

Behaviour Dynamics in Social Networks - Assignment 7

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Abstract

Verification by mathematical analysis of stationary points.

1 Determine equilibria for a constant stimulus

The values chosen for the parameters are: repetition=30, duration=30, $\eta_1=0.4$, $\eta_2=0.3$, $\mu_1=0.8$ and $\mu_2=0.9$.

1.1 Question 1

The final equilibrium values for the states rep, prep and feel based on observations in the simulation are:

rep: 1

prep: 0.991535551

feel: 0.89068188

1.2 Question 2

The observed equilibrium values based on observation in the simulation:

$\omega_1=0.832149364$

$\omega_2=0.898285371$

The predicted equilibrium values based on mathematical analysis:

$\omega_1=0.832149364$

$\omega_2=0.898285371$

The two sets of values for the connection weights are equal, therefore the accuracy is 0.

1.3 Question 3

The differences between the aggregated impact and the values for the two adaptive connections for these equilibria vary from 0 to 0.2 in the first case (aggimpact- ω_1) and from 0 to 0.1 in the second case (aggimpact- ω_2). By exploring the difference between the aggregated impact and ω_1 and ω_2 in the stationary points we can observe that the accuracy is $0 < 10^{-2}$.

1.4 Question 4

$$c_{feel}(\omega_2 \text{prep}(t)) = \text{feel}(t) \implies$$

$$\text{id}(\omega_2 \text{prep}(t)) = \text{feel}(t) \implies$$

$$\text{id}(\omega_2 \underline{\text{prep}}) = \underline{\text{feel}} \implies$$

$$\omega_2 \underline{\text{prep}} = \underline{\text{feel}}$$

If we replace the values with the observed ones we get: $0.898285371 * 0.991535551 = 0.890681512430035$. This means that the accuracy is $0.0000004 < 10^{-2}$, so we can say that the equation is verified.

2 Determine stationary points for an alternating stimulus

Formula used for accuracy: $(\text{observed value} - \text{predicted value}) / \text{predicted value} = \text{error}$. In our case, the observed values are ω_1 and ω_2 and the predicted value is the aggregated impact.

2.1 Question 1

The values chosen for the parameters are: repetition=40, duration=20, $\eta_1=0.4$, $\eta_2=0.3$, $\mu_1=0.8$ and $\mu_2=0.9$.

Examples of stationary point:.

rep: t0-t18, t20-t38 etc.

prep: t77, t78, t79, t115, t116 etc.

feel: t116, t117, t118 etc.

Examples of equilibrium points and the corresponding differences between the aggregated impact and ω_1 and ω_2 :

- point t78: $\text{aggimpact} - \omega_1 = -0.027005337 \implies \text{accuracy} = 0.25$ and $\text{aggimpact} - \omega_2 = -0.001819542 \implies \text{accuracy} = 0.11$
- point t116: $\text{aggimpact} - \omega_1 = -0.031671136 \implies \text{accuracy} = 0.25$ and $\text{aggimpact} - \omega_2 = -0.000811289 \implies \text{accuracy} = 0.11$

2.2 Question 2

The values chosen for the parameters are: repetition=20, duration=10, $\eta_1=0.4$, $\eta_2=0.3$, $\mu_1=0.8$ and $\mu_2=0.9$.

Examples of stationary points.

rep: t0-t8

prep: t159

feel: t160

Example of equilibrium point and the corresponding differences between the aggregated impact and ω_1 and ω_2 :

- point t218: $\text{aggimpact-}\omega_1=-0.01893416 \implies \text{accuracy}=0.25$ and $\text{aggimpact-}\omega_2=-1.59672\text{E-}05 \implies \text{accuracy}=-1.59672\text{E-}05/0.000143704$