Interview Presentation

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Past Experience

- 2015 - 2019 Bachelor, Master of Engineering
  Electrical and Electronic Engineering, Imperial College London
- 2017 Robot Intelligent Lab, Undergraduate Research Assistant
- 2018 Ocado Technology, Research Engineer (Intern)
- 2019 - Present, Research Engineer, Huawei

Robotics

Mobile manipulators for data center maintenance and versatile household tasks. I worked as a full-stack robotics engineer.

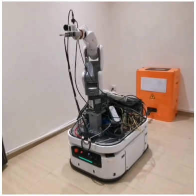

Figure 1: IT-Service Room Robot

Figure 2: Household Robot

Methods

- Visual-SLAM, NLP, Human Face/Pose Recognition
- Trajectory Planning, Forward/Inverse Kinematics, Lie Algebra and Group
- 3D Constrained Motion Planning in C-space

Visual Servo

Camera-based real-world navigation using image based visual servoing (IBVS) for holonomic mobile robots.

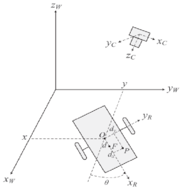

Figure 3: IBVS system

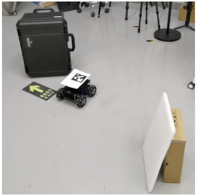

Figure 4: IBVS Robot

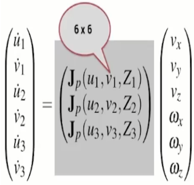

Figure 5: Image Jacobian

Methods

- LQR Control, Route Planning, Kalman Filtering, Image Jacobian, Camera Calibration
- Deep Learning: Monocular Depth Estimation, Semantic Segmentation

Multi-Robot Navigation

Online, decentralized collision avoidance MARL algorithm that couples various tote robots together through mutual separation constraints.

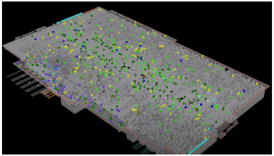

Figure 6: A multi-agent system modelled warehouse

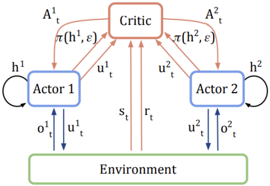

Figure 7: Center-Critic, Actor

Methods

- Multi-Agent Reinforcement Learning, VDN (Value Decomposition Networks), Counterfactual Multi-agent (COMA) Policy Gradients

ODN Network Optimization

Network optimisation tools for large-scale and complex WDM and ODN networks (often with tens of thousands of nodes). Use ODN network as an example.

$$\min N \sum_{u \in U} x(u) + \sum_{(d,u) \in Paths} len(d,u) y(d,u) \tag{1}$$

subject to

$$\sum_{u \in U} y(d,u) = 1 \tag{2}$$

$$\sum_{d \in D} y(d,u) \leq x(u) \cdot C_{max} \tag{3}$$

$$y(p_1) + y(p_2) \leq 1 \forall \quad \text{intersected}\{p_1, p_2\} \in Paths \tag{4}$$

ODN Network Optimization

Two problems in total: Can be analogous to Capacitated Facility Location Problem (CFLP) with tricky 'Intersection Constraints'. In addition, Travelling Salesman Problem (TSP) with multi-depot and multi-salesman.

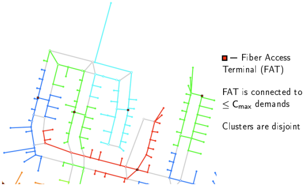

Figure 8: A ODN graph

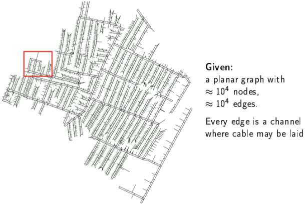

Figure 9: Results

Methods

- Mixed-Integer Linear Programming
- Graph Theory, Multilevel Graph Partitioning

Route Wavelength Allocation

We aim to allocate a set of demands (services) online D in the given network. Every demand $d \in D$ is a pair of end nodes $s, t \in V$ and a protection type p. Whereas the working path and protection path need comply to some thorny constraints (e.g. disjoint, wavelength consistence, time delay, hops).

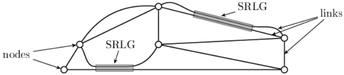

Figure 10: A RWA Graph

Methods

- Graph Theory, Suurballe's algorithm, Path planning
- Heuristics for Conflict Repairing

BSS on Sparsity

We Improve the K-SVD BSS algorithm by further learning a block sparsifying dictionary (SAC+BK-SVD), which clusters the dictionary atoms according to their similarity and those atoms are updated by blocks.

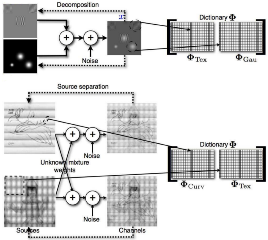

Figure 11: Blind Source Separation with MMCA

Methods

- Machine Learning, Large Dimensional Data Processing
- Image Signal Processing, Wavelets, Curvelets

Ultra-low Latency PON

Improved the existing PON in order to meet field-level industrial bus-line performance. We implemented many L2 link-layer innovations (e.g. DBA, multi-burst, guard time compression).

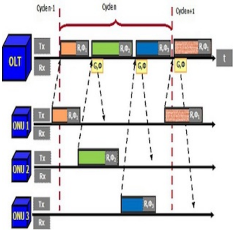

Figure 12: PON Frame

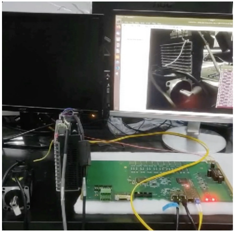

Figure 13: Super Bandwidth Bus-line (carrying videos)

Methods

- FPGA Verilog, Network Protocols
- Also worked as a CCSA representative

Projects During Internships

These projects are conducted before 2019.

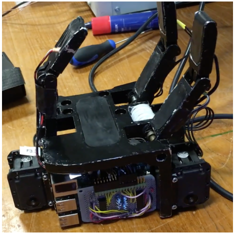

Figure 14: Dexterous Hand

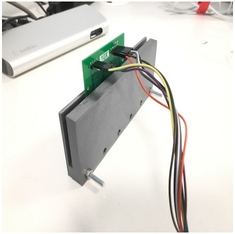

Figure 15: Linear Motor

Methods

- Motor Design, Motor Control, Mechatronics, Embedded Systems
- Maxwell Equations, Underactuated Robots

More Highlights

- Emphasis on Optimization, Robotics
- Also Experience on: Multi-agent Systems, Reinforcement Learning, Imitation Learning, Deep Learning (Computer Vision)
- ROS, OMPL, FCL, Python, C++, Matlab
- Soft Skills: Leadership, Communication Skills, Muli-Culture Background
- Saxophone, Guitar

Research Interest

- How to manipulate robots better, achieving dexterous locomotion and manipulation abilities that are self-perpetual and evolvable during interactions with outside world.
- How to assure efficient human-robot collaborations without sacrificing efficiency (i.e. finding the Pareto frontier), coping with complex and time-varying state space.