

[APPLIED RESEARCH INTERESTS]

- ❖ *Interactive learning*: imitation/feedback/reward shaping, curriculum/transfer learning, affect feedback
- ❖ *Practical machine learning*: adversarial attacks & defenses, knowledge distillation, low-data regime
- ❖ *Mobile robotics*: reinforcement learning for control, sim2real, structural & controller design optimization
- ❖ *Vision*: target tracking, visual localization, 3-D mesh embedding

[SELECTED WORK EXPERIENCE]

Element AI: research scientist; lead of applied robotics program

March 2017
– present

- ❖ Program – robotics: devised an applied research program for a team of scientists and engineers to develop and advance autonomous capabilities of mobile robots for collecting hard-to-obtain data, for diverse tasks including anomaly detection and monitoring
- ❖ Project – *learning to “drive” with applied RL*: worked on confidential collaborative client project: co-developed gym environment for a black-box dynamics vehicle simulator, and applied the open-source library Ray+Tune+RLlib, on AWS SageMaker cluster, to learn **efficient & robust “driving” policies**, so as to quantify performance on various tasks
- ❖ Project – *3D active mesh anomaly detection*: co-developed system for collecting RGBD frames using a robot arm to cover a manufactured target object, and performing 3D reconstruction and **detection of visual+structural anomalies** with respect to reference CAD
- ❖ Project – *unsupervised visual anomaly detection*: co-developed system for **localizing anomalies on natural objects (e.g. apples)**, by integrating pre-trained instance segmentation, object pose regression, visual embedding, and density estimation components
- ❖ Project – *physical adversarial textures for fooling visual tracking*: supervised a research intern and co-developed a method to robustly **fool visual trackers** into losing track of their target and locking onto inconspicuous-looking textured posters
- ❖ General – *applied AI/ML representative*: partnered with Industrial Solutions team to engage Fortune-500 companies in AI-first transformations, including project scoping, AI workshops, and exploratory modeling
- ❖ General – *interview committee member*: conducted CV screening and technical interviews for various research positions; actively contributed to interview process development, including definition of evaluation criteria, and design of coding problems

McGill University: lead engineer – software and systems at the Mobile Robotics Lab

February 2016
– May 2017

- ❖ Ported & enhanced Aqua swimming robot's real-time control software/OS/hardware
- ❖ Expanded driver support for new devices (IMU, uOLED display, USB3 camera, ...) into Aqua swimming robot's real-time control software and high-level ROS infrastructures
- ❖ Led teams of roboticists during multiple robot pool trials for research and evaluation purposes, under roles of primary developer, deployment specialist, and general manager

[SELECTED (REFEREED) CONFERENCE PUBLICATIONS]

- ❖ R. Wiyatno and A. Xu. Physical Adversarial Textures that Fool Visual Object Tracking, in *CVF/IEEE International Conference on Computer Vision (ICCV '19)*, Seoul, South Korea, 2019.
- ❖ A. Xu and G. Dudek. Maintaining Efficient Collaboration with Trust-Seeking Robots, in *Proc. of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS'16)* (**finalist for the IROS KROS Best Paper Award on Cognitive Robotics**), pp. 3312-3319, Daejeon, South Korea, 2016.

- ❖ D. Meger, J. Gamboa, A. Xu, P. Giguère, and G. Dudek. Learning Legged Swimming Gaits from Experience, in *Proc. of the IEEE International Conference on Robotics and Automation (ICRA'15) (finalist for the Best Conference Paper Award)*, pp. 2332-2338, Seattle, USA, 2015.
- ❖ A. Xu and G. Dudek. OPTIMo: Online Probabilistic Trust Inference Model for Asymmetric Human-Robot Collaborations, in *Proc. of the ACM/IEEE International Conference on Human-Robot Interaction (HRI'15)*, pp. 221-228, Portland, USA, 2015.
- ❖ M. Doniec, A. Xu, and D. Rus. Robust Real-Time High Definition Underwater Video Streaming with AquaOptical II, in *Proc. of the IEEE International Conference on Robotics and Automation (ICRA '13)*, pp. 5117-5124, Karlsruhe, Germany, 2013.
- ❖ F. Shkurti, A. Xu, M. Meghiani, J. Gamboa, Y. Girdhar, P. Giguère, B. Dey, J. Li, A. Kalmbach, C. Prahacs, K. Turgeon, I. Rekleitis, and G. Dudek. Multi-Domain Monitoring of Marine Environments using a Heterogeneous Robot Team, in *Proc. of the IEEE/RSJ International Conference on Intelligent Robots and System (IROS '12)*, pp. 1747-1753, Vilamoura, Portugal, 2012.
- ❖ G. Dudek, J. Sattar, and A. Xu. A Visual Language for Robot Control and Programming: A Human-Interface Study, in *Proc. of the IEEE International Conference on Robotics and Automation (ICRA '07)*, pp. 2507-2513, Roma, Italy, 2007.

