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June 12, 2015

Exercise 4

This exercise is due only on the May 25, 2015 (in two weeks). You can hand it in electronically to Oliver.Lomp@ini.rub.de or physically at the lecture that day.

Read the article "The dynamics of neural activation variables" by Reimann, H., Lins, J., Schöner, G., which appeared in the journal *Paladyn, Journal of Behavioral Robotics***6**:5770 (2015). The paper is available on the course web-page.

The paper reviews the simple activation dynamics we discussed in the lecture, and embeds these ideas in the field of neural networks. It also gives you an opportunity to review again the basic notions of dynamical systems.

1. Section 4 around Figure 4 provides an argument for the "$-u$" term in the dynamics of activation. In your own words, briefly summarize the argument.

2. Section 6 discusses multiple facets of self-excitation. Give a definition of hysteresis, using Figure 9 for reference, and write a short paragraph that explains how hysteresis can be useful in an autonomous robot.

3. Figure 13b shows the time course of a selection decision. Describe all background needed to understand what is shown here. In the shown simulation, three different patterns of dynamic behavior are observable. Describe these and explain the underlying mechanism in the dynamical equation.