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Uniform Confidence Corridors for Generalized Random Forests

Abstract

Random forests are a powerful tool of nonparametric data science and have been studied intensively for their theoretical properties and applicability in many scientific fields. Among the newest insights into their asymptotics are extensions towards Generalized Random Forests (GRF) with central limit theorem allowing to study pointwise influence of the features. Here, we extend these findings towards uniform convergence, hence allowing to check whether over a range of feature values one observes significant effects. We find critical values for the uniform confidence bands using multiplier bootstrap, since it is since it is well known that the standard approach via extreme value theory has a very slow asymptotic. Numerical simulations verify that this 'wild bootstrap' like method gives reliable results and coverage, also in small samples. As a real life application, we extend the labor force example provided in Athey et.al (2019) and find using uniform confidence bands that the father's low income doesn't always drive the conditional local average treatment effect of mother returning to the labor force after having third child. In addition, we consider a credit scoring application which lies at the heart of financial analysis and find that higher profitability doesn't give any financial institution a direct ticket to non-default category.

Keywords: Non-parametric estimates, generalized random forests, uniform confidence bands, multiplier