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Dynamic Measurement System Modeling with Machine Learning Algorithms

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Abstract : In this paper, ways of modeling dynamic measurement systems are discussed. Specially, for linear system with single-input single-output, it could be modeled with shallow neural network. Then, gradient based optimization algorithms are used for searching the proper coefficients. Besides, method with normal equation and second order gradient descent are proposed to accelerate the modeling process, and ways of better gradient estimation are discussed. It shows that the mathematical essence of the learning objective is maximum likelihood with noises under Gaussian distribution. For conventional gradient descent, the mini-batch learning and gradient with momentum contribute to faster convergence and enhance model ability. Lastly, experimental results proved the effectiveness of second order gradient descent algorithm, and indicated that optimization with normal equation was the most suitable for linear dynamic models.

Keywords : dynamic system modeling, neural network, normal equation, second order gradient descent
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