Lab 13

Hessian matrix and stationary points

$$f(x) = x_1^2 + x_2^3$$

$$f(x) = x_1^2 + x_2^2 + 8x_1x_2$$

Compute the stationary point and the Hessian of f(x).

Is the stationary point a local max/min or saddle point?

Does the Hessian being PSD leads to local minimum for all functions?
How about quadratic functions?

Least squared loss again

We talked about fitting a linear model $y = X \cdot \theta$ with data X and y by minimizing the squared loss. We derived closed-form solution using 1) SVD, 2) gradient.

Now let's look at another model $y_i = a \cdot \sin x_1 + b \cdot \cos x_2$

Given the same form of data and observations X and y, find a and b that lead to the least squared loss, i.e., $\min_{a,b} ||y - a \cdot \sin \vec{x_1} - b \cdot \cos \vec{x_2}||$

Least squared loss again

Linear regression with regularization.

$$\min_{a,b} ||y - X \cdot \theta||^2 + \rho||\theta||^2$$

- Calculate the derivative of this objective w.r.t. Theta.
- Is there always a closed-form analytical solution? What is it?