

Matthew Ricci

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Current position

Zuckerman Postdoctoral Fellow
School of Computer Science and Engineering
The Hebrew University of Jerusalem
Supervisor: Mor Nitzan

Areas of interest

Machine learning for dynamical systems
Network dynamics, oscillators
Representation of syntactic structures in neural networks

Education

- | | |
|------|---|
| 2020 | <i>Ph.D. in Computational Neuroscience</i>
Brown University
Specialization: Neural dynamics, computer vision
Advisor: Thomas Serre
Dissertation: "Towards Systematic Vision: Limitations of Convolutional Neural Networks and Future Directions in Oscillatory Coding" |
| 2012 | <i>MA/BA in Mathematics</i>
University of Pennsylvania
Specialization: Signal processing
Advisor: Philip Gressman |
| 2012 | <i>BA in Musicology</i>
University of Pennsylvania |

Specialization: American modernism, modernist performance practice
Advisors: Arman Schwartz, Emily Dolan

Appointments held

Jul. 2020 - Jul. 2021	<i>Postdoctoral Associate</i> Data Science Initiative Brown University Supervisor: Stuart Geman
Aug. 2018 - Dec. 2018	<i>Visiting Doctoral Researcher</i> Département d'informatique École normale supérieure (Ulm) Principal Investigator: Stéphane Mallat
2013-2014	<i>Research Assistant</i> Rutgers University Center for Cognitive Science Principal Investigator: Randy Gallistel

Grants, honors & awards

Jul. 1, 2021- Jul. 1, 2023	Zuckerman Postdoctoral Fellowship Hebrew University of Jerusalem Principal Investigator: Mor Nitzan
Sep. 1, 2017- July 1, 2019	NSF Graduate Research Fellowship Award no. 1644760 Principal Investigator: Thomas Serre
2018	Brown University Graduate School Travel Grant
2017	CCN Travel Grant
Jan. 1, 2015- Jan. 1, 2017	NIH Vision Training Grant Award no. 5T32EY018080-08 Principal Investigator: Michael Paradiso
2012	Admitted to Phi Beta Kappa
2011	Submatriculated into graduate program, Department of Mathematics, University of Pennsylvania

Peer-Reviewed Publications

PUBLISHED

Chalvidal, M., Ricci, M.G., Serre, T., VanRullen, R. (2021) Go With the Flow: Adaptive Control for Neural ODEs. 8th International Conference on Learning Representations, ICLR 2021 - Conference Track Proceedings

Alamia, A., Luo, C., Ricci, M.G., Kim, J., Serre, T. and VanRullen, R. (2020) Differential involvement of EEG oscillatory components in identity vs. spatial-relation reasoning tasks. *eNeuro*, 8 (1) ENEURO.0267-20.2020

Ricci, M., Cadène, R., & Serre, T. (2020). Same-different conceptualization : A machine vision perspective. *Current Opinion in Behavioral Sciences*, 37, 47–55. <https://doi.org/10.1016/j.cobeha.2020.08.008>

Ricci, M., and Serre, T. (2020). Hierarchical Models of the Visual System. *Encyclopedia of Computational Neuroscience*, 1–14. https://doi.org/10.1007/978-1-4614-7320-6_345 – 2

Kim, J., Ricci, M.G., and Serre, T. (2018) Not-so-CLEVR: Learning same-different relations strains feedforward neural networks, *Journal of the Royal Society Interface*, 8(4), <https://doi.org/10.1038/35073582>

Ricci, M.G., Kim, J. and Serre, T. (2018) Same-Different Problems Strain Convolutional Neural Networks, *Proceedings of the 40th Annual Conference of the Cognitive Science Society*.

