Foundations of Data Science: Calculus and Linear Algebra

Week 1	Lect 1	Calculus: Functions, Univariate and Multivariate functions, Norms of Vector functions and composite functions, Derivatives, Chain rule, Application of derivatives (Backpropagation),	Chapter 5, [1] [b] & [c]
	Lect 2	Taylor's theorem, Numerical derivatives, and Automatic Differentiation	
Week 2	Lect 3	Minimization of a function, Simple Linear Regression, Linear Regression, Ordinary Least square	[d]
	Lect 4	Computational Linear Algebra, Vector Space, subspace, span, linearly Independent vectors, basis, Inner product, Outer product, norm, dot product, projections, orthogonal projections	Chapters 2 & 3, [2.3] Chapters 4 & 5 [2,3]
Week 3	Lect 5	Matrices: Linear functions, Linear transformation, Matrix addition, Mat-Vect, Mat-Mat multiplication, Properties of matrices, Determinant	[e]
	Lect 6	The inverse of a matrix, Norms of matrices. Tensors, Kronecker, and Hardamard products. Column space of a matrix, the rank of a matrix, eigenvalues, and eigenvectors, PageRank.	Chapter 6 [2,3]
Week 4	Lect 7	Solutions of algebraic equations, Reduced row echelon form, Cramer's rule	Chapters 2 & 3 [2,3]
	Lect 8	**Iterative methods for the solution of a system of** algebraic equations (stationary and non-stationary methods)	[4]
Week 5	Lect 9	Matric Decomposition: QR factorization, Eigenvalue decomposition, Singular Value decomposition (SVD), Principal Component Analysis (PCA)	Chapter 7 [1] Chapter 4 [2] [f]
	Lect 10	Recap of Calculus and Linear Algebra. Concept-wise quizzes	

References:

1. Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong. Mathematics for Machine Learning. Cambridge University Press, 2020. (https://mml-book.github.io)
2. Gibert Strang. Linear Algebra for Everyone, Wellesley-Cambridge Press, 2020,
3. Gibert Strang, Introduction to Linear Algebra, https://math.mit.edu/~gs/linearalgebra/
4. Yousef Saad, Iterative methods for sparse linear systems, https://www-users.cse.umn.edu/~saad/books.html

Video Lectures:

a. https://www.youtube.com/watch?v=WUvTyaaNkzM
b. https://www.youtube.com/watch?v=TrcCbdWwCBc&list=PLSQl0a2vh4HC5feHa6Rc5c0wbRTx56nF7
c. https://www.youtube.com/watch?v=TrcCbdWwCBc&list=PLSQl0a2vh4HC5feHa6Rc5c0wbRTx56nF7
d. https://www.youtube.com/playlist?list=PLZHQObOWTQDPD3MizzM2xVFitgF8hE_ab
e. https://www.youtube.com/watch?v=gXbThCXjZFM