PhD Proposal

Modeling and Control of Cyber-Social Dynamics

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Team: NeCS (http://necs.inrialpes.fr)
Duration: 3 years, full salary (≈ 1500 euros per month after taxes)

Key dates:
- *before June 5*: contact the supervisors
- *June 8*: deadline for formal application
- End of June: Selection completed
- Fall 2017: PhD studies begin

Context: This work will be carried out in the NeCS team (Networked Control Systems), a joint CNRS/INRIA team at GIPSA-Lab laboratory in Grenoble, France. The team's research concerns modeling, estimation and control of networked systems, with a broad spectrum of theoretical and applied topics including security and privacy in cyber-physical systems, traffic networks, intelligent vehicles, social dynamics, analysis of large-scale complex networks.

Candidate profile: The candidate will have a MS degree in Applied Mathematics, Control Systems, Electrical Engineering, or related disciplines.

Topic description: Recent developments in digital communication and social networking provide people with unprecedented possibilities to interact and consequently form their opinions and feelings. Social media platforms also offer new opportunities to influence opinions and feelings. This influence can be obtained either through advertising or through more subtle means like altering the way individuals interact. A remarkable example of the latter possibility was the controversial Facebook experiment illustrated in [KGH14], which induced an emotional contagion in thousands of unaware users by tweaking their News Feeds to emphasize displays of sadness. The current situation motivates some urgent questions: How do opinions evolve in society dominated by digital interactions? To which extent can organizations or individuals orient public opinion and collective feelings? Supported by an established literature [Jac10], we will regard social systems as networks of interacting individuals: each individual possesses his/her opinion and interactions induce changes in the opinions. Mathematically, the structure of the social network is described by a graph: its nodes are the individuals and its arcs represent relations of friendship or acquaintance, which allow for the interactions. The project will thus start from models of social dynamics proposed by social scientists and will investigate their system-theoretic properties, seeking to identify both fundamental limitations and feasible control strategies. As an example of possible strategy, [RF16] seeks to optimize the position of opinion leaders in the social network.

Bibliography

[KGH14] A. D. I. Kramer et al. Experimental evidence of massive-scale emotional contagion through social networks. PNAS, 111(24):8788–8790, 2014
[Jac10] M. O. Jackson. Social and economic networks. Princeton University Press, 2010.
[RF16] W. S. Rossi and P. Frasca. The harmonic influence in social networks and its distributed computation by message passing, 2016 arXiv:1611.02955