Ricci, M.G., and Gallistel, R. (2017). Accurate Step-Hold Tracking of Smoothly Varying Periodic and Aperiodic Probability. *Atten. Percept. Psychophys.*, 1–32. <https://doi.org/10.3758/s13414-017-1310-0>

SUBMITTED

Ricci, M.G., Jung, M., Zhang, Y., Chalvidal, M., Soni, A., Serre, T. KuraNet: Systems of Coupled Oscillators that Learn to Synchronize

Gallistel, C.R., Johansson, F., Jirenhed, D.-A., Rasmussen, A., Ricci, M.G., Hesslow, G. Quantitative Properties of the Learned Pause in the Spontaneous Firing of the Cerebellar Purkinje Cell

Technical Reports and Preprints

Bohic, M., Pattison, L.A., Jhumka, Z.A., Rossi, H., Thackray, J.K., Ricci, M.G., Foster, W., Arnold, J., Mossazghi, N., Yttri, E.A., Tischfield, M.A., Smith, E. S-J, Abdus-Saboor, I., Abaira, V. Behavioral and nociceptor

states of inflammatory pain across timescales in 2D and 3D. *bioRxiv* 2019.12.16.877829

Ricci, M.G., Jung, M., Zhang, Y., Chalvidal, M., Soni, A., Serre, T. KuraNet: Systems of Coupled Oscillators that Learn to Synchronize. *arXiv:2105.02838 [nlin.AO]*

Chalvidal, M., Ricci, M.G., Serre, T., VanRullen, R. Go With the Flow: Adaptive Control for Neural ODEs. *arXiv:2006.09545 [cs.LG]*

Alamia, A., Luo, C., Ricci, M.G., Kim, J., Serre, T., VanRullen, R. Differential involvement of EEG oscillatory components in sameness vs. spatial-relation visual reasoning tasks *bioRxiv* 2019.12.16.877829

Gallistel, C. R., Johansson, F., Jirenhed, D.-A., Rasmussen, A., Ricci, M., and Hesslow, G. (2020). Quantitative Properties of the Creation and Activation of a Cell-Intrinsic Engram. *BioRxiv*, 2020.03.17.995258.

Ricci, M.G., Kim, J and Johansson, F. A Passage-of-time Model of the Cerebellar Purkinje Cell, 2016, *arXiv:1605.03060v2 [q-bio.NC]*

Works in Progress

Ricci, M.G., Thackray, J., Theis, T., Abaira, V. Automated modeling of higher-order behavioral sequences in mouse models of spinal injury (In preparation)

Ricci, M.G., Linsley, D., Govindarajan, L., Serre, T., Generalized Adversariality: Parameterized data set optimization to evaluate the limits of neural models and mechanisms (In preparation)

Articles Reviewed

Sims, C. R. (2016). Rate-distortion theory and human perception. *Cognition*, 152, 181–198. <https://doi.org/10.1016/j.cognition.2016.03.020>

Conferences, Talks and Workshops

AS CONFERENCE PRESENTER

July 2021

Theis, T., Thackray, J.K., Ricci, M.G., Abaira, V. “A machine vision approach for automated locomotor recovery at millisecond timescales”. 38th Annual National Neurotrauma Symposium, Virtual. July 11-14, 2021.

June 2020

Ricci, M.G., “N’Sync: Learning to Synchronize in Complex Networks” Brown University Uncoference, Virtual. June 29-30, 2020.

- Feb. 2020 Ricci, M.G., Zhang, Y., Soni, A., Jung, M., Serre, T. “Kura-Net: Exploring systems of coupled oscillators using deep learning” Poster, COSYNE 2020. Denver, USA. February 27-March 2, 2020.
- Feb. 2019 Ricci, M.G., Windolf, C., Serre, T. “A Formal Model of Neural Synchrony for Unsupervised Image Grouping”. Poster, COSYNE 2019. Lisbon, Portugal. February 28-March 3, 2019.
- July 2018 “Not-So-CLEVR: Same-different problems strain feedforward neural networks”. 40th Annual Meeting of the Cognitive Science Society”, July 25, 2018. Monona Terrace Community and Convention Center, Madison, WI.
- Sep. 2017 “A Dichotomy of Visual Relations, Or the Limits of Convolutional Neural Networks”, Conference on Cognitive Computational Neuroscience (CCN), September 6-8, 2017. Columbia University, NYC.
- Aug. 2017 “Deep RL Bootcamp”, August 26-27, 2017, University of California, Berkeley. (Accepted)
- June 2015 “Cell autonomous metabotropic signaling”, Kavli Futures Symposium – The Synapse Hypothesis: To be or not to be. June 25-26, 2015. University of California, Santa Barbara

