

NEITHER PROGRAMMABLE/GRAPHICAL CALCULATORS NOR COURSE MATERIAL
ARE ALLOWED IN THE EXAM!

1. *Bayes Decision Rule*

Present the Bayes decision rule carefully defining and explaining the notation! (6 p)

2. *Parametric Distribution Estimation*

You need to form an estimate of the probability distribution of a certain feature. The feature is a continuous real-valued random variable X with the density

$$p(x|\mu) = \frac{1}{\sqrt{2\pi}} e^{-\frac{1}{2}(x-\mu)^2}.$$

Using the Maximum Likelihood Estimation method, derive an estimate for the unknown parameter μ when you have N independent samples x_i from the distribution at your disposal! (6 p)

3. *AdaBoost*

Describe the operating principle of the AdaBoost (*Adaptive Boosting*) method when using a single weak classifier! (6 p)

4. *Discriminant Functions*

Figure 1 on the next page shows a data set in which two features have been measured from samples belonging to one of the three possible classes. Different symbols have been used to discriminate different classes. The symbols are the triangle (\blacktriangle), the square (\blacksquare), and the star (\star).

In the figure, both features are in range $[-2, 2]$, and the axes have been labeled in half unit steps. Construct discriminant functions that can be used to classify this data correctly! Furthermore, describe in detail how one can classify a new sample using the discriminant functions! (6 p)

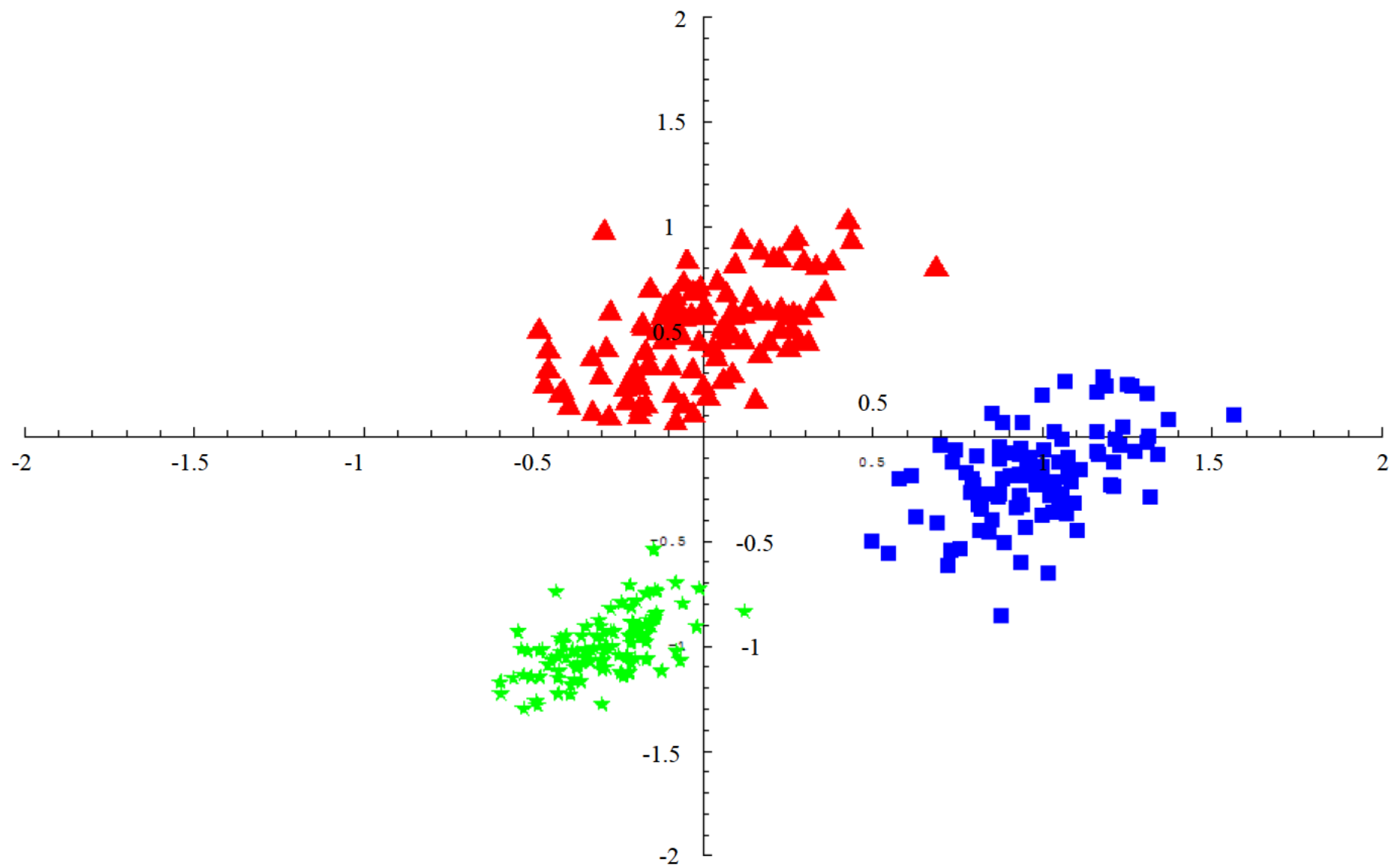


Fig. 1. Data for Question 4.