

Seismic Imaging and Optimal Transport

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Abstract

The purpose of exploration seismology is to find geophysical properties, such as wave velocity and location of reflecting sub layers in the earth from measurements of seismic waves at the surface. A recently popular computational technique for seismic imaging is Full Waveform Inversion, which is formulated as PDE constrained minimization where the miss-match between measured and computed signals plays an important role. The geophysical properties are given by unknown variable coefficients in the PDE. We propose using optimal transport and the Wasserstein metric for this miss-match in order to reduce the risk of only finding local minima in the PDE constrained minimization. The optimal transport can be given by the gradient of the solution to a Monge–Ampère equation. Analysis of convexity properties and numerical examples comparing these new techniques with the classical L2 miss-match will be presented.