

Lecture 22: Gaussian process regression

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Multivariate regression and automatic relevance determination

Automatic relevance determination

$$\underline{d} > 1 \quad \underline{x} = (x_1, \dots, x_d)$$

$$\underline{x}_{1:n} = (\underline{x}_1, \dots, \underline{x}_n)$$

$$(x_{11}, \dots, x_{1d})$$

SE Naïve:

$$c(\underline{x}, \underline{x}') = s^2 \exp \left\{ -\frac{\|\underline{x} - \underline{x}'\|^2}{2l^2} \right\} = s^2 \exp \left\{ -\sum_{i=1}^d \frac{(x_i - x'_i)^2}{2l^2} \right\}$$

Smart ARD

$$c(x, x') = s^2 \exp \left\{ -\sum_{i=1}^d \frac{(x_i - x'_i)^2}{2l_i^2} \right\}$$

$$\theta = (s, l_1, l_2, \dots, l_d)$$

(d+1 parameters)
Some of the l_i may become very big.

$$\max_{s, l_1, \dots, l_d} p(\theta, \sigma | \underline{x}_{1:n}, y_{1:n}) \Rightarrow$$