RU-YUAN ZHANG(张泗源)

Curriculum Vitae (Updated 09/25/2019)

Contact

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Research interests

Using state-of-the-art computational (e.g., Bayesian modeling, deep neural network) and experimental tools (fMRI and behavioral testing) to understand brain processing in normal subjects and psychiatric populations (schizophrenia, autism, etc)

Highlights

- 13 years of training and experience of cognitive neuroscience and functional neuroimaging.
- Highly interdisciplinary research background, bridging human cognition, brain science, magnetic resonance imaging techniques, machine learning, and neurological and psychiatric diseases.
- Experience in data acquisition and analyses in ultra-high field 7 Tesla whole-body scanner, and 10.5 Tesla scanner, which presents the world's highest magnetic strength for human brain imaging so far.
- Familiar with mainstream brain imaging software and proficient in large-scale clinical neuroimaging data analyses.
- Using state-of-the-art computational and neuroimaging methods to bridge human and machine intelligence.
- Applying machine learning methods for diagnosis and prediction of neurological and psychiatric diseases.
- Profound experience in experimental design, data collection, analyses in human behavioral experiments.
- Publications in top journals and conferences in brain sciences, neuroimaging, and computational neuroscience.

Education

2010-2016	University of Rochester, USA	**Ph.D**., Brain & Cognitive Sciences (BCS)

| 2010 - 2014 | University of Rochester, USA | **M.A**., Brain & Cognitive Sciences |
| 2006 - 2010 | Peking University, China | **B.A**., Psychology and Computer Science |

Appointment

| 2016-present | **Postdoctoral Research Associate (Advisors Dr. Kendrick Kay, Dr. Ben Hayden, Dr. Geoff Ghose)** Center for Magnetic Resonance Research, Department of Radiology, University of Minnesota at Twin Cities, MN. USA. |
| 2010 - 2016 | **PhD student (Advisors Dr. Duje Tadin, Dr. Daphne Bavelier)** Department of Brain & Cognitive Sciences and Center of Visual Science, University of Rochester, NY. USA. |

Awards and honors

2013	Student Travel Award for 12th Vision Sciences Society Annual Meeting
2010	Graduate Fellowship from Department of Brain & Cognitive Sciences, University of Rochester
2009	Undergraduate Research Fellowship from Institute of Psychology, Chinese Academy of Science
2009	Class Scholarship in Department of Psychology, Peking University
2008	Undergraduate Research Fellowship from Peking University
2008	GuangHua Undergraduate Scholarship, Peking University
2007	Class Scholarship in Department of Psychology, Peking University

Research Method and Skills

Research skills: visual psychophysics, structural and functional magnetic resonance neuroimaging, Bayesian modeling, deep learning, clinical populations
Research/Programming software: Matlab, Python, Psychotoolbox, FreeSurfer, FSL, AFNI, BrainVoyager, SPSS.

Research Support

- High-resolution imaging of spatial representation in human visual cortex. ***National Institute of Health of USA. R21 grant,*** $275,000 for two years (in revision and resubmission)*.*
  <u>Role: Key researcher</u>
  This project aims to investigate detailed spatial representation across layers of human visual cortex. By using the ultra-high-field 7 Tesla magnetic scanner can we obtain high-resolution (i.e., 0.8mm isotropic) functional images of brain activity. The high-resolution images can be further divided into different layers across gray matter based cortical depth. Furthermore, we build voxelwise spatial encoding models on the activity of each voxel and visualize as model parameters as spatial preference maps. I am responsible for drafting the grant application, experimental design, data acquisition, data modeling, and paper writing.

Adhoc Reviewer

Frontiers in System Neuroscience, Current Biology, Journal of Neuroscience, Neuroimage, Journal of Vision, Plos One, IEEE Access

Publications

(*co-first author, #corresponding/senior author)

Journal papers

1. **Zhang, R*.**, Kwon, O. S*. & Tadin, D. (2013) Illusory motion of stationary stimuli in visual periphery: evidence for a strong centrifugal prior. ***Journal of Neuroscience,*** 33, 4415-4423.

2. V. R. Bejjanki*., **Zhang, R*.**, Li. R., Lu. Z., Pouget, A., Green, CS, & Bavelier, D. (2014) Action video game facilitates development of better perceptual template. ***Proceedings of the National Academy of Sciences***, 111(47), 16961-16966.

