Plan Overview

A Data Management Plan created using DMPonline

Title: Spatio-temporal canards and delayed bifurcations in continuous neurobiological networks

Creator: Daniele Avitabile

Principal Investigator: Daniele Avitabile

Affiliation: Vrije Universiteit Amsterdam

Funder: Netherlands Organisation for Scientific Research (NWO)

Template: Data Management Plan NWO (September 2020)

Project abstract:

This proposal concerns the analytical and numerical construction of orbits displaying canard segments and delayed bifurcations in spatially-extended neurobiological networks and, more generally, in infinite-dimensional dynamical systems with time-scale separation. Single-cell biophysical neural models are naturally written as systems of ordinary differential equations (ODEs) with time- scale separation, and this feature has a strong influence on their dynamical repertoire. A mathematical multiple time-scale theory for neural excitability, and for the generation of complex neural rhythms such as mixed mode oscillations or bursting, has been developed for single-cell models, but is lacking at the level of neural populations, and for spatially-extended neural networks. In realistic biophysical single-cell models, canards and delayed bifurcations are responsible for neural rhythms observed experimen- tally, but their existence and role in spatially-extended models and infinite-dimensional dynamical systems is largely unexplored. The proposed research addresses this question in a class of nonlinear, nonlocal models of neural activity which represent the cortex as a continuum. These models are rigorously tractable, amenable to numerical simulation or bifurcation analysis, and their control parameters can be mapped to biophysical microscopic parameters in spiking neural networks. The models under consideration support slow-passages through bifurcations and spatio-temporal canards (orbits that display a spatial pattern and a temporal canard behaviour), whose analytical and numerical construction has now become possible, capitalising on recent results obtained by the applicant and the proposing team. The proposed analytical and numerical methods are applicable to generic infinite-dimensional systems with time scale separation in which the fast variables evolve according to a parabolic PDE or integro-differential equation, coupled to a finite (possibly large) number of slow variables.

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Spatio-temporal canards and delayed bifurcations in continuous neurobiological networks

General Information

Name applicant and project number

Daniele Avitabile, 613.009.136

Name of data management support staff consulted during the preparation of this plan and date of consultation.

I have used a template provided by my institution

1. What data will be collected or produced, and what existing data will be re-used?

1.1 Will you re-use existing data for this research?

If yes: explain which existing data you will re-use and under which terms of use.

- Yes

We may incidentally re-use published and freely available experimental or numerical data.

1.2 If new data will be produced: describe the data you expect your research will generate and the format and volumes to be collected or produced.

The data produced by this project will be:
* mathematical models (shared via Arxiv and published journals)
* numerical codes (plain text files, shared via GitHub)
* output of numerical simulations (plain text files, or .mat executable files shared via Zenodo).

1.3. How much data storage will your project require in total?

- 100 – 1000 GB

2. What metadata and documentation will accompany the data?

2.1 Indicate what documentation will accompany the data.

For the numerical simulations, the published code will allow reconstruction of the numerical data, and will be adequately documented to make it accessible to others. The mathematical models will be made available directly through the written publication, or a numerical code.

2.2 Indicate which metadata will be provided to help others identify and discover the data.

Metadata is attached to the paper, code and data in the repositories mentioned above

3. How will data and metadata be stored and backed up during the research?

3.1 Describe where the data and metadata will be stored and backed up during the project.

- Institution networked research storage

3.2 How will data security and protection of sensitive data be taken care of during the research?

- Not applicable (no sensitive data)

4. How will you handle issues regarding the processing of personal information and intellectual property rights and ownership?

4.1 Will you process and/or store personal data during your project?

If yes, how will compliance with legislation and (institutional) regulation on personal data be ensured?

- No

4.2 How will ownership of the data and intellectual property rights to the data be managed?

In the same way that the intellectual property rights of the publications is handled.

5. How and when will data be shared and preserved for the long term?

5.1 How will data be selected for long-term preservation?

- All data resulting from the project will be preserved for at least 10 years

I've mentioned above 3 publicly available repositories where data will be stored in the long term (Arxiv, GitHub, Zenodo).

5.2 Are there any (legal, IP, privacy related, security related) reasons to restrict access to the data once made publicly available, to limit which data will be made publicly available, or to not make part of the data publicly available?

If yes, please explain.

- No

5.3 What data will be made available for re-use?

- All data resulting from the project will be made available

5.4 When will the data be available for re-use, and for how long will the data be available?

- Data available as soon as article is published

5.5 In which repository will the data be archived and made available for re-use, and under which license?

Arxiv, GitHub, Zenodo, with MiT license or similar

5.6 Describe your strategy for publishing the analysis software that will be generated in this project.

I use code repositories in my daily workflow. These repositories are private and a button must be clicked to make them publicly available.
Upon acceptance, I will submit papers on Arxiv, and data on Zenodo.

6. Data management costs

6.1 What resources (for example financial and time) will be dedicated to data management and ensuring that data will be FAIR (Findable, Accessible, Interoperable, Re-usable)?

We will adhere to the open publication policies of the VU.