

## Exercises for “Vertiefung Neuronale Netze”

### SS 2018 Sheet 5

Due on: 27.4.2018

On the website [http://www.demogng.de/js/demogng.html?\\_3DV=0](http://www.demogng.de/js/demogng.html?_3DV=0)<sup>1</sup> you will find simulations of various topology preserving feature maps. In addition to the network-specific questions below, experiment with the different methods, characterize their advantages and disadvantages and answer the following questions for each method (SOM, GNG, Growing Grid):

- a) Can you interpret the neighborhood structure of the network properly?
- b) Having regions with a higher density of data represented by more neurons is called “Fovea effect”. Can you find it? Consider distributions “Fovea” and “SquareNonUniform”. Is it possible to suppress it by modifying the default parameters? Why?
- c) What happens in regions with no data samples? Use the distribution “2-Circles”.
- d) How does the neighborhood structure change, given the presence of a very high (very low) number of nodes?
- e) Which dimensions of the data manifold are represented first (particularly in the “growing” methods)? Consider the distributions “Cactus”, “Spiral”, “123-D” and use slow speed.
- e) How well can a trained network adapt to a time-varying data distribution? Compare the behavior for slowly and rapidly changing distributions (“Square-N”, “Corners-N” vs. “DragMe”)

**Task 5.1, SOM:** The learning rate as well as the neighborhoodradius are automatically declining in an exponential fashion from a given initial value ( $\varepsilon_i$  respectively  $\sigma_i$ ) to the termination value ( $\varepsilon_f$  bzw.  $\sigma_f$ ). Compare the evolved maps for the distributions “UnitSquare” and “2-Circles”. How can the initial and ending values be chosen, such that the map evolves without defects?

**Task 5.2, GNG:** The checkbox “Utility” toggles the utilization of the utility criterion. **a)** What does the utility criterion effect? **b)** What happens in case the threshold is too small e.g.  $k = 1$ ?

**Task 5.3, Growing Grid:** How does the “Growing Grid” grow? Where most often a new row or column is inserted? Compare distributions “UnitSquare” and “SquareNonUniform”. Speculate about the underlying row/column insertion algorithm. Which advantages can you find over its siblings “GNG” and “SOM”?

<sup>1</sup>Or: [file:///vol/ni/share/lehre/neuroII/www.demogng.de/js/demogng.html?model=GNG&distribution=Square-N&\\_3DV=0&speed=4](file:///vol/ni/share/lehre/neuroII/www.demogng.de/js/demogng.html?model=GNG&distribution=Square-N&_3DV=0&speed=4)