

# Babak Rahmani

Microsoft Research  
☎ +41 78 752 9254  
✉ rahmani.b91@gmail.com  
🐙 Github   in LinkedIn   🌐 Webpage

## Jobs

July 2022–Now **Postdoc Intern Researcher**, *Microsoft Research*, Cambridge, United Kingdom.  
Research on applications of Machine Learning for next generation cloud storage.

## Research Interests

System neuroscience  
Channel encoding and decoding  
Inverse problems

Learning of physical systems with neural networks  
Bayesian learning  
Brain imaging

## Education

- 2018– March 2022 **PhD, Electrical Engineering**, *EPFL*, Lausanne, Switzerland.  
▪ Inverse Problems in Computational Imaging, Applied Machine Learning and Deep Neural Networks.  
▪ Credits obtained: **26**.
- 2014–2016: **Master of Electrical Engineering**, *Sharif University of Technology*, Tehran, Iran.  
▪ M.Sc. in Engineering with a focus on Microwave and Optical Communications.  
▪ GPA: **17.77/20.00 (3.79/4)**.
- 2010–2014: **Bachelor of Electrical Engineering**, *Tehran University*, Tehran, Iran.  
▪ B.Sc. in Engineering with a focus on Telecommunications.  
▪ GPA: **18.03/20.00 (3.88/4)**.  
▪ Thesis: Device to Device Communication.

## Selected Ph.D. Courses

**Statistical physics for optimization and learning** .....5.75/6.00.....Instructor: Profs. Florent Krzakala and Lenka Zdeborová.

**Adaptation and Learning**.....Passed.....Instructor: Prof. Ali H. Sayed.

**Advance Topics in Machine Learning** .....5.25/6.00.....Instructor: Prof. Pascal Frossard, Cevher Volkan, and others.

**Machine Learning for Engineers**.....5.75/6.00.....Instructor: Prof. François Fleuret and others.

**Theory and Methods for Reinforcement Learning**.....5.50/6.00.....Instructor: Prof. Cevher Volkan.

**Deep Learning For Natural Language Processing**.....5.25/6.00.....Instructor: Dr. James Henderson.  
**Neural Computation**.....Audited.....Instructor: Prof. Bruno Olshausen.

## Publications\* & Patents

\* Please visit my [Google Scholar](#) for an updated version of the publications as well as conference proceedings.

- 2021 **B. Rahmani**, D. Psaltis, C. Moser, Natural image synthesis for the retina with variational information bottleneck representation, Thirty-Sixth Conference on Neural Information Processing Systems (**NeurIPS**), 2022.
- 2021 **B. Rahmani**, D. Psaltis, C. Moser, Variational framework for partially-measured physical system control: examples of vision neuroscience and optical random media, Workshop on Machine Learning and the Physical Sciences, **NeurIPS 2021**, Vancouver, 2021.
- 2021 **B. Rahmani**, D. Loterie, E. Kakkava, N. Borhani, U. Teğın, D. Psaltis, C. Moser, Partially-measured physical system characterization with neural networks, **Invited talk**, SPIE San Diego, 2021.
- 2021 **B. Rahmani**, D. Loterie, E. Kakkava, N. Borhani, U. Teğın, D. Psaltis, C. Moser, Multimode fiber projector with neural networks, **Conference presentation**, SPIE San Francisco, 2021.
- 2020 **B. Rahmani**, D. Loterie, E. Kakkava, N. Borhani, U. Teğın, D. Psaltis, C. Moser, Actor neural networks for the robust control of partially measured nonlinear systems showcased for image propagation through diffuse media, **Nature Machine Intelligence**, 2(7), 2020.
- 2020 **B. Rahmani**, D. Loterie, E. Kakkava, N. Borhani, U. Teğın, D. Psaltis, C. Moser, Multimode fiber projection with machine learning, **Conference presentation**, OSA Vancouver, 2020.
- 2020 U. Teğın, **B. Rahmani**, E. Kakkava, N. Borhani, D. Psaltis, C. Moser, Controlling spatiotemporal nonlinearities in multimode fibers with deep neural networks, **APL Photonics**, 5(3), 2020.
- 2020 E. Kakkava, **B. Rahmani**, N. Borhani, U. Teğın, C. Moser, D. Psaltis, Deep Learning-Based Image Classification through a Multimode Fiber in the Presence of Wavelength Drift, **Applied Sciences**, 10(11), 2020.
- 2020 O. Hemmatyar, M. Abbasi, **B. Rahmani**, M. Memarian, K. Mehrany, Wide-band/angle blazed dual mode metallic groove gratings, **IEEE Transactions on Antennas and Propagation**, 2020.
- 2019 E. Kakkava, **B. Rahmani**, N. Borhani, U. Teğın, D. Loterie, G. Konstantinou, C. Moser, D. Psaltis, Imaging through multimode fibers using deep learning: The effects of intensity versus holographic recording of the speckle pattern, **Optical Fiber Technology**, 52, 2019.
- 2019 U. Teğın, **B. Rahmani**, E. Kakkava, D. Psaltis, C. Moser, Spatiotemporal self-similar fiber laser, **Optica**, 6(11), 2019.
- 2019 M. Tavakol, **B. Rahmani**, A. Khavasi, Terahertz quarter wave-plate metasurface polarizer based on arrays of graphene ribbons, **IEEE Photonics Technology Letters**, 31(12), 2019.
- 2018 **Rahmani B.**, Loterie D., Konstantinou G., Psaltis D., Moser C., Multimode optical fiber transmission with a deep learning network, **Nature Light: Science & Applications**, 7(69), 2018.
- 2018 M. Tavakol, **B. Rahmani**, A. Khavasi, Tunable polarization converter based on one-dimensional graphene metasurfaces, **JOSA B**, 35(10), 2018.
- 2018 **Rahmani B**, K. Mehrany., Modeling of Periodic Array of Cut-through Slits with Sinusoidal Surface Conductivity at the Interfaces of an Anisotropic Medium, **IEEE Transactions on Antennas and Propagation**, 66(10), 2018.
- 2017 O. Hemmatyar, **B. Rahmani**, A. Bagheri, A. Khavasi, Phase Resonance Tuning and Multi-Band Absorption Via Graphene-Covered Compound Metallic Gratings, **IEEE Journal of Quantum Electronics**, 53(5), 2017.
- 2017 A. Bagheri, **B. Rahmani**, A. Khavasi, Effect of Graphene on the Absorption and Extraordinary Transmission of light in One Dimensional Metallic Gratings, **IEEE Journal of Quantum Electronics**, 53(3), 2017.
- 2016 **Rahmani B**, A. Bagheri., A. Khavasi., K. Mehrany, Effective Medium Theory for Graphene-covered Metallic Gratings, **Journal of Optics**, 18(10), 2016.

