Introduction to Liner algebra for AI

Syllabus

Part A: basics of linear algebra

What is vector,matrix, tensor- space, vector space -Linear combination -Span -linear dependence -linear independence -basis- dimension

Column and Row vectors - Span in matrix form- column space – row space – null vector -null space- left null space- Operations on matrices (matrix multiplication vectorization and Hadamard product) - Inner and Outer product

Column rank -row rank-rank– full rank – fat and thin matrix – rank deficient – singular – nonsingular – inverse

Length of vector – orthogonality orthogonal vector orthogonal basis – orthonormal – orthogonal matrix – Gram- smit orthogonalization (For orthogonal basis)

Some functions –functions in linear lagebra– affine function - quadratic function

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Part B: Norms & Normalizations

Vector norms - LP-norms

Matrix norms: Frobinous norm-spectral norm- nuclear norm -importance of normalization in machine leraning -batching data – batch norm -layer norm – Standardization - comparision

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Part C: Equations

Under determined system – over determined systems

linear equation equation, full rank case – low rank(rank deficient) case – noisy case – least squared method

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Part D: Eigens and Positive Definity

eigen value and eigen vector- algebraic multiplicity- geometric multiplicity–eigen space – eigen decomposition

Positive definite - Positive semi definite - Properties of PD and PSD

Part E: SVD & Special matrices

SVD – Skinny SVD – Compact SVD

Normal Distribution -Variance - Covariance matrix - Corrolation matrix – Modal matrix – How making features of datasets independent! – property of eigen values and eigen vectors of covariance matrix – scale invariant – translation invariant -rotation invariant

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Part F: You may need

Storing data Row major

Vectorization in numpy

Note: Other cases of study (not covered in this course): functions – Transformations- Eliminations- Decompositions- projections -multivariate calculous(Gradient-Hessian -Jacobian)