

Abdelrahman Abdelgawad

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EDUCATION

- Ph.D. candidate in Systems Engineering (2nd-year)** Boston University Sep 2024 – Present
Advisors: Roberto Tron, Sean Andersson (BU Robotics Lab) — Collaborating: Renato Mancuso (CPS Lab)
GPA: 4.0/4.0
Qualifying Exam passed Spring 2025
Relevant Coursework: Nonlinear Control, Optimization, Optimal Control, Deep Learning
- B.S. in Mechatronics and Robotics Engineering** Egypt-Japan University of Science and Technology Sep 2019 – Mar 2024
GPA: 3.93/4.0, Ranked 1st in the cohort
Thesis: Deep Reinforcement Learning Haptic Co-pilot for Cooperative Vehicle Steering [[GitHub](#)]
Advisors: Prof. Haitham El-Hussieny and Victor Parque

RESEARCH INTERESTS

Bridging **machine learning** and **control theory** to allow resource-constrained robots and safety-critical systems to learn and execute **complex behaviors** while guaranteeing formal safety and stability, with a focus on sample efficiency.

SELECTED PUBLICATIONS

- Accelerating Lyapunov-Stable Neural Control using Fulfillment Priority Logic** Accepted Jan 2026
American Control Conference (ACC) 2026
A. Abdelgawad, B. El Mabsout, Z. Wang, R. Mancuso, S. Andersson, R. Tron
- Closing the Intent-to-Behavior Gap via Fulfillment Priority Logic** [[Paper](#)] Oct 2025
IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) — 46% acceptance
B. El Mabsout*, A. Abdelgawad*, R. Mancuso (*equal contribution)
- Model- and Data-Based Control of Self-Balancing Robots** [[Paper](#)] Jun 2024
IFAC International Conference on Programmable Devices and Embedded Systems
A. Abdelgawad, T. Shohdy, A. Nada
- A Study on Broadcast Networks for Music Genre Classification** [[Paper](#)] Jul 2022
IEEE International Joint Conference on Neural Networks (IJCNN)
A. Heakl, A. Abdelgawad, V. Parque

RESEARCH EXPERIENCE

- Graduate Researcher** Sep 2024 – Present
Division of Systems Engineering, Boston University Boston, MA
- Developed Fulfillment Priority Logic (FPL), a framework for multi-objective RL that replaces hand-tuned reward weights with logical specifications, achieving up to $5\times$ sample efficiency over Soft Actor-Critic—the first non-linear utility scalarization for continuous control.
 - Accelerated neural Lyapunov-stable controller synthesis by using FPL to approximate stability conditions before formal verification, reducing training time by up to 95% ($18\times$) while preserving formal guarantees.
 - Contributed RL baseline implementation for a bilevel trajectory optimization framework for persistent monitoring.

HONORS AND AWARDS

- **Dean's Fellowship, Boston University (2024–2025):** Full tuition and \$41,373 stipend for first year PhD
- **Governorate Merit-based Bachelor's Scholarship (2019–2024):** Full tuition merit-based scholarship

PROJECTS

- Stability-Aware DreamerV3 (EC523 Deep Learning)** | *Python, PyTorch, MuJoCo* | [GitHub](#) Fall 2025
- Investigated Lyapunov regularization in DreamerV3's latent space to bias policies toward stable behaviors in MuJoCo and Gymnasium benchmark control tasks; identified key challenges in defining equilibrium in learned representations.
 - Established DreamerV3 baselines across DMControl and Gymnasium with sample efficiency and robustness analysis.
- Highrl** | *Python, RL, StableBaselines, PyTorch, Gym, GitHub CI, Unittest* | [GitHub](#) Oct 2022 – Apr 2023
- Developed a Python library for training robot agents on reach-avoid tasks using multi-level RL with automated environment generation and curriculum learning.
 - Deployed to PyPI with CI/CD, automated testing, and documentation.
- Self-Balancing Robot** | *Arduino, LabVIEW, MATLAB, PID, Fuzzy, $\mathcal{H}_\infty$ control* | [GitHub](#) Dec 2022 – Dec 2023
- Compared model-based (PID) and data-based (Fuzzy) controllers for a self-balancing robot with hardware validation (published at IFAC PDeS 2024).
 - Synthesized an $\mathcal{H}_\infty$ robust controller in Simscape simulation, achieving zero steady-state error for multiple different masses, lengths and friction surfaces.
- Motion Control of an ROV** | *MATLAB, ROS, Computer Vision* Sep 2022 – May 2023
- Developed the kinematic model of an underwater ROV and designed PID controllers for depth stabilization and 2D motion, achieving required positional accuracy during hardware testing using MATLAB and ROS.

PROFESSIONAL EXPERIENCE

- Production Engineer** Jul 2023 – Aug 2024
Si-Ware Systems *Cairo, Egypt*
- Automated Optical Core Module (OCM) Index detection through building a system utilizing the YOLO v8 object detection model, achieving 100% testing accuracy resulting in an error-free detection resembling a 50% increase in accuracy.

TEACHING, MENTORING & LEADERSHIP

- RISE Mentor** Jun 2025 – Aug 2025
Boston University — Research in Science & Engineering (RISE)
- Supervised a rising high-school senior on a scoped, 6-week full-time research project; scheduled weekly check-ins and day-to-day guidance.
 - Trained the student in lab methods/ethics and supported abstract and poster preparation for the RISE Symposium.
- Graduate Teaching Assistant** *Boston University — EK 125 Introduction to Programming for Engineers* Spring 2026
- Robotics Club Chairman** 2021–2022
Egypt-Japan University of Science and Technology (E-JUST)
- Raised \$13K in sponsorships; mentored 200+ students in robotics and deep learning workshops.

TECHNICAL SKILLS

- **Languages:** Python, MATLAB, LabVIEW.
- **Frameworks:** TensorFlow, PyTorch, ROS, Gazebo, Carla Simulator, CoppeliaSim, OpenCV, OptiTrack, Velodyne, MuJoCo.
- **Platforms:** Git, Arduino, Raspberry Pi, Linux, Simscape, Simulink.