Conic Optimization and some recent applications

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Linear Optimization (LO) deals with the problem of optimizing (i.e., minimizing or maximizing) a linear function over the intersection of an affine space and the nonnegative orthant. Its rich mathematical theory has been developed in the last 50 years. Although the applications are numerous, there are many real-life phenomena that cannot be described by a linear model, and hence the need for Nonlinear Optimization is apparent. Recently it has become clear that in many cases nonlinearity can be handled very well by replacing the nonnegative orthant in LO by a nonlinear convex cone, which has led to a new field, namely Conic Optimization (CO). Prototype examples of suitable cones are the Lorenz (or ice-cream, or second order) cone and the semidefinite cone. The theory of CO is extremely beautiful. Since many nonlinear optimization problems can be put in the form of a CO model, and these models, like LO models, can be solved efficiently, there is rich potential for new applications. In the lecture I will give an introduction to CO. Its use will be illustrated by discussing various recent applications, namely: minimization of a polynomial, wireless sensor location, fast distributed linear averaging and new bounds for binary codes.