

NONPARAMETRIC CURVE ESTIMATION UNDER MONOTONICITY CONSTRAINT-WITH APPLICATIONS TO BIOASSAY

RABI BHATTACHARYA*, THE UNIVERSITY OF ARIZONA, USA
&
LIZHEN LIN, DUKE UNIVERSITY, USA

ABSTRACT. A new nonparametric method *NAM* due to Bhattacharya and Lin (2010), (2011), (2013), based on isotonic regression and with its roots in the *BK method* of Bhattacharya and Kong (2007), is compared with its major competitors, namely, the (inverse) kernel method *DNP* due to Dette and Scheder (2010) and Dette et al. (2005), the method of *monotone splines* due to Kong and Eubank (2006), and the BK method. When appropriately designed all these methods yield asymptotically optimal confidence intervals and mean integrated squared errors. For finite sample comparisons, extensive simulation studies across a wide range of popular models as well as a number of data analyses are carried out here for applications of these methods to quantal bioassay and to benchmark risk analysis in environmental studies. The results show that the NAM generally outperforms the other methods when the number n of responses per dosage level is relatively large in comparison with the number m of dosage levels. The BK method coincides with the NAM for very small values of m such as 5 or less, with relatively large n . For larger m and smaller n , the DNP often performs best.

Keywords: Asymptotic optimality; finite sample comparison; mean integrated squared error; shape constrained regression;

E-mail address: rabi@math.arizona.edu