Curriculum Vitae of Anna Zafeiris

PERSONAL DATA:

Name: Dr. Anna Kinga Zafeiris
Maiden name: Lázár Anna Kinga
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Affiliation: Department of Biological Physics, Eötvös Loránd University (ELTE)
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EDUCATION:

- **Ph.D. degree:**
  2003-2008:
  Peter Pazmany Catholic University (PPCU) - Faculty of Information Technology (FIT)
  Topic: Modeling Visual Attention
  Supervisor: Prof. Tamás Roska
  Consultant: Dr. Zoltán Vidnyánszky
  Rating: Summa Cum Laude

- **University studies:**
  1998-2003: MSc in Computer Science, Systems and Software Engineering
  Orientation: Artificial Intelligence
  University of Sciences, Szeged, Hungary

  1995-2002: MSc in *Physics*
  University of Sciences, Szeged, Hungary

RESEARCH INTERESTS:

- Models of biological and social systems, using tools from mathematics, statistical physics and computer science, with special emphasis on network science, AI methods and agent-based modeling.
  - Collective behaviour: collective motion and collective decision making
  - Adaptive self organization, hierarchy formation
  - Network science
  - Opinion dynamics and belief system formation
  - Computational social science: computational history and archeology

TEACHING ACTIVITY (AT UNIVERSITIES): Courses taught at undergraduate and graduate level, both in Hungarian and English.

At ELTE (in English):

- 2021-: ***Bio-inspired Systems*** at ELTE-TTK, Fall Semesters
- 2017-2020 : ***The Statistical Physics of Biological Systems*** at ELTE-TTK, Fall Semesters

During Ph.D. (in Hungarian):

- 2005/06: ***Digital Computation Theory*** at PPCU-FIT
- 2005/06: ***Database Theory*** at PPCU-FIT
- 2004/05: ***Cellular Neural/Nonlinear Networks*** at PPCU-FIT
- 2003/04 and 2004/05: ***Discrete Mathematics I- II*** at PPCU-FIT

SUPERVISED DEGREE THESES: (Institute of Physics, Eötvös Loránd University of Sciences, Budapest)

- PhD, Physics:
  - Zoltán Kovács, topic: "The evolution of complex networks and hierarchies in social systems" (2023-, supervising together with Dr. Gergely Palla)
  - Evelin Berekméri, topic: "Investigation of collective behaviour with machine learning algorithms" (2019-2025, supervising together with Dr. Máté Nagy)

- MSc, Physics
  - Eszter Daniella Biri: "Opinion dynamics with realistic agents" (2021)
  - Evelin Berekméri: "Optimal decision making under limited access to information" (2019) (rated: "excellent")

- BSc, Physics
  - Barnabás Buza: "Continuous Axelrod Model" (2022)
  - Koppány Csanád Budai: "What can we learn from infection toy models? The effects of mortality rate, progression of disease and network structure" (2021)
  - Márton Fadgyas: "Creating artificial networks with real-life characteristics" (2021)
  - Máté Balázs: "Optimal group structures for promoting well-informedness, under various communication technologies", (2020)
  - Ádám Móricz: "Collective opinion dynamics under various communication technologies" (2019)

- Undergraduate research
  - Zsombor Komán, „Phenomenological theory of collective decision-making" 2016/17, Supervised together with Prof. Tamás Vicsek
  - Attila Horicsányi, „Internetes fórumokból felépíthető kommunikációs hálózatok hierarchikus tulajdonságainak elemzése" (in Hungarian)", 2018, „Tudományos Diákköri Konferencia (TDK)". Supervised together with Prof. Tamás Vicsek

FELLOWSHIPS (in chronological order):

- 2007: Research Fellowship for the spring semester at the University of Leuven, Belgium, Computational Neuroscience Research Group.
- 2007/08: Hungarian State Research Fellowship ("Deák Ferenc Scholarship")
- 2009/10 Greek State Fellowship for research on "Mathematical models of biological systems" at the Department of Mathematics of the National University of Athens, Greece.
- 2015/19: "Bolyai János" Research Scholarship for the topic "Optimal Collective decision making in hierarchical, heterogeneous, groups."
- 2018/19 "National Higher Education Excellence Scholarship – Bolyai+" in the topic of "Optimal strategies for gaining information in groups seeking for consensus, in complex environment".

