Matthew Varble

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Objective

I seek a job in industry which allows me to explore my mathematical interests and sharpen my software engineering skills. I will offer understanding of generative machine-learning models through a comprehensive understanding probability concepts. Ideally, I will also take part in software development of highly-scalable systems under a strong team from which I may learn and grow.

Ph.D. in Applied Mathematics
UC Santa Barbara
2016-2022

Bachelors of Science in Mathematics
Cal Poly
2012-2016

Experiences

Autonomous Systems Intern *(Toyon Research Corporation)* 2018 and 2019

- Refactored codebase for multipath emitter localization algorithms.
- Developed algorithm for associating measurements with TDOA data.
- My contributions in Section 3 in conference paper. 10.1109/AERO.2019.8741679

Projects

Personal Websites *(Javascript, React, Gatsby, D3, three.js, Webpack)* 2017-2022

- https://rodent.club. A blog in which I discuss math and programming projects.
- https://presentations.rat.supply. Presentations decks in a Javascript runtime.

GenTransportMCMC.jl *(Julia, Gen.jl, Markov Chain Monte Carlo)* 2021

- An implementation of transport map accelerated MCMC for the Gen.jl DSL.
- Working progress. Extensions may include incorporating various backends, like TensorFlow or PyTorch.

Party server *(Rust, Javascript, SQL, Warp, Tokio, Diesel, React, D3, Webpack)* 2021

- Rust-implemented server hosts a WebSocket REST API for realtime updates of party consumption data.
- Database managed by Diesel/R2D2 thread-pool, state streams controlled behind thread-safe mutex, web service hosted on asynchronous warp/hyper/tokio client.
- Web frontend implemented with React and D3.

Publications

Ground-Based Emitter Location in the Presence of Multipath *(IEEE Aerospace Conference)*

This paper is concerned with the state-estimation problem of locating an emitter which radiates both direct and reflected paths, signaling a receiver with angle-of-arrival (AOA) and time-difference-of-arrival (TDOA) measurements of each path. Locations of the emitter and each reflected image form correlated states we estimate using sequential Monte Carlo methods; we associate signals of these sources with our estimator through an AOA-greedy algorithm which allows us to use TDOA signals.
10.1109/AERO.2019.8741679

Large deviations of affine processes *(pending)*

We prove a large deviations principle (LDP) on the Skorokhod space $\mathbb{D}_{\mathbb{X}}[0,\infty)$ for families $(\epsilon X^{\epsilon})_{\epsilon>0}$ of affine processes ϵX^{ϵ} taking values in some abstract subset $\mathbb{X}$ of a vector space $\mathbb{V}$. The regime is of the small-noise Friedlin-Wentzel form, coming from natural mean-field phenomena. Our proof requires small tails of the associated affine jump kernel μ (i.e. $\int_{|v|>1} e^{\langle u,v\rangle}\mu(x,\mathrm{d}v) < \infty$ for all $u \in \mathbb{V}$) whereas previous results required $\mu = 0$ and $\mathbb{X}$ to be a canonical space.

Importance sampling of affine processes *(pending)*

Our LDP (from the above paper) induces an importance sampling scheme parameterized by functions $\theta : [0,\infty) \to \mathbb{V}$. Our proof indicates that no efficiency is loss when selecting θ from a specific family of piecewise functions which may be easily calibrated. These suggest an exact sampling algorithm of which we prove equivalent efficiency.