On developing Certifiable solvers: SDP Stability, Redundant constraints, and Sampling

Bang-Shien Chen

Many engineering problems involve solving nonconvex Quadratically Constrained Quadratic Programs (QCQPs). Because local optimization methods frequently get stuck in local minima, convex Semidefinite Programming (SDP) relaxations have become an important area of study for developing certifiable global solvers. This talk explores some of the interesting theoretical and practical aspects of building certifiable solvers. First, we examine the role of SDP stability under noise. We will highlight an optimization paradox: by adding redundant constraints and breaking standard optimization conditions like the Linear Independence Constraint Qualification (LICQ), we can expand the stable neighborhood to guarantee global solutions. Furthermore, we introduce sampling-based SDP relaxations, an algebra-free optimization method that automatically searches for redundant constraints. Ultimately, this talk aims to provide an overview of how redundant constraints and sampling techniques serve as useful concepts for studying and developing certifiable global solvers.