

Rotation Averaging and Strong Duality

Fredrik Kahl, Chalmers University of Technology

In this talk, I will explore the role of duality principles for optimization problems over the special orthogonal group $SO(3)$, in particular, rotation averaging. In its conventional form, rotation averaging is stated as a minimization over multiple rotation constraints. As these constraints are non-convex, this problem is generally considered challenging to solve globally. I will show how to circumvent this difficulty through the use of Lagrangian duality. While such an approach is well-known it is normally not guaranteed to provide a tight relaxation.

Based on spectral graph theory, one can analytically prove that in many cases there is no duality gap unless the noise levels are severe. This allows us to obtain certifiably global solutions to a class of important non-convex problems in polynomial time. I will also investigate related problems involving rotations, such as hand-eye calibration, estimation of camera pose and point-set registration, and characterize when a tight relaxation is obtained.