Chance-constrained optimization

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The optimization problem for chance-constrained optimization is given by -

$$\begin{aligned} \max_{w} \quad & \mu^T w \\ \text{s.t.} \quad & \phi^{-1}(\alpha)||C^{1/2}w||_2 \leq \mu^T w + d \\ & \sum_{i=1}^{n} w_i = 1 \\ & w_i \geq 0, \quad i = 1, \dots, n \end{aligned}$$

We have used CVXPY to solve the optimization problem. As the chance-constrained optmization problem is a Second Order Cone Problem (SOCP), we use the SOCP solver from CVXPY to find the optimum point of the problem. The SOCP solver solves the following problem:

$$\begin{aligned} \min \quad & f^T x \\ \text{s.t.} \quad & ||A_i x + b_i||_2 \leq c_i^T x + d_i, \quad i = 1, \dots, n \\ & Fx = g \end{aligned}$$

Comparing our formulation to this form, we get,

$$\begin{gathered} x = w; \quad f = \mu; \quad F = [1, 1, 1, \dots 1]; \quad g = 1 \\ A_0 = C^{1/2} * (\phi^{-1}(\alpha)); \quad b_0 = 0; \quad c_0 = \mu; \quad d_0 = d; \end{gathered}$$