Assignment 3 On Step Size and Speed Factors in a Network Model

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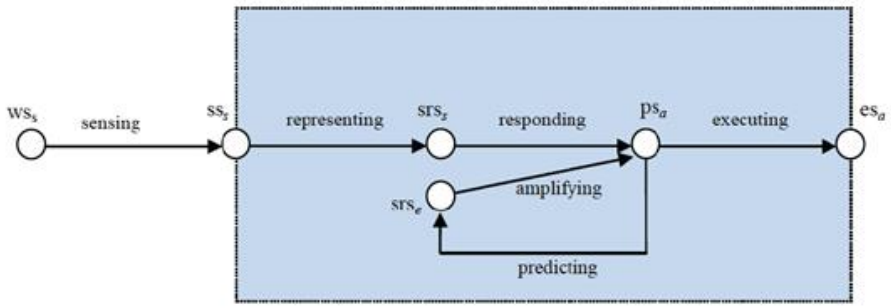
Assignment 3

On Step Size and Speed Factors in a Network Model

This assignment aims to explore more about the differences between step size d*t* (delta t *)* and the speed factors.

As a first step of this assignment, you are asked to model the example of temporal-causal network model described in Book 1, Chapter 2. The following figure shows the graphical conceptual representation of this network model. For more information about this model, please read Chapter 2, Section 2.4.2.



The following choices are made:

- Time is assumed to be measured in seconds
- The weights of all connections are equal to 1
- The values of state ws_s are equal to 1 for all time points
- The initial value of ws_s is 1 and for all other states it is 0
- The speed factors of all states are equal to 0.7 per second, except for the stimulus ws_s
- The step size d*t* is 1 second
- The end time of the simulation can be 20 seconds, or more when needed.
- The combination functions and parameter values of different states are as follows:

State	Combination Function	Parameter values
ws_s		
ss_s	**id(.)**	
srs_s	**id(.)**	
ps_a	**ssum$_\lambda$(..)**	$\lambda = 2$
es_a	**alogistic$_{\sigma,\tau}$(..)**	steepness $\sigma = 10$ threshold $\tau = 0.5$
srs_e	**id(.)**	

Q1. Specify the role matrices for this example and report the results of the simulation.

Q2. Assume that we can say that a physical action is happening, when the value of the action execution state es_a just becomes higher than 0.5. Report the time that this is happening.

As we know, usually our physical actions are much slower than our mind. As a conclusion, it should take more time for an action to happen.

Q3. What should change in order to delay the action execution es_a?

Q4. Find the proper value for this, in a way that the value of es_a becomes higher than 0.5 just after 20 seconds.

Q5. Assume that we want to have more smooth curves to be able to analyse the patterns more precisely. What should be changed?

Q6. Change the value of stepsize dt to 0.1.

Report the results.

a) Again, find the time that physical action happens ($es_a(t) > 0.5$). Is it the same as the result of Q2.?
b) How do you interpret the role of this concept dt? Explain at least two differences between step size dt and speed factor.

Q7. Assume that three empirical values 0, 0.11, 0.95 are given for $es_a(t)$ at three time points 0, 15, and 30 seconds, respectively. What step size, and what speed factor and parameter values for es_a would you use to get a simulation that nicely fits these values? Does the step size matter?