[EDUCATION]

McGill University, Montréal, Québec, Canada.
 Ph.D. in School of Computer Science
 Thesis: Efficient Collaboration with Trust-Seeking Robots
 Supervisor: Professor Gregory Dudek
 CGPA: **4.00** (out of 4.00)

2008 – 2017
 (degree granted in
 February 2017)

McGill University, Montréal, Québec, Canada.
 Bachelor of Computer Engineering
 Minor in Software Engineering
 CGPA: **4.00** (out of 4.00)
 Great Distinction

2004 – 2008
 (degree granted
 in May 2008)

[RESEARCH COMMUNITY INVOLVEMENT]

- ❖ Program co-chair for CRV 2018 and CRV 2019
- ❖ Reviewer for ICRA, IROS, RSS, RA-L, HRI, CoRL, CRV, ICCV, IJRR, AURO, ...
- ❖ Developer of the [ueye_cam ROS package](#) for IDS uEye cameras

[COMMUNICATION]

- ❖ Fluent in spoken and written English ❖ Adequate spoken French
- ❖ Adequate spoken Chinese Mandarin

[ROBOTICS AND SYSTEM DESIGN KNOWLEDGE]

- ❖ Proficient with Bayesian and statistical machine learning techniques, including Probabilistic Graphical Modeling, supervised regression, unsupervised clustering, and reinforcement learning methods
- ❖ Extensive knowledge of classical vision and robot perception algorithms, including color & edge processing, Hough transform, Iterative Closest Point, 2D image features (SIFT/SURF/...), etc.
- ❖ Extensive hands-on experience in designing, conducting, and managing robotics field experiments as well as controlled studies with human participants
- ❖ Familiar with core robotics algorithms for localization, SLAM, planning, and control
- ❖ Familiar with optimization-based algorithm design, such as using linear programming, mixed-integer programming, and nonlinear optimization methods
- ❖ Familiar with control-theoretic methods, including proportional-integral-derivative feedback design & tuning, trajectory optimization, etc.

[SOFTWARE DEVELOPMENT SKILLS]

- ❖ Fluent in Python, C++, C, MATLAB, HTML & JavaScript & CSS
- ❖ Extensive programming experience in 15+ years of academic research in field robotics, producing 200,000+ lines of (Linux/cross-platform) code in 50+ projects
- ❖ Extensive experience with development toolchains/environments such as CMake, GNU/Linux build tools, Eclipse, Jupyter Notebook & Lab, Matlab Markup
- ❖ Extensive experience with middlewares, frameworks, and libraries, including PyTorch, Tensorflow/Keras, ROS, Gazebo, OpenCV, Open3D, Ray+Tune+RLlib, Boost, Qt 4 & 5, GStreamer, JQuery / UI / Mobile
- ❖ Experience with virtualization and remote control tools, including Docker, VNC, screen
- ❖ Experience with in-field code deployment on x86/x64/ARM architectures for portable & embedded devices

[HARDWARE AND EMBEDDED SYSTEMS EXPERIENCE]

- ❖ Extensive working experience (software development, field deployment, electronics integration, platform maintenance; 15+ years cumulative) with:
 - Jaco2 and Gen3 manipulators by Kinova (www.kinovarobotics.com)
 - the Aqua family of amphibious robots by McGill University & Independent Robotics (www.aquarobot.net)
 - the Marine Autonomous Robotic Explorer (MARE) robotic surface vessel by McGill University
 - the Kingfisher unmanned surface vessel by Clearpath Robotics (www.clearpathrobotics.com/kingfisher)
 - the Unicorn UAV by Lockheed Martin Procerus Technologies (www.lockheedmartin.com/procerus)
 - the Pelican quadrotor by Ascending Technologies (www.asctec.de)
 - the AR.Drone line of quadrotors by Parrot Technologies (ardrone.parrot.com)
 - the Husky wheeled robot by Clearpath Robotics (www.clearpathrobotics.com/husky)
 - the SL-Commander planetary rover, instrumented by MDA (www.mdacorporation.com)
 - the Kubota RTV rugged truck, instrumented by Clearpath Robotics (www.clearpathrobotics.com)
- ❖ Extensive operational and programming experience with Arduino-compatible microprocessor boards: Arduino Uno/Due/Yun; PJRC Teensy 2 & 3, ESP8266 & ESP32, etc.
- ❖ Programming, configuration, and signal debugging experience with communication protocols, including UART/USART, SPI, I2C
- ❖ Extensive experience with electronics prototyping, including through-hole soldering, and breadboard & wire-wrap circuit designs