Positive Definite Matrices

[MOBI] Positive Definite Matrices

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Positive Definite Matrices

Math 2270 - Lecture 33 : Positive Definite Matrices
The thing about positive definite matrices is xTAx is always positive, for any non-zerovector x, not just for an eigenvector2 In fact, this is an equivalent definition of a matrix being positive definite A matrix is positive definite fxTAx > Ofor all vectors x 0 Frequently in physics the energy of a system in state x is represented as XTAX (or XTAx) and so this is frequently called the

Positive Definite Matrix
We consider real symmetric matrices only Matrix A is positive definite if the quadratic form of A is always positive xTAx >0 for any x 6=0 Chen P Positive Definite Matrix 9/57 PD ⇒eigenvalues >0 Let A be positive definite The eigenvalues of A are positive Proof Let λbe an eigenvalue of A and s be a corresponding eigenvector Then As = λs It follows that sTAs = λ(sTs) Hence λ

7.2 Positive Definite Matrices and the SVD
Positive semidefinite matrices include positive definite matrices, and more Eige nvalues of S can be zero Columns of A can be dependent The energy xTSx can be zero— but not negative This gives new equivalent conditions on a (possibly singular) matrix S DST 10 All eigenvalues of S satisfy 0 (semidefinite allows zero eigenvalues) 20 The energy is nonnegative for every x : xTSx 0 (zero

Rajendra Bhatia: Positive Definite Matrices
Positive Matrices We beginwith a quick review of some ofthe basic propertiesof positive matrices This will serve as a warmup and orient the reader to the line of thinking followed through the book 11 CHARACTERIZATIONS Let H be the n-dimensional Hilbert space Cn The inner product between two vectors x and y is written as hx,yi or as x∗y

POSITIVE DEFINITE MATRICES AND THE S-DIVERGENCE
POSITIVE DEFINITE MATRICES AND THE S-DIVERGENCE SUVRIT SRA (Communicated by) Abstract Hermitian positive de nite (hpd) matrices form a self-dual convex cone whose interior is a Riemannian manifold of nonpositive curvature The manifold view is endowed with a geodesically

convex distance function but the convex view is not Drawing motivation from convex optimization, we …

Lecture 7: Positive (Semi)Definite Matrices

2 Square roots of positive semidefinite matrices Theorem 3 For a positive semidefinite matrix A 2M n, there exists a unique positive semidefinite matrix B2M n such that B2 = A Proof The existence follows from the spectral theorem Indeed, we have A= Udiag[1;:::; n]U; with UU = I= UU; and we know that j 0 for all j2[1 : n] — see Observation 2 or Theorem 2 We then set B:= Udiag[p 1

Geometric Distance Between Positive Definite Matrices of …

definite or complex Hermitian positive definite matrices Sn length of geodesics connecting two points gives a has a natural Riemannian metric tensor, and the infimum geodesic distance δ2: Sn ×Sn → R, δ2(A,B):= n j=1 log2(λj(A−1B)) 1/2 (1) The Riemannian metric tensor and geodesic distance endow Sn Riemannian manifold, it is a symmetric space, a Bruhat–Tits with rich geometric

Lecture 25: Symmetric matrices and positive definiteness

Symmetric matrices and positive definiteness Symmetric matrices are good – their eigenvalues are real and each has a com plete set of orthonormal eigenvectors Positive definite matrices are even bet ter Symmetric matrices A symmetric matrix is one for which A = AT If a matrix has some special property (eg it's a Markov matrix), its eigenvalues and eigenvectors are likely to

QUADRATIC FORMS AND DEFINITE MATRICES

QUADRATIC FORMS AND DEFINITE MATRICES 3 13 Graphical analysis When x has only two elements, we can graphically represent Q in 3 di- mensions A positive definite quadratic form will always be positive except at the point where x = 0 This gives a nice graphical representation where the plane at x = 0 bounds the function from below Figure 1

Not Positive Definite Matrices--Causes and Cures

Not Positive Definite Matrices--Causes and Cures The seminal work on dealing with not positive definite matrices is Wothke (1993) The chapter is both reabable and comprehensive This page uses ideas from Wothke, from SEMNET messages, and from my own experience The Problem There are four situations in which a researcher may get a message about a matrix being "not positive definite" The four

