Aditya Vipradas
1209435588

MAE 598

Homework 3.

Design optimization.

1. (1) Least squares problem.

The training data is provided.

$x = \{x_1, x_2\}$.

$y = p$.

There are 11 data points for x & y.

The problem is to fit (x, y) in the function

$$p = x_1 \exp\left(A_{12}\left(\frac{A_{21}\, x_2}{A_{12}x_1 + A_{21}x_2}\right)^2\right) P_{1sat} + x_2 \exp\left(A_{21}\left(\frac{A_{12}\, x_1}{A_{12}x_1 + A_{21}x_2}\right)^2\right) P_{2sat}$$

Here, P_{1sat} & P_{2sat} are evaluated from the given data of a_1, a_2 & a_3 and the Antoine equation

$$\log(P_{sat}) = a_1 - \frac{a_2}{T + a_3}$$

$T = 20°C$

The function can be generalized as

$$y = X\beta + \epsilon$$

$\epsilon \rightarrow$ error & $\beta = \{A_{12}, A_{21}\}$.

The problem at hand is to estimate β such that the L2 norm of ϵ is minimized.

i.e. find β such that

$$\min \|y - X\beta\|^2,$$ the given function being a non-linear model.