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State-Observation Sampling and the Econometrics of Learning Models

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In nonlinear state-space models, sequential learning about the hidden state can proceed by particle filtering when the density of the observation conditional on the state is available analytically (e.g. Gordon et al., 1993). This condition need not hold in complex environments, such as the incomplete-information equilibrium models considered in financial economics. In this paper, we make two contributions to the learning literature. First, we introduce a new filtering method, the state-observation sampling (SOS) filter, for general state-space models with intractable observation densities. Second, we develop an indirect inference-based estimator for a large class of incomplete-information economies. We demonstrate the good performance of these techniques on an asset pricing model with investor learning applied to over 80 years of daily equity returns.

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