Homework 0 - Machine Learning

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1 Problem 1

Yes

2 Problem 2

(i) Introduction to Data Mining

(ii) Yes, Maths Department, MATH 5651

(iii) Yes, Computer Science, CSCI 5304

(iv) No, but currently taking EE 5239 (Introduction to Nonlinear Optimization)

3 Answer 3

$w^* = (cI + X^T X)^{-1} X^T Y$ where I is $n * n$ identity matrix.

4 Answer 4

Maximum of $w^T Aw$ is $\lambda_{max}||w||_2^2$
Minimum of $w^T Aw$ is $\lambda_{min}||w||_2^2$
where λ_{max} is maximum eigenvalue for A and λ_{min} is minimum eigenvalue for A.

5 Answer 5

Probability density function of a multivariate Gaussian distribution is

$\mathcal{N}(x|\mu, \mathbf{\Sigma}) = \frac{1}{\sqrt{(2\pi)^n|\mathbf{\Sigma}|}} \exp\left(-\frac{1}{2}(x-\mu)^T\mathbf{\Sigma}^{-1}(x-\mu)\right)$
where μ is a n dimensional mean vector, $\mathbf{\Sigma}$ is a n * n co-variance matrix, and $|\mathbf{\Sigma}|$ denotes the determinant of $\mathbf{\Sigma}$

Expression for multivariate Gaussian Distribution in terms of mean and precision matrix is

$\mathcal{N}(x|\mu, \boldsymbol{\theta}) = \frac{|\boldsymbol{\theta}|^{1/2}}{\sqrt{(2\pi)^n}} \exp\left(-\frac{1}{2}(x-\mu)^T\boldsymbol{\theta}(x-\mu)\right)$
where μ is a n dimensional mean vector, $\boldsymbol{\theta}$ is a n * n inverse co-variance matrix, and $|\boldsymbol{\theta}|$ denotes the determinant of $\boldsymbol{\theta}$