SEMINARIO

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Algebraic variety estimation. Applications to electrical network estimation problems.

Abstract: Given a data set of points in a real algebraic variety V with some error, we seek to determine V. The most common methods for finding polynomials generating an ideal I such that $V = V(I)$ look for polynomials of minimum variance using Vandermonde matrices, which are ill-conditioned. We discuss the advantages and drawbacks, and the relation with polynomial optimization of the less explored alternative of looking for a variety such that the sum of squared Euclidean distances form each point to it is minimum.

Electrical networks are a field in which arise interesting variety estimation problems, in which each variety is associated to a graph, so techniques from graph theory can help to estimate the variety. In previous work, we developed an algorithm to simultaneously estimate the topology and parameters of an electric network from voltage and power data measured at each node using spectral graph theory along with random walks on graphs to improve the numerical estimation. In a joint work with Alberto González, we present advances in the algorithm about its stopping criterion and the consistency of the estimations.

Another related estimation problem is Electrical Impedance Tomography, in which we estimate the parameters of an electric network only from measurements in the boundary nodes. This problem is severely ill-posed. We show experimental examples in which a formulation of EIT as a polynomial optimization problem with a penalty function improve the numerical estimations.

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