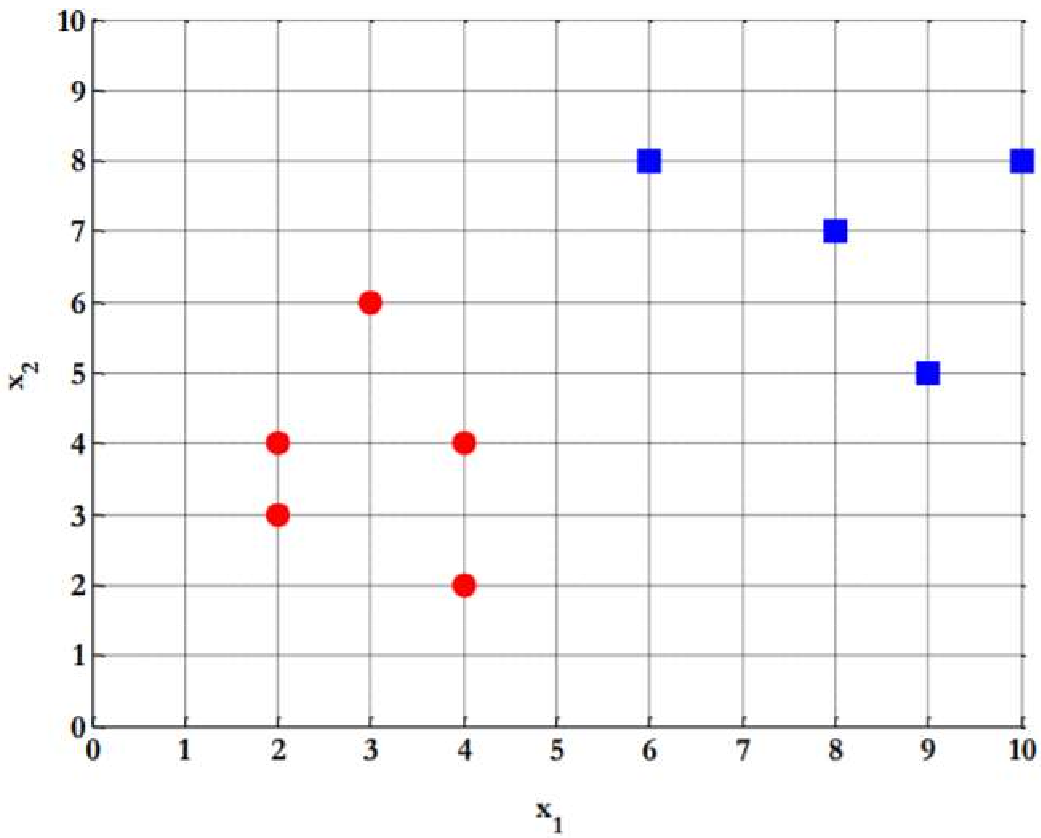
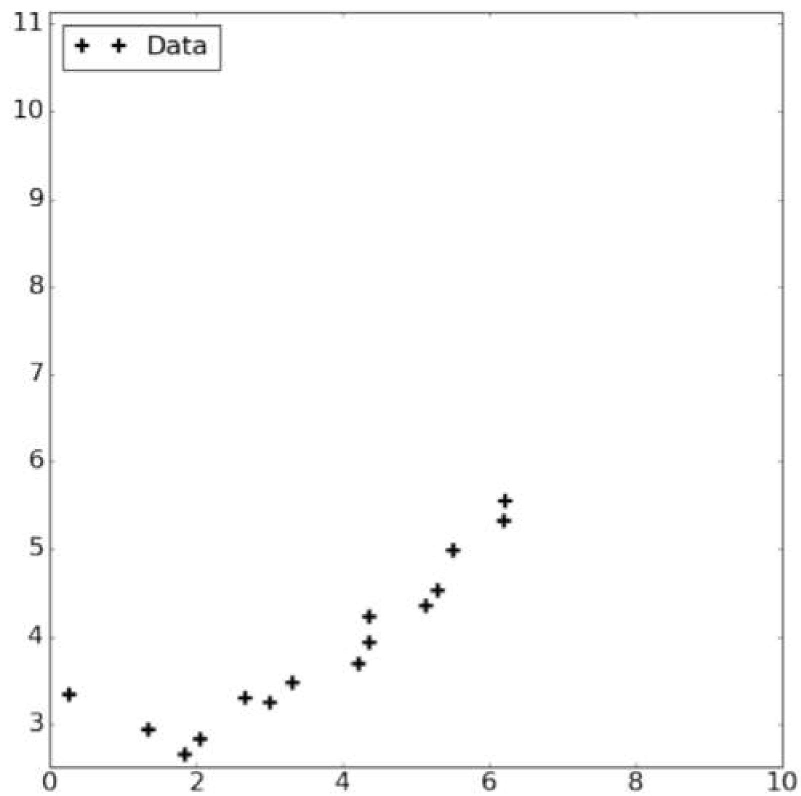
1. Compute the Linear Discriminant projection for the following two dimensional dataset.
   – Samples for class ω1 : X1=(x1,x2)={(4,2),(2,4),(2,3),(3,6),(4,4)}
   – Sample for class ω2 : X2=(x1,x2)={(9,10),(6,8),(9,5),(8,7),(10,8)}



2. (Basis Expansion)Linear Regression – Polynomial Basis Expansion

How the basis for the below data can be expanded?



3. Maximum Likelihood Estimation

(a)

Suppose we have a random sample $X_1, X_2, \cdots, X_n$ where:

- $X_i = 0$ if a randomly selected student does not own a sports car, and
- $X_i = 1$ if a randomly selected student does own a sports car.

Assuming that the X_i are independent Bernoulli random variables with unknown parameter p, find the maximum likelihood estimator of p, the proportion of students who own a sports car.

(b)

Suppose the weights of randomly selected American female college students are normally distributed with unknown mean μ and standard deviation σ. A random sample of 10 American female college students yielded the following weights (in pounds):

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115 122 130 127 149 160 152 138 149 180
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Based on the definitions given above, identify the likelihood function and the maximum likelihood estimator of μ, the mean weight of all American female college students. Using the given sample, find a maximum likelihood estimate of μ as well.

4. Bayes Parameter Estimation

Let S = {x1,x2,...,xn} be a set of coin flipping observations, where xi = 1 denotes 'Head' and xi = 0 denotes 'Tail'. Assume the coin is weighted and our goal is to estimate parameter θ , the probability of 'Head'. Assume that we flipped a coin 20 times yesterday, but we did not remember how many times the ’Head’ was observed. What we know is that the probability of 'Head' is around 1/4, but this probability is uncertain since we only did 20 trails and we did not remember the number of 'Heads'. With this prior information, estimate the parameter θ .