Kaleb S. Newman

◊ kaleb_newman@brown.edu ◊

RESEARCH INTERESTS

Multimodal Representation Learning, Physical Understanding, Human Visual Cognition

EDUCATION

Brown University, Providence, RI   *Sep 2021 - Present*
Sc.B. in Computer Science, Artificial Intelligence and Visual Computing   **GPA: 3.87/4.00**
Advisor/Mentor: Chen Sun, Thomas Serre

SELECTED AWARDS

Computing Research Association Outstanding Researcher Nominee	*2024*
MIT Undergraduate Research Conference Top Five Rated Paper	*2023*
Karen T. Romer Undergraduate Research Award (2x)	*2023, 2024*
NSF REU Conference Travel Grant	*2023*
Brown University Innovation Dojo Entrepreneurship Competition.	2022

PUBLICATIONS AND PAPERS

K. Newman, Shijie Wang, Yuan Zang, David Heffren, Chen Sun. Do Pre-Trained Vision-Language Models Encode Object States.
ECCV 2024 Workshop on Emergent Visual Abilities and Limits of Foundation Models

E. Houssain, **K. Newman**, A. Bao, M. Mann, Y. Li, H. Wang, W. Hall, C. Kurumada, Z. Bai. Supporting ASL Communication Between Hearing Parents and Deaf Children.
ACM SIGACCESS Conference on Computers and Accessibility

A. Bao*, **K. Newman*,** M. Mann, E. Houssain, C. Kurumada, Z. Bai. Building User-Centered ASL Communication Technologies for Parent-Child Interactions.
MIT Undergraduate Research & Technology Conference 2023 (Top 5 Rated Paper)

RESEARCH EXPERIENCES

PALM Lab – *Brown University*
Tracking Objects Undergoing State Transformations Project   **Nov 2022 – Present**
Advisor: Dr. Chen Sun
- Led a two-year research project on AI models for tracking object state changes, focusing on multimodal representations.
- Designed a novel dataset: ChangeIt-Frames and developed an evaluation framework for object physical state recognition tasks.
- Three first authored papers, with the final one accepted at ECCV 2024 Workshop, identifying multimodal representation failures in foundation models for the physical states of objects.
- Brown Computer Science Department nominated me for the North American CRA Outstanding Research Award.

Inter.play Lab – *University of Rochester*
Tabletop Interactive Play System Project.   **May 2023 – Sep 2023**
Advisor: Dr. Zhen Bai
- NSF-funded research on AI-mediated communication systems for hearing parents and Deaf or Hard-of-Hearing (DHH) children.
- Developed *Tap-to-Sign*, an AR-based ASL learning tool enabling real-time interaction and bridging communication gaps.

- Authored two publications detailing the system's design and feedback from the user study.

Serre Lab – *Brown University*
Projects in Long-Range Sequential Reasoning and Fine-Grained Fossil Recognition.   **Feb 2024 - Present**
Advisor: Dr. Thomas Serre
- Contributed to early-stage implementation of sequential models for long-range memory tasks, analyzing performance and scalability.
- Annotated and curated herbarium sheet data for high-resolution training samples.
- Current work on implementing pipelines for generating crops of plant specimens to train vision models.

Summer Student Theoretical Physics Session — *Brown University*
Advisor: *Dr. James Gates*
- Supersymmetry (String Theory) research and experimental mathematics.

TEACHING EXPERIENCE

CLPS1291: Computational Methods for Mind, Brain, and Behavior, Brown University, Teaching Assistant
Brown Machine Intelligence Community, Executive Board, Content/Teaching Lead: Created and taught workshops on Diffusion, Fundamentals of Computer Vision, and Neural Style Transfer.

RELEVANT COURSEWORK

Computer Science
- Programming Fundamentals (A), Discrete Structures and Probability (A), Computer Systems Fundamentals (A), Machine Learning (A), Deep Learning (A), Computer Vision (A), Learning and Sequential Decision Making (A), Computational Linguistics (A).

Cognitive Neuroscience / Cognitive Science
- Brain Damage and the Mind (A), Language Processing in Humans (A), Computational Cognitive Neuroscience (A), Memory, Space, and the Hippocampus (A).

Mathematics
- Intermediate Calculus (A), Linear Algebra (B), Statistical Inference I (B), Probabilities in Quantum Mechanics (A), Information Theory (A), Recent Applications of Probability and Statistics (A).

SELECTED TECHNICAL SKILLS

Machine Learning: Python, TensorFlow, Pytorch, Natural Language Processing, Computer Vision, Reinforcement Learning, Multimodal Foundation Models, Object Detection, Tracking, Pose Estimation, Segmentation
Additional Programming Languages: C, C++, C#, Java, Unity, Heroku, AWS

Technical Projects

PhyDream: Enhancing Model-Based Reinforcement Learning in Differentiable Physics Engines, *Spring 2024*
Utilized Google's differentiable physics engine, Brax, to improve the physical plausibility of world models in RL agents, achieving faster convergence in MuJoCo environments.
BERTSpies: Visual Question Answering, *Fall 2022*
Implemented and trained different types of early vision-language architectures for visual question answering. Presented at Brown University's Deep Learning Demo Day.
Autonomous Driving Risk Analysis, *Fall 2022*
Developed a model in the CARLA Driving Simulator that uses scene understanding to assess whether a vehicle is in a safe or dangerous driving scenario. Presented at the Brown University Computer Vision Poster Session.

Clubs

Black In AI, Brown Machine Intelligence Community, Black Student Association, National Society of Black Engineers
Brown Entrepreneurship