

Review of: "Annealed Stein Variational Gradient Descent for Improved Uncertainty Estimation in Full-Waveform Inversion"

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Potential competing interests: No potential competing interests to declare.

Manuscript entitled "Annealed Stein Variational Gradient Descent for Improved Uncertainty Estimation in Full-Waveform Inversion"

The manuscript concerns the estimation of uncertainty for the Full-Waveform Inversion applied to high-resolution subsurface velocity models from seismic data.

The present paper is of the practical interest due to the needs of exploration geophysics.

The topic of present paper is of the interest from theoretical viewpoint due to the ill-posedness of the Full-Waveform Inversion and corresponding Bayesian regularization, which provides both the regularized solution and the uncertainty of the results. The Variational inference is used for approximation of the probability distribution in the form of the Stein Variational Gradient Descent (SVGD).

The uncertainty estimates via the SVGD are improved by application of the annealed variant. The SVGD algorithm enables optimization problems to be solved by gradient descent algorithms for a certain number of particles, whilst introducing inter-particle communication.

The annealed SVGD can significantly improve convergence and performance compared o vanilla SVGD in Full-Waveform Inversion applications.

The use of Principal Component Analysis provides valuable insights on the optimization process.

In general, the paper is of high quality. The clarity and organization of the manuscript are of high quality. The exposition is detailed and no extra explanations are necessary.

I suggest the paper may be accepted.