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The Clarke Generalized Jacobian of the Projection onto the Cone of Positive Semi-definite Matrices and its Applications

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Abstract:
The problem of computing a correlation matrix with certain properties that is closest to a given symmetric matrix, arises frequently in Optimization, Statistics, and Finance and poses serious challenges for optimizers. The need to solve larger and larger instances of those problems led the quest in recent years to find fast, quadratically convergent, and computationally efficient algorithms. It is known that from the solution of the *dual* optimization problem one can easily obtain the solution of the original one. The formulation of the dual involves the projection operator onto the cone of positive semi-definite matrices which, in general, is a non-differentiable map. That non-differentiable nature hints that the non-smooth version of the Newton's method may be a natural tool for solving the dual. Central object in the non-smooth Newton's method when applied to the dual, is the *Clarke Generalized Jacobian* of the projection map. The Clarke Generalized Jacobian of a map G at X is the convex hull of all possible limits of Jacobians $\nabla G(X_n)$ as X_n approaches X. In order to calculate the latter we use the fact that the projection map is the gradient of a *spectral function*. Spectral functions are real-valued functions on a symmetric matrix argument X, depending only on the eigenvalues of X. That is, $F(X)$ is a spectral function when $F(U^T XU) = F(X)$ for all orthogonal U. This is a joint work with Jérôme Malick.

Refreshments will be provided.
For more information contact Darinka Dentcheva, Michael Zabarankin, Ionut Florescu, or call 201-216-5449.