PhD in Information Technology and Electrical Engineering

Università degli Studi di Napoli Federico II

PhD Student: Elena Napoletano

XXX Cycle

Training and Research Activities Report – Second Year

Tutor: Franco Garofalo

1. Information

    a. Elena Napoletano, M. Sc. Degree cum laude in Ingegneria Gestionale – University of Naples Federico II
    b. XXX Cycle- ITEE – Università di Napoli Federico II
    c. Fellowship: «Fondo Sociale Europeo, P.O. Campania 2007/2013-2014/2020»
    d. Tutor: Prof. Franco Garofalo

2. Study and Training activities

    a. Courses

        1. *"Game Theory and analysis of competitive dynamics for industrial systems"* (3 CFU)
           Lecturers: Prof. Lina Mallozzi

        2. *"The entrepreneurial analysis of engineering research projects"* (3 CFU)
           Lecturer: Prof. Luca Iandoli

        3. *"Scientific writing"* (3 CFU)
           Lecturer: Prof. Chie Shin Fraser

    b. Seminars

- Title: *"Radar adaptivity: Antenna Based Signal Processing Technique"* (0.5 CFU)
  Lecturer: Dr. Alfonso Farina
  Date: 12.02.2016

- Title: *"Adversarial Testing of Protocol Implementations"* (0.4 CFU)
  Lecturer: *Dr. Cristina Nita Notaru*
  Date: *23.02.2016*

- Title: *"Programmable Network Conjungations"* (0.4)
  Lecturer: *Dr. Roberto Bifulco*
  Date: *26.02.2016*

- Title: *"Challenging real-time measurement systems for immersive life-size augmented environment"* (0.4)
  Lecturer: *Dr. Giovanni Caturano*
  Date: *29.04.2016*
- Title: *"Agenti computazionali in un mondo complesso"* (0.6 CFU)
  Lecturers: *Prof. Giuseppe Zollo, Prof. Cristina Ponsiglione, ing. Elena Napoletano, ing. Anna di Meglio*
  Date: *23.05.2016*

c. External seminars

- Title: *"Complex Networks: theory, methods and applications II" (Lake Como School of Advanced Studies)* (4 CFU)
  Date: *16-20.05.2016*

- Title: *"2016 Workshop on Complexity in Engineering – COMPENG 2016" (Catania)* (1.6 CFU)
  Date: *4-5.07.2016*

3. Research activity

   a. Title: Herding as a leader-follower consensus problem

   b. Study: Dynamics and control of complex networks, agent-based models, behavioural economics, artificial financial markets, pinning control.

   c. Research description

Herding includes phenomena such as adaptation, imitation, and learning, which may be caused by unconscious or pre-rational behaviors, or by rational factors, such as externalities or optimal decision making.
In financial markets, herding phenomena are usually the result of the propagation of exogenous information through the multi-agent system, generating what are called *informational cascades* which drag the agents in a blind replication of the same trading decision.
The models in the literature do not take into account the possibility that not all the agents may herd. However, empirical evidence shows that herding phenomena with different intensities often arise.

We view herding phenomena as the convergence of the agents' opinion towards a general **consensus**.
We introduce a new model of opinion formation in an artificial market, in which each agent is a node of a **dynamical network**, and its state represents his current opinion on the expected value of the asset returns. We employ the network edges to describe the reciprocal influence among the agents. Moreover, leveraging the **pinning control strategy**, we model the exogenous information as a feedback control signal injected by an additional node, the *pinner*, and only affecting a subset of the financial agents.

We aim at verifying that our model of opinion formation is capable of triggering herding phenomena of different intensities.
Relying on the structural conditions available in the literature to predict the number of nodes which should reach consensus on the value of the pinner, we also numerically verify our capability of predicting the minimum intensity of the triggered informational cascades.

4. Products
   a. Publications
      i. Already published: DeLellis, P., Garofalo, F., Iudice, F. L., & Napoletano, E. (2015). "Wealth distribution across communities of adaptive financial agents". *New Journal of Physics*, *17*(8), 083003.

ii. In preparation: Garofalo,F. Iudice, F. L., & Napoletano, E. "Herding as a leader-follower consensus problem.

5. Conferences and Seminars

   a. Conference: *"2016 Workshop on Complexity in Engineering – COMPENG 2016" (Catania) 4-5.07.2016*

   b. Presentations made: *"Agenti computazionali in un mondo complesso" 23.05.2016*

Student: Elena Napoletano elena.napoletano@unina.it **Tutor: Franco Garofalo** franco.garofalo@unina.it **Cycle XXX**

	Credits year 1								Credits year 2								Credits year 3								
	Estimated	1 bimonth	2 bimonth	3 bimonth	4 bimonth	5 bimonth	6 bimonth	Summary	Estimated	1 bimonth	2 bimonth	3 bimonth	4 bimonth	5 bimonth	6 bimonth	Summary	Estimated	1 bimonth	2 bimonth	3 bimonth	4 bimonth	5 bimonth	6 bimonth	Summary	Total
Modules	18			3	4	7	6	**20**	9		6		3			**9**								**0**	**29**
Seminars	13		0,8	1,6	0,4		0,2	**3**	6		1,3	0,5	4,6	1,6		**8**								**0**	**11**
Research	34	10	9	5	7	6	5	**42**	42	10	3	9	3	8	10	**43**								**0**	**85**
	65	10	9,8	9,6	11	13	11	**65**	57	10	10	9,5	11	9,6	10	**60**	0	0	0	0	0	0	0	**0**	**125**