Mark Zolotas

Research Scientist, Institute of Experiential Robotics, Northeastern University

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My research interests span the domains of machine learning, robot control, and extended reality. At the intersection of these interests is my overarching goal to augment human-robot interaction and collaboration. I approach this ambition by studying and advancing how robots model user behavior, provide assistance, and effectively communicate with humans.

Employment

Research Scientist, Northeastern University *Dec. 2022 - Present*
Institute of Experiential Robotics
- Lead research projects, participate in grant writing activities and other efforts to secure external funding, co-advise university students, and create research outcomes including but not limited to academic publications, open-source codebases, and robot demonstrations

Postdoctoral Research Associate, Northeastern University *Jan. 2021 - Dec. 2022*
Department of Electrical and Computer Engineering
- Advisor: Professor Taskin Padir
- Coordinated funded research projects, conducted research on human-robot collaboration, and mentored students

Education

Ph.D. in Robotics, Imperial College London *Oct. 2016 - Jan. 2021*
Department of Electrical and Electronic Engineering
- Thesis: "Explainable Shared Control in Assistive Robotics"
- Supervisor: Professor Yiannis Demiris

M.Eng. in Electronic and Information Engineering, Imperial College London *Oct. 2012 - June 2016*
Department of Electrical and Electronic Engineering
- Graduated with First Class Honours, equivalent to a GPA of 4.0/4.0
- Dissertation: "Self-Organising Error Detection and Correction in Open Multi-Agent Systems"
- Supervisor: Professor Jeremy Pitt

Research Grants

Co-investigator, DARPA Perceptually-enabled Task Guidance (PTG) program *Northeastern University*
"ENKIx: Enabling Knowledgeable Task Guidance In the Extremes" *2021 - 2025*
- Direct team of researchers to develop perception and environment modeling capabilities for ENKIx, an augmented reality task guidance system designed within the scope of the DARPA PTG program
- Represent the Northeastern University subcontractor of the ENKIx project at principal investigators' meetings and demos

Senior Personnel, NSF Future of Work at the Human-Technology Frontier project *Northeastern University*
"Co-worker Robots to Impact Seafood Processing (CRISP)" *2019 - 2024*
- Define and manage research directions for the CRISP project, investigating the development and deployment of collaborative robots to improve sustainability, productivity, safety and workers' quality of life in the seafood processing industry
- Published and presented findings on human-robot collaboration frameworks to enhance human factors and ergonomics

Principal Investigator, U.S. DOE Marine Energy Collegiate Competition (MECC) *Northeastern University*
Northeastern University selection for the MECC *July 2023 - June 2024*
- Oversee a team of university students in creating a technological solution to help the marine energy industry as part of the MECC, sponsored by the Department of Energy's Water Power Technologies Office

Project Coordinator, Verizon industry project *Northeastern University*
"Supporting Aging In Place Through Multimodal Sensing and Reasoning" *Sept. 2021 - Sept. 2022*
- Led a project funded by Verizon spanning five research labs at Northeastern University, aimed at building a mobile robot platform with an integrated multimodal sensor suite that could monitor and support elderly people during their day-to-day activities at home
- Maintained and managed all project deliverables, including reports, software integration, and demonstrations of the robot prototype

Postdoctoral Research Associate, U.S. DOE American-Made E-ROBOT Challenge *Northeastern University*
"Precise Air-Sealing Robot for Inaccessible Spaces (PARIS)" *Jan. 2022 - April 2022*
- The PARIS solution to the E-ROBOT challenge was a multi-track robotic platform proposed to reduce the heat loss of leaky attics by navigating crawlspaces for air-sealing without needing to retrofit the space
- Supervised and assisted students in structuring the robot software architecture for localization and mapping

Postdoctoral Research Associate, Advanced Robotics for Manufacturing (ARM) project *Northeastern University*
"Automation of Characterization and Evaluation (ACE) in PPE Manufacturing Plants" *Jan. 2021 - August 2021*
- ACE was an ARM Institute-funded project focused on engineering a human-supervised robotics and automation workcell to test and characterize personal and protective equipment (PPE)
- Guided undergraduate and graduate students on the robotics and machine learning techniques necessary to characterize PPE

Awards

DARPA PTG ENKIx Award (~350,000 USD) Co-investigator (50% effort) for the Northeastern University subcontractor award under the DARPA PTG program to provide perceptual grounding for the ENKIx project system. *2023*

