Shayan Pardis

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Research Interests

My research spans reinforcement learning, multiagent learning, and composition of models (e.g. mixture of experts) with applications in robotics.

Education

Massachusetts Institute of Technology — Cambridge, MA
*Bachelor of Science in **Computer Science and Engineering** (Course 6-3)* — Sep. 2022 - May 2025
*Bachelor of Science in **Mathematics** (Course 18)* — **GPA: 5.0/5.0**
Graduate coursework: Multiagent Learning, Sensorimotor Learning, High-Dimensional Statistics, Symmetry Machine Learning, Natural Language Processing, Quantum Computation, Programming Synthesis, Secure Hardware Design

Sharif University of Technology — Tehran, Iran
*Transferred to MIT after second year; **GPA: 3.9/4.0*** — Sep. 2020 - May 2022

Publications

Probabilistic Homotopy Optimization for Dynamic Motion Planning — published in IROS 2024
Shayan Pardis*, Matthew Chignoli*, Sangbae Kim — https://arxiv.org/abs/2408.12490

Research Experience

Research in Video Language Planning — Cambridge, MA
MIT; Supervised by Prof. Leslie Kaelbling and Prof. Yilun Du — Sep. 2024 - Present
- Developing methods for interactive plan refinement that enables high quality long-horizon planning
- Formulating composition of a diffusion policy and vision language model with Evidence lower bound (ELBO)
- Finetuning a goal conditioned diffusion policy to generate subgoal images with a dynamic horizon length

Research in Trajectory Optimization — Cambridge, MA
MIT; Supervised by Prof. Sangbae Kim — Feb. 2023 - May 2024
- Designed an optimization method inspired by Curriculum Learning and Probabilistic Roadmaps (PRM) that traverses the multi dimensional homotopy space from a relaxed (easy) problem to the original (hard) problem. This framework automates the discovery of highly dynamic trajectories (e.g. acrobatic maneuvers for humanoids), which previously required handcrafted expert initialization and heuristics. Published in IROS 2024.
- Enhanced the throughput of the QP-based controller for the MIT Humanoid robot by 4x through parallel programming techniques.

Awards

Gold medal (rank 10) in International Olympiad in Informatics (2020)
Gold medal (rank 1) in Iran National Olympiad in Informatics (2019)
ICPC 2021 World Finalist (Asia-Tehran region champion)
Silver medal (rank 24) in Asia-Pacific Informatics Olympiad (2020)

Work Experience

Citadel LLC — New York City, NY
Quantitative Developer Intern at Central Risk Engineering — Jun. 2024 - Aug. 2024
- Developed distributed system infrastructure tools utilizing Kubernetes, gRPC, multiprocessing, Cloud Run, Redis; **Secured a return offer**.
- Designed a parallel testing framework that identified performance bottlenecks, achieving a 2x speedup by optimizing queuing mechanism.

Google Summer of Code — Mountain View, CA (Remote)
Julia CUDA Developer — Jun. 2023 - Sep. 2023
- Developed CUDA kernels for QuantumClifford.jl, a Julia package for Quantum Error-Correcting Codes; achieved 10x speedup (details)

SIMCON — Wuerselen, Germany (Remote)
Geometric Algorithm Design Intern — Sep. 2021 - Mar. 2022
- Designed a 3D mesh contraction algorithm to convert meshes into skeleton graphs with enhanced accuracy and 2x speedup (in C++)

Carriot Tehran, Iran
Data Science Intern Jul. 2021 - Sep. 2021
- Designed and trained a model to map addresses to their corresponding locations (geocoding problem) utilizing OSM and Elasticsearch.

Abarkelas Tehran, Iran
Web Developer (Part-Time) Oct. 2020 - Jun. 2021
- Developed backend (Django) and frontend (NuxtJs). Set up Prometheus and Grafana for monitoring. Created PWA for the website

Projects

Novel Shape Generation with SO3-Equivariant Auto-Encoders (MIT 6.S966, Symmetry ML) | Repository Apr. 2024 - May 2024
Designed an SO(3) equivariant autoencoder using spherical harmonics and a latent space traversal that separates rotation from deformation.

Decision State Space Models (MIT 6.8200, Sensorimotor Learning) | Repository Apr. 2024 - May 2024
Reimplemented Decision Transformer replacing transformer with S4 model and demonstrated improved performance in credit assignment tasks.

Formal Complexity Verification (MIT 6.S981, Programming Synthesis) | Repository Oct. 2023 - Dec. 2023
Formulated time complexity verification of a program as synthesizing a fix-point function. The demo uses a custom language with Python syntax.

FaceExplore (Personal Project, to be used at MIT Ring Delivery) | Repository Jun. 2023 - Aug. 2023
Developed a face search engine using a pretrained ResNet for feature extraction and a custom hierarchical clustering method to identify faces of over 500 students in a large (40GB) dataset of images. Utilized MTCNN for face detection and React, Flask, Nginx, and Docker for the website.

Scripty (HackMIT 2024) | Repository Sep. 2024 - Sep. 2024
Developed an educational tool to track student performance on projects, providing live feedback and tips, and automating infrastructure setup for instructors. Built with Python, DSPy, Kubernetes, and React; won Warp and Orbstack challenge prizes.

Sharif AI Challenge | Repository Mar. 2021 - May 2021
Developed AI agents for a multiagent game, achieving 4th place in the competition. Used Huffman code for cost-efficient communication and A* algorithm for planning under uncertainty.

ShelveBot (MIT 6.4210, Robotics Manipulation) | Repository Oct. 2023 - Dec. 2023
Demonstrated pick-and-place capabilities on the PR2 robot. Integrated RRT, Inverse Kinematics, and Trajectory Optimization for motion planning. Utilized a custom DSL for symbolic planning and optimized grasp selection. Recieved the **Outstanding Project Award**.

Teaching and Leadership

Author of Olympiad Graph Theory Book Feb. 2020 - Dec. 2021
Led a team of 10 peers to write a 200-page online book on graph theory in Persian, available at gtoi.shaazzz.ir, focusing on algorithmic approaches to graph theory concepts which helped thousands of students prepare for the Iranian National Olympiad in Informatics.

Algorithm Course Organizer (Iranian National Olympiad in Informatics Summer Camp) Jul. 2021 - Aug. 2021
Main Organizer, lecturer, and problem setter for the algorithm course in Iran National Olympiad in Informatics 2021. Delivered lectures on flow algorithms, number theory, and dynamic programming. Designed 3 out of 9 final exam problems.

Teaching Assistant for Natural Language and Computation (MIT 6.S051, Prof. Robert Berwick) Sep. 2022 - Dec. 2022
Revised and created new lab practices including: Segmentation, Parsers, Semantic Parsing with Lambda Calculus, and Grammar Inference.

International Orientation Coordinator and Resident Peer Mentor (MIT) Aug. 2023 - Dec. 2023
Organized events and one-on-one meetings with incoming students to help them adjust to the life at MIT.

Workshop Organizer (MIT Global Teaching Lab, Armenia) Jan. 2024 - Jan. 2024
Organized a month-long workshop on algorithmic problem solving for high school students in Armenia to spread enthusiasm for computer science. The workshop started with 10 students and ended with 40.