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Estimation of density quantile function.

Let $X_1, X_2, \cdots$ be an i.i.d. sequence of random variables with distribution function $F(x) = P(X_1 \leq x)$ and quantile function $Q(s) = \inf(x: F(x) \geq s)$. Consider likewise the empirical distribution function $F_n$ and the empirical quantile function $Q_n$, based on $X_1, \cdots, X_n$. Assuming that $F$ is $k$ times continuously differentiable with $k \geq 2$, the author estimates $f(Q(s))$, where $f(x) = F'(x)$. His arguments are based on the Bahadur-Kiefer representation of sample quantiles and on approximations of empirical processes by Brownian bridges. Two theorems are proved for the limiting asymptotic joint normality of the estimators, and concerning the uniform convergence. A third theorem is provided when the sequence $X_1, X_2, \cdots$ is $\varphi$-mixing and stationary.


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