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A Bayesian Reinterpretation of Dynamical System Identification by Sparse Regression Methods[1] ROBERT K NIVEN, The University of New South Wales, Australia, LAURENT CORDIER, Institut Pprime, Poitiers, France., MARKUS ABEL, MARKUS QUADE, Ambrosys GmbH, Potsdam, Germany., ALI MOHAMMAD-DJAFARI, CentraleSupélec, Gif-sur-Yvette, France. — Recently, many researchers have developed sparse regression methods for the identification of a dynamical system from its time-series data. We demonstrate that these methods fall within the framework of Bayesian inverse methods. Indeed, the Bayesian maximum *a posteriori* method, using Gaussian likelihood and prior functions, is equivalent to Tikhonov regularization based on Euclidean norms. This insight provides a Bayesian rationale for the choice of residual and regularisation terms for any problem, respectively from the Bayesian likelihood and prior distributions. It also provides access to the full Bayesian inversion apparatus, including estimation of uncertainties in the inferred parameters and the model, explicit calculation of the optimal regularization parameter, and the ranking of competing models using Bayes factors. In addition, advanced Bayesian methods are available to explore the inferred probability distribution of the model, should this be desired. We demonstrate these points by analysis of several dynamical systems using standard and Bayesian sparse regression methods. We also discuss the estimation of intermediate parameters and their handling within a Bayesian framework.

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