Introduction to Focus Areas in Bioinformatics – WS19/20

Prof. Dr. Tim Conrad

7 Project 7

- Deadline: 08.12.2019, 23:59
- All files need to be available through your GIT repository, in the directory "Project 7".
- You can work in teams up to 3 people. Please state in the report the group member names.
- If your code is in python, I must be able to run your code within a Google Colab notebook. If your code is not in Python or R, you must provide a manual how to compile and run it on a Linux machine.

7.1 Modeling and Simulation of complex biological systems

We will use the PySB library (http://pysb.org/) to model and simulate complex biological systems. Your tasks are as follows:

(1) Implement and simulate the Tyson cell division model such that you can reproduce figure 3 from the original paper: "Modeling the cell division cycle: cdc2 and cyclin interactions"
by JJ Tyson, PNAS (1991), 88 (16)
(This might help: https://github.com/LoLab-VU/pysb-tutorials/blob/master/tutorials/Tyson_cycle_tutorial.ipynb)

(2a) Read the paper „Modeling, Simulating, and Parameter Fitting of Biochemical Kinetic Experiments" by D. Goulet, SIAM REVIEW, 58 (2).

(2b) Implement and simulate the model described in the Goulet paper in a modeling framework of your choice (e.g. PySB, Copasi, Matlab etc.) such that you can reproduce figures 2 and 6.

7.2 Deliverables

Your need to upload all source codes and a report to your GIT repository.

- The report should be about 600-1200 words in length (this is roughly 1-2 pages, depending on your layout).
- The report must be delivered in PDF format using the BMC template (including the abstract as defined in project 5).
- The following sections must be present (you can add more if needed):
    - Tyson Cell Division Model
        - Background and Description of the model
          (including a brief discussion, why this is a complex model)
        - Brief description of the chosen model implementation and simulation
        - Results
          (including the produced figures)
    - Receptor Dimerization Model
        - Background and Description of the model
          (including a brief discussion, why this is a complex model)
        - Brief description of the chosen model implementation and simulation
          (including a list of the generated model ODEs)
        - Results and Discussion
          (including the produced figures and a discussion about the generated ODE model vs. the ODE model described in the paper)
    - Discussion: How does this project ("Complex Systems") differ from the projects of the previous weeks ("Data Science")? (Or why not?)