3. Cavanaugh M.R*., **Zhang, R*.**, Melnick M.D., Das. A., Roberts,M., Tadin,D., Carrasco,M., $ Huxlin,. K. R. (2015) Visual recovery in cortical blindness is limited by high internal noise. ***Journal of Vision,*** *15*(10), 9-9.

4. Nyquist J.B., Lappin J. S., **Zhang, R.,** & Tadin, D. (2016) Perceptual Training yields rapid improvements in visually impaired youth. ***Scientific Reports,*** *6***,** 37431.

5. **Zhang, R.,** Engel, S., & Kay, K. (2017) Binocular Rivalry: a window into cortical competition and suppression. ***Journal of Indian Institute of Sciences,*** 1-9. *97*:477

6. Park, Wj, Schauder, K.B., **Zhang，R.**, Bennetto, L., &Tadin D. (2017) High internal noise and poor external noise filtering characterize perception in autism specturm disorder. ***Scientific***

Reports, 7, 17584.

7. **Zhang , R#.,** &Tadin, D. (2019) Disentangling locus of perceptual learning in the visual hierarchy of motion processing. ***Scientific Reports***, *9*, 1557.

8. Kay K., Jamison K., Vizioli L., **Zhang R**., Margalit E, Ugurbil K. (2019) A critical assessment of data quality and venous effects in ultra-high-resolution fMRI. ***Neuroimage,*** *189*, 847-869.

9. Fang, W., **Zhang, R**., Zhao, Y., Wang, L., Zhou, Y. (2019) Attenuation of pain perception induced by the rubber hand illusion. ***Frontiers in Neuroscience***, *13*, 261.

10. Zhang, C., Qiao, K., Wang, L., Tong, L., Hu, G., **Zhang, R-Y#**., Yan, B#. A visual encoding model based on deep neural networks and transfer learning for brain activity measured by functional magnetic resonance imaging. ***Journal of Neuroscience Methods,*** 108318.

Conference papers

11. **Zhang, R-Y#**., Kay, K. (2017) Attentional field model does not explain task-dependent spatial representation in human ventral temporal cortex. ***Proceedings of Conference on Cognitive Computational Neuroscience.*** [PDF](https://www2.securecms.com/CCNeuro/docs-0/592873f768ed3fff4b8a2562.pdf) (https://www2.securecms.com/CCNeuro/docs-0/592873f768ed3fff4b8a2562.pdf)

12. **Zhang, R#**., & Kay, K. (2018) The impact of noise correlation on multivariate pattern classification in fMRI. ***Proceedings of Conference on Cognitive Computational Neuroscience***. [PDF](https://ccneuro.org/2018/proceedings/1186.pdf) (https://ccneuro.org/2018/proceedings/1186.pdf)

13. Zhang, C., Duan, X., **Zhang, R#**., Tong, L#. (2018) Representation of adversarial images in deep neural networks and the human brain. ***Proceedings of Conference on Cognitive Computational Neuroscience***. [PDF](https://ccneuro.org/2018/proceedings/1066.pdf) (https://ccneuro.org/2018/proceedings/1066.pdf)

14. Zhao, Y., Ran, X., Zhang, L., **Zhang, R#**., Ku, Y#. (2018) Modeling visual working memory in Schizophrenia. ***Proceedings of Conference on Cognitive Computational Neuroscience***. [PDF](https://ccneuro.org/2018/proceedings/1076.pdf) (https://ccneuro.org/2018/proceedings/1076.pdf)

15. **Zhang, R-Y#**., Wei, X-X., Kay, K. (2019) Trial-by-Trial voxelwise noise correlations improve population coding of orientation in human V1. ***Proceedings of Conference on Cognitive Computational Neuroscience***. [PDF]

In review/revision

16. **Zhang, R-Y#.,** Kay, K. Flexible attentional modulation in human ventral temporal cortex. (in review). [bioRxiv]

(https://www.biorxiv.org/content/10.1101/279935v2)

17. Zhao, Y., Ran, X., Zhang, L., **Zhang, R-Y**[#]., Ku, Y[#]., Atypically larger variability of resource allocation accounts for visual working memory deficits in schizophrenia. (in review). bioRxiv (https://www.biorxiv.org/content/10.1101/424523v1)

