

Lab assignment 9

Optimization in ML (CSL4010)

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1. Using proximal gradient method find

$$\min_x \frac{1}{2}(x_1 - 2)^2 + \frac{1}{2}(x_2 - 2)^2 + 0.5\|x\|_1$$

Use $\alpha_k = 1/2$ and $\alpha_k = 1/(r+k)$, r is last digit of your roll no, with some random initial approximation.

For rest problems take $\alpha_k = \max_{eig}(A^T A)/2 + 0.5$

2. Result of 'train dataset' depends on value 1 and value 2. Find the best fitting hyperplane $y = a^T x + \beta$.
Construct and solve the problem

$$\min_x \frac{1}{2}\|Ax - y\|^2 + \frac{\lambda}{2}\|x\|_1$$

, $\lambda = |R/10 - 5|$, where R is last digits of your roll number.

3. Price of house based on area, bedrooms, and bathrooms are given in four column data. Find the best fitting hyperplane $y = a^T x + \beta$. Construct and solve the problem

$$\min_x \frac{1}{2}\|Ax - y\|^2 + \frac{\lambda}{2}\|x\|_1$$

, $\lambda = |R/10 - 5|$, where R is last digits of your roll number.

4. Purchase frequency y depends on locality score x according to the curve $y = e^{\theta_1 x}(\cos(\theta_2 x) + \sin(\theta_3 x))$.
Using proximal gradient method, solve l_1 regularized nonlinear least square problem to find the optimal value of θ^* and estimate purchase frequency for $R/10 + 1$, where R is last two digits of your roll number.

5. Solve Problem 1, 2, 3, and 4 using l_2 regularization with same regularization parameter.