CS 357: Numerical Methods

Lecture 14: Orthogonal Iteration Singular Value Decomposition

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Finding Eigenvectors

- Can we simultaneously (sort of) find all the eigenvectors of A?
- What about this algorithm

X_0 = arbitrary n x p matrix of rank p
for k=1,2,…
    $X_k = AX_{k-1}$

Orthogonal Iteration

- How about this?

X_0= n x p matrix of rank p
for k=1,2,….
    #compute reduced QR factorization
    $Q_{k+1}R_{k+1}=X_k$
    $X_{k+1}=AQ_k$

Orthogonal Iteration

X_0= n x p matrix of rank p
for k=1,2,….
    #compute reduced QR factorization
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The Schur Form: Finding Eigenvalues

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Singular Value Decomposition (SVD)

$$A = U\Sigma V^T$$

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Inversion using SVD

$$A = U\Sigma V^T$$

Assume A is an n x n matrix

The Pseudo Inverse

- When A is not square we can compute the pseudo-inverse

Pseudo Inverse and Least Squares

Notes on Computing the SVD