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Local Bilinear Multiple-Output Quantile Regression

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A new quantile regression concept, based on a directional version of Koenker and Bassett's traditional single-output one, has been introduced in Hallin, Paindaveine and Siman, Annals of Statistics 2010, 635-703, for multiple-output regression problems. The empirical counterpart of that concept produces polyhedral contours that cannot adapt to nonlinear or/and heteroskedastic dependencies. A local bilinear version of those contours is proposed here, which asymptotically recovers the conditional halfspace depth contours of the multiple-output response. A Bahadur representation is established, along with asymptotic normality results. Examples are provided.