Lekan Molu

AI | Robotics | Control Systems

Rerum Cognoscere Causas: To know the causes of things.

✉ *patlekno@icloud.com*

Education

2019 - 2021 **Postdoctoral Scholar**, The University of Pennsylvania, Philadelphia, PA, USA.
Design, build, and control of a soft robot for assisted MRI-based cancer radiation therapy.

2014 - 2019 **PhD in Electrical and Computer Engineering**, *University of Texas at Dallas*, Richardson, USA. *"A Multi-DOF Soft Robot Mechanism for Patient Motion Correction and Beam Orientation Selection in Cancer Radiation Therapy"*.

2011 - 2013 **Master of Science in Engineering in Control Systems**, *The University of Sheffield*, Sheffield, United Kingdom. *"Autonomous Navigation of a Rotorcraft Unmanned Aerial Vehicle using Machine Vision"* .

Experience

Preamble

Teaming *First-class, productivity-oriented* individual with experience working alongside diverse and geographically distributed teams to create and execute plans to bring-up, and validate designs to achieve system level functionalities. Closely collaborating with partnership teams (e.g. cross-geographic/cross-organization research, engineering, technical program managers, product teams, supply chain), and external vendors by optimizing the technological and manufacturing innovation for volume scale-up. Experience with the physics and algorithmics of sensors fusion and integration into physical systems, conceiving new control laws and exacting their numerical algorithmics on modern computing platforms; software infrastructure build-up for large research projects; subsystems testing and calibration methodology via (quick) prototype, test, refine cycle (as part of overall systems development). Collaborating and managing through positive influence. Experience in companies and universities (United States, Europe, Asia, and Africa) across disciplines and industries to create business processes, address organizational issues, carve out system requirements, drive technical and business innovation.

Computing Overview

Software 2.0 Experience in large deep models and foundation models testing, refinement, probing, and utilities (GPT-4o, o1, Google Gemini, OpenVLA, RT-2, etc.) for robot and other automation problems. Multi-node, multi-GPU via SLURM and Distributed data parallel training and refinement of large deep models and policies: GPU and OpenMP-based cpu threads optimization; scaling distributed training via consistent maximization of GPU utilization across inter-geographic cloud clusters; efficient data access on Azure blob storage containers; optimizing container efficiency through nimble data retrieval.

OS OSX, Debian, Ubuntu, Windows, Raspian.

Programming C++, Python, Mathematica, MATLAB, LabVIEW.

Learning Deep networks, Azure cloud (blob storage, multi-node-multi-GPU model training and deployment) with tools internal to Microsoft Research, PyTorch, and CuPy. Foundation models evaluation including GPT-4o, GPT-4o1, Transformers, recurrent networks, convolutional neural networks, Gaussian Processes, computer vision (SAM, DINO etc), ML object detection etc.

CAD Solid Works, AutoDesk Inventor, Blender, Adobe Illustrator, Adobe After Effects.

ROS Robot operating system SKUs including Indigo, Jade, Kinetic, and Melodic; and ROS 2 systems including Bouncy Bolson, Ubuntu Kame and Mate embedded distros.

Libraries	Point Cloud, OpenCV, Eigen, Docker, PyTorch, Numpy, CuPy, SciPy, Scikit-Learn, C++11/14/17.
Web	HTML (beginner), Markdown (proficient).

Hardware Overview

Prototyping	Experience in components selection (including design and control of soft actuators, programmable linear actuators, robot mechanism design, harmonic drives, 3D custom parts printing), sensors (MEMs, line and RGB-D cameras, and optical systems) selection and integration, microcontrollers integration (National Instruments, Raspberry Pi's, Arduinos), components specifications, schematic design, PCB layout and bring up.
Embedded Systems	Experience with design of embedded systems, completing board layouts, assembling, testing, debugging, and integrating designs into opto-electro-mechanical systems. Communication protocols (e.g. SPI, I^2C, TCP/IP, UDP), Linux/Python scripting, and C++. Enjoy being hands-on in the lab, rapid software prototyping; enjoy being in the details (soldering, oscilloscopes, data acquisition) and a thriving gusto for engineering.

