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*

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.