Recent developments in copositive programming

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A symmetric matrix is called copositive, if it generates a quadratic form taking no negative values over the positive orthant. Contrasting to positive-semidefiniteness, checking copositivity is NP-hard. In a copositive program, we have to minimize a linear function of a symmetric matrix over the copositive cone subject to linear constraints. This program is convex, so there are no non-global local solutions. On the other hand, there are several hard non-convex programs which can be formulated as copositive programs. By using the copositive formulation, the complexity of solving these non-convex programs is shifted towards the complexity of sheer feasibility. As a consequence, duality theory is slightly more complex than in the linear programming case. For instance, there can be a positive duality gap, or the dual program may not attain the optimal value although it is feasible and bounded. This talk addresses basic theory, algorithms and applications, among them combinatorial problems like max-clique and max-cut, or supervised (SVM) and unsupervised learning (clustering).