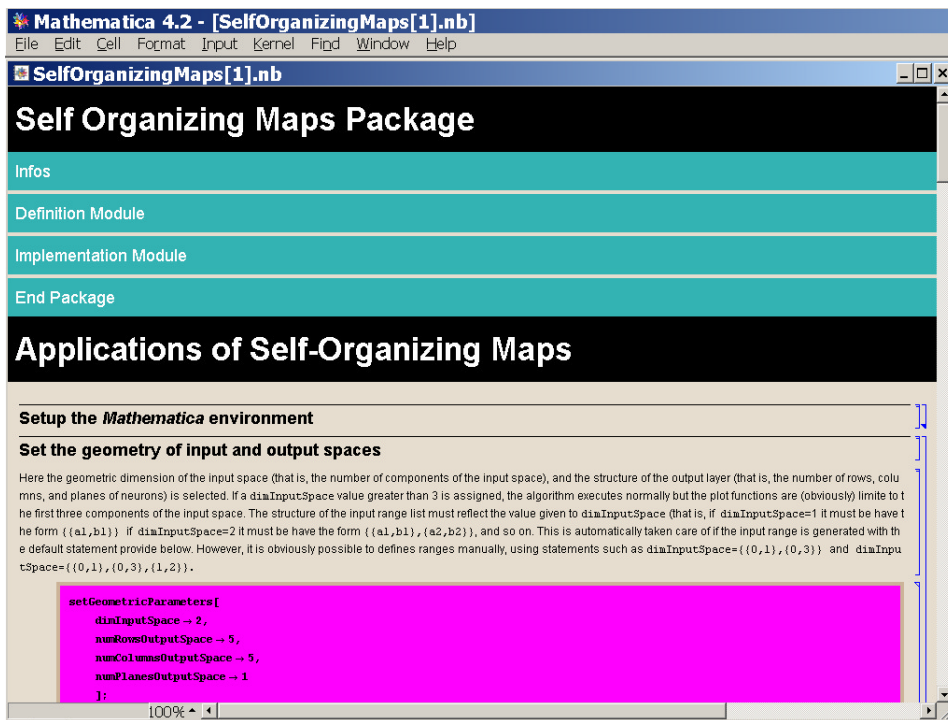# Exercise 1: SOM basics

The goal of this first exercise is to familiarize with the notebook and the basic concepts of Self-Organizing Maps (SOM).


The Mathematica note-book is organized into two parts. The first is a pack-age that implements the algorithm. When you open the notebook for the first time, the cells of the pack-age are closed and you see only their titles. If you are interested in the details of the implementation, you can open the cells by dou-ble clicking on their right end.

The second part of the notebook uses the func-tions defined within the SOM package to illustrate the workings of the SOM algorithm

Select all the cells of the notebook by pressing "CTRL"+"A" on the keyboard. Then, evaluate the selected cells pressing "SHIFT"+"ENTER". Note that the evaluation of the cells can take some time. Observe the results of the execution an try to understand the meaning of the various elements defined in the "Application" part of the note-book, and of the plots that are generated. In particular, in this first exercise focus on the following aspects.


Distribution of training points
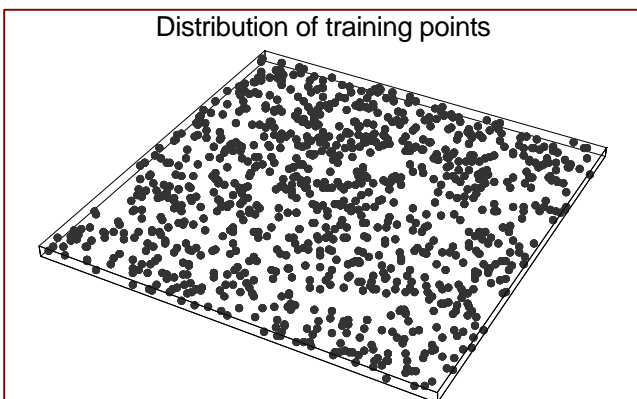
The notebook is initially set up to train a 5 x 5 lattice of neurons using as a training set points randomly distributed in a bi-dimensional interval.

