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Title:

Rank-based quantile regression analysis with applications in osteoporosis diagnosis

Abstract:

In this talk, we present a new methodology for estimating extreme quantiles based on nomination sampling. This approach utilizes expert knowledge and/or baseline measurements to design follow-up sample selection procedures based on ranks. We also propose a rank-based check function to incorporate the rank information of selected samples in the estimation process. We apply this methodology to estimate the prevalence of osteoporosis in the Canadian province of Manitoba. Our numerical studies show that rank-based quantile regression models outperform their simple random sampling (SRS) counterparts for analyzing upper/lower tail quantiles of the bone mineral density (BMD) distribution. Moreover, the proposed method requires a significantly smaller sample compared to SRS to estimate lower/upper tail conditional quantiles with comparable mean squared errors, resulting in a significant reduction in time and cost compared to traditional approaches. A recent extension of our methodology to a classification problem using rank-based support vector machine will also be discussed.