Exercises for MI

Exercise sheet 10

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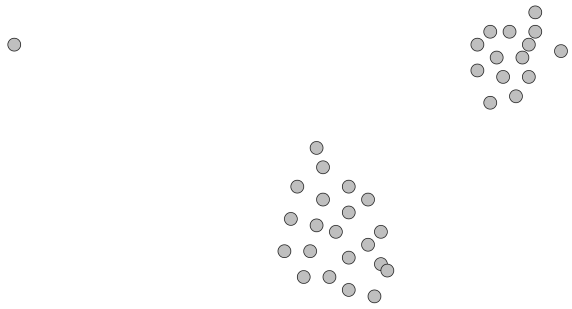
When you have finished with the exercises, you should continue with the exam sheet from the previous years, which can be found at the course's home page.

Exercise 1

For the following data set:



- identify two initial cluster centers such that 2-means clustering initialized with these cluster centers will terminate with the single outlier forming one cluster, and all other points the second cluster
- identify two initial cluster centers such that 2-means clustering initialized with these cluster centers will terminate with the two big groups of points forming different clusters (and the outlier belonging to one of those)

In both cases indicate the (approximate) position of the final cluster centers.

Exercise 2*

Consider the data points plotted in Figure 1.

- Perform two iterations of the k-means algorithm using
  - the data points $(2, 6)$ and $(3, 5)$ as the initial cluster centers.

– the Euclidean distance as distance metric

- Calculate the sum of squared errors using the initial cluster centers and the cluster centers that you found above.

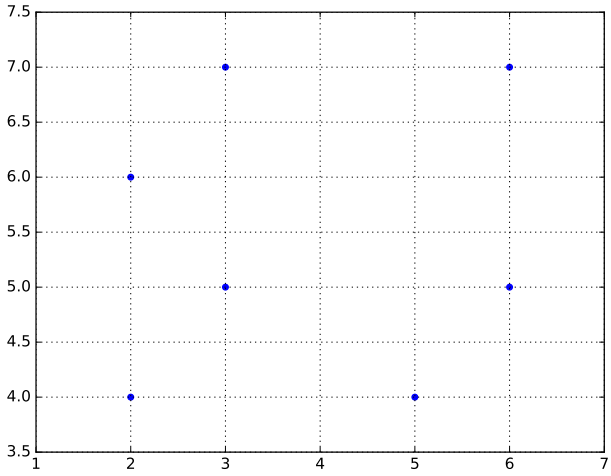


Figure 1: Data to be clustered in Exercise 2.

Exercise 3 Use WEKA to perform clustering experiments on the datasets clustering clusters.arff and clustering random.arff.

1. Perform k-means clustering for $k = 1, 2, 3, 4, 5, 6, 7, 8$ on the two data sets. For each clustering, WEKA outputs the "Within cluster sum of squared errors" (which corresponds to the sum of squared errors). Make a plot of this error as a function of k for both datasets. How can plots like these be used to determine the "right" number of clusters?

2. For $k = 3$ perform 4 runs each of k-means clustering using different setting of the random seed (left click in the 'Clusterer' text field to set the random seed). Compare the results obtained in the different runs using the "Visualize cluster assignment" function (accessible via the Result list panel). How does this help you to decide which of the two datasets has 3 "real" clusters?

Exercise 4* Perform one more iteration of the EM algorithm for the example on Slide 11.20. Note that you will first need to complete the last two maximization calculations for the 2nd iteration, which is left unfinished on the slides.