ANQI XU – 徐安琪

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[APPLIED RESEARCH INTERESTS]

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

[SELECTED WORK EXPERIENCE]

Element AI: research scientist; applied reinforcement learning team lead — March 2017 – December 2020

- *RL for industrial process simulations:* developed a Python RL interface extending the Alpyne API for AnyLogic simulations, supporting **learner-centric control** and **multiple agents**; demonstrated significant gains from learned policy using Multi-Agent Reinforcement Learning (MARL) over heuristic for dispatching trucks within an open pit-mine simulation
- *RL-assisted design*: implemented and enhanced the sample efficiency for a vehicle design method, which **jointly optimizes behavior and design**, by leveraging the Soft Actor-Critic deep reinforcement learning algorithm
- *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
- *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
- *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
- *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

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. Meghjani, 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. 2008 – 2017
Ph.D. in School of Computer Science (degree granted in
Thesis: Efficient Collaboration with Trust-Seeking Robots February 2017)
Supervisor: Professor Gregory Dudek
CGPA: **4.00** (out of 4.00)

McGill University, Montréal, Québec, Canada. 2004 – 2008
Bachelor of Computer Engineering (degree granted
Minor in Software Engineering in May 2008)
CGPA: **4.00** (out of 4.00)
Great Distinction

[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 gradient-based / gradient-free 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 16+ years of academic and industrial research, 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, Jupyter Notebook & Lab, VS Code
- ❖ Extensive experience with middlewares, frameworks, and libraries, including PyTorch, Tensorflow/Keras, ROS, Gazebo, OpenCV, Open3D, Ray+Tune+RLLib, Boost, Qt
- ❖ Experience with virtualization and remote control tools, including Docker, VNC, screen

[Hardware and Embedded Systems Experience]

- ❖ Extensive working experience (software development, field deployment, electronics integration, platform maintenance) 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 and Bebop lines of quadrotors by Parrot Technologies (ardrone.parrot.com)
  - ○ the Tello quadrotor by DJI / Ryze Robotics (www.ryzerobotics.com/tello)
  - ○ 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, 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