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Machine Learning for Visual Computing
Assignment 2

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1 Assignment 2

1.1 The dual optimization problem

Tasks:

- Generate a suitable training set of linearly separable data
- Plot the input vectors in $\mathbb{R}^2$ and visualize corresponding target values (e.g. by using color).

Figure 1: Plot of the input vectors with the target value visualized by colour.

Figure 1 shows the input vectors.

- Visualize the support vectors and plot the decision boundary.

Figure 2: Plot of the transformed input vectors with the target value visualized by colour.

Figure 2 shows the transformed input vectors.

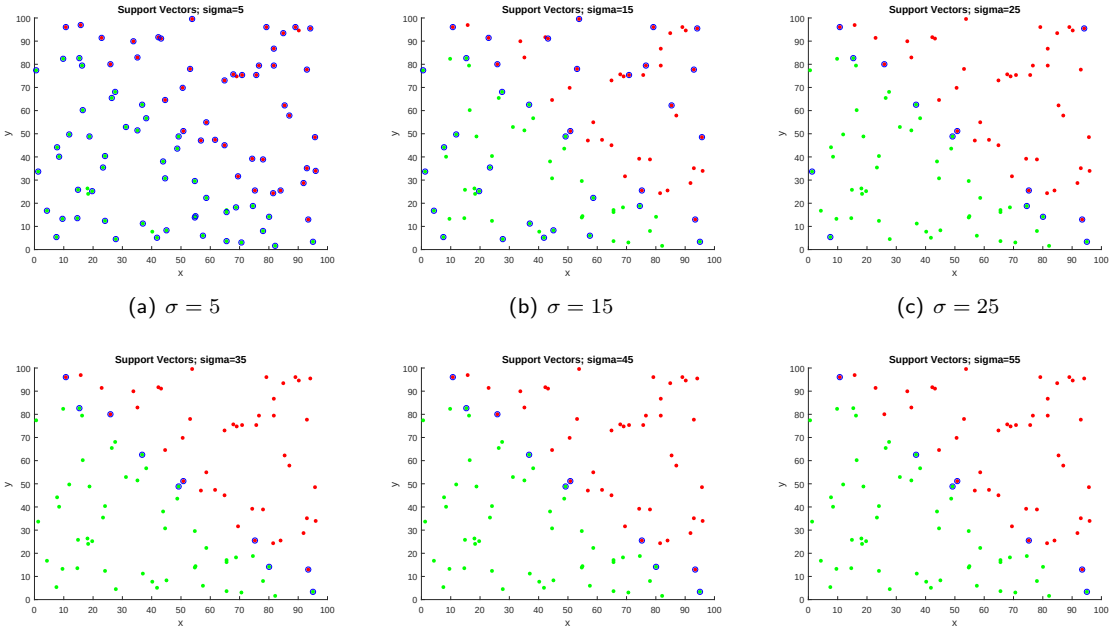
1.2 The kernel trick

Tasks:

- Try different values for σ (the RBF parameter).

The radial basis function kernel is defined by $K(x, y) = exp(-\frac{\|x-y\|^2}{\sigma^2})$. The corresponding support vectors are shown in Figure 3 for different values of the RBF parameter σ. In the lecture notes about RBF-networks, we discussed a selection of $\sigma = 2 * avgdist$, where $avgdist$ denotes the average distance of the centers. Having distances between the data points of approximately 10 units (or slightly more), $\sigma = 25$ is then selected.

- Generate a non-linearly separable training set, plot the data, visualize the support vectors and plot the decision boundary.



(a) $\sigma = 5$ (b) $\sigma = 15$ (c) $\sigma = 25$

(d) $\sigma = 35$ (e) $\sigma = 45$ (f) $\sigma = 55$

Figure 3: Support Vectors for different values of the RBF parameter σ.

Figure 4: Plot of the decision boundary in the original data space found by the perceptron (green curve) together with labelled data points.