Bassel El Mabsout

Curriculum Vitae

+1 (857) 939-8769 | bmabsout@bu.edu | https://github.com/bmabsout
Boston, MA, USA | https://bmabsout.com | Google Scholar (Rxv9W98)

EDUCATION

Ph.D. candidate in Computer Science **2018 – Present**

Boston University
Advisor: Dr. Renato Mancuso

M.S in Computer Science **2022**

Boston University

B.S. in Computer Science **2012 – 2015**

American University of Beirut

RESEARCH INTERESTS

Empowering roboticists to **faithfully** translate high-level intent into **reliable** robot behaviors on *resource-constrained* systems. I develop tools combining programming languages and machine learning to synthesize controllers meant for the real world. Through carefully designed *adaptation* methods and a principled approach to *sim-to-real* transfer, my work ensures learned controllers remain **robust** when deployed.

My topics of interest include:

Reinforcement Learning ◇ Embedded Systems ◇ Type Theory ◇ Metaheuristics ◇ Control systems

PUBLICATIONS

[1] **Mabsout B.*** ◇ Mysore S.* ◇ Saenko K. ◇ Mancuso R. **2021**
How to train your quadrotor: A framework for consistently smooth and responsive flight control via reinforcement learning
ACM Trans. Cyber-Phys. Syst., 5(4) 10.1145/3466618

[2] **Mabsout B.*** ◇ Mysore S.* ◇ Saenko K. ◇ Mancuso R. **2021**
Regularizing Action Policies for Smooth Control with Reinforcement Learning
ICRA 10.1109/ICRA48506.2021.9561138

[3] Mysore S. ◇ **Mabsout B.** ◇ Mancuso R. ◇ Saenko K. **2021**
Honey. I Shrunk The Actor: A Case Study on Preserving Performance with Smaller Actors in Actor-Critic RL
IEEE CoG 10.1109/CoG52621.2021.9619008

[4] **Mabsout B.** **2023**
Tree Shaping, a solution to the expression problem showcased via a compiler for a programming language named Puler
Masters Thesis, Boston University hdl.handle.net/2144/49330

* Authors contributed equally

ONGOING RESEARCH

Population Descent **Submitted**

A natural-selection based Memetic algorithm which adaptively controls hyperparameter selection via a normalized fitness function – PREPRINT

Sim2Real Adaptation via Anchored Learning **Submitting**

Anchors allow for adapting RL-based controllers on the fly while mitigating the issue of catastrophic forgetting. Our method does so by finding controllers which satisfy performance conditions both in simulation and reality – PREPRINT

Safety-critical controller learning **Ongoing**

We construct learned bounded Lyapunov functions for maintaining safety under a differential equation and on residual dynamics. Adapting controllers to improve the probability of safety and performance in the real world – SOURCE

State-estimation using Gaussian splatting **Ongoing**

The pose of a quadrotor is estimated by combining Gaussian splatting with an onboard camera feed. Estimation occurs in real-time on the embedded system

Multi-objective RL via generalized-mean scalarization **Ongoing**

We use the generalized-mean for scalarizing a normalized multi-Q-value function forming a continuous specification in a multi-objective RL setting

RESEARCH EXPERIENCE

Graduate Research Assistant **2018 – Present**

Boston University

- Developed novel reinforcement learning algorithms for quadrotor control
- Created frameworks for safety-critical controller learning
- Implemented state estimation using Gaussian splatting

Research Assistant **2016 – 2018**

American University of Beirut

- Developed *neural-swarm*, a collection of experimental optimization algorithms
- Implemented decentralized swarm control systems

TEACHING EXPERIENCE

Course Instructor - CS 654 **2023**

Boston University

- Created and supervised projects for 24 students
- Mentored students in modeling and controlling AmazingBall System
- Developed curriculum focusing on minimizing sim2real gap

Research Mentor **2021 – Present**

RISE Program: Mentored undergraduate researcher in gradient-based optimization
BU Spark: Supervised team of 5 students in quadrotor research project
Efficient RL: Guided graduate students in power-efficient reinforcement learning

SERVICE & LEADERSHIP

Peer Review Venues

ICLR ◇ ICRA ◇ ROBOT ◇ EMSOFT ◇ COG ◇ DATE ◇ ECRTS ◇ RTSS ◇ TJCA

Academic Service

- [Add department/university service]

SELECTED PROJECTS

Stochastic dynamics learning **BU/MIT**

Achieving safer learned model-based control requires accurate models, given most real-world systems are stochastic, we built Generative Adversarial Networks which modeling the distribution of the system's trajectories – SOURCE

Honda Ridesharing **SAIL**

In collaboration with BU's SAIL and Honda, we worked on privacy preserving (using MPC) preferential ride-sharing. My responsibilities included defining optimization constraints so users with similar preferences get pooled together

Seizure Prediction **Machine learning – CS542**

A Kaggle competition project which accurately predicted seizure activity in epileptic patients. Utilizing machine learning techniques, we achieved the highest score with a significant margin (AUC score of 0.92) – PREPRINT

Finding a NASH-ε Equilibrium **Complexity Theory – CS535**

This term paper simplifies an existing proof of the complexity class specifying the run-time of finding approximate Nash equilibria – PREPRINT

Haskell Blog **Personal Blog**

I created a Haskell blog hosted on IPFS about programming language concepts such as automatic differentiation and dependently typed vector construction which garnered some interest and was featured on Haskell News

TECHNICAL SKILLS

Programming Languages

IMPERATIVE	C ◇ C++ ◇ Go ◇ Java ◇ Python
FUNCTIONAL	Haskell ◇ F# ◇ Clojure
THEOREM PROVERS	Rocq ◇ Lean ◇ ATS
WEB	JavaScript ◇ TypeScript ◇ Elm
DEVELOPMENT	SQL ◇ Nix ◇ Make ◇ Fish ◇ Bash
GRAPHICS	GLSL ◇ WGSL
MARKUP	LaTeX ◇ Typst ◇ HTML ◇ CSS ◇ XML ◇ Markdown

Frameworks & Libraries

ML	TensorFlow ◇ PyTorch ◇ JAX ◇ Keras
SCIENTIFIC	NumPy ◇ SciPy ◇ Pandas
ROBOTICS	Spinning Up ◇ PyBullet ◇ Gurobi
WEB	React Native ◇ Firebase

HASKELL Megaparsec ◇ Recursion-Schemes ◇ Polysemy ◇ ImplicitCAD

Tools

DEVELOPMENT Git ◇ Nix ◇ GNU Utils ◇ Make ◇ Docker
SOFTWARE AutoCAD ◇ GIMP ◇ Photoshop ◇ Jupyter Notebook
HARDWARE Soldering ◇ Oscilloscope ◇ Multimeter ◇ Lazer Cutter ◇ Embedded Systems