A trace inequality for positive definite matrices

A TRACE INEQUALITY FOR POSITIVE DEFINITE MATRICES ELENA-VERONICA BELMEGA, SAMSON LASAULCE, AND MEROUANE DEBBAH¶ Abstract In this note we prove that TrfMN+PQg , 0 when the following two conditions are met: (i) the matrices M;N;P;Q are structured as follows M = A ¡ B, N = B¡1 ¡A¡1, P = C¡D, Q = (B+D)¡1 ¡(A+C)¡1 (ii) A, B are positive deflnite

Appendix C: Positive Semidefinite and Positive Definite …

COMPLEX POSITIVE SEMIDEFINITE AND POSITIVE DEFINITE MATRICES 263 C2 COMPLEX POSITIVE SEMIDEFINITE AND POSITIVE DEFINITE MATRICES Definition C4 The N x N Hermitian matrix V is said to be positive semidefinite if aHva 2 o (C21) for any complex N x 1 vector a where the superscript H denotes complex conjugate transposition Definition C5 The N x N Hermitian matrix V is …

Positive definite matrices and minima - MIT OpenCourseWare

Studying positive definite matrices brings the whole course together; we use pivots, determinants, eigenvalues and stability The new quantity here is xTAx; watch for it This lecture covers how to tell if a matrix is positive definite, what it means for it to be positive definite, and some geometry Positive definite matrices Given a symmetric two by two matrix a b , here are four ways to

Appendix A: Some Matrix Algebra - Wiley

A4 POSITIVE-DEFINITE MATRICES A symmetric matrix A is said to be positive-definite (pd) if x'Ax > 0 for all x, x ^ 0 We note that a pd matrix is also psd A41 The eigenvalues of a pd matrix A are all positive (proof is similar to A31); thus A is also nonsingular (A26) A42 A is pd if and only if there exists a nonsingular R such that A = RR' Proof This follows from A3

Positive and Negative De nite Matrices and Optimization

Positive and Negative De nite Matrices and Optimization The following examples illustrate that in general, it cannot easily be determined whether a sym-metric matrix is positive de nite from inspection of the entries Example Consider the matrix A= 1 4 4 1 : Then Q A(x;y) = x2 + y2 + 8xy and we have Q A(1; 1) = 12 + (1)2 + 8(1)(1) = 1 + 1 8 = 6 <0: Therefore, even though all of the entries

Products of Positive Semidefinite Matrices

We also determine those matrices which can be expressed as the product of two or four positive semidefinite matrices These results are analogous to the ones obtained before by C S Ballantine for products of positive definite matrices 1 INTRODUCTION

A generalization of a trace inequality for positive …

A GENERALIZATION OF A TRACE INEQUALITY FOR POSITIVE DEFINITE MATRICES ELENA VERONICA BELMEGA, MARC JUNGERS, AND SAMSON LASAULCE Abstract In this note we generalize the trace inequality derived by [1] to the case where the number of terms of the sum (denoted by K) is arbitrary More precisely we prove that TK = Tr 8 <: XK k=1 (Ak ¡Bk) 2 4 ˆ Xk ‘=1 B‘!¡1 ¡ ˆ Xk …

Not Positive Definite Correlation Matrices in Exploratory …

An inter-item correlation matrix is positive definite (PD) if all of its eigenvalues are positive It is positive semidefinite (PSD) if some of its eigenvalues are zero and the rest are positive Finally, it is indefinite if it has both positive and negative eigenvalues (eg Wothke, 1993) This …

Riemannian Sparse Coding for Positive Definite Matrices

Anoop Cherian, Suvrit Sra Riemannian Sparse Coding for Positive Definite Matrices ECCV - European Conference on Computer Vision, Sep 2014, Zurich, Switzerland pp299-314, 101007/978-3-319-10578-9_20 hal-01057703 Riemannian Sparse Coding for Positive Definite Matrices Anoop Cherian1 Suvrit Sra2 1 LEAR team, Inria Grenoble Rhˆone-Alpes, France 2 Max Planck Institute for