

## 4 Insight into Kernels

There are four basic kernels that are currently in use. The linear kernel in which  $K$  is just the identity matrix and the result is just the regular inner product. As a summary, the four most common kernels with parameters  $\gamma$ ,  $r$ , and  $d$  are given as

- Linear Kernel:  $K(x, z) = x^T z$
- Polynomial Kernel:  $K(x, z) = (\gamma x^T z + r)^d, \gamma > 0$
- Radial Basis Function Kernel:  $K(x, z) = \exp(-\gamma \|x - z\|^2), \gamma > 0$
- Sigmoid:  $K(x, z) = \tanh(\gamma x^T z + r)$

The Gaussian Kernel is a special case of the Radial Basis Function (RBF) kernel. The Gaussian Kernel is given as

$$K(x, z) = \exp\left(\frac{-\|x - z\|^2}{2\sigma^2}\right)$$