Anna Kinga Zafeiris, Ph.D.

Summary Profile

Experienced researcher with a strong interdisciplinary background in computational modeling, complex systems, and data-driven analysis of biological and social phenomena. Proven track record in academic research, EU-funded projects, and interdisciplinary collaborations in biology, archaeology, and computational social science. Adept in agent-based modeling, statistical physics, network analysis, and artificial intelligence. Passionate about applying rigorous scientific methods to real-world challenges in healthtech, behavioral analytics, smart systems, and decision-making under uncertainty.

Core Competencies

• Modeling of collective behavior in biological and social systems

• Network science, opinion dynamics, and belief system modeling

• Agent-based simulations and adaptive self-organization

• Outlier detection, anomaly modeling, and behavior prediction

• Modeling of protein mutation pathways using transformer-based LLMs (ESM-2)

• AI & machine learning techniques for group decision-making

• Scientific computing and data analysis in Python (NumPy, Pandas, matplotlib, SciPy, scikit-learn, seaborn, UMAP, pickle)

• Extensive prior experience in MATLAB for simulations and model development

• Skilled in algorithm development, optimization routines, and high-dimensional data processing

Professional Experience

Senior Research Fellow, Department of Biological Physics, Eötvös Loránd University (ELTE)
2009 – present

• Participated in EU and national research projects on collective motion, opinion dynamics, and decision-making in complex environments.

• Modeled biological systems ranging from immune cell behavior and bacterial swarming to the collective dynamics of human communities, using agent-based approaches.

• Worked on modeling protein mutation pathways using ESM-2 (a protein language model), for evolutionary analysis.

• Developed computational models for belief formation and social coordination, focusing on the mechanisms underlying opinion dynamics and consensus emergence in complex groups.

• Supervised PhD, MSc, and BSc students in topics ranging from infection models to AI in behavioral studies.

Education

Ph.D. in Information Technology, 2008
Péter Pázmány Catholic University, Faculty of Information Technology
Dissertation: Modeling Visual Attention
Supervisor: Prof. Tamás Roska | Consultant: Dr. Zoltán Vidnyánszky

M.Sc. in Computer Science, 2003
University of Szeged, Hungary (AI Orientation)

M.Sc. in Physics, 2002
University of Szeged, Hungary

Selected Projects & Collaborations

• H2020 RedAlert Project: Early warning system for online radicalization (2017–2020)

• Inflanet (EU): Inflammation modeling using collective behavior tools (2024–2025)

• Lendület Innovation Archaeology Group: Modeling social structure and communication in archaeological contexts (2022–)

• OTKA K128780: Optimal collective mechanisms in high-dimensional complex systems (2018–2024)

• Bolyai+ and Bolyai Fellowships: Research on information access and consensus mechanisms

Selected Publications

• Zafeiris & Vicsek (2018), *Why we live in hierarchies*, SpringerBriefs in Complexity (Book)

• Zafeiris (2022), *Opinion polarization in human communities*, Entropy 24(9), 1320

• Berekméri & Zafeiris (2020), *Optimal collective decision making*, Scientific Reports 10:16997

• Zafeiris & Vicsek (2013), *Group performance via hierarchical competence*, Nature Communications 4:2484

• Vicsek & Zafeiris (2012), *Collective Motion*, Physics Reports, 517(3-4)

Professional Profiles & Contact

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ResearchGate: https://www.researchgate.net/profile/Anna-Zafeiris

Location: Budapest, Hungary | Open to remote or hybrid opportunities