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Lappeenranta University of Technology

LUT Machine Vision and Pattern Recognition

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BM40A0700 Pattern Recognition

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Exercise 7 solutions: Linear classification

1. Perceptron (2 points): A Matlab function

```
w = percep(class, data)
```

performing the perceptron algorithm for two-dimensional data is given as a separate source file.

The given datasets have different characteristics:

- (a) `data1.mat` is a reasonable dataset for the simple perceptron since the classes are linearly separable. The search for the weight vector succeeds since the number of misclassifications decreases to zero with, for example, $w = [0.1643, -0.0222, -2.5242]^T$. The results are presented in Figures 1(a) and 1(b).
- (b) `data2.mat` seems to be a simple case. However, it is modified from the XOR problem, and as such, cannot be solved with a single perceptron. The results are not meaningful, but they are presented after 1000 iterations in Figures 1(c) and 1(d).
- (c) `data3.mat` represents a linearly nonseparable case. The number of misclassifications is reduced, but does not go to zero. After 1000 iterations, $w = [0.1875, -0.0802, -2.0962]^T$ and the results are as in Figures 1(e) and 1(f).

Additional files: `data1.mat`, `data2.mat`, `data3.mat`, `s027.m`.

2. Least mean square (LMS) linear classifier (1 point): not published.

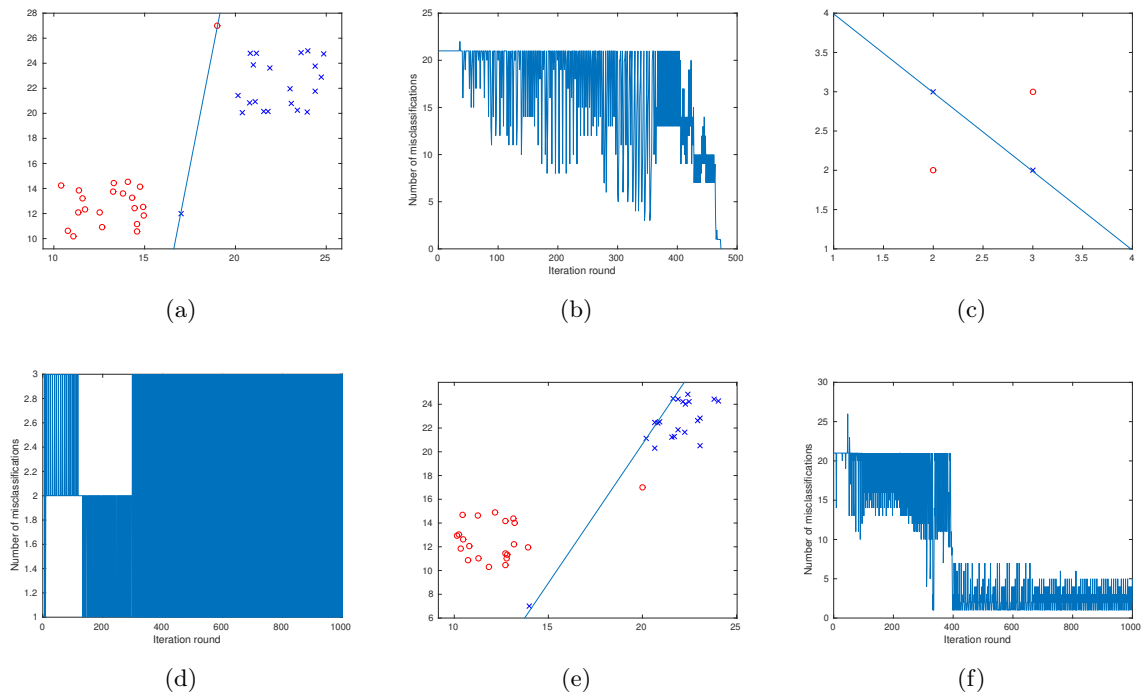


Figure 1: Resulting decision boundaries and numbers of misclassifications for the three datasets. Maximum number of iterations: 1000.