Call for Applications

Postdoctoral Fellowship in Bayesian Computation, Computer Experiments, and Predictive Coding

Background

We are looking for a Postdoctoral Fellow to join our research team to work on an interdisciplinary research project at the intersection of Bayesian computing, physics-based computer experiments, and predictive coding.

The project aims to work in a cross-disciplinary team developing algorithms and performing numerical and experimental work in materials physics. The team is developing novel Bayesian computational methods for complex computer experiments and physics-based simulation models, with particular emphasis on scalable Markov Chain Monte Carlo (MCMC), Hamiltonian Monte Carlo (HMC), Sequential Monte Carlo (SMC), Bayesian calibration, inverse problems, and uncertainty quantification. A key component of the project will lead to new physics-informed Bayesian methods, including Gaussian processes, Bayesian hierarchical models, and Bayesian neural networks that enable efficient inference when direct evaluation of scientific simulators is computationally expensive.

The project will explore emerging connections between predictive coding and Bayesian computation, with a focus on developing algorithms for new energy efficient material platforms where cpu-intensive operations are replaced by novel physical components that exploit functional material properties. Constraints imposed by the material physics will be investigated in terms of prediction-error-driven mechanisms for probabilistic inference and critical evaluations determined for their relationships with conventional MCMC methods and hierarchical Bayesian models. The overarching goal is to develop new computational frameworks that integrate Bayesian inference and predictive coding for efficient analysis of data obtained from complex physics-based simulation experiments and design algorithms for implementation on material platforms that provide energy efficient alternatives to conventional semiconductor based technologies.

Duties

The Postdoctoral Fellow will play an integral role in the development and implementation of the research program. Working within an interdisciplinary team of statisticians and physicists, the successful candidate will contribute to the development of new Bayesian computational methodology to address experimental and computational data analysis problems. In this context they will have opportunities to work on novel MCMC and related sampling algorithms, Bayesian calibration and uncertainty quantification for computer experiments, modeling for computationally expensive physics-based simulators, and predictive-coding approaches to probabilistic inference on novel material hardware platforms.

Candidate is expected to develop methodological and computational research, implement and evaluate proposed methods using simulated and scientific problems, prepare research manuscripts for publication, and present research findings at conferences and workshops.

Candidates with strong backgrounds in Bayesian statistics, computational statistics, MCMC, computer experiments, uncertainty quantification, machine learning, and computational physics are particularly encouraged to apply. Experience with Gaussian processes, Bayesian hierarchical modeling, predictive coding, scientific computing, or physics-based simulation models would be considered an asset. Strong programming skills in Python, R, Julia, C/C++, or related computational environments are desirable.

Support
The total salary for the position will be $55,000 per year plus. Anticipated start date is November 2026, for one year, with the possibility of extension subject to funding and satisfactory progress.

Application
Please contact either Saman Muthukumarana (Saman.Muthukumarana@umanitoba.ca), Max Turgeon (Max.Turgeon@umanitoba.ca), or Robert Stamps (Robert.Stamps@umanitoba.ca) by September 30, 2026, if you are interested in the position. Please include a current curriculum vitae (CV) along with the names and contact information of three references with your expression of interest.