Modelling Complex Systems: Project Sheet 3

May 14, 2014

The deadline for this first exercise sheet is midnight Friday 20th of June 2014.

In this project you are asked to implement and investigate a model described in a scientific paper. You should complete this project in groups. The best group size is 3-4, but any group with between 1 and 5 participants is fine. Each group member will be given the same mark for your work and you should write just one report per group.

The following is a list of papers you can choose from:

- Error and attack tolerance of complex networks, Albert et al. (2000)
- Effective leadership and decision-making in animal groups on the move, Couzin et al. (2005)
- Shape and efficiency in spatial distribution networks, Gastner & Newman (2006)
- Statistical physics of social dynamics, Castellano et al. (2009). *Note: This is a review paper so choose one or two models to look at.*
- Self-Organized Criticality: An Explanation of 1/f Noise, Bak et al. (1987)
- Evolutionary games and spatial chaos, Nowak & May (1992)
- Collective Motion of Humans in Mosh and Circle Pits at Heavy Metal Concerts, Silverberg et al. (2013)

You should choose just one paper to work with during your project, although you can also read and implement other papers related to the one you choose.

Please submit hand-ins on Studentportalen. All names of contributing authors should be clearly stated. All code should be submitted as an appendix and not as part of the answer to the hand-ins. Please feel free to submit videos illustrating your results where appropriate, with via Studentportalen or uploaded elsewhere.

I will not account for the number of authors when marking. I will mark on an absolute scale out of 25 based on the overall quality of the submission.

Report description

In the project you should implement and investigate a model similar to (but not necessarily identical to) the one described in the paper. You should write a report of no more than 10 pages including figures, consisting of

Model description Here you describe your model implementation, including how it differs (if at all) from that described in the paper.

Simulation results Provide a few sample runs for different parameter values to give an overall understanding of the behavior of the model. Think of a good measure to characterize your model outcome and then investigate how systematically changing a parameter produces an outcome. You are welcome to include videos of your simulation output.

Analytical results Consider how you might be able to find mathematical results for a simplified version of your model. Think about possible mean-field models, approximations and Master equations and how they might be applied here.

Conclusions Describe what we can conclude from the model simulations. Use Google scholar to find other papers which have cited or are cited by the paper you study and discuss your results with reference to these other works. Explain their relevance to the application area

A final mark out of 25 will be given on the basis of the overall quality of the report.