

# Hessameddin Akhlaghpour

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## Summary

16+ years of experience in computer science, neuroscience, and molecular biology. Highly skilled in engineering, software development, and scholarly research. Expert at algorithms and data structures with awards in international programming competitions. Significant contributions to experimental and theoretical neuroscience and biology.

## Education

**Princeton University**, PhD in **Neuroscience** (2011 - 2017)

**Sharif University of Technology**, BSc in **Computer Engineering** (2007-2011)

## Awards

2nd Place team in ACM ICPC Regional Contest, West Asia Site, (2009) ♦ 3rd Place team in ACM ICPC Regional Contest, West Asia Site, (2008) ♦ **Silver Medal**, International Olympiad in Informatics (IOI), Zagreb, Croatia (2007) ♦ **Bronze Medal**, International Olympiad in Informatics (IOI), Mérida, Mexico (2006)

## Research and Work Experience:

**Google** Senior Software Engineer (2025 - current)

**Role:** Improving the Timing of Ad Break Interruptions on Youtube using Generative AI and Other Algorithmic Methods

**The Rockefeller University** (2017-2025)

Research Associate (2021 - 2025) and Postdoctoral Fellow (2017 - 2021) in Laboratory of Integrative Brain Function

**Role:** Developed a new experimental system (involving imaging and stimulating neurons of fruit flies placed in a VR environment) to gain fundamental scientific insights about spatial computation and memories in the brain.

### Software Development Projects:

- Developed a software for real-time (30ms latency) video tracking of a spherical treadmill using advanced 3D modeling and optimization.
- Developed a general purpose graphics rendering codebase using ray-tracing.
- Developed a semi-automated ROI detection method, reducing manual imaging labor by 10x (adopted by labs at NYU and Rockefeller University).
- Developed an algorithm for automatic detection of egg-laying events in flies, reducing tracking labor by 10x.
- Developed an algorithm and a multi-threaded C++ implementation to detect non-linear rearrangements in long-read RNA sequencing data, handling large datasets (100s of GB).

## Independent Projects

- Developed a new machine learning method aimed at solving abstraction, reasoning, and intelligent problem solving, by combining aspects of probabilistic programming, markov models, search algorithms, and combinatory logic. Codebase supports multithreading (C++). Ideal for neuro-symbolic approaches.
- Proposed a Turing-equivalent model of biomolecular computation that requires only a handful of RNA cleavage/ligation rules. The resulting paper was called "**one of the most important biology papers of the year**"... "**the implications [of which] are profound.**" ([Prof Sam Gershman](#))
- Created a mathematical statistics framework for hypothesis-testing based on Bayes factors.
- Created an online scavenger-hunt with hundreds of teams participating over many years. (in Farsi, [persianpuzzles.com](http://persianpuzzles.com))

## Skills

**Programming:** C++, Python, R, Java, Rust, Javascript, Matlab, Haskell ♦ **Machine Learning:** Pytorch, Tensorflow, Keras, CUDA ♦ **Bioinformatics:** SAMtools, BLAST, SMRT analysis ♦ **Experimental Neuroscience:** 2P imaging, electrophysiology, optogenetics, Immunohistology, fly genetics, animal behavior

## Talks

- **Keynote Speaker** at **NeuroAI workshop**: Validating models: How would success in NeuroAI look like?, Tromsø-Trondheim, Norway, Sep 2024 [[t.ly/zKyfO](https://t.ly/zKyfO)] Talk Title: "Intracellular molecular computation is the missing ingredient"
- **Keynote Speaker** at Minimal Cognition: Brained or Brainless Biological Intelligence. Erice, Italy, June 2024 [[t.ly/4ROcp](https://t.ly/4ROcp)] Talk Title: "An emerging bridge between polynucleotides and intelligent computation in nature"
- **Keynote Speaker** at Luskin Endowment for Thought Leadership Symposium "Pushing the Boundaries: Neuroscience Cognition and Life", UCLA 2023 [[youtu.be/984vm12HUF0](https://youtu.be/984vm12HUF0)] Talk Title: "Surprising parallels between RNA biology and combinatorial logic"
- Speaker at Symposium on "RNA and memory: the second encounter", International Conference on Learning and Memory (LEARNMEM) 2023, Huntington Beach, CA [[t.ly/ogGGE](https://t.ly/ogGGE)]

## Publications

- **Hessameddin Akhlaghpour**, Jazz Weisman, Gaby Maimon, "Head-fixed flies express spatial preferences for rewarded locations in a path-constrained virtual environment" [in preparation].
- Vikram Vijayan, Fei Wang, Kaiyu Wang, Arun Chakravorty, Atsuko Adachi, **Hessameddin Akhlaghpour**, Barry J. Dickson, and Gaby Maimon. "A rise-to-threshold process for a relative-value decision." Nature(2023): 1-9.
- **Hessameddin Akhlaghpour**, "An RNA-based theory of natural universal computation." Journal of theoretical biology 537 (2022): 110984.
- Vikram Vijayan, Zikun Wang, Vikram Chandra, Arun Chakravorty, Rufe Li, Stephanie L. Sarbanes, **Hessameddin Akhlaghpour**, and Gaby Maimon. "An internal expectation guides Drosophila egg-laying decisions." Science advances 8.43 (2022): eabn3852.
- **Hessameddin Akhlaghpour**, Joost Wiskerke, Jung Yoon Choi, Joshua P Taliaferro, Jennifer Au, and Ilana B. Witten. "Dissociated sequential activity and stimulus encoding in the dorsomedial striatum during spatial working memory." eLife 5 (2016): e19507
- Burrows, Brittany E., Marc Zirnsak, **Hessameddin Akhlaghpour**, Megan Wang, and Tirin Moore. "Global Selection of Saccadic Target Features by Neurons in Area V4." The Journal of Neuroscience 34, no. 19 (2014): 6700-6706.
- **Hessameddin Akhlaghpour**, Mohammad Ghodsi, Nima Haghpahan, Vahab S. Mirrokni, Hamid Mahini, and Afshin Nikzad. "Optimal iterative pricing over social networks." In Internet and Network Economics, pp. 415-423. Springer Berlin Heidelberg, 2010.

## Fellowships

Kavli Institute for Neuroscience Postdoctoral Fellowship (2019) ♦ Harvey Karp Postdoctoral Fellowship (2017) ♦ National Science Foundation (NSF) Graduate Research Fellowship (2011)