RESEARCH PROJECTS AND RESEARCH INVOLVEMENT

- **ELTE Department of Biological Physics**
  Various roles since 2009
  Research on collective motion, collective decision-making, adaptive self-organization, and hierarchy formation
  https://physics.elte.hu/en/BIO_home
- **MTA–ELTE Lendület Innovation Archaeology Group**
  Member (2022–)
  Institute of Archaeological Sciences, ELTE
  https://lendulet-innovacio.hu/en/
- **Inflanet – Inflammation Research Against Endemics**
  Participant (2024.12.01 – 2025.05.31)
  https://inflanet.eu
- **MTA–ELTE Lendület Collective Behaviour Research Group**
  Supportive Member (2022–2025)
  Eötvös Loránd University, Faculty of Science
  https://collective.elte.hu
- **MTA–ELTE Statistical and Biological Physics Research Group**
  Researcher (2014 – 2022)
  Supported by HUN-REN
- **"Lendület" Evolutionary Genomics Research Group**
  Collaborator (2022.10.01 – 2024.11.30)
- **OTKA Grant (K 128780)**
  Project member (2018.09.01 – 2024.08.31)
  "Optimal collective mechanisms in high-dimensional complex systems"
- **RedAlert (H2020, EU Project)**
  Participant (2017.06.01 – 2020.09.30)
  Grant no. 740688
  cordis.europa.eu/project/id/740688

- **PPKE – Faculty of Information Technology and Bionics**
  Research assistant (2006 – 2008)
  Visual attention modeling
- **SZTAKI (Institute for Computer Science and Control)**
  Research assistant (2005 – 2008)
  Visual attention modeling

PROFESSIONAL EXPERTISE AND COMPETENCIES:

- Mathematical modeling of complex systems
- Agent-based modeling and simulation
- Network science (structure and dynamics)
- Computational social science
  - Computational archeology, computational history
  - behavior modeling, decision systems, anomaly detection
- Statistical data analysis and machine learning
- Experience with interdisciplinary teams (biology, social science, archaeology)
- Programming: Python (SciPy, NumPy, scikit-learn), MATLAB
- Scientific communication (writing, mentoring, public speaking)

5 MOST RELEVANT PUBLICATIONS:

1) T. Vicsek, **A. Zafiris**, "Collective Motion", *Physics Reports*, 517(3-4), pp. 71-140, 2012.
2) **Anna Zafeiris** and Tamás Vicsek: *Why we live in hierarchies: a quantitative treatise*, SpringerBriefs in Complexity, 2018 (Book)
3) Evelin Berekméri and **Anna Zafeiris**, „Optimal collective decision making: consensus, accuracy and the effects of limited access to information", *Scientific Reports*, 10(1), 1-12, 2020.
4) **Anna Zafeiris,** Tamás Vicsek, "Group performance is maximized by hierarchical competence distribution", *Nature Communications*, 4, Article number: 2484, doi:10.1038/ncomms3484, 2013.
5) **Anna Zafeiris**, "Opinion polarization in human communities can emerge as a natural consequence of beliefs being interrelated", Entropy 24(9), 1320 (2022)

FULL PUBLICATION LIST:

Books:

- **Anna Zafeiris** and Tamás Vicsek: *Why we live in hierarchies: a quantitative treatise*, SpringerBriefs in Complexity, 2018

Book chapters:

- **A. Lázár,** Karl Pauwels, Marc Van Hulle, Tamas Roska, *Scene analysis of unstable video flows – using multiple retina channels and attentional methods*, in: "Integrated Circuits, Photodiodes and Organic Field Effect Transistors", R. McIntire and P. Donnell (Eds.), NovaScience (NY), USA, 2009
- **Anna Zafeiris** and Tamás Vicsek, *Advantages of hierarchical organization: from pigeon flocks to optimal network structures*, in "Research in the Decision Sciences for Global Business: Best Papers from the 2013 Annual Conference" Gyula Vastag (Ed), FT Press Operations Management, USA, 2015.

