

Lekan Molu

Robotics / Control Systems / ML

Rerum Cognoscere Causas: To know the causes of things.

3620 Hamilton Walk
John Morgan Building, #183
Perelman School of Medicine
The University of Pennsylvania
Philadelphia, PA 19104-5156
☎ +1-267-881-8844
✉ patlekano@gmail.com

Education

- 2019 **PhD in Electrical and Computer Engineering.**
"A Multi-DOF Soft Robot Mechanism for Patient Motion Correction and Beam Orientation Selection in Cancer Radiation Therapy." Advisors: Nick Gans (University of Texas at Dallas) and Steve Jiang (UT Southwestern Medical Center.)
- 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."* Advisor: Tony J. Dodd.

Publications

Premier IEEE Robotics and Automation Society, Algorithmic Foundations of Robotics, and Medical Physics publications (WAFR, IROS, NIPS, PhysMed, and ICRA) are highly selective venues for archival papers, similar to selective IEEE journals in visibility and strong scientific/engineering communications.

Published/Accepted Papers

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 Kulkarni, 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.

Papers under review

Olalekan Ogunmolu, James Pikul, and Rodney Wiersma. [Kinematics and Kinetics of an In-Parallel-Actuated Soft Manipulator](#). (Under preparation for submission to) *IEEE Transactions on Robotics*, Fall 2020.

Alexander L. Van Slyke, **Olalekan Ogunmolu** and Rodney Wiersma. [A Universal Phantom Analysis Method Based on XML-SVG Wireframes with Novel Functional Object Identifiers](#). Submitted to *The International Journal of Medical Physics Research and Practice*, September 2020.

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.

Abstracts

Olalekan Ogunmolu, Xinmin Liu, and Rodney Wiersma. [Paths Replanning for Head and Neck Motion Correction in Robotic Stereotactic Radiosurgery](#). Accepted to the *AAPM/COMP Meeting*. July 2020.

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](#). *Medical Physics (AAPM)* 46 (6), E237-E237, San Antonio, TX, July 2019.

Olalekan Ogunmolu, Azar Sadeghnejad Barkousaraie, Nicholas Gans, Steve Jiang, and Dan Nguyen. [An Approximate Policy Iteration Scheme for Beam Orientation Selection in Radiation Therapy](#). *Medical Physics (AAPM)* 46 (6), E386-E386 San Antonio, TX, July 2019.

Azar Sadeghnejad Barkousaraie, **Olalekan Ogunmolu**, Steve Jiang, and Dan Nguyen. [A Reinforcement Learning Application of Guided Monte Carlo Tree Search Algorithm for Beam Orientation Selection in Radiation Therapy](#). *Medical Physics (AAPM)* 46 (6), E236-E236, San Antonio, TX, July 2019.

Olalekan Ogunmolu, Nicholas Gans, and Tyler Summers. [Minimax Iterative Dynamic Game: Application to Nonlinear Robot Control Tasks](#). *IEEE International Conference on Robotics and Automation. Machine Learning for Planning and Control Workshop Extended Abstract (ICRA 2018)*, Madrid, Spain. October 2018.

Olalekan Ogunmolu, Nicholas Gans, and Tyler Summers. [Minimax Iterative Dynamic Game: Application to Nonlinear Robot Control Tasks](#). *IEEE International Conference on Robotics and Automation, Late Breaking Result Abstract* Brisbane, Australia, May 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.

Tyler Summers, **Olalekan Ogunmolu**, and Nicholas Gans. [Robustness Margins and Robust Guided Policy Search for Deep Reinforcement Learning](#)". *IROS 2017 Abstract Only Track*, Vancouver, BC, Canada. September 2017.

Olalekan Ogunmolu, Nick Gans, Steve Jiang, and Xuejun Gu. [An Image-Guided Soft Robotic Patient Positioning System for Maskless Head-And-Neck Cancer Radiotherapy: A Proof-of-Concept Study](#). *American Association of Physicists in Medicine (AAPM) Annual Meeting*, Annaheim, CA, USA. July 2015.

Experience: Leadership, Hardware, and Computing

Collaborator/Team Leader Experience leading/working with teams to create and execute plans to bring-up, and validate designs to achieve system level functionalities. Experience working closely with partnership teams (e.g. research and supply chain, industrial manufacturing), and external vendors by optimizing the manufacturing process for volume scale-up. Designing sensor integration, testing and calibration methodology for volume manufacturing at lowest cost, and iterating on ideas, prototype, test, refine cycle. Managing by positive influence.