Research Experience Chronology

Research Experience	Experience at the intersection of machine learning, control systems, and robotics research for automated decision-making in physical and virtual systems. Reinforcement learning via contextual bandits, rewards modeling, state representation, policy optimization, safety in learning-based designs etc. Improving control of autonomous (and robotics) systems via robustness and safety design – from conceptualization to numerical algorithmics, and planning and spatial intelligence on robotics platforms (e.g., the Kinova robot, Clearpath mobile robot platform, UR2, UR5, Fanuc Robot, and various custom soft robot mechanisms, planning on mecanum wheels etc.).
May '21 - June '21	**Senior Researcher**, Microsoft Research, New York, NY, USA. Reinforcement learning for decision-making, foundation models for agentic decision making, nonlinear control of dynamical systems, mentoring junior researchers including postdocs, interns; cross-geographic, cross-team building spanning Amsterdam, Madrid (Spain), Cambridge (UK), Seattle, and Montreal for global research projects bring-up and collaborations.
Summer '18	**Research Intern**, Preferred Networks, Otemachi, Chiyoda-ku, Tokyo, Japan. "Preferred Networks is one of a tiny handful of Japanese 'unicorns', or technology startups valued at more than $1 billion." – The Wall Street Journal, 10/15/2018 *Research Intern within the Robotics Team. Worked on stable learning of complex robot motion-planning/manipulation tasks.*
Fall '17 - Spring '19	**Research Assistant**, Medical Aritificial Intelligence and Automation Laboratory, Division of Medical Physics and Engineering, Radiation Oncology Department, UT Southwestern Medical Center. *Research Assistant for Dr. Steve Jiang, Barbara Crittenden Professor of Cancer Research, UTSW Department of Radiation Oncology.* Developed a multidisciplinary approach (spanning Deep learning, optimal control, dynamic programming, and game theory) in order to solve the classic beam orientation optimization (BOO) problem.
Summer - Fall '17	**Research Assistant**, Dr. Tyler Summers, Mechanical Engineering, UT Dallas. *Dynamic Programming, Decision Theoretic Control, Machine/Reinforcement Learning.* Developed a game-theoretic controller for mitigating the lack of robustness in multi-stage decision policies on physical robots (P3DX).
Fall '14 - Spring 19	**Research Assistant**, Dr. Nick Gans, Electrical Engineering, University of Texas at Dallas. *Control Systems, Systems Identification, State Estimation and Computer Vision.* Conceived the prototypical testbed, procured hardware, integrated components to simulate soft robot compensating systems for patients in intensity modulated radiotherapy.

Summer '16	**Hardware Integration Intern**, Amazon Robotics LLC.
	SLAM, Software and Hardware Integration Intern for Tye Brady, Chief Technology Officer.
	Helped integrate the hardware and software for the P3-DX robot used as a recreational robot in the Amazon Robotics' North Reading, MA office. Collaborated closely as a team member within the robotic manipulation team: helped with emerging fulfillment centers end-of-arm-tooling (EOAT) design reviews, amazon robotics 2016 challenge problems design, helped other interns on their projects etc.
Spring '16	**Hardware Integration Intern**, Advanced Robotics Lab, Amazon Robotics LLC.
	Hardware Integration Intern for Dr. Andy Stubbs, Senior Hardware Systems Engineer.
	Computer vision (point cloud, depth, and RGB) integration for objects sorting, and pick and place line scanners at a prototype fulfillment center (later adopted for the Cataret, NJ fulfillment center).

Select OpenSource Projects

VowpalWabbit	Interaction-grounded learning on the Vowpal Wabbit platform. Available at https://github.com/VowpalWabbit/vowpal_wabbit.
PCL	Fix for segfault in our-cvfh algorithm in the point-cloud library. (Available at PR 1827)
Levelsetpy	A software package system for dynamical systems' safety-verification. Available at https://github.com/robotsorcerer/levelsetpy.
Lyapunov-Learner	Python Implementation of "Learning Control Lyapunov Functions for Dynamical Systems". (Available at https://github.com/robotsorcerer/LyapunovLearner)
DICE	Sørensen-Dice coefficients in Torch7. (Available at https://github.com/robotsorcerer/nn).

Publications

Recent preprints

Lekan Molu, Namhoon Lee, and Venkatraman Renganathan. Hopf-Lax Nonconvex Optimization of Reachable Sets on Non-viscous Hamilton-Jacobi PDEs. 2025.

