

Shaiyan Keshvari

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Education

- Massachusetts Institute of Technology, PhD in Brain and Cognitive Sciences** 2011 – 2016
- Thesis: At the interface of materials and objects in peripheral vision (Advisor: Ruth Rosenholtz)
 - NSF Graduate Research Fellow, NSF GROW Fellowship, Henry E. Singleton Fellow
- Rice University, B.S. in Physics, B.A. in Cognitive Sciences** 2006 - 2010
- Cum Laude, Cognitive Sciences graduation honors
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Experience

Perceptual Science Group, MIT - PhD student (2011-2016), postdoc (2016 – 2017) 2011 - current

- Advisor: Ruth Rosenholtz
 - Conducted psychophysical experiments and modeling to demonstrate that an image statistics-based model predicts performance on tasks in peripheral vision
 - Tested whether convolutional neural nets trained for object recognition generalize to predict human perceptual grouping behavior
 - Found that humans perceive the detailed “gist” of a web page in one eye fixation
- Advisor: Edward Adelson
 - Helped prototype GelSight touch sensor (gelsight.com) for detecting lumps under skin
 - Created a novel dataset and developed a Fourier spectrum model for successful detection
- TA for Computer Vision, Intro Neuroscience, Intro Neural Computation, Perception

Perceptual Intelligence Labs, TU Delft – Visiting student

Summer 2015 / Winter 2016

- Advisor: Maarten Wijnntjes
 - Independently conceived of and wrote NSF proposal to fund participation in this project
 - Designed and carried out eye tracking experiments on material perception, and found that a high-dimensional texture model predicts peripheral material classification ability
 - Wrote code for the Eye Tribe and EyeLink eye trackers in Psychtoolbox

Laboratory for Computational Audition, MIT – Graduate student

2012 - 2015

- Advisor: Josh McDermott
 - Designed and ran auditory experiments on sound texture perception and found that salient outliers bias estimation of average pitch and comodulation level

Theoretical Neuroscience Lab, Baylor College of Medicine – Research assistant

2010 - 2011

- Advisor: Weiji Ma (now at NYU)
 - Mathematically derived and empirically tested models of visual short term memory
 - Found that the memory precision fluctuates randomly, but observers are aware of and nearly optimally account for the fluctuations
 - Used parallel computing and Monte Carlo simulations to generate predictions

Pomerantz Perception Lab, Rice University – Research assistant

2006 - 2010

- Advisor: James Pomerantz
 - Designed experiments in E-Prime and custom analyses on perceptual grouping in vision

Physics Department, Rice University – Research assistant

2007 - 2010

- Compact Muon Solenoid (CMS) experiment at CERN
 - Commissioned electronics hardware inside the detector
- Muon to electron (Mu2e) experiment at Fermilab
 - Wrote a C++ a package to stimulate a particle detector’s geometry in a larger framework

Skills

- Programming: MATLAB with Psychtoolbox and eye tracking, C++, Linux
 - Modeling: image statistics, Bayesian modeling, convolutional neural nets
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Research Interests

- **Material perception:** Humans can rapidly identify materials, such as a hardwood floor or a smooth leather jacket, even within a complex scene. Texture models suggest algorithms for efficiently rendering materials in immersive displays, especially when the materials are viewed peripherally. I plan to apply vision research towards developing such algorithms.
 - **Vision for HCI and VR/AR:** Understanding the nature of peripheral vision has implications for what properties a successful gaze-contingent VR/AR display should have and how to successfully overlay images on the real world in AR. I am interested to study peripheral vision in immersive environments, and apply the findings to new algorithms for rendering.
 - **Modeling peripheral vision:** The vast majority of what we see is falls in the visual periphery. It plays a necessary role in many visual tasks, such as object and scene recognition, navigation, and planning of saccades. My current interest is to develop better models of peripheral vision to help inform tools for evaluating designs and displays.
 - **Bayesian models of VSTM:** We are only able to recall and use a subset of the information that we perceive. For example, when detecting changes in displays, some differences go unnoticed, while others pop out. The nature of such limitations may have implications for how to optimally display information in interfaces to minimize interference and memory strain.
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Publications

- Jahanian, A., Keshvari, S., Vishwanathan, S. V. N., & Allebach, J. P. (2017). Colors — Messengers of Concepts: Visual Design Mining for Learning Color Semantics. *ACM ToCHI*, 24(1), 1–39.
 - Keshvari, S., Rosenholtz, R. (2016) Pooling of continuous features provides a unifying account of crowding. *Journal of Vision*, 2016; 16(3):39.
 - Keshvari, S.*, Van den Berg, R.*, & Ma, W. J. (2013). No Evidence for an Item Limit in Change Detection. *PLoS Computational Biology*, 9(2), e1002927. (*contributed equally)
 - Keshvari, S., Van den Berg, R., & Ma, W. J. (2012). Probabilistic Computation in Human Perception under Variability in Encoding Precision. *PLoS ONE*, 7(6).
 - Natu, V. S., Jiang, F., Narvekar, A., Keshvari, S., Blanz, V., & O'Toole, A. J. (2010). Dissociable neural patterns of facial identity across changes in viewpoint. *Journal of Cognitive Neuroscience*, 22(7), 1570–82.
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Work in Progress

- Jahanian, A., Keshvari, S., Rosenholtz, R. (*in rev.*) Web Page Gist: Effective Design Communicates in a Single Eye Fixation
 - Rosenholtz, R., Yu, D., Keshvari, S. (*in prep.*) Challenges to pooling models of crowding: Implications for visual mechanisms
 - Keshvari, S., Wijntjes, M. (*in prep.*) The interface of materials and objects in vision
 - Keshvari, S., Rosenholtz, R. (*in prep.*) Evidence for Configural Superiority Effects in Convolutional Neural Networks
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Selected Presentations

- Keshvari, S., Rosenholtz, R. Evidence for Configural Superiority Effects in Convolutional Neural Networks. Poster presented at 2017 Vision Sciences Society (VSS) conference.
 - Keshvari, S., McDermott, J. Segregation and Integration in Sound Textures. Poster presented at 2015 Association for Research in Otolaryngology (ARO) conference.
 - Keshvari, S., Rosenholtz, R. Effects of grouping on crowding with informative flankers. Talk presented at 2014 Vision Sciences Society (VSS) conference.
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Community Involvement

- Graduate Resident Tutor (residential associate) at MIT's Random Hall (2012 - 2016)
 - o Interviewed by and chosen for position by undergraduates
 - o Responsible for promoting the well-being of between 25 and 35 residents
- Thirsty Ear Pub at MIT (2012 – present)
 - o Bartender (2012 - present) and student group president (2013 - 2014)
 - o Applied for university-wide grants and formally advocated for the pub to administration