Innovation Experience solving complex system issues, developing system requirements, driving technical innovation and roadmap. Experience gathering requirements, defining high level architecture, executing hardware design, and product validation. Experience in companies and universities, across disciplines and industries.

Hardware

Prototyping Experience in components selection (including design and verification of programmable soft actuators, linear actuators, bike gear drivetrains, & braking systems), sensors (MEMs, liquid metals, & 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, in the details (soldering, oscilloscopes, data acquisition) and a thriving gusto for engineering.

Computing

OS OSX, Debian, Ubuntu, Windows, Raspian.

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

Learning DNN, CNN, RNN, Gaussian Processes, CV/ML object detection etc.

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

ROS Hydro, Indigo, Jade, Kinetic, and Melodic, Bouncy Bolson, Ubuntu Kame and Mate embedded distros.

Libraries Point Cloud, OpenCV, Eigen, Docker, PyTorch, Numpy, SciPy, Scikit-Learn, C++11/14/17.

Web HTML, Markdown.

Select OpenSource Projects

Lyapunov-Learner Python Implementation of "Learning Control Lyapunov Functions for Dynamical Systems". (Available at <https://github.com/lakehanne/LyapunovLearner>)

PCL Fix for segfault in our-cvfh algorithm in the point-cloud library. (Available at [PR 1827](#))

GPS Catkinized version of Levine et. al's guided policy search algorithm in ROS Indigo (Available at <https://github.com/lakehanne/gps>). Dockerized version available at [gps-docker](#).

Keyence Minimal source code for retrieving profile map from the keyence LJV-7000 series line scanners. (Available at <https://github.com/lakehanne/keyence>)

- RBN** Recurrent Batch Normalization of Neural Networks in Torch7. (Available at <https://github.com/element-research/rnn>)
- DICE** Sørensen-Dice coefficients in Torch7. (Available at <https://github.com/lakehanne/nn>).

Chronological Experience: Research, Teaching, Industry

Research

- Summer '19 - **Postdoctoral Scholar**, [The University of Pennsylvania](#), Philadelphia, PA, USA.
Present Design, build, and control of a soft robot for assisted MRI-based therapy.
- 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. Implemented Khansari-Zadeh's CLF-DM on the Tokyo Robotics 7-DoF Arm. Proposed a DP approach for better complex robot trajectory imitation.
- Fall '17 - **Research Assistant**, Medical Artificial Intelligence and Automation Laboratory, Division of Medical
Spring '19 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 **Research Assistant**, Dr. Tyler Summers, Mechanical Engineering, UT Dallas.
'17 *Dynamic Programming, Decision Theoretic Control, Machine/Reinforcement Learning.*
Developed a conservative controller for mitigating the lack of robustness in multi-stage decision policies.
- Fall '14 - **Research Assistant**, Dr. Nick Gans, Electrical Engineering, University of Texas at Dallas.
Spring 19 *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.

Teaching

- January 20 - **Adjunct Instructor, RBOT 250- Robot manipulation, planning and control**, *Brandeis University*.
Designing course outlines and teaching.
- Fall '14 - '16 **Teaching Assistant, Introduction to Robotics**, *University of Texas at Dallas*.
Guided students during laboratories in programming the Robai Cyton 300R2 Robot and graded homeworks.
- Spring '15 **Teaching Assistant, Linear Systems (M.S. Class)**, *University of Texas at Dallas*.
Responsible for helping Masters students with linear control theory applications; graded homeworks and midterms.
- Spring '14 **Instructor, Analysis and Design of Digital Systems**, *Adekunle Ajasin University*.
Developed course modules, sole instructor for sophomore students, graded homeworks, designed and graded exams.
- Summer '14 **Instructor, Digital Logic Design**, *Adekunle Ajasin University*.
Co-developed course modules, joint-instructor for junior students, graded homeworks, designed and graded exams.

Miscellaneous

- 2009–2011 **Supply Chain Manager, Apapa Plant**, *Coca-Cola Hellenic Bottling Company Plc*, Lagos, Nigeria.
Minimized glass breakages by 40%, assured efficiency in supply chain operations by coordinating with the Ikeja/Head Office Logistics teams, supervised 3 Coca-Cola mega warehouse managers leading to a reduction in waste by 35% after a 9-month stint at Apapa mega-plant. Introduced new standard operating procedures company-wide and country-wide to formalize waste minimization processes, and improve production supply chain processes. This led to the Apapa plant being the highest selling plant for all Coca-Cola products for two consecutive quarters.