Haoxiang You, **Lekan Molu**, and Ian Abraham. Is the Bellman Equation Enough for Learning Control? 2025.

Published and Recently accepted

Lekan Molu. Fast Whole-Body Strain Regulation in Continuum Robots. *IEEE American Control Conference*, Denver, Co. July 2025.

Lekan Molu. LevelSetPy: A GPU-Accelerated Package for Resolving Hyperbolic Hamilton-Jacobi Partial Differential Equations. *ACM Transactions on Mathematical Software.* March 2025.

Lekan Molu. The Python LevelSet Toolbox (LevelSetPy). *IEEE Conference on Decision and Control (CDC)*. Milan, Italy. December 2024.

Anurag Koul⋆, Shivakanth Sujit⋆, Shaoru Chen, Ben Evans, Lili Wu, Byron Xu, Rajan Chari, Yonathan Efroni, Miro Dudik, **Lekan Molu**, John Langford, Alex Lamb. PCLAST: Discovering Plannable Latent States. *International Conference on Machine Learning (ICML),* Vienna, Austria, July 2024.

Lekan Molu and Shaoru Chen. Structural Properties and Control of Soft Robots Modeled as Discrete Cosserat Rods. *IEEE Conference on Decision and Control (CDC)*, Milan, Italy. December 2024.

Shaoru Chen, **Lekan Molu**, and Mahyar Fazlyab. Verification-aided Learning Neural Network Barrier Functions with Termination Guarantees. *American Control Conference (ACC)*, 2023.

Alex Lamb, Riashat Islam, Yonathan Efroni, Aniket Didolkar, Dipendra Misra, Dylan Foster, **Lekan Molu**, Rajan Chari, Akshay Krishnamurthy, John Langford. Guaranteed Discovery of Control-Endogenous Latent States with Multi-Step Inverse Models. *Transactions in Machine Learning Research.* February 2023.

Lekan Molu. Mixed H2/H-Infinity Policy Learning Synthesis. *World Congress, International Federation of Automatic Control*, Yokohama, Japan. July 2023.

Tengyang Xie, Akanksha Saran, Dylan J Foster, **Lekan Molu**, Ida Momennejad, Nan Jiang, Paul Mineiro, and John Langford. Interaction-Grounded Learning with Action-inclusive Feedback.*Neural Information Processing Systems (Neurips).*, New Orleans, La. May 2022.

Azar Sadeghnejad Barkousaraie, **Olalekan Ogunmolu**, Steve Jiang, and Dan Nguyen. A Fast Deep Learning Approach for Beam Orientation Selection Using Supervised Learning with Column Generation on IMRT Prostate Cancer Patients. *The International Journal of Medical Physics Research and Practice*, 2020.

Olalekan Ogunmolu, Michael Folkerts, Dan Nguyen, Nicholas Gans, and Steve Jiang. Deep BOO: Automating Beam Orientation Selection in Intensity Modulated Radiation Therapy. *Algorithmic Foundations of Robotics XIII, International Workshop* (*WAFR*), Mérida, Mexico. December 2018.

Olalekan Ogunmolu, Xinmin Liu, Nicholas Gans, and Rodney Wiersma, Mechanism and Model of a Soft Robot for Head Stabilization in Cancer Radiation Therapy. *IEEE International Conference on Robotics and Automation (ICRA 2020)*, 2020.

Azar Sadeghnejad Barkousaraie, **Olalekan Ogunmolu**, Steve Jiang, and Dan Nguyen. Using Supervised Learning and Guided Monte Carlo Tree Search for Beam Orientation Optimization in Radiation Therapy. Appeared in *Artificial Intelligence in Radiation Therapy (AIRT). Lecture Notes in Computer Science, vol 11850. Springer Cham*, Presented at *International Conference on Medical Image Computing and Computer Assisted Intervention, XXII* (*MICCAI*), Shenzhen, China. 2019.

Olalekan Ogunmolu, and Rodney Wiersma. A Real-Time Patient Head Motion Correction Mechanism for MRI-Linac Systems. (*AAPM/COMP Meeting*). July 2020.

Olalekan Ogunmolu, Xinmin Liu, and Rodney Wiersma. Paths Replanning for Head and Neck Motion Correction in Robotic Stereotactic Radiosurgery. *AAPM/COMP Meeting.* July 2020.