step   1
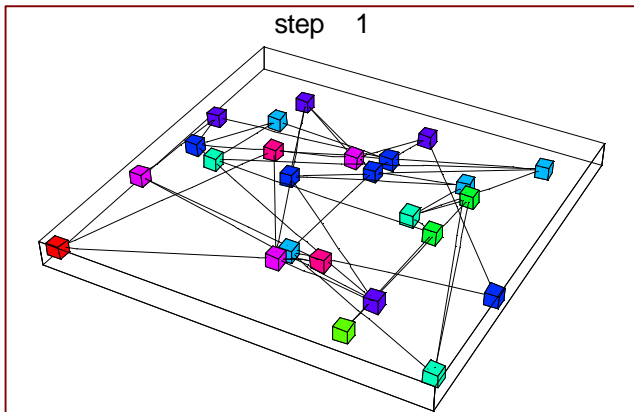
The weights of the neurons are initially assigned with random values in the same interval (this is done for illustrative purposes; in real applications the weights are usually given small random values). Hence, if we represent each neuron as a colored box whose color reflects its position in the lattice and whose position is determined according to its weights, the network appears as a random distribution of colored boxes. Neurons that are adjacent in the lattice are represented as connected by a continuous line.

step   4864
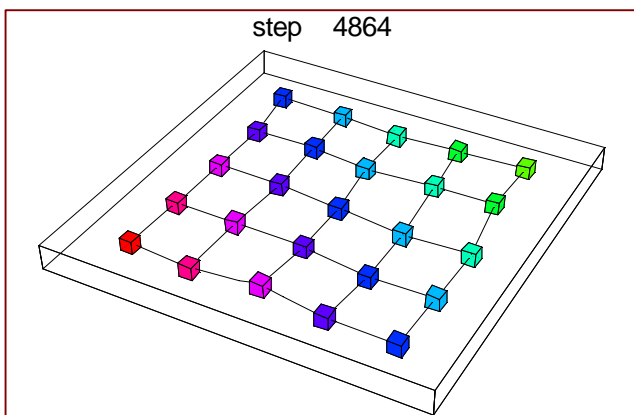
By presenting repeatedly the set of training points to the SOM algorithm we observe the self-organization of the network. If everything goes smoothly, the lattice of neurons unfolds (following the change of the associated weights) to reflect the statistical properties of the training set.

step   36
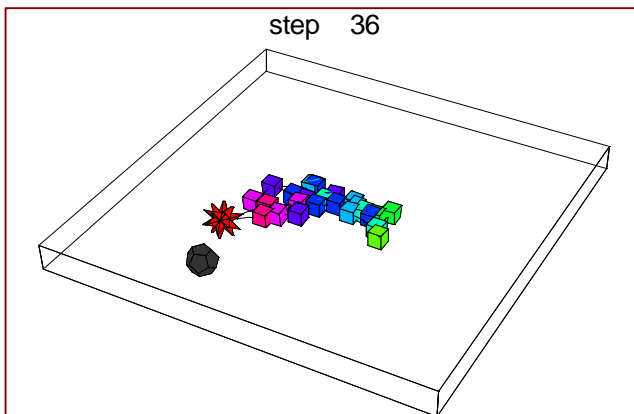
During the training, the active training point at each time step is represented as a dark dodecahedron, and the winning neuron is represented as a stellate dodecahedron.

To animate the unfolding of the network select all the plots of the unfolding and press "CTRL"+"Y". You can slow the animation using the buttons that appear at the bottom of the notebook window during the animation. Note that the first steps of the training are shown one by one, whereas at later stages many intermediate steps are skipped by the plotting procedure. Observe how the training point "attracts" the winning neuron and the other neurons of the network, and how the resulting displacement changes during the training.

SelfOrganizingMaps[1].nb *

step = 30

150%