Overview

CSDP is a solver for semidefinite programming (SDP) problems. It was originally written in 1997 and its C implementation continues to be periodically supported by the original author, Brian Borchers. Using the ASCII SDPA format[1], SDPs can be easily passed to the solver. Alternatively, problems can be directly encoded via its C API.

The purpose of this document is to give examples of how to reformulate SDPs into the form that CSDP accepts (either SDPA or its C interface). This often requires algebraic manipulation to write the problem in the primal SDP form as specified in the CSDP User Guide[2]. Note that CSDP can work with matrices that have both symmetric blocks and diagonal blocks. The use of diagonal blocks are particularly useful for encoding and solving linear programs (LP).

CSDP solves semidefinite programming primal–dual problems of the form

$$
\begin{aligned}
\mathcal{P}: \quad & \max_{X \in \mathbb{S}^n} \quad \mathrm{tr}(CX) \\
& \text{s.t.} \quad \mathrm{tr}(A_i X) = b_i, \ \forall i \in [m] \\
& \qquad\quad X \succeq 0 \\
\mathcal{D}: \quad & \min \quad b^\top y \\
& \text{s.t.} \quad \sum_{i=1}^{m} y_i A_i - C = Z \\
& \qquad\quad Z \succeq 0,
\end{aligned}
$$

where C, A_i, y, b. Note that different packages and presentations of primal–dual SDP problems may differ slightly.

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[1] http://plato.asu.edu/ftp/sdpa_format.txt
[2] https://github.com/coin-or/Csdp/files/2485526/csdpuser.pdf