Uzay Çetin
Thesis Supervisor: Assoc. Prof. Haluk O. Bingöl
Thesis Co-supervisor Assoc. Prof. Dr. Adil Sarıbay
COMPUTATIONAL MODELS OF ATTENTION COMPETITION

Abstract
The main focus of this thesis is to study the social dynamics of cooperation and competition among "boundedly rational" agents. Several adaptive complex systems are designed in which agents with limited attention capacity, confront a wealth of information. A rather exploratory approach is taken and primarily, agent-based modeling (ABM) is used to study the dynamics of competitive endeavours, such as artificial markets and games.

First, we built a simple model in which cultural items compete for the limited attention of agents and we investigate the impact of advertisement pressure. We observe that the market share of the advertised item improves as a result of an increase in the standard items. Secondly, we work on attention games in a specific context of Iterated Prisoners Dilemma. We find out it is best for agents to pay attention to defectors in order to achieve a higher social welfare. Thirdly, we investigate the co-evolution of cooperation and memory. This time agents are ``hard-wired'' to pay attention to defectors. As opposed to what we expect, we observe that subsequent generations loose their memory and are ultimately invaded by defectors, when playing with a defector brings non-negative payoffs. We reformulate the payoff matrix structure to incorporate negative payoffs, in a systematic way, and show how threat (of receiving negative payoffs) fosters greater memory size and cooperation. We also observe how memory acts like an immune response of the subsequent generations against aggressive defection. This functionality of self-immunization has emerged as a result of the co-evolutionary process.

PUBLICATIONS

Journals

1. **Uzay Cetin** and Haluk O. Bingol, The Dose of the Threat Makes the Resistance for Cooperation, Advances in Complex Systems, 2017. (SCI-E)
   (Accepted)
2. **Uzay Cetin** and Haluk O. Bingol, "Attention competition with advertisement", Physical Review E 90 (3), 032801, 2014. (SCI)
   DOI: 10.1103/PhysRevE.90.032801
3. **Uzay Cetin** and Haluk O. Bingol, "Iterated Prisoners Dilemma with limited attention", Condensed Matter Physics 17 (3), 33001, 2014. (SCI-E)
   DOI: 10.5488/CMP.17.33001

Conferences

1. **Uzay Cetin**, Haluk Bingol, "An Introduction to Complex Systems Modeling", AB2016 Akademik Bilisim Konferansları, 2016, Adnan Menderes University
2. **Uzay Cetin**, Haluk O. Bingol, "Computational Models for Attention Competition: Agent Based Models for Attention Scarcity", International Conference on Computational Social Science, June 8-11, 2015, Finlandia Hall, Helsinki, Finland.
3. **Uzay Cetin**, Haluk Bingol, "On Limited Attention", AB2015 Akademik Bilisim Konferansları, 2015, Anadolu University
4. Nejat Kutup, **Uzay Cetin**, "Introduction to Network Science with R and Gephi", AB2015 Akademik Bilisim Konferansları, 2015, Anadolu University
5. **Uzay Cetin**, "How cooperation evolves?" IBEROT 2014 Insan Bilgisayar Etkilesimi ve Robot Teknolojisi Sempozyumu, Istanbul Gelisim University

6. **Uzay Cetin**, Haluk Bingol, “On Advertisement Effect”, AB2014 Akademik Bilisim Konferansları, 2014, Mersin University
7. **Uzay Cetin**, Haluk Bingol, “A sentiment extension to the Simple Recommendation Model”, 3rd MC Meeting of COST MP0801, Eindhoven, The Netherlands, 2011.

Defense Jury Members

1. Assoc. Prof. Dr. Haluk O. Bingol — Boğaziçi University
2. Assoc. Prof. Dr. Adil Sarıbay — Boğaziçi University
3. Assist. Prof. Dr. Albert Ali Salah — Boğaziçi University
4. Assoc. Prof. Dr. Mehmet Gençer — İzmir Ekonomi University
5. Assist. Prof. Dr. R. Murat Demirer — Üsküdar University
6. Prof. Dr. Yaman Barlas — Boğaziçi University

Defense Date: 05.01.2017