Geodesic convexity and covariance estimation

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Geodesic convexity is a generalization of classical convexity which guarantees that all local minima of g-convex functions are globally optimal. We consider g-convex functions with positive definite matrix variables, and prove that Kronecker products, and logarithms of determinants are g-convex.

We apply these results to two modern covariance estimation problems: robust estimation in non-Gaussian distributions, and Kronecker structured models. Maximum likelihood estimation in these settings involves non-convex minimizations. We show that these problems are in fact g-convex. This leads to straight forward analysis, allows the use of standard optimization methods and paves the road to various extensions via additional g-convex regularization.