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SPEAKER TITLES/ABSTRACT

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"Multiscale Analysis of BART"

The widespread popularity of Bayesian tree-structured regression methods has raised considerable interest in theoretical understanding of their empirical success. However, theoretical literature on methods such as Bayesian CART and BART is still in its infancy. This paper affords new insights about Bayesian CART in the context of structured wavelet shrinkage under the white noise model. We exhibit precise connections between tree-shaped sparsity priors and unstructured spike-and-slab priors, which are regarded as ideal but are rather theoretical in nature. We show that the more practical Bayesian CART priors lead to adaptive rate-minimax posterior concentration in the l_∞ sense, performing nearly as well as the theoretical ideal (up to a log term). To further explore the benefits of structured shrinkage, we propose the g-prior for trees, which departs from the typical wavelet product priors by harnessing correlation structure induced by the tree topology. While the majority of wavelet type theoretical results for CART focus on dyadic trees, here we do not require that splits are at dyadic locations. We introduce the library of weakly balanced Haar wavelets and show that Bayesian CART is equivalent to Bayesian basis selection from this library. To illustrate that l_∞ adaptation is an intricate phenomenon, where internal sparsity plays a key role, we show that dense trees are incapable of adaptation. While one of the major appeals of BART is uncertainty quantification via credible sets, asymptotic normality justifications have thus far been unavailable. Building on the l_∞ adaptation property, we provide new fully non-parametric and adaptive Bernstein-von Mises statements for Bayesian CART using multiscale techniques. (Joint work with Ismael Castillo)