

# Department of Biostatistics and Medical Informatics Seminar

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the University of Wisconsin–Madison



Friday, March 7, 2025

12:00-1:00 pm

Biotech Seminar Auditorium \*or\* via Zoom

<https://uwmadison.zoom.us/j/99879638765?pwd=wbtqxoucEFlPVCVc9SFbvKB1Av7Xk.1>

Passcode: 343271

## Scalable piecewise smoothing in high dimensions with BART

**Abstract:** Bayesian Additive Regression Trees (BART) is an easy-to-use and highly effective nonparametric regression model that approximates unknown functions with a sum of binary regression trees (i.e., piecewise-constant step functions) that one-hot encode categorical predictors. Consequently, BART is fundamentally limited in its ability to “borrow strength” across multiple categories and to estimate smooth functions. Initial attempts to overcome this second limitation replaced the constant output in each leaf of a tree with a realization of a Gaussian Process (GP). While these elaborations are conceptually elegant, most implementations are computationally prohibitive, displaying a cubic per-iteration complexity.

We propose ridgeBART, an extension of BART built with trees that (i) can assign multiple categorical levels to both branches of a decision tree node and (ii) output linear combinations of ridge functions (i.e., a composition of an affine transformation of the inputs and non-linearity). We develop a new MCMC sampler that updates trees in linear time and derive near-minimax-optimal posterior contraction rates for estimating smooth and piecewise smooth functions. We demonstrate ridgeBART’s effectiveness on synthetic data and use it to estimate the probability that a professional basketball player makes a shot from any location on the court in a spatially smooth fashion.

The talk is based on the following papers: <https://arxiv.org/abs/2411.07984> and <https://arxiv.org/abs/2211.04459>

**Bio:** Sameer Deshpande is an Assistant Professor in the Department of Statistics at the University of Wisconsin–Madison. Prior to that, he completed a postdoc with Professor Tamara Broderick at MIT and earned his Ph.D. in Statistics at Wharton where he was supervised by Professors Ed George and Veronika Rockova. His research interests include Bayesian hierarchical modeling, Bayesian regression trees, model selection, causal inference, and applications in public health and sports. His website is <https://skdeshpande91.github.io/>.



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