DEVIATION OF DISCRETE DISTRIBUTIONS

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Abstract. In discrete probability there are naturally arising situations where two discrete probability distributions are given, and one can derive estimates for the difference of the corresponding generating functions over the interval $[0, 1]$. Then the problem is, how those estimates can be transformed into estimations for the difference of probabilities.

For example, consider a finite collection of possibly dependent random events. Let N denote the (random) number of events that occur. In many cases N is approximately Poisson distributed, particularly, when the number of events is large, their probabilities are small, and the dependence is weak. This can be quantified in several ways, like sieve methods or Chen–Stein approximation. A great advantage of the latter is that it provides an estimate for the total variation distance of N from the Poisson law, but there are models, lacking independence, where it is very hard to apply.

Sieve methods often work with generalized Bonferroni-type lower or upper estimates for $P(N = 0)$. Such bounds can easily be transformed into estimates for the probability generating function of N over the interval $[0, 1]$, which can then be compared with the corresponding Poisson generating function.

The talk is devoted to the problem of estimating the deviation of two discrete probability distributions in terms of the supremum distance between their generating functions over the interval $[0, 1]$. One of the distributions may be fixed, or both can be arbitrary. The deviation can be measured by the difference of the kth terms, or by total variation distance. In addition, we illustrate the limitations of such estimations by counterexamples, showing how large an upper estimate must be.

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