Articles:

- **A. K. Lázár**, R. Wagner, D. Bálya, T. Roska, "Functional representations of retina channels via the refineC retina simulator," *Cellular Neural Networks and their Applications. Proceedings of the 8th IEEE international workshop,* pp. 333-338, 2004, Budapest
- Bálya D., **Lázár A.**, "Retinal processing", *XI. MITT Kongresszus*, 2005, Pécs.
- Vidnyánszky Z., Kovács G., **Lázár A.**, "Active vision" , *XI. MITT Kongresszus*, 2005, Pécs.
- **A. Lázár**, A. Kocsor, "An application of ranking methods: retrieving the importance order of decision factors," *IEEE International Workshop on Soft Computing Applications SOFA 2005*, Szeged, Hungary – Arad, Romania.
- T. Roska, D. Bálya, **A. Lázár**, K. Karacs, R. Wágner, M. Szuhaj, "System aspects of a bionic eyeglass", *Proc. of International Symposium on Circuits and Systems ISCAS,* pp. 161-164, *2006*, Kos, Greece.
- **A. Lázár**, T. Roska, "Human Tested Saliency Map Generation in the Bionic Eyeglass Project", *Proceedings of The 10th IEEE International Workshop on Cellular Neural Networks and their Applications,* pp. 91-95, *2006*, Istanbul, Turkey.
- K. Karacs, **A. Lázár**, R. Wagner, D. Bálya, T. Roska, "Bionic Eyeglass: an Audio Guide for Visually Impaired," *Proceedings of the 1st Biomedical Circuits and Systems Conference,* pp. 190-193, *2006*, London, UK.
- K. Karacs, **A. Lázár**, R. Wagner, B. Balint, T. Roska, M. Szuhaj "Bionic Eyeglass: The first prototype A personal navigation device for visually impared – A review,"*1st International Symposium on Applied Sciences in Biomedical and Communication Technologies*, ISABEL 2008, art. no. 4712625
- **A. Lázár**, Z. Vidnyánszky, T. Roska, "Modeling stimulus-driven attentional selection in dynamic natural scenes," *International Journal of Circuit Theory and Applications*, 37(1), pp. 3-30, 2009
- **A. Lázár**, D. Abel, T. Vicsek, "Modularity Measure of Networks with Overlapping

Communities”*, EPL (Europhysics Letters)*, 90, pp. 18001, 2010

- **A. Lázár**, D. Abel, T. Vicsek, “Modularity Measure of Networks with Overlapping Modules”*, European Conference on Complex Systems,* 2010, Lisbon, Portugal (2nd prize of Best Paper Awards)
- T. Vicsek, **A. Zafiris**, “Collective Motion”, *Physics Reports*, 517(3-4), pp. 71-140, 2012.
- **Anna Zafeiris,** Tamás Vicsek, “Group performance is maximized by hierarchical competence distribution”, *Nature Communications*, 4, Article number: 2484, doi:10.1038/ncomms3484, 2013.
- **Anna Zafeiris**, Zsombor Komán, Enys Mones and Tamás Vicsek, “Phenomenological theory of collective decision-making”, *Physica A*, 479, pp. 287-298, 2017.
- Maryam Zamani, Feresteh Rabbani, Attila Horicsányi, **Anna Zafeiris** and Tamás Vicsek „Differences in structure and dynamics of networks retrieved from dark and public web forums” *Physica A: Statistical Mechanics and its Applications,* 525, 326-336, 2019.
- Evelin Berekméri, Imre Derényi ansd **Anna Zafeiris**, „Optimal structure of groups under exposure to fake news”, *Applied Network Science*, 4(1), 1-13, 2019.
- Evelin Berekméri and **Anna Zafeiris**, „Optimal collective decision making: consensus, accuracy and the effects of limited access to information”, *Scientific Reports*, 10(1), 1-12, 2020.
- **Anna Zafeiris**, “Opinion polarization in human communities can emerge as a natural consequence of beliefs being interrelated”, Entropy 24(9), 1320 (2022)