

# Gabriel Sarch

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## Current Research

### **Self-supervision, active interaction, and commonsense reasoning in embodied agents**

- Developing embodied artificial agents that can perceive, interact with, and manipulate the environment to perform commonsense reasoning and instruction following tasks (e.g. cleaning up a room)
- Improving perception (e.g. object detection) through active learning, interaction, and self-supervised label generation
- Using non-parametric memories and templates to enable few-shot embodied instruction following from demonstrations or successful episodes.

### **State-of-the-art computer vision as a model of the primate visual system**

- How does the brain represent 3D scene and object geometry? Examining dorsal and ventral neural predictivity of deep learning models that incorporate 3D scene geometry information.
- What role does self-supervision play in primate visual learning? Examining neural predictivity of deep learning networks with differing self-supervised training objectives.

## Education

**Carnegie Mellon University**, Pittsburgh, PA, USA  
Neuroscience Institute & Machine Learning Department  
2020 - (expected graduation date: 2025)

Ph.D. Student, Neural Computation

- Advisors: Prof. Katerina Fragkiadaki and Prof. Michael Tarr
- Masters in Machine Learning expected 2023

**University of Rochester**, Rochester, NY, USA  
Department of Biomedical Engineering  
2016-2020

B.S., Biomedical engineering, *magna cum laude*  
GPA: 3.95/4.00

## Skills

Computer Languages and Other Tools: Python, Matlab, Unix shell/bash, Git, common cluster computing tools, HTML/CSS

ML/AI Tools & Simulation Environments: Pytorch, TensorFlow/Keras, Tensorboard, PyCortex, Ai2thor, Habitat, Carla

General laboratory methods: contrastive learning, self-supervised learning, cluster analysis, linear & integer programming, convex optimization, search, probabilistic inference, statistical machine learning, density estimation, learning theory, signal processing, electrophysiology

## Experience

**Carnegie Mellon University**, Computer Vision Laboratory, Pittsburgh, PA, USA

PIs: Prof. Katerina Fragkiadaki and Prof. Michael Tarr

*PhD Student Researcher* *August 2020-present*

See Current Research above

**Active Vision Laboratory**, University of Rochester, Rochester, NY, USA

PI: Prof. Jude Mitchell

*Research Assistant* *August 2018 – August 2020*

- Studied cortical laminar differences in pre-saccadic attention
- Assisted with primate electrophysiology recordings and analysis

**Computational Neurobiology Laboratory**, National Institutes of Health, Bethesda, MD, USA

PI: Dr. Jeffrey Smith

*Internship Program* *May 2018 – August 2018*

## Publications

**Sarch, G.**, Tung, HW., Wang, A., Prince, J., Fragkiadaki, K., Tarr, M. (in prep). Self-supervised 3D view prediction models of the dorsal visual stream.

**Sarch, G.**, Fang, Z., Harley, A. W., Schydlo, P., Tarr, M., Gupta, S., & Fragkiadaki, K. (in submission). TIDEE: Novel Room Reorganization using Visuo-Semantic Common Sense Priors.

Yates, J., Coop, S., **Sarch, G.**, Wu, R., Butts, D., Rucci, M., Mitchell, J. (in submission). [Beyond Fixation: detailed characterization of neural selectivity in free-viewing primates.](#)

**Sarch, G.\***, Fang, Z.\*, Jain, A.\*, Harley, A. W., & Fragkiadaki, K. (2021). [Move to See Better: Self-Improving Embodied Object Detection.](#) *British Machine Vision Conference 2021.* (\*equal contribution)

## Presentations

**Sarch GH**, Yates JL, Coop SH, Mitchell JF (2019) Identification of cortical layers from current source density (CSD) analysis and two local field potential (LFP) band-power measures in marmoset V1. Society for Neuroscience Marmoset Symposium 2019. Chicago, IL, 2019. Poster.

**Sarch GH**, Pavindra PH, Smith JC (2018) Computational Modeling of Respiratory Neural Circuits. NIH Bethesda, MD, 2018.