

# 1 The Kernel in SVM

Given an input  $X$  with observations (rows)  $x_i$ ,  $i = 1, \dots, 3$ , we have the radial basis kernel,  $K$  equal to:

$$K = \begin{pmatrix} \exp(-\frac{1}{c}\|x_1 - x_1\|^2) & \exp(-\frac{1}{c}\|x_1 - x_2\|^2) & \exp(-\frac{1}{c}\|x_1 - x_3\|^2) \\ \exp(-\frac{1}{c}\|x_2 - x_1\|^2) & \exp(-\frac{1}{c}\|x_2 - x_2\|^2) & \exp(-\frac{1}{c}\|x_2 - x_3\|^2) \\ \exp(-\frac{1}{c}\|x_3 - x_1\|^2) & \exp(-\frac{1}{c}\|x_3 - x_2\|^2) & \exp(-\frac{1}{c}\|x_3 - x_3\|^2) \end{pmatrix}$$

When we have 3 observations, the kernel has size  $3 \times 3$ .