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.

Deep learning models 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, USA — 2020 – exp. 2025
Neuroscience Institute & Machine Learning Department
Ph.D. Student, Neural Computation

- Advisors: Dr. Katerina Fragkiadaki and Dr. Michael Tarr
- M.S. in Machine Learning expected 2023

University of Rochester, Rochester, USA — 2016-2020
Department of Biomedical Engineering
B.S., Biomedical engineering, *magna cum laude*

Grants & Awards

National Science Foundation Graduate Research Fellowship (NSF-GRFP)	2020
Tau Beta Pi Engineering Honor Society	2020
2020 Outstanding Award for Academic Excellence in Biomedical Engineering	2020
2019 Outstanding Award for Academic Excellence in Biomedical Engineering	2019
University of Rochester Center for Visual Science (CVS) Research Fellowship	2019
National Institutes of Health Ruth L. Kirschstein National Research Service Award	2019
University of Rochester Dean's Scholarship	2016-2020

Experience

Carnegie Mellon University — Aug 2020 – present
PIs: Dr. Katerina Fragkiadaki and Dr. Michael Tarr
PhD Student Researcher

- See Current Research above

Active Vision Laboratory, University of Rochester Aug 2018 – Aug 2020
PI: Prof. Jude Mitchell
Research Assistant

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

Computational Neurobiology Laboratory, National Institutes of Health May 2018 – Aug 2018
PI: Dr. Jeffrey Smith
Internship Program

- Researched computational models of the pre-Bötzinger respiratory rhythm generator

Cognitive Neurophysiology Laboratory, University of Rochester Jan 2018 – May 2018
PI: Prof. Edmund Lalor
Research Assistant

- Researched contextualized semantics for speech comprehension decoding in EEG

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)*

Posters

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.

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

Last updated: June, 2022