Ruoyang (Jessica) Hu

781-354-8219 | ruoyanghu7@gmail.com | www.linkedin.com/in/ruoyang-hu/ | ruoyanghu.github.io/ | Google Scholar

RESEARCH INTEREST

I am interested in how humans perceive and interact with the world. My research focuses on visual memory and attention, using experimental design, computational modeling, and data-driven analysis. I am especially interested in understanding cognitive limitations and their underlying causes through methods such as eye tracking, EEG, and behavioral experiments, with the goal of generating interpretable insights and real-world applications.

EDUCATION

University of Rochester **Rochester, NY**
Joint Ph.D. in Brain and Cognitive Sciences & Computer Science *Sep. 2019 – Aug. 2025*
- **Advisor:** Robert A. Jacobs
- **Thesis:** The Role of Higher-Level Information in Visual Working Memory and Attention

Rutgers University **New Brunswick, NJ**
B.S. in Computer Science & B.A. in Cognitive Science , Honors Tracks in Both Majors *Sep. 2015 – May 2019*
- Cumulative GPA: 3.776/4.0

LABORATORY EXPERIENCE

Computational Cognition & Perception Lab at University of Rochester **Rochester, NY**
Graduate Researcher, supervised by Prof. Robert Jacobs *Sep. 2019 – Aug. 2025*

Investigating the Role of Category and Semantics in Human Visual Memory
- Designed online interactive experiments and developed computational models to study human behavior
- Hosted web-based behavioral experiments (HTML, CSS, JavaScript) on AWS EC2, collecting over 30,000 trials of data within two weeks via Amazon Mechanical Turk
- Conducted statistical tests, including t-tests and mixed-effects logistic regression to identify significant factors influencing task performance; visualized results using Matplotlib and Seaborn
- Utilized Bayesian generative simulation to compare with human data and extend understanding of human performance
- Reported and published findings in the peer-reviewed journals *Cognition (2021)* and *Cognitive Science (2024)*

Modeling Visual Attention with Context-Modulated CNNs
- Invented a lightweight and interpretable deep learning model inspired by human visual attention, and demonstrated its flexibility across related visual tasks
- Designed a dual-network architecture in Python using PyTorch CUDA, combining a CNN for visual input with a fully connected network that encodes task context and dynamically modulates attention
- Trained the model to handle multi-object classification tasks by integrating context-aware gating, achieving a 260% accuracy improvement on a custom dataset adapted from Multi-MNIST
- Visualized attention maps to demonstrate interpretable model behavior aligned with human-like spatial and feature attention patterns

Computational Vision & Psychophysics Lab at Rutgers University **New Brunswick, NJ**
Research Assistant, supervised by Prof. Melchi M. Michel *Jan. 2017 – May 2019*
- Studied how the visual system processes color hue differences and integrates information across saccades in a visual discrimination task
- Designed and programmed 2IFC psychophysics experiments in MATLAB to test perceptual thresholds for hue discrimination using HSL color space; fit data with psychometric models to estimate detection boundaries
- Conducted eye-tracking visual search experiments to examine how participants use transsaccadic memory to integrate and weight visual information across saccades
- Preprocessed and analyzed behavioral and eye-tracking data using Fourier analysis, Bayesian modeling, and statistical methods in R

Laboratory of Vision Research at Rutgers University **New Brunswick, NJ**
Research Assistant, Supervised by Prof. Thomas Papathomas *Jul. 2018 – May 2019*
- Built reverse perspective stimuli (e.g., the hollow-mask illusion) using 3D modeling software Blender to investigate top-down influences on depth perception
- Transitioned experimental methods from physical setups to immersive VR environments using Unity and the Oculus Rift, enabling flexible manipulation of visual stimuli
- Conducted behavioral experiments with participants viewing either real or virtual stimuli; measured and recorded illusion reversal times to assess perceptual switching dynamics

