# 2022년 제 1회 통계세미나

고려대학교 통계연구소와 BK21 통계학교육연구팀이 다음과 같이 공동으로 세미나를 개최하오니 많은 참여 바랍니다.

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## The art of BART: Minimax optimality over nonhomogeneous smoothness in high dimension

<Abstract>

Considerable effort has been directed to developing asymptotically minimax procedures in problems of recovering functions and densities. These methods often rely on somewhat arbitrary and restrictive assumptions such as isotropy or spatial homogeneity. This work enhances theoretical understanding of Bayesian forests (including BART) under substantially relaxed smoothness assumptions. In particular, we provide a comprehensive study of asymptotic optimality and posterior contraction of Bayesian forests when the regression function has anisotropic smoothness that possibly varies over the function domain. The regression function can also be possibly discontinuous. We introduce a new class of sparse piecewise heterogeneous anisotropic Holder functions and derive their minimax lower bound of estimation in high-dimensional scenarios under the L2-loss. Next, we find that the default Bayesian tree priors, coupled with a Dirichlet subset selection prior for sparse estimation in high-dimensional scenarios, adapt to unknown heterogeneous smoothness, discontinuity, and sparsity. These results show that Bayesian forests are uniquely suited for more general estimation problems which would render other default machine learning tools, such as Gaussian processes, suboptimal. Our numerical study shows that Bayesian forests outperform other competitors such as random forests and deep neural networks, which are believed to work well for discontinuous or complicated smooth functions. Beyond nonparametric regression, we also show that Bayesian forests can be successfully applied to many other problems including density estimation and binary classification.

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