Olalekan Ogunmolu, A Multi-DOF Soft Robot Mechanism for Patient Motion Correction and Beam Orientation Selection in Cancer Radiation Therapy. *PhD Thesis, University of Texas at Dallas, UT Southwestern Medical Center* 2019.

Olalekan Ogunmolu, Nicholas Gans, and Tyler Summers. Minimax Iterative Dynamic Game: Application to Nonlinear Robot Control Tasks. *IEEE/RSJ International Conference on Intelligent Robots and Systems* (*IROS*), Madrid, Spain. October 2018. DOI: 10.1109/IROS.2018.8594037.

Olalekan Ogunmolu, Adwait Kulkarn, Yonas Tadesse, Xuejun Gu, Steve Jiang, and Nick Gans. Soft-NeuroAdapt: A 3-DOF Neuro-Adaptive Pose Correction System For Frameless and Maskless Cancer Radiotherapy. *IEEE/RSJ International Conference on Intelligent Robots and Systems* (*IROS*), Vancouver, BC, Canada. September 2017. DOI: 10.1109/IROS.2017.8206211.

Olalekan Ogunmolu, Xuejun Gu, Steve Jiang, and Nick Gans. Vision-based control of a soft-robot for Maskless Cancer Radiotherapy. *IEEE Conference on Automation Science and Engineering (CASE)*, Fort-Worth, Texas, August 2016. DOI: 10.1109/CoASE.2016.7743378.

Olalekan Ogunmolu, Xuejun Gu, Steve Jiang, and Nick Gans. A Real-Time Soft-Robotic Patient Positioning System for Maskless Head-and-Neck Cancer Radiotherapy. *IEEE Conference on Automation Science and Engineering (CASE)*, Gothenburg, Sweden, August 2015. DOI: 10.1109/CoASE.2015.7294318.

Olalekan Ogunmolu, Dan Nguyen, Xun Jia, Weiguo Lu, Nick Gans, and Steve Jiang. Automating Beam Orientation Optimization for IMRT Treatment Planning: A Deep Reinforcement Learning Approach. *60th Annual Meeting of the American Association of Physicists in Medicine*, Nashville, TN (*AAPM*). July 2018.

Yara Almubarak, Joshi Aniket, **Olalekan Ogunmolu**, Xuejun Gu, Steve Jiang, Nicholas Gans, and Yonas Tadesse, Design and Development of Soft Robots for Head and Neck Cancer Radiotherapy. *SPIE: Smart Structures + Nondestructive Evaluation,* Denver, CO, U.S.A. March 2018.

Technical Reports

Olalekan Ogunmolu, Nicholas Gans, and Tyler Summers. Robust Zero-Sum Deep Reinforcement Learning. *arxiv PrePrints, arxiv ID:1710.00491*, Oct 2017.

Olalekan Ogunmolu, Xuejun Gu, Steve Jiang, and Nicholas Gans. Nonlinear Systems Identification Using Deep Dynamic Neural Networks. *arxiv PrePrints, arxiv ID:1610.01439*, Oct 2016.

Patent applications

Alex Lamb, Riashat Islam, Yonathan Efroni, Aniket Didolkar, Dipendra Misra, Dylan Foster, **Olalekan Ogunmolu**, Rajan Chari, Akshay Krishnamurthy, John Langford. Controllable Latent Space Discovery Using Multi-Step Inverse Model, Nov. 2022.