U.S. DOE Marine Energy Collegiate Competition (MECC) Selection Award (20,000 USD) Advisor for the Northeastern University team competing in the National Renewable Energy Laboratory's 2024 MECC. *2023*

NASA Challenge Second Place & Best Technical Paper (4,000 USD) Advisor for the participating team of Northeastern University in the NASA 2020-2021 RASC-AL Moon to Mars Ice and Prospecting Challenge. *2021*

Departmental Graduate Teaching Assistant of the Year Awarded for teaching duties conducted within the Electrical & Electronic Engineering department of Imperial College London. Finalist of the university-wide prize. *2019*

IET Prize for Innovation in Robotics (250 GBP) Paper presented at the leading annual UK Robotics conference, TAROS, was awarded the Prize for Innovation, sponsored by the Institution of Engineering and Technology (IET) Robotics. Transformed a student group project under my supervision into this conference paper. *2019*

EPSRC Doctoral Training Award (~70,000 GBP) Granted a full EPSRC studentship consisting of a 16,500 GBP bursary per annum, tuition fees of 4,000 GBP per annum and a travel allowance of 700 GBP. *2016*

Teaching

My teaching experience has encompassed a variety of undergraduate and graduate level courses, covering fundamentals in computer science and topics on robotics, machine learning, and artificial intelligence.

Course Instructor

Summer 2022 **EECE 5644 Introduction to Machine Learning & Pattern Recognition** *Northeastern University*
Created and delivered course material on foundations in machine learning, such as Bayesian decision theory, logistic regression, linear regression, dimensionality reduction, model selection, parameter estimation, neural networks, clustering, and so forth. Developed a complementary software repository of machine learning resources.

2017 - 2018 **EE2-12 Object-oriented Software Engineering** *Imperial College London*
Taught undergraduates software engineering concepts and fundamentals of object-oriented programming in C++, such as encapsulation, inheritance, and polymorphism. Independently managed and marked assessments for these classes, including writing the examinations. Received a **Student Academic Choice Award**.

Teaching Assistant

2017 & 2020 **EE2-18 Algorithms & Data Structures** *Imperial College London*
Tutored undergraduate students in weekly lab sessions and marked course assignments.

2016 - 2019 **EE4-60 Human-Centered Robotics** *Imperial College London*
Guided students on their human-robot interaction projects and graded courseworks. Prepared and presented tutorial lectures on the ROS middleware to undergraduate and graduate robotics students.

2016 - 2019 **EE1-07 Introduction to Computing** *Imperial College London*
Assisted in teaching computer science basics in C++ to undergraduates across weekly labs. Marked courseworks.

2017 - 2019 **EE4-67 Mobile Healthcare & Machine Learning** *Imperial College London*
Guided students on machine learning practices and app development in Unity. Graded course deliverables.

Spring 2017 **EE2-15 Language Processors** *Imperial College London*
Assisted in teaching undergraduate students about compilers and assemblers during weekly labs.

Fall 2016 **EE3-16 Artificial Intelligence** *Imperial College London*
Taught students how to program in Prolog, a logic-based programming language, for lab problems.

Supervision & Mentorship

I have mentored students at various levels of experience, ranging from Ph.D. candidates to undergraduate interns and M.S. students on projects. Four peer-reviewed academic papers submitted by students under my supervision have been accepted for publication.

Ph.D. Students

2023	**Neset Unver Akmandor:** Research on model predictive control for motion planning in mobile manipulation tasks via deep reinforcement learning.	*Northeastern University*
2022 - Present	**Rui Luo:** Research on shared control and skill acquisition in dexterous teleoperation.	*Northeastern University*
2022 - Present	**Drake Moore:** Research on human-robot collaboration and learning from demonstration frameworks involving augmented reality headset interfaces.	*Northeastern University*
2022 - Present	**Ananya Trivedi:** Research on probabilistic motion models for skid-steer mobile robots using Gaussian processes and stochastic model predictive control.	*Northeastern University*

