

# Incremental Neural Data Assimilation

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Data assimilation is a central problem in many geophysical applications, such as weather forecasting. It aims to estimate the state of a potentially large system, such as the atmosphere, from sparse observations, supplemented by prior physical knowledge. The size of the systems involved and the complexity of the underlying physical equations make it a challenging task from a computational point of view. Neural networks represent a promising method of emulating the physics at low cost, and therefore have the potential to considerably improve and accelerate data assimilation. In this work, we introduce a deep learning approach where the physical system is modeled as a sequence of coarse-to-fine Gaussian prior distributions parametrized by a neural network. This allows us to define an assimilation operator, which is trained in an end-to-end fashion to minimize the reconstruction error on a dataset with different observation processes. We illustrate our approach on chaotic dynamical physical systems with sparse observations, and compare it to traditional variational data assimilation methods.

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