EMRE R. ALCA

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EXPERIENCE

Associate of Systems Biology, Harvard Medical School Boston, MA.
Supervisor: Prof. Jeremy Gunawardena *January 2024 - Present*

- Proved new theorems in graph theory that show thermodynamic equilibrium sets explicit limitations on the information processing capabilities of chemical reaction networks.
- Developed new methods for numerical calculation of the transient quantities of stochastic processes in python. Previous methods scaled exponentially with graph size, this new algorithm scales polynomially.
- Collaborated with researchers at Yale mapping the evolution of intracellular communication networks through evolutionary history, making use of various data visualization tools within matplotlib.
- Presented novel results to other scientists at Harvard Medical School with no physics background.
- Supervised undergraduate student projects with 100% of students making novel discoveries.

Visiting Research Student, California Institute of Technology Pasadena, CA.
Supervisor: Prof. Erik Winfree *May 2023 - August 2023*

- Performed novel research on relationships between neural computation (Hopfield networks) and highly multi-component liquid-liquid phase separation–like with water and oil–which make biodroplets.
- Developed numerical simulations of PDE's (Cahn-Hilliard) affording the simulation and training of neural networks and their analogy to liquid-liquid phase separation (python, Tensorflow).

Research Assistant, University of Toronto Toronto, On.
Supervisor: Prof. Alan Aspuru-Guzik *November 2020 - February 2022*

- Developed foundational software for an automated laboratory in materials science. This software integrated multiple proprietary robots into a single interoperable python package.
- Developed autonomous (closed-loop) experimental workflows using machine learning for experimental recommendations (Bayesian optimization across categorical variables, implemented using PyTorch) with data stored in SQL databases.
- Managed undergraduate students in research courses with 100% of students receiving an *A* grade.

PUBLICATIONS

Seifrid, M., Strieth-Kalthoff, F., Haddadnia, M., Wu, T. C., **Alca, E.**, Bodo, L., ... & Aspuru-Guzik, A. (2024). Chemspyd: an open-source python interface for Chemspeed robotic chemistry and materials platforms. Digital Discovery.

EDUCATION

University of Toronto *September 2019 - November 2023*
H.B.Sc. Physics Major & Cognitive Science Major with Distinction
Student Representative for the University College Curriculum Committee

TECHNICAL STRENGTHS

Math & Physics	Stochastic Processes, Thermodynamics, Graph Theory, Neural Networks, Dynamical Systems & Chaos
Programming Languages	Python, Java, JavaScript,
Software	NumPy, Matplotlib, SciPy, Git, Tensorflow, PyTorch, Excel
Design	LaTeX, Illustrator, Photoshop, Fusion360,