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Exercise Sheet 9
Intelligent Systems
Quantification

This exercise sheet will be discussed on February 10, 2021

Exercise 1 - Quantifying self-organised systems

In chapter 13 you can find methodologies on how to quantify self-organised systems. For each of the three systems in the Figure 1

A. compute the static degree of self-organisation
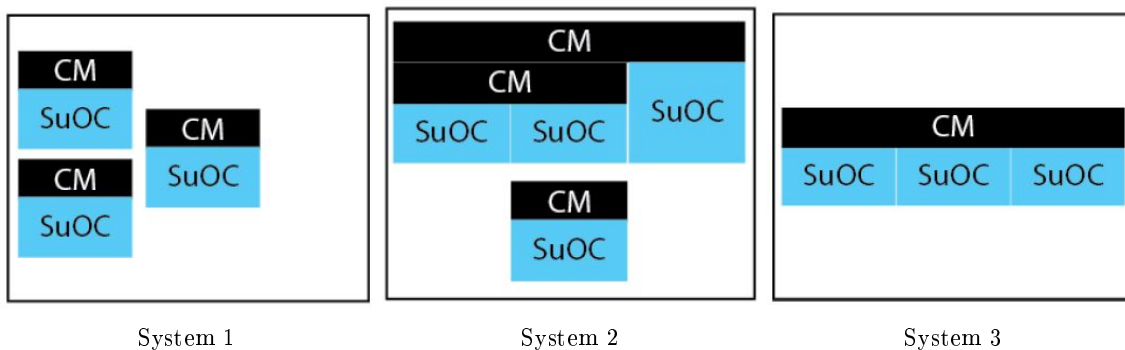
B. categorise the static degree of self-organisation

System 1   System 2   System 3

Abbildung 1: Three different self-organised systems.

Exercise 2 - Dynamic degree of self-organisation

Nature and most organic-computing systems applications consist of agents that interact dynamically between each other. These systems can modify their structure autonomously in order to optimize their utility function to achieve the system's target or at least stay at survival state.
Next, you are introduced to the topology of a router network communicating over the Internet in two subsequent observations made at times t_0 and t_1

A. Build two graphs of the system for each observation

B. Quantify the self-organization of the process between the two observations

Observation at time $t = t_0$

- Request message of size 10-packets using TCP protocol from router ID-102 to router ID-101
- Request message of size 12-packets using UDP protocol from router ID-101 to router ID-203
- Request message of size 03-packets using UDP protocol from router ID-203 to router ID-100
- Request message of size 06-packets using TCP protocol from router ID-100 to router ID-203
- Request message of size 01-packets using TCP protocol from router ID-007 to router ID-101
- Request message of size 05-packets using TCP protocol from router ID-101 to router ID-102

Observation at time $t = t_1$

Two new router of ID-301 and ID-311 were added to the system.

- Request message of size 05-packets using TCP protocol from router ID-102 to router ID-101
- Request message of size 03-packets (each) using UDP protocol from router ID-101 to routers ID-100 and ID-007
- Request message of size 12-packets (each) using UDP protocol from router ID-100 to routers ID-301 and ID-311
- Request message of size 01-packets using TCP protocol from router ID-301 to router ID-203
- Request message of size 10-packets using TCP protocol from router ID-100 to router ID-203
- Request message of size 06-packets using UDP protocol from router ID-203 to router ID-101
- Request message of size 02-packets using TCP protocol from router ID-007 to router ID-101
- Request message of size 05-packets using TCP protocol from router ID-101 to router ID-102

Remark:

Please notice that a single package has the size of 1 byte.