Ran Cheng

An Intelligent Robotics Researcher

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EDUCATION

M. S. McGill University (2017 - 2019) **Montreal, Canada**

Research Area: Robotics, Computer Vision, Visual SLAM, Visual Perception, Autonomous Control, Reinforcement Leaning, Deep Learning

Coursera (2016 – 2017) **Online**

Completed Courses: Neural Network for Machine Learning (UToronto), Robotics: Specialization (UPenn), Machine Learning (Stanford)

B. S. Tongji University (GPA: 3.9, Top 0.02%**):** **Shanghai, China**

Honors and Awards: Outstanding Diploma thesis, National Aspiration Fellowship, Second Class Prize Fellowship, Social Activism Award, IBM Outstanding Contribution Award, Microsoft Imagine Cup, FTC (First Tech Challenge, a Robot Competition Conference) Technician

EXPERIENCE

Mobile Robotics Lab, McGill University, *Research Assistant, Supervisor: Gregory Dudek* *Sep. 2017 – Now.* **Montreal, Canada**

- **Deep RL** based autonomous control and planning framework, learning from **Visual SLAM priors** and **back-projections**.
- **Synthesized hierarchical neural network** controller for autonomous driving in complex environment and variant landscapes.
- **Active sampling** and Inversed Reinforcement Learning/ Imitation Learning based dynamic environment model prediction.

iLab USC, *Research Assistant, Supervisor: Laurent Itti* Apr. 2015 – Jul.2017. **Los Angeles, USA**

- Conducted research on various topics such as **Visual Odometry**, **Saliency** based **perception** and **gaussian process** model based active control. Co-developed **neuromorphic** powered object recognition toolkit and it's topological SLAM implementation.

Apple *Summer Teaching Assistant* May 2013 – Aug. 2013. **Shanghai, China**

- Taught over 200 students about developing various products for Apple and supervised their learning throughout the summer.
- 3 won the Apple Student Scholarship, 11 participated in WWDC and 73.75% started their iOS dev life in big companies.

PROJECTS

- **Active Visual Navigation in Robotics**: **DIY** three robot platforms (underwater/land-rover/UAV), architectured with Nvidia TX2 and many low level PID controllers to perform safe but agile control tasks. Synthesized **Resnet** with **Deep Deterministic Policy Gradient (DDPG)** to learn best possible path model according to VO navigation metrics and huristic objectives. (available on gitlab)
- **Visual Odometries**: Refactored **Stereo-DSO** (gitlab) with feature augmented keyframe loop closure, including **Bundle Adjustment** and **g2o** backend optimization framework from OBR-SLAM. re-implement ORB-SLAM2 in MacOS and iOS (available on github), optimized the three-thread architecture by optimized UI rendering to fit mobile device. Decreased Relative Pose Error by 17.21%.
- **Learning from Simulator**: Leveraged the **3D engine** (Unreal/AirSim) to power DDPG and Imitation Learning to do fast task learning. We have modeled the framework for **Unreal Engine** and **AirSim** with Aqua, Husky and Quadcopter to perform complex autonomy through simulator. We then apply the policy learnt to **refit** (Few-shot Learning) in the real-world field robots, average converge time reduce by 12-15 times. (gitlab)
- **Visual Odometry Perception FrameWork:** Proposed a framework, which learn the **tracking behaviour** of Visual SLAM from the internal point-hessian, and evaluate pose outputs **in real-time** by applying **umeyama alignment**. (gitlab)
- **Saliency Object Segmentation:** Proposed a **Hebbian-based** neural network for **bottom-up** visual attention to **segment** salient objects in a clustered environment, achieved 82% average alignment per batch (320 out of 72,252 pictures) compared with ***Saliency model***, Itti et, al.

PUBLICATIONS

- ***Synthesizing Neural Network based Autonomy with Deep Dynamic Programming***, ICRA 2019, **R. Cheng**, G. Dudek (Preprint)
- ***Predicting Visual Pose Estimation Failure on a Vehicle forOff-Road Driving***, ICRA 2018, **R. Cheng**, T. Manderson , G. Dudek
- ***Navigation in the Service of Enhanced Pose Estimation***, ISER 2018, Travis Manderson, **Ran Cheng**, David Meger and Gregory Dudek
- ***Vision-Based Autonomous Underwater Swimming in Dense Coral for Combined Collision Avoidance and Target Selection***, IROS 2018, T. Manderson, Juan C. G. Higuera, **R. Cheng,** and G. Dudek

PROFESSIONAL SERVICES

Reviewer: ICRA for International Conference on Robotics and Automation, **IROS** for International Conference on Intelligent Robots.

Supervisor: McGill Robotics (2017-2018), visual perception and navigation team (20 members).

Membership: student member of **IEEE**.