15.081 Fall 2009
Recitation
for Lectures {22}
Semidefinite Programming

1 Basics of Eigen Analysis

Eigen Analysis is an important problem that arises in various areas

- System Stability analysis
- Convergence of various linear-iterative algorithms
- Markov-chains - rate of convergence to steady state distributions etc.

Eigenvalues of a matrix

Eigen values of a matrix A are the solutions of the equation

$$Det(A - xI) = 0$$

Also each eigen value has a corresponding eigen vector v such that

$$Av = \lambda v$$

For nice matrices, we have n eigen values and n eigen vectors where $n = rank(A)$.

Another property is that A can be written as $A = \sum \lambda_i v_i v_i^T$ where $\{\lambda_i\}$ and $\{v_i\}$ are the eigenvalues and eigenvectors respectively.

Standard problems

Without loss of generality assume $\lambda_1 \geq \lambda_2 \geq \ldots \geq \lambda_n$. In the recitation the following problems were discussed.

- find X such that $\lambda_1$is minimized.

- find X such that λ_n is maximized.
- find X such that $\lambda_1 - \lambda_n$ is minimized.
- find X such that $\kappa = \frac{\lambda_1}{\lambda_n}$ is minimized. κ is called the condition number of a matrix and arises in many applications.

The survey by Boyd and Vandenbergh is a good source for SDP.

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