Select Invited Talks and Organized Workshops

Cornell Tech	Towards Safe Autonomous Systems: Between Bellman and Isaacs. Cornell Tech, New York, New York. 2025.
Princeton University	Numerical algorithms for verification in autonomous systems.. Princeton, New Jersey. 2025.
Microsoft Research (Global)	A Collision-Free Engine for Autonomous Systems. Microsoft Research Annual TechFest (Project Green) Lead Workshop Organizer, Redmond, Greater Seattle Area, 2025.
McGill University	Emerging mathematical modeling and control tools for deformable robots and animated characters.. MILA and McGill University. Nov 2024.
Microsoft Research (Global)	Towards structured representations in deep models and policies: symmetries, compactness, and vector homomophisms. Microsoft Research Annual TechFest (Project Green) Lead Workshop Organizer, Redmond, Greater Seattle Area, 2024.
Yale University	Mixed $H2_2/H_\infty$ stochastic RL policy optimization analysis.. Yale University, New Haven, Conn, USA. Nov 2023.
Open Robotics	Soft-Robotic Position Correction Mechanisms in Intensity-Modulated Radiation Therapy. **Open Robotics Foundation**, Mountain View, CA, USA. January 2019.
Stanford University	Robotic Radiotherapy: Automating Position Correction in Intensity-Modulated Radiation Therapy. Department of Energy Resources Engineering, **Stanford University**, Stanford, CA, USA. November 2018.
UChicago	Robotic Radiotherapy: Automating Position Correction in Intensity-Modulated Radiation Therapy. Department of Radiation and Cellular Oncology, **The University of Chicago**, Chicago, IL, USA. November 2018.
ATR CNS Labs	Minimax Iterative Dynamic Game. Department of Brain Robot Interface, **Computational Neuroscience Labs, ATR**, Osaka, Japan. August 2018.
Preferred Networks	Neural Networks and Adaptive Control. **Preferred Networks Tech. Talk**, Chiyoda-ku, Tokyo. Japan. August 2018.
Google	SoftNeuroAdapt: A 3-DoF Neuro-Adaptive Healthcare System. *Work presented by Nick Gans*, **Google Robotics**, Mountain View, CA. USA. September 2017.
UTARI, Fort Worth, TX	A Wearable Soft Robotic Modular System for Head and Neck Motion Correction in Intensity-Modulated Radiation Therapy. **University of Texas at Arlington Research Institute**, Fort Worth, Texas, USA. May 2019.
EFSC'17 Vancouver, BC	Soft Robotic Modules as Position Correcting Mechanisms in Cancer RT. *3rd **Entrepreneurship Forum & Start-up Competition**, EFSC'17,* Vancouver, BC, Canada. September 2017.
UTSW, Dallas, TX	A 3-DOF Neuro-Adaptive Patient Pose Correcting System For Frameless and Maskless Cancer Radiotherapy. *Physics Research Seminar Series, Radiation Oncology Department, **UT Southwestern Medical Center**,* Dallas, TX, USA. March 2017.

Research Mentoring

Postdoctoral Scholars at MSR

2024 - 2025	Taylor Webb, Princeton Neuroscience PhD, UCLA and MSR Postdoc. Resuming as Assistant Professor at University de Montreal, 2025.

2023 - 2024	Shaoru Chen (UPenn ECE PhD co-advised by George Pappas); advised as MSR Postdoc. Now Senior Machine Learning Engineer at LinkedIn, 2024 - Present.
2023 - 2024	Anurag Koul (Oregon State PhD); advised as MSR Postdoc. Now Senior Applied Scientist II at Amazon NYC, 2024 - Present.
2022 - 2024	Akanksha Saran (UT Austin CS PhD); advised as MSR Postdoc. Now Research Scientist at Sony AI, Bay Area.
2022 - 2023	Hosein Hasanbeig (Oxford PhD advised by Alessandro Abate); advised as MSR postdoc. Now Senior Researcher at Microsoft Experiences+Devices Management, Washington D.C.

Research Interns at MSR

Summer 2024	Abulikemu Abuduweili, CMU Robotics PhD Student. Incoming Research Scientist at Reliant Robotics, Bay Area.
Summer 2022	Leilei Cui, NYU PhD Student. Now Postdoctoral scholar at Massachusetts Institute of Technology (MIT).
Summer 2023	Harley Wiltzer, McGill PhD Student; advised by Marc Bellemare and David Meager.
Summer 2023	Thomas C.K. Zhang, UPenn 5th-year PhD Student advised by Nikolai Matni.
Summer 2023	Etiosa Omeike, Princeton CS BA, MSR undergraduate intern; now PhD student with Prof. Marynel Vázquez at Yale.

Auxiliary PhD Students

2024 -	Will Sharpless, UCSD Mechanical and Aerospace Engineering PhD Student; advised by Prof. Sylvia Herbert.
2023 -	Gilbert Bahati, Caltech Mechanical Engineering PhD student, advised by Prof. Aaron Ames.
2024 -	Haoxiang You, Yale Mechanical Engineering PhD Student; advised by Prof. Ian Abraham.
2025 -	Promise Ekpo, Princeton Masters student; now PhD student at CornellTech Airlab (advised by Prof. Angelique Taylor).

