

Machine Learning

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CSCI 567

Spring 2019

Discussion 3

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Linear Regression

Problem 1

Minimize the total absolute error (L_1 norm) of linear regression when $D = 0$:

$$\min_{w_0} \sum_n |w_0 - y_n|$$

Problem 2

Suppose A is a square matrix. Then A is singular if and only if $\lambda = 0$ is an eigenvalue of A . Prove this statement.

Problem 3

Suppose A is a square nonsingular matrix and λ is an eigenvalue of A . Prove that $1/\lambda$ is an eigenvalue of the matrix A^{-1} .

Problem 4

Find eigenvalues and eigenvectors for

$$A = \begin{pmatrix} 2 & 3 \\ 2 & 1 \end{pmatrix}$$

Problem 5

The eigenvectors of a symmetric matrix A corresponding to different eigenvalues are orthogonal to each other. Prove this statement.

Problem 6

Let $u, x \in \mathbb{R}^n$ are column vectors, A is $(n \times n)$ matrix.

Task 1. Compute $\frac{\partial}{\partial x} u^T x$ and $\frac{\partial}{\partial x} x^T u$

Task 2. Compute $\frac{\partial}{\partial x} \|x\|_2^2$

Task 3. Compute $\frac{\partial}{\partial x} x^T A x$