Mach Learn (2013) 93:93–114
DOI 10.1007/s10994-013-5388-x

A comparative evaluation of stochastic-based inference methods for Gaussian process models

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Received: 14 December 2012 / Accepted: 28 May 2013 / Published online: 28 June 2013

Abstract Gaussian Process (GP) models are extensively used in data analysis given their flexible modeling capabilities and interpretability. The fully Bayesian treatment of GP models is analytically intractable, and therefore it is necessary to resort to either deterministic or stochastic approximations. This paper focuses on stochastic-based inference techniques. After discussing the challenges associated with the fully Bayesian treatment of GP models, a number of inference strategies based on Markov chain Monte Carlo methods are presented and rigorously assessed. In particular, strategies based on efficient parameterizations and efficient proposal mechanisms are extensively compared on simulated and real data on the basis of convergence speed, sampling efficiency, and computational cost.

Keywords Bayesian inference · Gaussian processes · Markov chain Monte Carlo · Hierarchical models · Latent variable models

1 Introduction

Gaussian Process (GP) models represent a class of models that are popular in data analysis due to the associated flexibility and interpretability. Both these features are a direct consequence of their rich parameterization. Flexibility is due to the nonparametric prior over

Editors: Hendrik Blockeel, Kristian Kersting, Siegfried Nijssen, and Filip Železný.

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