Info-Gap Forecasting and the Advantage of Sub-Optimal Models

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Abstract

We consider forecasting in linear discrete-time systems. Historical data indicate that the transition matrix is constant over time. However, the underlying laws governing the system are unknown and it is uncertain that the system properties will remain constant. An info-gap model is used to represent uncertainty in the future transition matrix. The forecaster desires the average forecast of a specific state variable to be within a specified interval around the correct value. Traditionally, forecasting is based on using a model which has optimal fidelity to historical data. Our first theorem asserts the existence, and indicates the construction, of models with sub-optimal fidelity to historical data which are more robust to model error than the optimal model. Our second theorem identifies conditions in which the probability of forecast success increases with increasing robustness to model error. Combining these results leads to a methodology for identifying reliable forecasting models for systems whose trajectories evolve in unknown ways over time.

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