Is global moment matching the optimal scheme for spectrum estimation?

Tiancheng Yu[†], Jiantao Jiao[*], Yanjun Han[*] and Tsachy Weissman[*]

[†] *Tsinghua University* [*] *Stanford University*

{*yutc, jiantao, yjhan, tsachy*}*@stanford.edu*

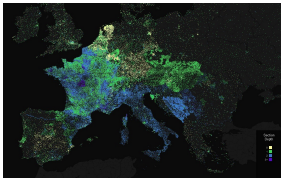
August 21, 2017

Why spectrum estimation for high-dimensional data?

To see the structure and shape of the data!

(a) Medical

(b) Genomic

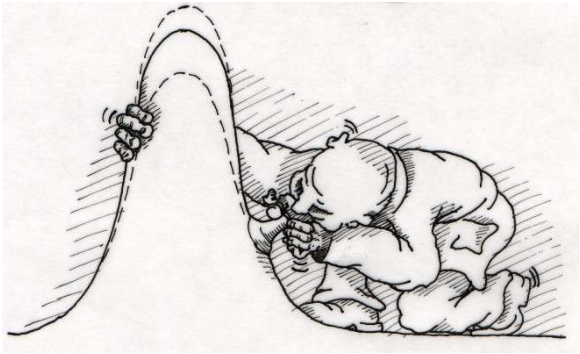


(c) Geographical

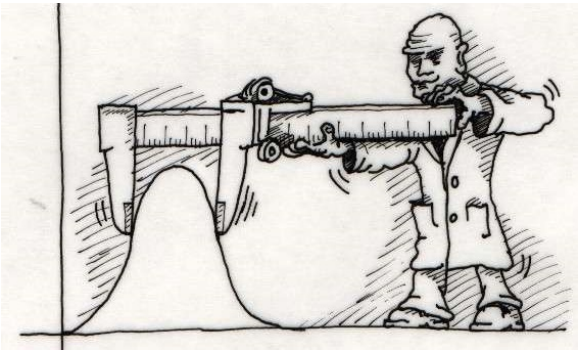
(d) Economic

Surprisingly, this can be done via moment matching approach with small sample size!

Moment Matching: infer complicated properties from simple features!



(e) Complicated Properties



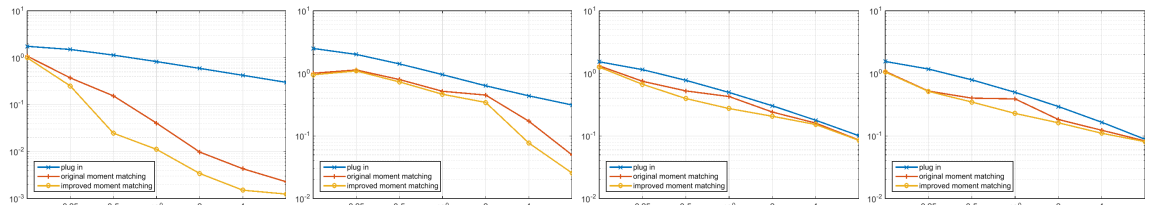
(f) Simple Features

Improving moment matching

Both stronger theoretical guarantee

$$\mathbb{E}\left\{\sum_{i=1}^{d}\left|\hat{\lambda}_i - \lambda_i\right|\right\} \lesssim b\left[\left(\frac{Ckd}{n}\right)^{k/2} + \frac{d}{k}\right]$$

and better empirical performance!



(g) Identity (h) Spike (i) Uniform (j) Teoplitz

We are now proving moment matching is optimal by constructing a minimax lower bound.