Improved noisy population recovery, and reverse Bonami-Beckner inequality for sparse functions.


Summary: The noisy population recovery problem is a basic statistical inference problem. Given an unknown distribution in \(\{0, 1\}^n\) with support of size \(k\), and given access only to noisy samples from it, where each bit is flipped independently with probability \((1 - \mu)/2\), estimate the original probability up to an additive error of \(\varepsilon\). We give an algorithm which solves this problem in time polynomial in \((k^{\log \log k}, n, 1/\varepsilon)\). This improves on the previous algorithm of A. Wigderson and A. Yehudayoff [“Population recovery and partial identification”, in: Proceedings of the 53rd annual IEEE symposium on foundations of computer science, FOCS 2012. Los Alamitos: IEEE Computer Society. 390–399 (2012)] which solves the problem in time polynomial in \((k^{\log k}, n, 1/\varepsilon)\). Our main technical contribution, which facilitates the algorithm, is a new reverse Bonami-Beckner inequality for the \(L_1\) norm of sparse functions.

Keywords: Bonami-Becker inequality; Fourier analysis; population recovery

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