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Network Dynamics
Winter 2015/16

Assignment 1

Ausgabe: 21 Oct 2015 **Abgabe:** 28 Oct 2015

Problem 1: Relative Agreement model

Complete the proof of Proposition 1.1 in Chapter: *An example of social influence: Relative agreement* of the lecture notes.

Problem 2: Relative Agreement model

Let $A = \{1, \ldots, n\}$ be a set of agents. Given opinions $x = (x_1, \ldots, x_n)$ and uncertainties $u = (u_1, \ldots, u_n)$ for all agents, the (directed) *actual influence graph* graph $G(x, u) = (V, E)$ is given by $V =_{\text{def}} A$ and $E =_{\text{def}} \{ (i, j) \mid h_{ij} \geq u_i \}$ where h_{ij} denotes the overlap of the opinion segments of distinct agents $i, j \in A$.

Suppose we are given six agents, i.e., $A = \{1, 2, 3, 4, 5, 6\}$, together with the following opinion/uncertainty pairs (x_i, u_i):

$$(x_1, u_1) = (0.7, 0.3), \quad (x_2, u_2) = (0.3, 0.2), \quad (x_3, u_3) = (0.1, 0.6)$$
$$(x_4, u_4) = (-0.1, 0.2), \quad (x_5, u_5) = (-0.3, 0.6), \quad (x_6, u_6) = (-0.8, 0.2)$$

For the sake of simplicity, we set the decay constant $\mu = 1$.

(a) Determine the actual influence graph $G(x, u)$.

(b) Determine the actual influence graph $G(x', u')$ where x' and u' are the opinions and uncertainties of all agents after an interaction $(3, 5)$ according to the update rules of the Relative Agreement model.

Problem 3: Relative Agreement model

Prove or disprove the following statement for actual influence graphs (defined in Problem 2):

> Suppose an actual influence graph $G(x, u)$ for a set A of agents consists of two weakly connected components. Then, there is no interaction pair (i, j) such that, after the interaction, the actual influence graph $G(x', u')$ consists of a single weakly connected component.