

Matthew Ricci

Data Science Initiative
Brown University
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Current position

Postdoctoral Associate

Data Science Initiative
Brown University
Advisor: Stuart Geman

Areas of interest

Optimal control of coupled oscillators
Perceptual organization and functional connectivity
The representation of syntactic structures in neural networks

Education

2020

Ph.D. in Cognitive Science

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

MA/BA in Mathematics

University of Pennsylvania
Specialization: Signal processing
Advisor: Philip Gressman

2012

BA in Musicology

University of Pennsylvania
Specialization: American modernism and performance practice
Advisors: Arman Schwartz, Emily Dolan

Appointments held

Aug. 2018 -
Dec. 2018

Visiting Doctoral Researcher

Département d'informatique
École normale supérieure, Paris
Principal Investigator: Stéphane Mallat

2013-2014

Research Assistant

Rutgers University Center for Cognitive Science
Principal Investigator: Randy Gallistel

Grants, honors & awards

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

2012

Phi Beta Kappa Outstanding Thesis Award, University of Pennsylvania

2012

Rose Award for Outstanding Thesis, University of Pennsylvania

2011

Submatriculated into graduate program, Department of Mathematics, University of Pennsylvania

Peer-Reviewed Publications

PUBLISHED

Ricci, M., and Serre, T. (In press). Hierarchical Models of the Visual System. In: D. Jaeger and R. Jung (Eds.), The Encyclopedia of Computational Neuroscience. New York, NY: Springer.

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., Cadène, R., Serre, T. “Same-Different Conceptualization: A Machine Vision Perspective”

Chalvidal, M., Ricci, M.G., Serre, T., VanRullen, R. “Neural Optimal Control for Representation Learning”

Alamia, A., Luo, C., Ricci, M.G., Kim, J., Serre, T. and VanRullen, R. “Differential involvement of EEG oscillatory components in identity vs. spatial-relation reasoning tasks,”

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”

Ricci, M.G., Kim, J and Johansson, F. “A Passage-of-time Model of the Cerebellar Purkinje Cell”

Technical Reports and Preprints

Chalvidal, M., Ricci, M.G., Serre, T., VanRullen, R. “Neural Optimal Control for Representation Learning” *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*

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

Ricci, M.G., Zhang, Y., Serre, T., “Optimizing an oscillator glass” (In preparation)

Ricci, M.G., Zhang, Y., Soni, A., Chalvidal, M., Jung, M., Serre, T. “An end-to-end differentiable clustering algorithm using the Kuramoto Model” (In preparation)

Ricci, M.G., Windolf, C., Zhang, Y., Harrison, M., Serre, T., “Energy-based models for unsupervised learning using phase coding” (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

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| June 2020 | Ricci, M.G., “N’Sync: Learning to Synchronize in Complex Networks” Brown Unconference. 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

	<p>“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</p>
Nov. 2019	<p>“The Serre Lab: From machine learning to biology and back again”, Information Theory (APMA 1710). Instructor: Govind Menon. November 11, 2019.</p>
Oct. 2019	<p>“Coupled Oscillators for Data Science: A Research Program”, Serre Lab-ANITI Joint Meeting, PIs: Thomas Serre, Rufin VanRullen. October 24, 2019.</p>
Sep. 2019	<p>“Review: Coupled Oscillators for Perceptual Grouping”, Carney Institute for Brain Science. September 5, 2019.</p>
April 2019	<p>“Systems of coupled neural oscillators: Results and applications based on Slotine, Izhikevich, Kuramoto”, Carney Institute for Brain Science. April 30, 2019.</p>
Aug. 2019	<p>“Kosterlitz Machines”, Carney Institute for Brain Science. August 7, 2019.</p>
Oct. 2018	<p>“Get Rhythm: Object Multiplexing in Phase Neural Networks”. Centre de Recherche Cerveau et Cognition, Toulouse, France. October 2., 2018</p>
March 2018	<p>“Reinforcement Learning 101”, Computational Cognitive Science (CLPS 1291). Instructor: Thomas Serre. March 22, 2018.</p>
Dec. 2017	<p>“Visual Relations and Convolutional Networks”, Perception & Action Seminar, Brown University, Department of Cognitive, Linguistic and Psychological Sciences. December 7, 2017</p>
Oct. 2015	<p>“Contemporary Problems in Vision”, Brown University, Department of Cognitive, Linguistic and Psychological Sciences. October 9, 2015.</p>
June 2015	<p>“Contemporary Problems in Vision”, UCL Gatsby Computational Neuroscience Unit. June 26, 2015.</p>
June 2015	<p>“Challenges to Hebbianism: A Case from Cerebellar Learning”, UCL Gatsby Computational Neuroscience Unit, June 25, 2015.</p>
June 2015	<p>“Challenges to Hebbianism: A Case from Cerebellar Learning”, University of Geneva. June 3, 2015.</p>
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

SAT Instructor₁₃

MCAT Instructor₁₃

References

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Matthew Harrison

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