

November 6, 2014

### Neural Dynamics, Exercise 4, Nov 6, 2014

Read the Chapter "The dynamics of neural activation variables" by Gregor Schöner, Hendrik Reimann, and Jonas Lins. This is essentially a script of the last three lectures. Boxes 1.1, 1.2 and 1.4 are new compared to the lectures.

1. In light of Box 1.4 go back to the Einstein argument at the beginning of the chapter. Make your own figures to make plausible that the variance of the level of activation increases in time without the  $-u$  term. You can take Figure 1.2 of the chapter and expand it, annotate it, explain it. Formulate in your own words, why the  $-u$  term is necessary to make neural dynamics work.
2. In light of Box 1.2, write down the neural dynamics of the feed-forward neural network illustrated in Figure 1.16 of the Chapter. Use labeled activation variables,  $u_j$  within index  $i = 1, 2, 3, \dots$ . The strength of connection from neuron,  $i$ , to neuron  $j$  next can be denoted by  $c_{i,j}$ . Take into account that only activation passed through the sigmoidal function,  $g(u_i)$ , serves as input to another neuron.
3. Similarly, try to write down the equations of the neural dynamics of the small recurrent neural network shown in Figure 1.17. This gives you practices in writing down long equations...
4. Write down in one paragraph at least one point that you now understood better than in the lectures.
5. Formulate at least one question you have about the Chapter. Can be a question of clarification, of generalization, of criticism.