18. Zhang, C., Duan, X., **Zhang, R-Y**[#]., Tong, L[#]. Dissociable neural representations of adversarially perturbed images in deep neural networks and the human brain. (in revision). arXiv (https://arxiv.org/abs/1812.09431)

19. Zhao, Y*., Ran, X., Zhang, L., **Zhang, R-Y**[#]., Ku, Y[#]. Unexpected higher resilience to distraction during visual working memory in schizophrenia. (in review). bioRxiv (https://www.biorxiv.org/content/10.1101/567859v1?rss=1)

20. **Zhang, R-Y**[#]., Wei, XX., Kay, K., Understanding multivariate brain activity: evaluating the effect of voxelwise noise correlations in functional magnetic resonance imaging. (in review). bioRxiv (https://www.biorxiv.org/content/10.1101/592618v1)

21. Liu, S., **Zhang, R-Y**., Kishimoto, T. Analysis and Prospect of Clinical Psychology Based on Topic Models: Hot Research Topics and Scientific trends in the Latest Decades (in review).

22. Endogenous hormone levels are associated with alterations of functional connectivity in patients with prolactinomas. Yao, S., Lin, P., Cao, C., Juvekar, P., **Zhang, R-Y.**, Vera, M., Golby, A.J., Xu, G., Tie, Y., Song, J. (in review) bioRxiv (https://www.biorxiv.org/content/10.1101/746297v1)

23. Attentional bias towards negative faces in social anxiety with and without comorbid depression. Kishimoto, K., Wen, X., Li, M., **Zhang, R-Y.**, Yao, N., Huang, Y., Qian, M. (in revision)

24. Ultra-high-resolution fMRI reveals differential representation of categories and domains across human ventral temporal cortex. Margalit E., Jamison K.W., Weiner K.S., Vizioli L., **Zhang R-Y.**, Kay K., Grill-Spector K. (in review)

25. A temporal decomposition method for removing venous effects from task-based fMRI. Kay, K., Jamison, K.W., **Zhang, R-Y.**, Ugurbil, K. (in preparation)

26. **Zhang, R-Y.,** Lu, Z., Martin, B., Jaeggi, Susanne., Green C.S., & Bavelier, D. 'Learning to learn' as a mechanism for generalization of learning: Lessons from action video games. (in preparation).

27. Reorganization of visual processing following long-term adaptation to severe optical aberrations. Barbot, A, Park, W-J, **Zhang, R-Y**, Huxlin, K.R., Tadin, D., Yoon,G. (in preparation)

Conference presentations

2019

- **Zhang, R-Y**[#], Wei, X-X, Kay, K. (2019) Trial-by-Trial voxelwise noise correlations may enhance the fidelity of population codes in functional magnetic resonance imaging. (Society of Neuroscience Annual Meeting 2019)
- **Zhang, R-Y**[#], Wei, X-X, Kay, K. (2019) Trial-by-Trial voxelwise noise correlations improve population coding of orientation in human V1. (Annual Conference on Cognitive Computational Neuroscience 2019)
- Zhao, Y., Ran, X., Zhang, L., **Zhang, R**[#]., Ku, Y[#]. (2019) Abnormally enhanced resilience to distraction in visual working memory in schizophrenia. (2019 Annual Meeting of Society of Biological Psychiatry)
- Zhao, Y., Ran, X., Zhang, L., **Zhang, R**[#]., Ku, Y[#]. (2019) Atypically larger variability of resource allocation accounts for visual working memory deficits in schizophrenia. (2019 Annual Meeting of Society of Biological Psychiatry)
- Margalit, E., Jamison, K., Weiner, K., Vizioli, L., **Zhang, R.**, Kay, K., and Grill-Spector, K. (2019) Differential representation of object category information follows anatomical differences in ventral temporal cortex. (Vision Sciences Society Annual Meeting 2019)
- Ge, Y., **Zhang, R.**, Qian, C., Chen, C., Mesik, J., Engle, S., He S. (2019) Underlying mechanisms of temporal dynamics in bistable perception. (Vision Sciences Society Annual Meeting 2019).