AS GUEST SPEAKER

- June 2020 “The Kuramoto Model Meets Machine Learning: Some Early Results in the Statistical Modeling of Oscillatory Systems”. University of Ghent. PI: Tom Verguts. June 19, 2020
- Nov. 2019 “The Serre Lab: From machine learning to biology and back again”, Information Theory (APMA 1710). Instructor: Govind Menon. November 11, 2019.
- Oct. 2019 “Coupled Oscillators for Data Science: A Research Program”, Serre Lab-ANITI Joint Meeting, PIs: Thomas Serre, Rufin VanRullen. October 24, 2019.
- Sep. 2019 “Review: Coupled Oscillators for Perceptual Grouping”, Carney Institute for Brain Science. September 5, 2019.
- April 2019 “Systems of coupled neural oscillators: Results and applications based on Slotine, Izhikevich, Kuramoto”, Carney Institute for Brain Science. April

30, 2019.

- Aug. 2019 “Kosterlitz Machines”, Carney Institute for Brain Science. August 7, 2019.
- Oct. 2018 “Get Rhythm: Object Multiplexing in Phase Neural Networks”. Centre de Recherche Cerveau et Cognition, Toulouse, France. October 2., 2018
- March 2018 “Reinforcement Learning 101”, Computational Cognitive Science (CLPS 1291). Instructor: Thomas Serre. March 22, 2018.
- Dec. 2017 “Visual Relations and Convolutional Networks”, Perception & Action Seminar, Brown University, Department of Cognitive, Linguistic and Psychological Sciences. December 7, 2017
- Oct. 2015 “Contemporary Problems in Vision”, Brown University, Department of Cognitive, Linguistic and Psychological Sciences. October 9, 2015.
- June 2015 “Contemporary Problems in Vision”, UCL Gatsby Computational Neuroscience Unit. June 26, 2015.
- June 2015 “Challenges to Hebbianism: A Case from Cerebellar Learning”, UCL Gatsby Computational Neuroscience Unit, June 25, 2015.
- June 2015 “Challenges to Hebbianism: A Case from Cerebellar Learning”, University of Geneva. June 3, 2015.
- June 2015 “Challenges to Hebbianism: A Case from Cerebellar Learning”, Neurospin. June 5, 2015.
- March 2014 “Non-stationary Bernoulli Processes: Ideal Observers’ Predictions and Surprisals”, Rutgers University Center for Cognitive Science. March 28, 2014.

AS ORGANIZER

- April 2018 “Beyond Deep Learning Workshop: Session 2”, Brown University, April 6, 2018
Speakers: David Heeger (NYU), Dima Amso (Brown University), Tom Griffiths (UC Berkeley)
- Jan. 2018 “Beyond Deep Learning Workshop: Session 1”, Brown University, January 18-19, 2018
Speakers: Matthias Bethge (Universität Tübingen), Randy Gallistel (Rutgers University), Gary Marcus (NYU), Samuel Gershman (Harvard)

Teaching

BROWN UNIVERSITY

2019-present

Mentor

Visiting undergraduate researcher, Yuwei Zhang

Nankai University

Project: An end-to-end differentiable clustering algorithm using the Kuramoto Model

2019

Teaching Assistant

Human Cognition (CLPS 0200)

Instructor: Katheryn Spoehr

2018

Teaching Assistant

Deep Learning in Brains, Minds and Machines (CLPS 1950)

Instructor: Thomas Serre

2017

Teaching Assistant

Introduction to Programming for Mind, Brain and Behavior (CLPS 1292)

Instructor: Thomas Serre

2016-2018

Mentor

Masters student, Charles Windolf

Department of Applied Mathematics, Brown University

Project: Angular Gibbs random fields for image processing

UNIVERSITY OF PENNSYLVANIA

2012-2013

Tutor

Multivariable calculus, linear algebra (MATH 103, MATH 104)

Department of Mathematics

PRINCETON REVIEW

2013

SAT Instructor

2013

MCAT Instructor

References

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Matthew Harrison

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