Luhuan Wu

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Last Updated: Aug. 2022

Research Interests

I have broad research interests in machine learning and statistics. Specifically, my recent interests lie in:

- **Probabilistic Machine Learning:** latent variable models, deep generative models, variational inference
- **Uncertainty Quantification:** Bayesian modeling, conformal prediction
- **Causal Inference:** invariant prediction, out-of-distribution generalization

Education

Columbia University — New York, NY, USA
Ph.D. in Statistics — 2020 –Current
M.S. in Data Science — 2018 –2020

Nanjing University — Nanjing, Jiangsu, China
B.S. in Mathematics — 2014–2018

Publication

1. **Variational Nearest Neighbor Gaussian Process** In *ICML*, 2022
   Luhuan Wu, Geoff Pleiss, and John P. Cunningham
   A variational Gaussian process approximation that enables (1) setting inducing points to observations (2) mini-batch optimization over both observations and inducing points.

2. **Bias-free Scalable Gaussian Processes via Randomized Truncations** In *ICML*, 2021
   Andres Potapczynski*, **Luhuan Wu***, Dan Biderman*, Geoff Pleiss, and John P. Cunningham
   A theoretical study of the biases in two popular GP learning techniques, conjugate gradients and random Fourier features. Randomized truncation estimators that eliminate these biases in exchange for increased variance.

3. **Hierarchical Inducing Point Gaussian Process for Inter-domian Observations** In *AISTATS*, 2021
   Luhuan Wu*, Andrew Miller*, Lauren Anderson, Geoff Pleiss, David Blei, and John P. Cunningham
   An inter-domain Gaussian process inference method that scales to millions of inducing points and its application to a large astronomical modeling problem.

4. **Variational Objectives for Markovian Dynamics with Backward Simulation** In *ECAI*, 2021
   Antonio Khalil Moretti*, Zizhao Wang*, **Luhuan Wu***, Iddo Drori, Itsik Pe'er
   An inference and learning algorithm for deep state space models that utilize backward simulation and particle smoothing techniques.

5. **Inverse Articulated-body Dynamics from Video via Variational Sequential Monte Carlo** In *NeurIPS Workshop on Differentiable Vision, Graphics, and Physics in Machine Learning*, 2020
   Dan Biderman, Christian A Naesseth, **Luhuan Wu**, Taiga Abe, Alice C Mosberger, Leslie J Sibener, Rui Costa, James Murray, John P Cunningham.
   A pipeline for body dynamics inference from video: use a convolutional network to track joint positions, embed these as the joints of a linked robotic manipulator, and finally apply a probabilistic physical model whose states specify second-order rigid-body dynamics with a novel distributed nested SMC inference algorithm.

6. **Smoothing Nonlinear Variational Objectives with Sequential Monte Carlo** In *ICLR Workshop on Deep Generative Models for Highly Structured Data*, 2019
   Antonio Khalil Moretti*, Zizhao Wang*, **Luhuan Wu**, Itsik Pe'er
   An inference and learning algorithm for deep state space models that conditions proposal distributions on the full time-ordered sequence of observations.

Skills

Programming: Python, R, Java

Open-source contribution: Implemented the Variational Nearest Neighbbor Gaussian Process in GpyTorch (a Gaussian process library with GPU acceleration and implemented in PyTorch).

Professional Service

Reviewer for AISTSTS (2022), JMLR (2021)

Invited Talk

Variational Nearest Neighbor Gaussian Process In *The 35th New England Statistical Symposium*, 2022.

Teaching

Columbia University

Introduction to Probabilistic Graphical Models	Spring 2022
Probability and Statistics for Data Science	Fall 2021
Time Series Analysis	Summer 2021
Introduction to Probability and Statistics	Spring 2021
Introduction to Probabilistic Graphical Models	Fall 2020
Applied Machine Learning for Financial Modeling	Spring 2019

Scholarships and Awards

Merit Student of Nanjing University	2017
Scholarship for Chinese National Elite Program in Basic Science	2016, 2017
People's Scholarship	2016, 2017
Aegon Industrial Fund Scholarship	2015