

NPTEL Video Lecture Topic List - Created by LinuXpert Systems, Chennai

NPTEL Video Course - Electrical Engineering - NOC:Applied Linear Algebra for Signal Processing, Data Analytics

Subject Co-ordinator - Prof. Aditya K. Jagannatham

Co-ordinating Institute - IIT - Kanpur

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

- Lecture 1 - Vector Properties: Addition, Linear Combination, Inner Product, Orthogonality, Norm
- Lecture 2 - Vectors: Unit Norm Vector, Cauchy-Schwarz inequality, Radar Application
- Lecture 3 - Inner Product Application: Beamforming in Wireless Communication Systems
- Lecture 4 - Matrices, Definition, Addition and Multiplication of Matrices
- Lecture 5 - Matrix: Column Space, Linear Independence, Rank of Matrix, Gaussian Elimination
- Lecture 6 - Matrix: Determinant, Inverse Computation, Adjoint, Cofactor Concepts
- Lecture 7 - Applications of Matrices: Solution of System of Linear equations, MIMO Wireless Technology
- Lecture 8 - Applications of Matrices: Electric Circuits, Traffic flows
- Lecture 9 - Applications of Matrices: Graph Theory, Social Networks, Dominance Directed Graph, Influential Nodes
- Lecture 10 - Null Space of Matrix: Definition, Rank-Nullity Theorem, Application in Electric Circuits
- Lecture 11 - Gram-Schmidt Orthogonalization
- Lecture 12 - Gaussian Random Variable: Definition, Mean, Variance, Multivariate Gaussian, Covariance Matrix
- Lecture 13 - Linear Transformation of Gaussian Random Vectors
- Lecture 14 - Machine Learning Application: Gaussian Classification
- Lecture 15 - Eigenvalue: Definition, Characteristic Equation, Eigenvalue Decomposition
- Lecture 16 - Special Matrices: Rotation and Unitary Matrices, Application: Alamouti Code
- Lecture 17 - Positive Semi-definite (PSD) Matrices: Definition, Properties, Eigenvalue Decomposition
- Lecture 18 - Positive Semidefinite Matrix: Example and Illustration of Eigenvalue Decomposition
- Lecture 19 - Machine Learning Application: Principle Component Analysis (PCA)
- Lecture 20 - Computer Vision Application: Face Recognition, Eigenfaces
- Lecture 21 - Least Squares (LS) Solution, Pseudo-Inverse Concept
- Lecture 22 - Least Squares (LS) via Principle of Orthogonality, Projection Matrix, Properties
- Lecture 23 - Application: Pseudo-Inverse and MIMO Zero Forcing (ZF) Receiver
- Lecture 24 - Wireless Application: Multi-Antenna Channel Estimation
- Lecture 25 - Machine Learning Application: Linear Regression
- Lecture 26 - Computation Mathematics Application: Polynomial Fitting
- Lecture 27 - Least Norm Solution
- Lecture 28 - Wireless Application: Multi-user Beamforming
- Lecture 29 - Singular Value Decomposition (SVD): Definition, Properties, Example

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- Lecture 30 - SVD Application in MIMO Wireless Technology: Spatial-Multiplexing and High Data Rates
- Lecture 31 - SVD for MIMO wireless optimization, water-filling algorithm, optimal power allocation
- Lecture 32 - SVD application for Machine Learning: Principal component analysis (PCA)
- Lecture 33 - Multiple signal classification (MUSIC) algorithm: system model
- Lecture 34 - MUSIC algorithm for Direction of Arrival (DoA) estimation
- Lecture 35 - Linear minimum mean square error (LMMSE) principle
- Lecture 36 - LMMSE estimate and error covariance matrix
- Lecture 37 - LMMSE estimation in linear systems
- Lecture 38 - LMMSE application: Wireless channel estimation and example
- Lecture 39 - Time-series prediction via auto-regressive (AR) model
- Lecture 40 - Recommender system: design and rating prediction
- Lecture 41 - Recommender system: Illustration via movie rating prediction example
- Lecture 42 - Fast Fourier transform (FFT) and Inverse fast Fourier transform (IFFT)
- Lecture 43 - IFFT/ FFT application in Orthogonal Frequency Division Multiplexing (OFDM) wireless technology
- Lecture 44 - OFDM system: Circulant matrices and properties
- Lecture 45 - OFDM system model: Transmitter and receiver processing
- Lecture 46 - Single-carrier frequency division for multiple access (SC-FDMA) technology
- Lecture 47 - Linear dynamical systems: definition and solution via matrix exponential
- Lecture 48 - Linear dynamical systems: matrix exponential via SVD
- Lecture 49 - Machine Learning application: Support Vector Machines (SVM)
- Lecture 50 - Support Vector Machines (SVM): Problem formulation via maximum hyperplane separation
- Lecture 51 - Sparse regression: problem formulation and relation to Compressive Sensing (CS)
- Lecture 52 - Sparse regression: solution via the Orthogonal Matching Pursuit (OMP) algorithm
- Lecture 53 - OMP Example for Sparse Regression
- Lecture 54 - Machine Learning Application: Clustering
- Lecture 55 - K-Means Clustering algorithm
- Lecture 56 - Introduction to Stochastic Processes and Markov Chains
- Lecture 57 - Discrete Time Markov Chains and Transition Probability Matrix
- Lecture 58 - Discrete Time Markov Chain Examples
- Lecture 59 - m-STEP Transition Probabilities for Discrete Time Markov Chains
- Lecture 60 - Limiting Behavior of Discrete Time Markov Chains
- Lecture 61 - Least Squares Revisited: Rank Deficient Matrix
- Lecture 62 - Least Squares using SVD
- Lecture 63 - Weighted Least Squares
- Lecture 64 - Weighted Least Squares Example
- Lecture 65 - Woodbury Matrix Identity - Matrix Inversion Lemma
- Lecture 66 - Woodbury Matrix Identity - Proof
- Lecture 67 - Conditional Gaussian Density - Mean
- Lecture 68 - Conditional Gaussian Density - Covariance

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Lecture 69 - Scalar Linear Model for Gaussian Estimation

Lecture 70 - MMSE Estimate and Covariance for the Scalar Linear Model