

March 17, 2025

Dear Faculty Search Committee,

I am writing to **strongly recommend** Bassel El Mabsout for a faculty position at your institution. I am an Assistant Professor in the Department of Computer Science at Boston University, and I conduct research in computer architecture and system design for robotics applications. I first met Bassel when I joined the department in fall 2023, through his advisor, Professor Renato Mancuso. Since then, I have been delighted to have an ongoing research relationship with Bassel, ideating new research directions, working to co-write an NSF proposal, and serving on his PhD proposal committee.

Outstanding Research Contributions: Bassel is an independent thought leader, and fearlessly interdisciplinary, with a track record of making significant research contributions in fields outside of his advisor's primary expertise— that is, his impact extends beyond cyber-physical systems into machine learning, programming languages, energy-efficient computing, and robotics. In conducting this interdisciplinary convergent research, Bassel has published his work in prestigious venues such as the IEEE International Conference on Robotics and Automation (ICRA) and ACM Transactions on Cyber-Physical Systems, furthering frontiers in different fields.

For example, Bassel's work on the first successful reinforcement learning-based attitude controller for quadrotors, published in ACM Transactions on Cyber-Physical Systems, represents a substantial advancement in robotic control systems. This work was not merely an incremental improvement, but a fundamental rethinking of how reinforcement learning could be applied to complex quadrotor control problems. This work has garnered significant attention in the field, highlighting its novelty and importance.

Similarly, Bassel's CAPS regularization technique presented at IEEE ICRA 2021 has accumulated an impressive 99 citations in a relatively short time. As someone working at the intersection of disciplinary boundaries myself (computer architecture and robotics), I know that

cross-disciplinary research can be challenging, and I am impressed that Bassel has nimbly traveled in a short time from a background primarily in programming languages to making significant contributions to reinforcement learning. This is all the more impressive because his advisor's expertise is in cyber-physical systems, rather than machine learning.

Thesis Proposal and Future Research Directions: Most recently, I was impressed by Bassel's work on Fulfillment Priority Logic (FPL), currently under submission to IROS 2025, and which I first saw presented by Bassel in his thesis proposal (I am a member of his committee). His thesis proposal presented a coherent and compelling research narrative centered around closing what he terms the "intent-to-behavior gap" in reinforcement learning for robotics. His Fulfillment Priority Logic framework stands as an elegant solution to one of the fundamental challenges in reinforcement learning: how to reliably translate a designer's high-level intentions into consistent agent behaviors.

This research represents a breakthrough in how reinforcement learning objectives can be specified and composed—this work, grounded in the sturdy abstractions of programming languages, will have far-reaching implications across machine learning, robotics, and optimization and control. It brings a systematic approach to the construction of objective functions, which currently suffer from a need for human-in-the-loop tuning that is iterative, tedious, and error-prone. Bassel's work is a turning point in bringing the creation of these functions closer to a reproducible and efficient science, rather than an art. He has synthesized insights across several domains, and is producing the sort of visionary first-paper (rather than last-paper) work that will launch Bassel to success as a junior faculty member. His work opens numerous avenues for exploration, from formal verification of learned controllers to improved domain adaptation techniques. This positions him to establish a productive, impactful research program immediately upon beginning his faculty career.

Research Collaborations and Technical Expertise: In our collaborative research efforts, Bassel has demonstrated leadership, initiative, and practical technical expertise. For example, Bassel, Renato, and I have been brainstorming and collaborating on an NSF Medium proposal (in preparation) focused on neural network control for under-instrumented limbed robots. The proposal explores hardware-software co-design for energy-efficient control and learned runtime adaptation techniques on constrained platforms. As we have drafted the proposal, I have been impressed by Bassel's substantial contributions to the writing effort, where he has taken a

leadership position in making progress in the proposal manuscript and articulating a clear research vision.

Bassel pairs that high-level vision with practical hands-on technical creativity and problem-solving abilities. As we have worked to generate preliminary results for our grant-in-progress, Bassel has led a team of Master's students working to implement motion control on a small resource-constrained quadruped platform (the Petoï Bittle). As an example of the typical end-to-end competency that Bassel demonstrates: When faced with the sensor limitations of this under-instrumented robot (the Bittle has no position encoders for feedback on joint angles), Bassel proposed a clever hack to the servo motors to extract angle information, which would greatly increase the capabilities of the robot. He then guided one of his Master's student mentees, Patrick Carpanedo, in implementing this solution in the lab, resulting in a significantly easier-to-train robot for almost no additional hardware cost.

As of the writing of this letter, Bassel's preliminary methodology for applying reinforcement learning on the Bittle robot has already yielded impressive results in simulation. He successfully demonstrated enabling Bittle to learn to walk in qualitatively well-behaved gaits, and even achieved this feat for challenging scenarios where we experimented with having only minimal IMU information available. This early work by Bassel blazes a trail towards applying advanced learning techniques to small-scale, affordable, resource-constrained articulated robots, which can have significant benefits for application spaces such as medical devices, search and rescue, infrastructure and industrial inspection, and environmental monitoring.

Mentorship and Educational Contributions: Bassel's excellence extends beyond research to mentorship, where he has shown exceptional talent. During our collaboration, he helped direct one of my Master's program summer interns, Demetrios Kechris, in combining inverse-kinematics with learned control. His patient guidance and clear explanations allowed the student to make significant progress despite limited prior experience in reinforcement learning.

Additionally, his leadership of the F1Tenth Racing Team, where he guided 11 students to a second-place medal in an autonomous racing competition, further showcases his ability to effectively communicate complex concepts and inspire students to achieve excellence in challenging technical domains.

I have frequently encouraged my students (from undergraduate to Master's and PhDs) to go seek Bassel's mentorship and technical advice on a range of topics. He is a role model and proactively contributes to a positive and enriching intellectual community in our department. For example, he has organized a control theory reading group that includes two of my PhD students, Alp Eren Yilmaz and Abin Binoy George. This initiative has fostered valuable cross-pollination of ideas between our research groups and created opportunities for students to develop deeper understanding of control theory as it applies to robotic systems. His comprehensive survey on modern control theory with machine learning techniques has helped students significantly increase their understanding of these complex topics.

In conclusion, based on my direct experience working with Bassel on research initiatives, observing his mentorship capabilities, and evaluating his proposed thesis work, I am confident that he will be an outstanding addition to your department. His exceptional ability to work across disciplinary boundaries, mentor students effectively, and pursue innovative research directions makes him ideally suited for a tenure-track position at your university.

I enthusiastically recommend Bassel El Mabsout and would be happy to provide any additional information that might be helpful in your evaluation.

Sincerely,

Sabrina Neuman

—

Sabrina M. Neuman

Assistant Professor, Boston University Department of Computer Science

2023-2026 Boston University Innovation Career Development Professor

sneuman@bu.edu

sites.bu.edu/sneuman