2018

- **Zhang, R**., & Kay, K. (2018) The impact of noise correlation on multivariate pattern classification in fMRI. (Annual Conference on Cognitive Computational Neuroscience 2018).
- Zhang, C., Duan, X., **Zhang, R**[#]., Tong, L[#]. (2018) Representation of adversarial images in deep neural networks and the human brain. (Annual Conference on Cognitive Computational Neuroscience 2018).
- Zhao, Y., Ran, X., Zhang, L., **Zhang, R**[#]., Ku, Y[#]. (2018) Modeling visual working memory in Schizophrenia. (Annual Conference on Cognitive Computational Neuroscience 2017).
- Zhang, C., Duan, X., Tong L., **Zhang R** (2018). Representation of adversarial images in deep neural networks and the human brain (Asia-Pacific Conference on Vision 2018).
- Racey, C., **Zhang, R.**, Kay, K., Schloss K B. (2018). The neural substrate for semantic associations underlies color preference judgments (Vision Sciences Society Annual Meeting 2018)
- Kay, K., Jamison, K., Vizioli, L., **Zhang, R.**, Margalit, E. (2018). Ultra-high-resolution fMRI: a critical assessment. (Organization of Human Brain Mapping Annual Meeting 2018)

2017

- Jamison K, Vizioli L, **Zhang R**, Tao J, Winawer J, Kay K. (2017). A tool for automatic

identification of cerebral sinuses and corresponding artifacts in fMRI (Vision Sciences Society Annual Meeting 2017).

- **Zhang R**, Kay K. (2017). Attentional field model does not explain task-dependent spatial representation in human ventral temporal cortex (Annual Conference on Cognitive Computational Neuroscience 2017).

2016

- **Zhang, R.,** Tadin, D. (2016). The complete transfer of learning between component and pattern motion: psychophysical evidence for training-induced plasticity in MT. (Vision Sciences Society Annual Meeting 2016)

2015

- **Zhang, R**., Kwon, O.S., & Tadin, D. (2015). Specificity and transfer of perceptual learning of motion. (Vision Sciences Society Annual Meeting 2015)

- Kwon, O.S., **Zhang, R**., & Tadin, D. (2015). Temporal evolution of motion direction judgments. (Vision Sciences Society Annual Meeting 2015)

2014

- **Zhang, R**., Jaeggi, S.M., Buschkuehl, M.,& Bavelier, D. (2014). Working memory and skill learning as a function of video game experience. (Association for Psychological Science Convention 2014)

- Cavanaugh, M.R., Melnick, T.M., **Zhang, R**., Roberts, M., Das, A., Tadin, D., Carrasco, M., & Huxlin, K.R., (2014). Residual inefficiencies of recovered vision in cortically blind fields – insights from the equivalent noise analysis. (Vision Sciences Society Annual Meeting 2014)

- Cavanaugh, M.R., Das, A., Melnick, T.M., **Zhang, R**., Tadin, D., Carrasco, M., & Huxlin, K.R., (2014). Engineering the Eye IV Restoring Vision 29th Symposium. Center of Visual Science, University of Rochester. (29th Center of Visual Science Symposium)

2013

- **Zhang, R**., Green, S., Lu, Z., & Bavelier, D. (2013). Speeding up Learning: Action Video Games and Perceptual Learning. Journal of Vision, 13(9), 1089-1089. (Vision Sciences Society Annual Meeting 2013)

2012

- **Zhang*, R**., Kwon*, O.S., & Tadin, D. (2012) Illusory motion of stationary stimuli in visual periphery: evidence for a strong centrifugal prior. (**=equally contributing authors). Computational Foundations of Perception & Action 28th Symposium. Center of Visual Science, University of Rochester. (28th Center of Visual Science Symposium)

- **Zhang, R**., Bejjanki, V. R., Lu, Z., Green, S., Pouget, A., & Bavelier, D. (2012). Action Video Games playing improves learning to learn in perceptual learning.

Journal of Vision, 12(9), 1130-1130. (Vision Sciences Society Annual Meeting 2012)

2011

- **Zhang, R.**, Li, R., Lu, Z., & Bavelier, D. (2011). Perceptual templates improvement through action video game playing and comparison to perceptual learning. i-Perception, 2(4), 269-269. (Asia-Pacific Conference of Vision 2011)
- **Zhang, R**., & Tadin, D. (2011). Illusory centrifugal motion direction observed in brief stimuli: psychophysics and energy model. i-Perception, 2(4), 389-389. (**Abstract** at Asia-Pacific Conference of Vision 2011)
- **Zhang, R**., & Tadin, D. (2011). Illusory centrifugal motion direction observed in stationary stimuli: Dependency on duration and eccentricity. Journal of Vision, 11(11), 769-769. (Vision Sciences Society Annual Meeting 2011)

