Asymptotic Theory for Estimation of the Hüsler-Reiss Distribution via Block Maxima Method

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ABSTRACT

The Hüsler-Reiss distribution describes the limit of the pointwise maxima of a bivariate normal distribution. This distribution is defined by a single parameter, λ. We provide asymptotic theory for maximum likelihood estimation of λ under a block maxima approach. Our work assumes independent and identically distributed bivariate normal random variables, grouped into blocks where the block size and number of blocks increase simultaneously. With these assumptions our results provide conditions for the asymptotic normality of the Maximum Likelihood Estimator (MLE). We characterize the bias of the MLE, provide conditions under which this bias is asymptotically negligible, and discuss how to choose the block size to minimize a bias-variance trade-off. The proofs are an extension of previous results for choosing the block size in the estimation of univariate extreme value distributions (Dombry and Ferreria, 2019), providing a potential basis for extensions to multivariate cases where both the marginal and dependence parameters are unknown. The proofs rely on the Argmax Theorem applied to a localized loglikelihood function, combined with a Lindeberg-Feller Central Limit Theorem argument to establish asymptotic normality. Possible applications of the method include composite likelihood estimation in Brown-Resnick processes, where it is known that the bivariate distributions are of Hüsler-Reiss form.