Patents

- 2019 C. Moser, **B. Rahmani**, D. Psaltis, System and method for projecting images through scattering media, Under evaluation.

## Research Experience

EPFL, Lausanne, Switzerland

- February 2021 ***Blind Deconvolution.***  
– Ongoing As the research project of the Statistical physics for optimization and learning course, I am working on the blind deconvolution problem which involves recovering the signal under Gaussian noisy channel in the Bayesian setting using probabilistic graphical models, replica method and approximate message passing algorithms.
- August 2020 ***RetinaAI.***  
– Ongoing I am involved with a neuroscience-related project in which the goal is to use data-driven methods based on machine learning to control the spikings of Retina Ganglion Cells (RGCs) via intelligent stimulation of the photo-receptors so as to produce the same spiking of RGCs evoked by stimulation via natural images but with certain constraints. During the course of the project, I have been exposed to various concepts in machine learning such as Representation Learning and Variation Autoencoders. This ongoing project also required me to build the hardware (optical setup and stimulation/recording apparatus) needed for collecting data.
- January 2019 ***Neural networks for control: nonlinear time-varying complex media control.***  
– August 2021 Developing semi-supervised neural-network based controllers for online control of time-varying media of optical fibers. During the course of this project, I was exposed to several concepts in Deep Learning ranging from Auto-encoders, adversarial training and untrained neural networks to dealing with the nuisances of big data from real-world systems. **Results published in Nature Machine Intelligence.**
- January 2018 ***Neural networks for inference: computational image reconstruction.***  
– August 2018 Developing state-of-the-art deep neural networks for image reconstruction in the multimodal complex media of optical fibers. During the course of this project, I was exposed to concepts such as super-resolution imaging and denoising with neural networks. **Results published in Nature Light science and applications.**

## Honors & Awards

- 2017 **Cornell University Fellowships Award** for Ph.D. program in Electrical Engineering, USA.
- 2017 **Graduate Assistantship Award** for Ph.D. program in Electrical Engineering at Georgia Institute of Technology, USA.
- 2014 **Scholarship** for M.Sc. in the Communications major at University of Tehran, Tehran, Iran. Entrance examination waived as an award for being among the **Top-10% students (out of 120+)**.
- 2010 Ranked **187th among approximately 150,000 participants** in the nationwide university entrance examination in Mathematics and Physics fields for B.Sc. degree.
- 2007 Admitted in the first stage of nationwide Mathematics Olympiad for High school students in Iran.

## Academic Achievements & Recognitions

- 2020 **News coverage** of First author paper “Actor neural networks for the robust control of partially measured nonlinear systems showcased for image propagation through diffuse media.
- 2020 First author paper “Multimode optical fiber transmission with a deep learning network” was recognized as one of the **top downloaded papers in top-tier Nature journal Light: Science & Applications in 2019.**
- 2019 **First prize** for EPFL’s Electrical Engineering department (EDEE) end-of-the-year poster competition.
- 2019 **Invited talk** on the use of **Deep Learning for solving inverse problem and computational imaging** at a major Photonics conference venue, SPIE Photonics West 2019, San Francisco, California, USA.

2018 **Second prize** for EPFL's Electrical Engineering department (EDEE) end-of-the-year poster competition.

## Leadership & Voluntary Experiences

2020-2022 PhD Student Representative of the EPFL's Electrical Engineering Students.  
Reviewer of various journals/venues such as **Nature**, **NeurIPS**, IEEE, APL, OSA.

## Familiarity with Computer Systems and CAD Software

Machine Learning Tensorflow (pro), Pytorch , scikit-learn

Programming Languages Python, C, C++, MATLAB, Assembly, Verilog and FPGA programming

Windows Software Microsoft Office Package, AutoCAD

Operating System Microsoft Windows, Linux

## Teaching Assistantship\*

Spring, 2018 : **Teaching assistant of Math and Physics**, EPFL.

Spring, 2015 : **Teaching assistant of Engineering Mathematics**, Sharif University of Technology.

fall, 2015 : **Teaching assistant of Engineering Mathematics**, Sharif University of Technology.

\* Held tutorial session, assisted students with laboratory experiments, marked assignments and exams.

## Referees

### **Prof. Christophe Moser**

*Associate Professor, Department of  
Electrical Engineering*  
EPFL, Lausanne, Switzerland  
✉ christophe.moser@epfl.ch

### **Prof. Demetri Psaltis**

*Full Professor, Department of  
Electrical Engineering*  
EPFL, Lausanne, Switzerland  
✉ demetri.psaltis@epfl.ch