Uri **Cohen**

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INTRODUCTION

ABOUT ME

I am an aspiring scientist in the field of computational neuroscience, interested in developing theories on the dynamics of learning and memory in the brain, with possible applications to machine learning. I have strong mathematical background and hands-on experience with advanced methods from statistical physics and computer science, applied to analyze problems and experimental results from neuroscience and machine learning.

PHD THESIS

Title: *Analysis of invariant object representations through linear classification of manifolds*.
Advisor: Prof. Haim Sompolinsky
In my PhD thesis, I used statistical physics methods to analyze neuronal responses to objects and measure the properties important for linear object classification. Those are geometric properties of object manifolds which I use to shed light on object representations in artificial deep networks and in the brain and how it changes across levels of processing.

RESEARCH INTERESTS

- Population coding and manifold representation of sensory information.
- Biological learning and its relation to memory encoding and usage.
- Neural implementation of world-models and its application to reinforcement learning.
- Biological alternatives to error backpropagation, implementation of gradient descent.
- Predictive coding and its relation to learning and memory.

EDUCATION

2011 – 2021 PhD at the Hebrew University of Jerusalem

PhD program in *Brain Sciences: Computation and Information Processing*, at the Edmond & Lily Safra Center for Brain Sciences.

2002 – 2005 BSc at the Hebrew University of Jerusalem

Graduated *Summa Cum Laude* a double-major degree in Mathematics and Cognitive sciences.

EXPERIENCE

2007 – 2010 Senior Team Lead and Senior Software Developer at Microsoft R&D

Leading a team of 4 software developers and handling all professional aspects: mentoring and guiding professional growth, project management and technical leadership.

2005 – 2007 Senior Software Developer at Kidaro (an Israeli start-up)

The leading technical person from project inception and building the company's work processes, through design and implementation of a complete product, to being acquired by Microsoft.

AWARDS

- 2011 Recipient of the Hebrew University Rector's award (the highest academic award).
- 2005 Graduated *Summa Cum Laude* (average grade 97.2) a BSc at the Hebrew University.
- 2004-5 *Amirim Nature* excellence program for Hebrew University students.
- 2004 Recipient of the Hebrew University Rector's award.
- 2003 Recipient of the Hebrew University Rector's award.
- 1995 *Gur Arye prize* for high-school graduation projects for my work on *Statistical analysis and game theory of the mastermind game*.

ACTIVITIES

- Teaching experience: served 7 years as teaching-assistant
  - *Statistical Physics of learning and Memory* (introductory seminar for physics students): mentoring students in preparing their talks and giving several lectures.
  - *Statistical mechanics of spin glasses and neural networks*: giving several lectures.
  - *Topics in the Theory of Deep Learning*: a weekly lecture and preparing exercises.
- Co-organizer of the *Deep Learning Journal Club*, at the Jerusalem deep-learning center.
- Reviewer for *Journal of Machine Learning Research* (*JMLR)*.
- Industry-level software developer skills and experience in using deep learning tools.

PUBLICATIONS

- Froudarakis, E., **Cohen, U.**, Diamantaki, M., Walker, E. Y., Reimer, J., Berens, P., Sompolinsky, H. & Tolias, A. S. (2020). *Object manifold geometry across the mouse cortical visual hierarchy*. bioRxiv.
- **Cohen, U.**, Chung, S., Lee, D. D., & Sompolinsky, H. (2020). *Separability and geometry of object manifolds in deep neural networks*. Nature communications, 11(1), 1-13.
- **Cohen, U.**, Chung, S., Lee, D. D., Freiwald, W., Tsao, D. & Sompolinsky, H. (2019). *Geometric properties of face representations in the macaque face patch system and deep neural networks*. COSYNE 2019, poster presentation.
- Chung, S., **Cohen, U.**, Sompolinsky, H., & Lee, D. D. (2018). *Learning data manifolds with a cutting plane method*. Neural computation, 30(10), 2593-2615.
- **Cohen, U.**, & Sompolinsky, H. (2014). *Computational benefits of sensory expectation cancellation*. ISFN 2014, poster presentation.
- Mattioni, M., **Cohen, U.**, & Le Novère, N. (2012). *Neuronvisio: a graphical user interface with 3d capabilities for neuron*. Frontiers in neuroinformatics, 6, 20.

In preparation:
- **Cohen, U.** & Sompolinsky, H. (2021). *Single-trial classification error of neural manifolds*.
- **Cohen, U.** & Sompolinsky, H. (2021). *Soft-margin classification of object manifolds*.

REFERENCES

- **Prof. Haim Sompolinsky**: Center for Brain Science, *Harvard*; Edmond and Lily Safra Center for Brain Sciences, *The Hebrew University of Jerusalem*. haim@fiz.huji.ac.il
- **Prof. Daniel D. Lee**: Tisch University Professor of Electrical and Computer Engineering, *Cornell Tech*; Executive Vice President, *Samsung Research* ddl46@cornell.edu
- **Dr. Jonathan Kadmon**: Swartz Foundation Fellow at the Applied Physics department, Institute for Theoretical Physics, Stanford. kadmonj@stanford.edu

SKILLS

- Have a wide-field perspective on computational neuroscience, machine learning.
- Fluent with advanced mean-field methods from statistical physics (replica and cavity methods, message passing, kernel methods, KKT)
- Superb software engineering skills (fluent coding at C/C++/Python/MATLAB)
- Passion for teaching, extensive experience.

- Experience in numerical methods, deep learning tools and large-scale simulations.
- Experience in neural data analysis, analyzed several data-sets (e.g. Freiwald & Tsao 2010, Stringer, Pachitariu et al. 2019).
- A team player and good at collaboration.
- Thorough, down-to-details approach.
- Welcomes feedback and criticism.