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Fitting Linear Ordinary Differential Equation and Machine Learning Models using Matrix Frechet derivatives with application in

Using a trace formula recently introduced in [Nguyen, 2022] for the Frechet derivative of an analytic matrix function, we revisit the problem of fitting a model whose state variables are governed by a system of linear differential equations. Applications include fitting the equation for radioactivity in blood samples [Jennrich and Bright, 1976] and fitting financial time series. The trace formula allows us to use a derivative-based solver for both problems. We also discuss other applications of Frechet derivative in numerical calculations, including finding zeros of a function involving matrix exponential in machine learning [Sustik and Dhillon, 2012] and finding the Riemannian center of mass (in computer vision) [Chakraborty and Vemuri, 2019].