EE5907/EE5027 Week 5: Nonparametric Approaches

Q1: Parzen's Window

Consider data samples x_1, x_2, x_3, x_4 to be $1, 3, 4, 10$. Using the Gaussian Parzen's window: $\frac{1}{\sqrt{2\pi h^2}} e^{-\frac{x^2}{2h^2}}$, what is the Parzen's window estimate of $p_h(x)$ at $x = 2$ and $x = 5$ for $h = 1$?

Q2: KNN

Consider training data $x_1 = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$, $x_2 = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$, $x_3 = \begin{pmatrix} -1 \\ 0 \end{pmatrix}$, $x_4 = \begin{pmatrix} 0 \\ -1 \end{pmatrix}$ with corresponding class labels $y_1 = 0, y_2 = 0, y_3 = 1, y_4 = 1$. What is the 3-NN estimate of the class label posterior probabilities of datapoints $x_5 = \begin{pmatrix} 0 \\ 0.5 \end{pmatrix}$ and $x_6 = \begin{pmatrix} -1 \\ -1 \end{pmatrix}$, where the distance metric used is the Euclidean distance? What are the MAP classifications of data points x_5 and x_6?