN, Dept. of Applied Mathematics, Yale University, New Haven, CT 06511, ROBERT LEVIS, Dept. of Chemistry and Center for Advanced Photonics Research, Temple University, Philadelphia, PA 19122 — Strong-field control settings involve highly nonlinear processes. Typically, both search and detection spaces are high-dimensional (with dimension ∼100 each). This poses considerable problems to analysis and interpretation of the process-related data. Here, we use the recently developed nonlinear statistical method of diffusion mapping to effectively reduce the combined dimensionality of the search and detection space and to sample essential patterns in the lower-dimensional representation. The diffusion maps are constructed and analyzed for the case study of maximizing integrated intensity in a second harmonic generation experiment. The use of a sampling set of 1000 random pulses in the diffusion mapping is sufficient for effective dimensionality reduction and for revealing the inherent structure of the process-related data. Extrapolation of the low-dimensional diffusion-space pattern helps indicate the area in the search space that is most amenable to effective optimization. The diffusion-mapping algorithm is sufficiently fast and robust that may make it a valuable preprocessing tool for optimal pulse searching.

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