Mark Zolotas

Research Scientist, Toyota Research Institute

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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 establish effective human-robot interactions where people live and work. I approach this ambition by studying and advancing how robots model human behavior, provide assistance, and communicate with people.

Employment

Research Scientist, Toyota Research Institute (TRI) *June 2024 - Present*
Large Behavior Models (LBM) Division
- Conduct robotics foundation model research within the LBM division of TRI, resulting in peer-reviewed publications, demonstrations of state-of-the-art robotics capabilities, and open-source releases of collected data and code

Research Scientist, Northeastern University *Dec. 2022 - May 2024*
Institute for Experiential Robotics
- Led research directions, participated in grant writing activities and other efforts to secure external funding, co-advised university students, and created research outcomes including but not limited to academic publications and open-source codebases

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

Education

PhD in Robotics, Imperial College London *Oct. 2016 - Oct. 2020*
Department of Electrical and Electronic Engineering
- Thesis: "Explainable Shared Control in Assistive Robotics"

MEng 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"

Research Projects & Grants

Technical Contributor, Boston Dynamics Collaboration project on the Atlas Humanoid *TRI*
"Large Behavior Models and Atlas Find New Footing" *2024 - Present*
- Core technical member of the AI research team focused on building language-conditioned policies for the Atlas humanoid to perform long-horizon, whole-body manipulation tasks
- Contributed to the development, deployment, and experimentation of the LBM policy architectures responsible for enabling Atlas to complete tasks that required coordinated locomotion and dexterous manipulation

Research Scientist, LBM Team *TRI*
"A Careful Examination of Large Behavior Models for Multitask Dexterous Manipulation" *2024 - Present*
- Designed and implemented components of a VR/XR robot teleoperation system leveraging the Apple Vision Pro headset
- Supported robot operations within data collection and evaluation pipelines used to create LBMs

Co-investigator, DARPA Perceptually-enabled Task Guidance (PTG) program *Northeastern University*
"ENKIx: Enabling Knowledgeable Task Guidance In the Extremes" *2021 - 2024*
- Directed a 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
- Represented 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*
- Defined and managed 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

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

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 (5,000 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*

Technical Skills

Programming	C/C++, Python, C#, Swift, Java, Matlab, SQL, Prolog
Software	ROS 1 & 2, TensorFlow, PyTorch, JAX, Amazon Web Services (AWS) Ray, Amazon SageMaker, Bazel build, Unity, Git, Jupyter, OpenCV, scikit-learn, .NET
Robots	Custom-build robotic wheelchairs, UR Cobot arms, Kinova Gen3, ABB YuMi, Hello Robot Stretch, Franka Emika Panda, Aldebaran Nao, Boston Dynamics eAtlas
VR/XR Headsets	Apple Vision Pro, HTC Vive, HoloLens 1 & 2, Valve Index
Simulators	Drake, Gazebo, MuJoCo

Select Publications

Publications in which I am the lead author are marked with ** and the symbol † in the author list denotes equal contributions

Journal Articles

[J6] TRI LBM Team, **"A Careful Examination of Large Behavior Models for Multitask Dexterous Manipulation "**, *Under review, 2025* **arxiv2025**

[J5] A. Trivedi, S. Prajapati, M. Zolotas, M. Everett, T. Padır, **"Chance-Constrained Convex MPC for Robust Quadruped Locomotion Under Parametric and Additive Uncertainties"**, *IEEE Robotics and Automation Letters*, 2025 **RAL2025**

[J4] M. Zolotas†, P. Long†, K. Sagar, T. Padır, **"constrained_manipulability: A ROS 2 library to Compute and Visualize Constrained Capacities for Robotic Manipulators"**, *The Journal of Open Source Software*, 2025 ***JOSS2025b***

[J3] M. Zolotas†, P. Long†, T. Padır, **"robot_collision_checking: A Lightweight ROS 2 Interface to FCL (Flexible Collision Library)"**, *The Journal of Open Source Software*, 2025 ***JOSS2025a***

[J2] M. Zolotas, R. Luo, S. Bazzi, D. Saha, K. Mabulu, K. Kloeckl, T. Padır, **"Imposing Motion Variability for Ergonomic Human-Robot Collaboration"**, *IISE Transactions on Occupational Ergonomics and Human Factors*, 2024 ***TOEHF2024***

[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*, 2021 ***FRAI2021***

Conference Proceedings

[C10]	A. Trivedi, S. Prajapati, A. Shirgaonkar, M. Zolotas, T. Padır, **"Data-Driven Sampling Based Stochastic MPC for Skid-Steer Mobile Robot Navigation"**, *IEEE International Conference on Robotics and Automation*, 2025	**ICRA2025**
[C9]	R. Luo†, M. Zolotas†, D. Moore, T. Padır, **"User-customizable Shared Control for Robot Teleoperation via Virtual Reality"**, *IEEE/RSJ International Conference on Intelligent Robots and Systems*, 2024	***IROS2024b***
[C8]	M. Carvajal, K. Mabulu, M. Lalji, J. Flanagan, R. Luo, S. Hibbard, T. Chinthapatla, R. Bettadpur, S. Bazzi, M. Zolotas, K. Kloeckl, T. Padır, **"A Voxel-Enabled Robotic Assistant for Omnidirectional Conveyance"**, *IEEE/RSJ International Conference on Intelligent Robots and Systems*, 2024	**IROS2024a**
[C7]	A. Trivedi, M. Zolotas, A. Abbas, S. Prajapati, S. Bazzi, T. Padır, **"A Probabilistic Motion Model for Skid-Steer Wheeled Mobile Robot Navigation on Off-Road Terrains"**, *IEEE International Conference on Robotics and Automation*, 2024	**ICRA2024**
[C6]	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*, 2023	**CASE2023**
[C5]	M. Zolotas and Y. Demiris, **"Disentangled Sequence Clustering for Human Intention Inference"**, *IEEE/RSJ International Conference on Intelligent Robots and Systems*, 2022	***IROS2022***
[C4]	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*, 2022	***ROMAN2022***
[C3]	M. Zolotas and Y. Demiris, **"Towards Explainable Shared Control using Augmented Reality"**, *IEEE/RSJ International Conference on Intelligent Robots and Systems*, 2019	***IROS2019*** 47 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 (Oral Presentation)*, **IET Prize for Innovation in Robotics**, 2019	**TAROS2019**
[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*, 2018	***IROS2018*** 65 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*, 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*, 2016	***SASO2016***

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*, 2020	***IJCAI2020***