Master's Students

2023	**Sarthak Gupta:** Advisor for Master's project on 6-DoF object pose estimation using RGB and/or depth image streams from the Microsoft HoloLens 2.	*Northeastern University*
2023	**Ana Manzano Rodriguez:** Advisor for Master's project on egocentric vision-based action recognition in the context of cooking tasks.	*Northeastern University*
2021 - 2022	**Eric Dusel:** Industry sponsor/advocate for the student's Gordon Engineering Leadership program on shared control for assistive robotic wheelchairs.	*Northeastern University*
2019	**M.Eng. Group Project:** "InstruMentor: An Interactive Robot for Musical Instrument Tutoring" (TAROS19 paper accepted for oral presentation, **IET Prize for Innovation**)	*Imperial College London*

Undergraduate Students

2021 - Present	**Co-op Program:** Interview, hire, and manage students on full-time research internships. List of students: Rania Alshawabkeh, Lisa Byrne, James Flanagan, Muneer Lalji, Gary Lvov, Tyler Mckenzie, Henry Noyes, Risha Ranjan, John Wilkins, Dina Zemlyanker.	*Northeastern University*
2021	**NASA's RASC-AL Moon to Mars Ice & Prospecting Challenge:** "Percussive And Rotary Surveying & Extracting Carousel" (**won 2nd place** and **best technical paper**)	*Northeastern University*

Professional Activities & Service

Peer Reviewing

Reviewed several manuscripts (**total: 27**) for top-tier journals and conferences in artificial intelligence, computer vision and robotics.

Journals	IEEE Transactions on Robotics (2023) IEEE Robotics and Automation Letters (2022, 2023) Elsevier Robotics and Computer-Integrated Manufacturing (2021) IEEE Technology and Society Magazine (2018, 2019, 2020)
Conferences	IEEE International Conference on Robotics and Automation (2019, 2021, 2023, 2024) IEEE-RAS International Conference on Humanoid Robots (2023) IEEE International Conference on Robot and Human Interactive Communication (2022) IEEE Winter Conference on Applications of Computer Vision (2021, 2022) IEEE/CVF Conference on Computer Vision and Pattern Recognition (2020, 2021) IEEE/RSJ International Conference on Intelligent Robots and Systems (2019)
Workshops	RSS Pioneers Workshop (2022) eCAS Workshop on Engineering Collective Adaptive Systems (2017)

Academic Service

2023 - Present	Member	*IEEE Technical Committee on Shared Control*
2023	Participant & Presenter	*DARPA Perceptually-enabled Task Guidance (PTG) PI Meeting*
2022	Regular Session Chair	*IEEE/RSJ International Conference on Intelligent Robots and Systems*
2020 - 2021	Program Committee Member	*Winter Conference on Applications of Computer Vision*
2015 - 2016	Degree Representative	*Imperial College London, Electronic & Information Engineering*
2014	Student Volunteer	*IEEE International Conference on Self-Adaptive and Self-Organizing Systems*

Invited Talks & Demonstrations

2023	Extended Reality for "Explainable" Telerobotics	*Engineering Seminar Series, King's College London*
2023	Extended Reality for "Explainable" Telerobotics	*Personal Robotics Lab, Imperial College London*
2023	Panel: Perspectives on Research Convergence Poster Presentation	*NSF FW-HTF PI Meeting*
2021	Explainable Shared Control in Assistive Robotics	*EECE 5550 Mobile Robotics, Northeastern University*
2021	Doctoral Consortium Track	*IJCAI*
2019	ABB-Imperial Digital Energy Demonstrator Launch Event	*Imperial College London*
2016	Workshop on Foundations and Applications of Self* Systems	*IEEE SASO Conference*

Outreach

2023	Department of Electrical & Computer Engineering showcase to undergraduate students	*Northeastern University*
2022 & 2023	Institute of Experiential Robotics Open House demonstrating research to the public	*Northeastern University*
2022	Telephone Campaign where current students contact alumni for advice and fundraising	*Imperial College London*
2017	College Undergraduate Open Day tour guide	*Imperial College London*

Publications

Key Numbers

Publications in peer-reviewed journals:	1 published, 1 under review
Publications in peer-reviewed conferences:	8 published, 3 submitted
Publications in peer-reviewed workshops/abstracts:	3 published
Total citations (Google Scholar)	100+ in total 𝔉: bit.ly/3FlRs0M

Publications in which I am the lead author are marked with **

Journal Articles

[J1] M. Zolotas, M. Wonsick, P. Long, T. Padır, **"Motion Polytopes in Virtual Reality for Shared Control in Remote Manipulation Applications"**, *Frontiers in Robotics and AI*, vol. 8, 2021 — ***FRAI2021***, 7 citations