2009

- **Zhang, R**. & Fang, F. (2009). Top-down influence on invisible face to gain access to awareness during continuous flash suppression (poster presentation). Workshop on Cognitive Science: From Cellular Mechanisms to Computational Theories (CS-2009), May, 2009, Beijing, China. (Beijing International Cognitive Science Workshop)

Computational Methods Courses

Peking University, Computer Science
Introduction to Computer Science
Data Structure and Algorithm

Tsinghua University, Computer Science

| Computational Neuroscience | Instructor: Dr. Zhaoping Li | Audit |

University of Rochester, Brain & Cognitive Sciences (BCS)

Computational Neuroscience	Instructor: Dr. Alex Pouget	Grade: A
Computational Methods in Cognitive Science	Instructor: Dr. Robert Jacobs	Grade: A
Computational Neuroscience (Spring 2015)	Instructor: Dr. Ralf Haefner	Audit

University of Minnesota,Psychology

| Deep Learning and Human Vision | Instructor:Dr. Dan Kersten |

Online Courses

| Computational Neuroscience (Coursera) | Instructor: Dr. Rajesh P.N. Rao and Dr. Adrienne Fairhall |

Machine Learning (Coursera)	Instructor: Dr. Andrew Ng
Statistical Analysis of fMRI Data (Coursera)	Instructor: Dr. Martin Lindquist
Introduction to Statistics: Descriptive, Probability and Inference (Edx)	Instructor: Dr. Ani Adhikari

<u>Ongoing and planned courses</u>

Probabilistic Graphical Models (Coursera)	Instructor: Dr. Daphne Koller
Neural Networks for Machine Learning (Coursera)	Instructor: Dr. Geoffery Hinton
An Introduction to Interactive Programming in Python (Coursera)	

Talks

2018   Institute of Science and Technology for Brain-Inspired intelligence, Fudan University

2017   Perception Lunch Talk, Department of Psychology, University of Minnesota, Twin Cities.

2016   Perception Lunch Talk, Department of Psychology, University of Minnesota, Twin Cities.

2016   Talk, the School of Psychology, South China Normal University, Guangzhou, China

2016   Talk, Neuro-Cognitive Research Center, South University of Science and Technology of China

2016   Invited Talk, Department of Psychology, Zhejiang University, Hangzhou, China.

2016   Invited Talk, Department of Psychology, the School of Education, Suchow University, Suchow, China.

2016   Talk, Institute of Cognitive Neuroscience, the School of Psychology and Cognitive Science, East China Normal University, Shanghai, China.

2015   Talk, National Institute of Health, Laboratory of Dr. Biyu He

2015   Talk, University of California, Berkeley, Laboratory of Dr. Jack Gallant

2015   Talk, Center of Visual Science, University of Rochester

2014   Graduate student lunch talk, Department of Brain& Cognitive Sciences, University of Rochester

2013   Graduate student lunch talk, Department of Brain& Cognitive Sciences, University of Rochester

Teaching

University of Rochester

2015   Instructor for graduate course *Special Topic in Vision* (BCS)

2014   Teaching assistant for undergraduate course *Foundation of Cognitive Sciences* (BCS111)

2013   Teaching assistant for undergraduate course *Foundation of Cognitive Sciences* (BCS111)

2011   Teaching assistant for undergraduate course *Perception & Action* (BCS151)

Peking University

2009   Teaching assistant for undergraduate course *Central Neuro System*

2010   Teaching assistant for undergraduate course *Cognitive Neuroscience*

Professional Membership (Past and Present)

Vision Sciences Society (2010-present)
Association for Psychological Science (2014-2015)
Cognitive computational neuroscience (2017-present)

Other research-related activities

2015   Participant, University of Rochester Deep Learning Reading Group

2014-2016   Organizer and participant, Center for Visual Science journal club

2015   Student host for Prof. Christopher Baker, Boynton Colloquium Series Lecture, Center of Visual Science

2014   Student host for Prof. Sheng He, Boynton Colloquium Series Lecture,

Center of Visual Science

2012   Student host for Prof. Takeo Watanabe, Boynton Colloquium Series
            Lecture, Center of Visual Science