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

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 Yilun Du — Sep. 2024 - Present
- Developing methods for interactive plan refinement for enhanced long-horizon task planning
- Finetuning diffusion models 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.

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)

Projects

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

Better Offline RL with S4 Models (MIT 6.8200, Sensorimotor Learning) — 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) — 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) — Jun. 2023 - Aug. 2023
Created a face search engine that uses a custom clustering method on ResNet vector embeddings (unsupervised). Implemented MTCNN for face detection and used React, Flask, Nginx, and Docker for the website.

Scripty (HackMIT 2024) — Sep. 2024 - Sep. 2024
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 — Mar. 2021 - May 2021
Developed an AI agent for a distributed game that ranked 4th in the competition. Used Huffman-code for cost-efficient communication and A* algorithm for shortest path detection over a not-fully-explored map.

Work Experience

Citadel LLC — New York City, NY
Quantitative Developer Intern in Central Risk Engineering — Jun. 2024 - Aug. 2024
- Developed tools for distributed system infrastructure and secured a return offer; Kubernetes, gRPC, multiprocessing, Cloud Run, Redis

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

Teaching and Service

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.

Algorithm Course Coordinator (Iranian National Olympiad in Informatics Summer Camp) Jul. 2021 - Aug. 2021
Organized the course and delivered lectures on flow algorithms, number theory, and dynamic programming. Designed 3 out of 9 final exam problems.

Author of Olympiad Graph Theory Book Feb. 2020 - Dec. 2021
Initiated and was the main contributor to an online book on graph theory in Persian, available at gtio.shaazzz.ir, with a focus on algorithmic approaches to graph theory concepts.