Invited Talks

- 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. <i>Work presented by Nick Gans, Google Robotics</i> , 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. <i>Physics Research Seminar Series, Radiation Oncology Department, UT Southwestern Medical Center</i> , Dallas, TX, USA. March 2017.
IEEE Arlington, TX	Towards automated accurate patient positioning in maskless cancer radiotherapy. <i>IEEE Computational Intelligence Society</i> , UT Arlington, TX, USA. December 2015.

Awards and honors

○ Google AI Travel and Conference Grant	October 2018
○ IEEE RAS/IROS Travel Award (IROS 2018)	August 2018
○ Finalist at the 3rd Entrepreneurship Forum and Startup Competition Sponsored by IEEE Robotics and Automation Society, KUKA AG, and Univ. Hamburg	August 2017
○ NSF Doctoral Consortium Award (IROS 2017)	August 2017
○ Mary and Richard Templeton Graduate Fellowship	August 2017
○ ROSCon Scholarship (Open Software for Robotics Foundation)	July 2017
○ President's Teaching Excellence Award for Teaching Assistants	Nom. Feb. 2017
○ Golden Key International Honour Society	Inducted Dec. 2016
○ IEEE RAS/ISAM Travel Award (CASE 2016)	August 2016
○ Ericsson Graduate Fellowship	2015 - 2016
○ Jonsson Scholarship	2014 - 2015
○ Achievement Award, University of Florida (<i>Declined</i>)	Fall 2014
○ PTDF Overseas Scholarship Award, £25,500+ for one year. (~1.7% acceptance)	2011

Select Leadership

Professional Organizations

2020-Present	NYAS , <i>The New York Academy of Sciences</i> , Member.
2017-Present	IEEE RAS , <i>The IEEE Robotics and Automation Society</i> , Member.
2020-Present	AAPM , <i>The American Association of Physicists in Medicine</i> , Junior Member, Member.
2020-Present	ASTRO , <i>The American Society for Radiation Oncology</i> , Member.

Peer Reviewing Activities (Research)

- '20 **ICLR**, *The International Conference of Learning 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, '20 **ICML**, *International Conference on Machine Learning*.
- '18,'19,'20 **CDC**, *IEEE International Conference on Decision and Control*, Flagship Control and Decision-Making Control Conference Proceedings in the World.
- 2017-Present **DSCC**, *American Society of Mechanical Engineers (ASME) Dynamic Systems and Control Conference*, Conference Proceedings.
- '17-'20 **ICRA**, *IEEE International Conference on Robotics and Automation*, Flagship IEEE Robotics and Automation Society Conference in the World.
- '17-'20 **IROS**, *IEEE/Robotics Society of Japan (RSJ) International Conference on Intelligent Robots and Systems*, Flagship IEEE/RSJ Conference on Robotics.
- '17, '18,'19 **ACC**, *IEEE American Control Conference*, Premiere American Control Conference Venue.
- '17, '18 **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 **Invited Contributor**, *IEEE/RSJ International Conference on Robots and Intelligent Systems (IROS)*, Abstract Only Track, Vancouver, BC, Canada.
- 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.

Mentoring

PhD mentoring:

- 2019 – Present Iretiayo Akinola. Columbia University CS PhD Student working on RL-based robotic grasping.

Masters mentoring:

- 2016 – 2017 Adwait Kulkarni. Mechanical Engineering Masters student (Currently at Drov Technologies, MN).
- 2015 Ajith Venkateswaran. Computer Engineering Masters student (Currently Senior Robotics Software Engineer, Samsung Research, America).

Undergraduate mentoring:

- Summer 2017 Rachael Thompson. Plano High School Student. Currently an undergrad at MIT's CSAIL. Class of 2021
- 2013-2014 Blessing K. Currently a PhD student at Tufts University.
- 2016 - 2017 Alex Tomkovich. Computer Engineering Junior.

References

Nick Gans

Principal Research Scientist and the Division Head for
UTARI's Automation & Intelligent Systems Division
University of Texas at Arlington Research Institute
Fort Worth, TX, USA

Steve Jiang

Barbara Crittenden Professorship in Cancer Research
Vice Chair, Department of Radiation Oncology
Director, Div. of Medical Physics and Engineering
University of Texas Southwestern Medical Center
Dallas, TX, USA

Rodney Wiersma

Associate Professor of Radiation Oncology
Director of Physics Research
Perelman School of Medicine
The University of Pennsylvania
Philadelphia, PA, USA

Debo Ayoade

Data Engineer, Google Cloud
Alphabet, Inc.
Austin, TX, USA