Arijit Dasgupta

arijitdg[at]mit.edu arijitdasgupta.com Singapore Citizen

Research Interests: *Probabilistic Machine Learning, Physical Reasoning, 3D Scene Perception, Cognitive AI*

Education

- **Massachusetts Institute of Technology** — Cambridge, MA, USA
  Ph.D - Electrical Engineering and Computer Science — *Sep 2022 - Present*
- **Massachusetts Institute of Technology** — Cambridge, MA, USA
  M.S - Electrical Engineering and Computer Science — *Sep 2022 - May 2025*
  GPA: 5/5; Advisors: Joshua Tenenbaum & Vikash Mansinghka
- **National University of Singapore** — Singapore, Singapore
  B.Eng (Honours) - Mechanical Engineering — *Aug 2018 - May 2022*
  ***Valedictorian**; GPA: 4.85/5 (Highest Distinction)*
  Minor in Computer Science; University Scholars Programme

Industry, Government & Academia Programs

- **Project CHI (Computation and Human Intelligence)** — USA
  Graduate Student Collaborator — *Mar 2024 - Present*
  - Contributing to large-scale effort to build field-wide standard machine-executable models of the human mind. Tested and evaluated GenJAX, a GPU-accelerated probabilistic programming system, and currently contributing to the ChiBrain initiative.
- **Joint University Microelectronics Program (JUMP) 2.0** — USA
  CoCoSys: Center for the Co-Design of Cognitive Systems — *Jun 2023 - May 2025*
  - SRC Research Scholar funded by Semiconductor Research Corporation (SRC) and DARPA. Presented research via posters and gave a talk to all industry and academic members of the CoCoSys center.
- **DARPA Machine Common Sense Program** — USA
  Collaboration with MIT-IBM Watson AI Lab — *Sep 2022 - Dec 2023*
  - Collaborated with MIT-IBM Watson AI Lab team to build an image-computable probabilistic AI system for physical commonsense reasoning using GenJAX. Results passed and excelled all program benchmarks.

Selected Publications

- Eric Li*, Arijit Dasgupta*, Yoni Friedman, Mathieu Huot, Vikash K. Mansinghka, Thomas O'Connell, William T. Freeman, Joshua B. Tenenbaum (Under Review). **GenMatter: Perceiving Physical Objects with Generative Matter Models.**
- Arijit Dasgupta*, Eric Li*, Mathieu Huot, William T. Freeman, Vikash K. Mansinghka, Joshua B. Tenenbaum (2025). **GenParticles: Probabilistic Particle-Based Modeling for Object-Centric Motion.** *Robotics: Science & Systems 2025 Workshop on Structured World Models for Robotic Manipulation (SWOMO)* https://openreview.net/pdf?id=7axVuVeOBj
- Arijit Dasgupta, Andrew D. Bolton, Vikash K. Mansinghka, Joshua B. Tenenbaum, Kevin A. Smith (2025). **Seeing through Occlusion: Uncertainty-aware Joint Physical Tracking and Prediction.** *Proceedings of the Annual Meeting of the Cognitive Science Society, Volume 47* https://escholarship.org/uc/item/20w6k4fd
- Arijit Dasgupta, Jiafei Duan, Yi Lin, Su-Hua Wang, Renée Baillargeon, Cheston Tan (2023). **A Benchmark for Modeling Violation-of-Expectation in Physical Reasoning Across Event Categories.** *Proceedings of the Annual Meeting of the Cognitive Science Society, Volume 45* https://escholarship.org/uc/item/37f0j4c9
- Jiafei Duan*, Arijit Dasgupta*, Jason Fischer, Cheston Tan (2022). **A Survey on Machine Learning Approaches for Modelling Intuitive Physics.** *In International Joint Conference on Artificial Intelligence 2022* https://doi.org/10.24963/ijcai.2022/763

* denotes co-first authorship

Research Experience

- **A*STAR, Institute for Infocomm Research** — Singapore
  Cognitive AI & Computer Vision (Prof Marcelo Ang & Dr Cheston Tan) — *May 2021 - Feb 2022*
  - Developed 3D synthetic dataset for Violation-of-Expectation paradigm; work published at a 2022 NeurIPS Workshop and CogSci 2023. Co-authored survey paper on Machine Learning Approaches for Modelling Intuitive Physics (IJCAI 2022).
- **DSO National Laboratories** — Singapore
  Machine Learning for Network Protocols — *June 2020 - Dec 2020*
  - Introduced novel unsupervised deep learning approach to automated protocol reverse engineering. Developed enigma, a Python software framework API for APRE analysis. Published at IEEE SSCI 2021.
- **National University of Singapore** — Singapore
  Drone Vision & Control (Dr Sutthiphong Srigrarom) — *Feb 2021 - May 2021*
  - Designed drone path planning methodologies for projectile interception with depth camera. Implemented trajectory prediction and control architecture in ROS. Published at IEEE-archived ICCAS 2021.

Honors and Awards

- SRC Research Scholar - 2023 to 2025
- A*STAR Undergraduate Scholarship - 2018 to 2022
- NUS Valedictorian (Mechanical Engineering) - 2022
- Sung Kah Kay Memorial Prize - 2022
- NUS Faculty of Engineering Dean's List $\times$ 4 - 2019 - 2022
- University Scholars Programme President Honour Roll - 2022

Technical Skills, Frameworks and Tools

- **Programming Languages**: Python, C/C++, Julia, MATLAB, SQL, HTML/JavaScript
- **Frameworks**: JAX, CUDA, PyTorch, ROS, Linux/Zsh, Gen.jl/GenJAX, Flask, React/Next.js
- **Productivity Tools**: Git, Linear, Cursor, Notion, LaTeX
- **AI/ML/ProbProg**: Probabilistic Programming, GPU Programming, Sequential Monte Carlo/MCMC, Bayesian Model Calibration, Unsupervised Learning, Deep Learning
- **Physical AI & Hardware**: 3D Computer Vision, PyBullet/MuJoCo Simulation, Rerun, 3D CAD Modeling, Engineering Manufacturing & Prototyping, Inverse Graphics
- **Computational Cognitive Science**: Human Behavioral Experimentation, Bayesian Cognitive Modeling, Psychophysical Trial Design, Custom Web Based Experiment Platforms

Industrial Experience

- **A*STAR, Advanced Remanufacturing and Technology Centre** — Singapore
  Robotics Software Development — *May 2019 - Aug 2019*
  - Developed Autonomous Ground Vehicle (AGV) fleet controller using ROS C++ in Gazebo simulation environment for mobile industrial robots.
- **Singapore Armed Forces, 23rd Battalion Singapore Artillery** — Singapore
  Rocket System Operator — *Apr 2016 - Feb 2018*
  - Operationally trained in operating High Mobility Artillery Rocket System (HIMARS) and eight other military vehicles. Contributed to Exercise Forging Sabre 2017 in Arizona, USA. Acquired leadership, communication, and teamwork skills.

Selected Undergraduate Projects

- **Teaching a Simulated Spider Robot to Walk using AI (Deep Reinforcement Learning)**: Created CAD model using SolidWorks and trained robot to walk in PyBullet simulation using DDPG. (Nov '20)
- **Flapping-Wing Micro-Aerial Vehicle (Deep Reinforcement Learning & Flapping Wing Flight)**: Modified design of state-of-the-art FW-MAV. Contributed to design, manufacturing, and assembly. Developed setup to train FW-MAV to learn to fly using deep reinforcement learning in controlled environment with infrared cameras. Software built in ROS with C++ & Python (May '21)