General Engineering Mentoring

2017 - 2018	Adwait Kulkarn. UT Dallas Mechanical Engineering Masters student. Currently Vice President of Engineering at Drov Technologies, MN.
2017 - 2018	Ajith Venkateswaran. UT Dallas Computer Engineering Masters student. Senior Robotics Software Engineer, Samsung Research, America; Now Software Tech Lead Embedded Automotive Platforms, Wayve, Bay Area.
2017 - 2019	Rachael Thompson. Plano High School Student. Currently an undergrad at MIT's CSAIL. Class of 2021. Now PhD Student at Brown.

━━━━ Select Leadership

Professional Organizations

2020 -	**NYAS**, *The New York Academy of Sciences, Member.*
2017 -	**IEEE RAS**, *The IEEE Robotics and Automation Society, Member.*
2017 -	**IEEE CSS**, *The IEEE Control Systems Society, Member.*

Research community leadership and activities

2017-Present	**Journals and Conference Papers Reviewing Activities**, *ASME, ICML, ICLR, IEEE ICRA, IROS, ACM, ACC, CDC,* and *IFAC* publications are top journals and proceedings in the fields of Mechanical Engineering, Machine Learning, Electrical Engineering, Computing machinery, and Automatic Control Engineering respectively, known for disseminating bleeding-edge research and cutting-edge technological advancements in robotics, machine learning and control systems.
'20	**ICLR**, *The International Conference of Learnng Representations*, A 1% publication avenue for cutting-edge research on all aspects of deep learning used in the fields of artificial intelligence, statistics and data science, as well as important application areas such as machine vision, computational biology, speech recognition, text understanding, gaming, and robotics.

'19 **JBHI**, *An IEEE Journal of Biomedical and Health Informatics Access.*

'19 **External Grants Reviewer**, *AI for Species Discovery,* National Geographic Society.

'18,'19 **Automatica**, *The International Federation of Automatic Control (IFAC).*

'17, '18, '19 **Access**, *IEEE Access Journal.*

'17, '18, '19 **NCAA**, *Springer's Neural Computing and Applications .*

'17 - **ICML**, *International Conference on Machine Learning .*

'18 - **CDC**, *IEEE International Conference on Decision and Control*, Flagship Control and Decision-Making Control Conference Proceedings in the World.

2017 - **DSCC**, *American Society of Mechanical Engineers (ASME) Dynamic Systems and Control Conference*, Conference Proceedings.

'17 - **ICRA**, *IEEE International Conference on Robotics and Automation*, Flagship IEEE Robotics and Automation Society Conference in the World.

'17 - **IROS**, *IEEE/Robotics Society of Japan (RSJ) International Conference on Intelligent Robots and Systems*, Flagship IEEE/RSJ Conference on Robotics.

'17 - **ACC**, *IEEE American Control Conference*, Premiere American Control Conference Venue.

'17 - **The IFAC World Congress**, *The International Federation of Automatic Control*, A worldwide, interdisciplinary congress of scientists and engineers to share up-to-date, complete and universal view of control and analysis techniques.

Miscellaneous

2017 – Now **Member**, **IEEE Control Systems Society**.

2017 – Now **Member**, **IEEE Robotics and Automation Society**.

2016–Now **Member**, *IEEE Boston*, Greater Boston, USA.

2015 – 2016 **Science instructor**, *IEEE Dallas Shoulder of Giants Workshops*, Dallas, TX.
Participant at IEEE Dallas Young Professionals community outreaches in promoting STEM education and awareness in the Dallas/Fort-Worth Metroplex.

2015 **Summer Science Program**, *University of Texas at Dallas*, Richardson, TX.
Trained high-school kids in basic robots control and programming with the Berkeley Snap! kit and arduino.

2012 **Workshop participant**, *ILA Berlin Airshow*, Berlin, Germany.
Selected by Cassidian (an EADS company) for the *Aerospace Systems Engineering* workshop.

2012 **Workshop participant**, *Farnborough International Airshow*, NE Hampshire, England.
Selected by Airbus (an EADS company) among participants at the *UAV and Fighter Aircraft* workshop.

Languages

English Reads, writes, and speaks fluently   *Lived in Nigeria, United Kingdom and United States.*