Shape interpolation-based data assimilation with Wasserstein distance

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In this paper, we introduce the optimal transport theory to level-set-based data assimilation method. Level-set method could describe the motion of the geometric shape of a given system only using an initial contour. To obtain reliable prediction, active contour containing in image observation data should be assimilated in order to modify such model. However, position errors from observation and background will have great influence on the result when there is no prior information about the weight parameters between them. In this regard, we use Wasserstein distance in optimal transport theory rather than the traditional Euclidean distance to measure the misfit. The non-local metric combined with the level-set method is taken as a kind of shape interpolation which can deal with such non-gaussian position and shape error to some extent. The decent performance of numerical tests demonstrates the efficiency of our proposed method.