Conference Proceedings

[C8] G. Lvov, M. Zolotas, N. Hanson, A. Allison, X. Hubbard, M. Carvajal, T. Padır, **"Mobile MoCap: Retroreflector Localization On-The-Go"**, *IEEE International Conference on Automation Science and Engineering*, pp. 1-7, 2023 — **CASE2023**

[C7] M. Shaham, M. Skopin, H. Hochsztein, K. Mabulu, L. Milburn, J. Tukpah, A. Tunik, J. Winn, M. Zolotas, D. Erdoğmuş, T. Padır, **"Human-Supervised Automation Test Cell to Accelerate Personal Protective Equipment Manufacturing During the COVID-19 Pandemic"**, *IEEE International Symposium on Technologies for Homeland Security*, pp. 1-8, 2022 — **HST2022**

[C6] M. Zolotas and Y. Demiris, **"Disentangled Sequence Clustering for Human Intention Inference"**, *IEEE/RSJ International Conference on Intelligent Robots and Systems*, pp. 9814-9820, 2022 — ***IROS2022***, 5 citations

[C5] M. Zolotas, R. Luo, S. Bazzi, D. Saha, K. Mabulu, K. Kloeckl, T. Padır, **"Productive Inconvenience: Facilitating Posture Variability by Stimulating Robot-to-Human Handovers"**, *IEEE International Conference on Robot and Human Interactive Communication*, pp. 122-128, 2022 — ***ROMAN2022***, 1 citation

[C4] P. Chang, R. Luo, M. Zolotas, T. Padır, **"Manipulation of Deformable Linear Objects in Benchmark Task Spaces"**, *IEEE International Conference on Automation Science and Engineering*, pp. 1910-1916, 2022 — **CASE2022**

[C3] M. Zolotas and Y. Demiris, **"Towards Explainable Shared Control using Augmented Reality"**, *IEEE/RSJ International Conference on Intelligent Robots and Systems*, pp. 3020-3026, 2019 — ***IROS2019***, 30 citations

[C2] S. Bagga, B. Maurer, T. Miller, L. Quinlan, L. Silvestri, D. Wells, R. Winqvist, M. Zolotas, Y. Demiris, **"instruMentor: An Interactive Robot for Musical Instrument Tutoring"**, *Towards Autonomous Robotic Systems*, pp. 303-315, 2019 (Oral Presentation, **IET Prize for Innovation in Robotics**) — **TAROS2019**, 6 citations

[C1] M. Zolotas, J. Elsdon, Y. Demiris, **"Head-Mounted Augmented Reality for Explainable Robotic Wheelchair Assistance"**, *IEEE/RSJ International Conference on Intelligent Robots and Systems*, pp. 1823-1829, 2018 — ***IROS2018***, 47 citations

Workshop Papers

[W2]	A. Trivedi, S. Bazzi, M. Zolotas and T. Padır, **"Probabilistic Dynamic Modeling and Control for Skid-Steered Mobile Robots in Off-Road Environments"**, *International Conference on Assured Autonomy*, pp. 57-60, 2023	**ICAA2023**
[W1]	M. Zolotas and J. Pitt, **"Self-Organising Error Detection and Correction in Open Multi-agent Systems"**, *International Workshops on Foundations and Applications of Self* Systems*, pp. 180-185, 2016	***SASO2016*** 5 citations

Extended Abstracts

[A1]	M. Zolotas and Y. Demiris, **"Transparent Intent for Explainable Shared Control in Assistive Robotics"**, *International Conference on International Joint Conferences on Artificial Intelligence*, pp. 5184-5185, 2020	***IJCAI2020*** 2 citations

References

- Professor Taşkın Padır, Northeastern University (current advisor)
  Director of the Institute for Experiential Robotics and Amazon Scholar
  t.padir@northeastern.edu
- Professor Yiannis Demiris, Imperial College London (Ph.D. supervisor)
  Royal Academy of Engineering Chair in Emerging Technologies and Head of the Intelligent Systems and Networks group
  y.demiris@imperial.ac.uk
- Professor Deniz Erdoğmuş, Northeastern University (research projects collaborator)
  Professor of ECE & CTO of Kostas Research Institute at Northeastern University
  d.erdogmus@northeastern.edu
- Associate Professor Jaime Ruiz, University of Florida (DARPA project collaborator)
  Ruiz Human-Computer Interaction Lab
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