DD2434/FDD3434 Machine Learning, Advanced Course
Module 5 Exercise

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Contents

Instead of presenting a summary of the subject, these exercise problems will refer to the Ranganath paper.

5 Black-Box Variational Inference – Exercises

5.1 Score functions

Derive the score function of the following distributions:
a) $\mathcal{N}(\mu, \tau^{-1})$ w.r.t. μ and w.r.t. τ
b) Gamma(α, β) w.r.t. α and w.r.t. β
c) Beta(a, b) w.r.t a and w.r.t. b.

5.2 Cartesian Matrix Model

We will examine BBVI for the Cartesian Matrix model in the Exercises of Module 3 and apply the same mean-field approximation. Furthermore, we will assume $q(\mu_r) = \mathcal{N}(\nu_r, \gamma_r^{-1})$ and $q(\xi_c) = \mathcal{N}(\nu_c, \gamma_c^{-1})$.
a) Draw the DGM/PGM for the model.
b) Derive the scores of $q(\mu_r)$ and $q(\xi_c)$.
c) Determine which variables are in the Markov Blanket of μ_r and ξ_c. Derive $p_i(y, \mu_r)$ for $z_i = \mu_r$ and $z_i = \xi_c$.
d) Using Algorithm 2. in the Ranganath paper, implement the BBVI algorithm with Rao-Blackwellization and the proposed Control variate.