SELECTED PROJECTS

Formal and Computational Semantics Lab at University of Rochester **Rochester, NY**
Team member, supervised by Prof. Aaron White *Jan. 2022 – May. 2022*
Modeling Verb Semantics in Natural Language Inference (NLI)

- Collected and pre-processed a novel dataset of over 3,000 natural language inferences from 40 human participants to study how verb semantics (e.g., try, manage, fail) affect inference
- Fine-tuned RoBERTa and LSTM models in PyTorch to predict human inference labels
- Standardized model outputs across datasets using isotonic regression to support joint training

Department of Computer Science at University of Rochester **Rochester, NY**
Team member, supervised by Prof. Chenliang Xu *2022*
Brain-inspired Memory Mechanisms for Continual Learning

- Collaborated with Biomedical Engineering scientists to design a continual learning model using Hebbian/anti-Hebbian learning and generative replay
- Achieved 93.5% accuracy on class-incremental classification, matching state-of-the-art performance with fewer parameters
- Built and evaluated the model in PyTorch, with sequential task experiments and visualizations of model behavior
- Applied neuroscience-inspired learning rules to improve interpretability and reduce catastrophic forgetting

TEACHING EXPERIENCE

Teaching Assistant, Cognition, University of Rochester **2023**

- Held office hours, review sessions, and updated study guides to support student learning
- Graded homework assignments and exams; provided individual assistance with course material

Teaching Assistant, Computer Models of Perception & Cognition, University of Rochester **2020 – 2021**

- Collaborated with the professor to design exams and evaluate student work
- Delivered a guest lecture on **sampling approaches to posterior inference**

Mentor, Computer Science Programming, Rutgers University Learning Center **2018 – 2019**

- Helped students with their course projects in data structures and algorithms
- Reviewed student code and gave lectures on key concepts; led one-on-one or group discussion and review sessions

PUBLICATIONS

- **Hu, Ruoyang**, and Robert A. Jacobs. *A Neural Network Model of Spatial and Feature-Based Attention.* ArXiv Preprint 2405.12345 (2025)
- **Hu, Ruoyang**, and Robert A. Jacobs. Does Stimulus Category Coherence Influence Visual Working Memory? A Rational Analysis. Cognitive Science (2024)
- **Hu, Ruoyang**, and Robert A. Jacobs. Semantic influence on visual working memory of object identity and location. Cognition (2021)

PRESENTATIONS & TALKS

Fourth-Year Graduate Student Talk, Department of Brain and Cognitive Sciences, University of Rochester 2023
"Top-Down Attention in Image Captioning and Semantic Segmentation", CS Area Exam Oral Presentation, Department of Computer Science, University of Rochester 2023
"Representing Visual Memory with Semantic Information", Machine Vision Seminar, University of Rochester 2023
Third-Year Graduate Student Talk, Department of Brain and Cognitive Sciences, University of Rochester 2022
"Veridicality, Negation-Raising, and Fine-Grained Inference", NSF NRT-DESE Award Showcase 2020

FELLOWSHIPS & AWARDS

Robert L. and Mary L. Sproull Fellowship 2019 – 2021
National Science Foundation Research Traineeship Data-Enabled Science and Engineering NRT-DESE award 2019 – 2020
Honor Student, School of Arts and Sciences, Rutgers University 2019
SAS Excellence Award, School of Arts and Sciences, Rutgers University 2016

SKILLS

- **Programming & Tools:** Python, MATLAB, R, PsychoPy, C/C++, JavaScript, Git, Jupyter, Linux, Bash, AWS (EC2), SQL
- **Data Science & Statistics:** ETL Pipelines, Data Cleaning, Feature Engineering, A/B Testing, Bayesian Analysis, Causal Inference, Experimental Design, Data Visualization (Matplotlib, Seaborn)
- **Machine Learning & Modeling:** Deep Neural Networks, Generative Models (GAN, VAE), Logistic Regression, Tree-Based Models, XGBoost