Pranshu Malik

Naturalistic Control — in Humans, also for Robots

 pranshumalik14 pranshu-malik
pranshu.malik@malikpra.in

Interests

Sensorimotor Neuroscience · Robotics · Internal Models · Generalizable Control · Perception · Embodied Intelligence

Education

Okinawa Institute of Science and Technology Okinawa, Japan
Ph.D. in Neuroscience and Robotics *Jan. '25 — Present*

— Rotation projects on prediction and action in neural processing, and on interactional sense of self and other
— Planned rotation with cognitive neurorobotics and information theory units on principled modelling of human motor control
— Selected coursework: Neural Representations and Dynamics in Motor Control, Brain Computation, Cognitive Neurorobotics

University of Western Ontario London, Canada
M.Sc. in Neuroscience; cGPA: 4.0/4.0 *Sept. '22 — Oct. '24*

— Thesis title: The Nature of Reflexes in Online Planning and Control [link]
— Advisors: Andrew Pruszynski, Paul Gribble
— Recipient of the Vector Scholarship in Artificial Intelligence ($17.5k) and the BrainsCAN Graduate Studentship ($50k)
— Selected coursework: Principles of Neuroscience, Reinforcement Learning

University of Toronto Toronto, Canada
B.A.Sc. in Electrical Engineering; cGPA: 3.92/4.0 *Sept. '17 — Apr. '22*

— Engineering International Scholar: received a full tuition fee waiver for the entire duration of the program ($229k)
— Recipient of the Adel S. Sedra Gold Medal for achieving the highest cumulative average in the graduating class
— Graduated with High Honors and Minor in Robotics and Mechatronics; Dean's Honor List in all semesters
— Selected coursework (*graduate-level): Linear Control Systems, Signals and Systems, Fields and Waves, Digital Systems, Digital Signal Processing, Probability, *Random Processes, *Sensory Communication, System Mapping, Machine Learning, Real-time Control Systems, Robot Modeling and Control, Mechatronics, Philosophy of Religion

Selected Research & Professional Experiences

Graduate Student, Western Institute for Neuroscience London, Canada
Sensorimotor Superlab *Sept. '22 — Oct. '24*

— Investigated the coupling between feedback and voluntary motor control by carefully estimating update times for both modalities; also tried investigating the reliance of implicit adaptation on motor variability
— Led multiple discussions on motor planning and control; also mentored and trained undergraduate research assistants

Navigation Engineering Intern, Zebra Technologies Mississauga, Canada
Path-Planning and Control Team *May '20 — Aug. '21*

— Critiqued, implemented, and tested auto-navigation algorithms from literature for deployment on inventory scanning robots
— Redesigned path planner to improve aisle scan coverage and efficiency by robustly handling obstructions and curved aisles
— Developed tools for rapidly prototyping planners and controllers and benchmarking their performance; written in Julia
— Reviewed and fixed real-life behavior and performance bugs; identified, proposed, and applied planner improvements

Undergraduate Research Assistant, Motion Adaptation Science Lab Toronto, Canada
Toronto Rehabilitation Institute *May '18 — Aug. '18*

— Developed finite element models (FEMs) of the lower leg for the computational study of electrostimulation applications
— Streamlined development workflow of bio-electric FEM studies from MRI data using Inventor, Comsol, and Matlab

Invited Talks & Posters

2. Stretch Reflexes Quickly Integrate Spatial Task Constraints During Reaching. Invited talk, Department of Cognitive and Brain Sciences, IIT Gandhinagar, 2024.

1. Computing Error-bounded Inverse Kinematics Solutions in Fixed-time using Low-Power Analog Circuits. Podium presentation, Undergraduate Engineering Research Day, University of Toronto, 2021. [slides]

Technical Skills

Python · Julia · Matlab · C/C++ · Git · Typst · LaTeX · OpenCV · ROS · Graphics Design · 3D Design · Machining

Selected Projects

Intuitive Robot Arm Reach: Undergraduate final-year project with the goal of developing a reach control method by combining algorithmic models of human motor-learning processes, such as proximodistal exploration and motor babbling. Designed and evaluated an interpolation-based method that covered the entire reachable space, contrary to tuning for specific reach targets.

Analog IK Solver: Presents a generic computation method for inverse kinematics of serial robots using a modular and digitally reconfigurable analog circuit. Error-bounded approximate solutions are found in fixed time by continuously evaluating forward kinematics using periodic, phase-locked, and frequency-scaled waveforms as successive joint configurations.

CollabBots: A robotic platform, built from scratch, with two opposing robotic arms and orthogonal cameras to implement and test visual servoing and collaborative scheduling for picking and placing toy blocks in pre-specified goal patterns.

Miscellaneous

Academic Officer: Elected to represent the student assembly at OIST and liaise with the graduate school. Responsibilities include identifying inefficiencies and suggesting improvements in the academic program and advocating for student concerns and interests.

Big Ideas Committee: Led a club that is a part of the Society for Neuroscience Graduate Students (SONGS) at Western University. We hosted didactic discussions as well as regular share-what-you-read sessions on topics like creativity, philosophy of science, and consciousness. We also organized a student-led panel discussion on the scientific and philosophical study of consciousness, which was attended by 40+ graduate students and postdocs.

Hobbies and Side Interests: Photography and painting; systems thinking; education; citizen science; cognitive architectures; philosophy of mind, memory, and action; Indian philosophy; Sanskrit language; yoga and meditation.

Sports and Outdoor Activities: Love playing cricket and badminton, and have also played in local cricket leagues. I also enjoy running, hiking, camping, and long walks in nature.