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Objectives

Improve robotic manipulation and grasping skills to match human-level efficiency and bring recently matured robotics technologies into our life through products and services.

Experience

Current Appointments

Professor	2020-present	Computer Science & Eng., University of South Florida

Previous Appointments

Associate Chair of Graduate Affairs	2018-2020	Computer Science & Eng., University of South Florida
Associate Professor	2015-2020	Computer Science & Eng., University of South Florida
Visiting Associate Professor	2016-2017	Mechanical Engineering, Stanford University
Assistant Professor	2009-2015	Computer Science & Eng., University of South Florida
Post-doc	2008-2009	School of Computing, University of Utah
Post-doc	2007-2008	Mitsubishi Electric Research Labs (MERL), Boston, MA
Software Engineer	2000-2001	Atwell Cop., Tokyo, Japan

Education

Ph.D. Computer Science, 2002-2007, University of Utah, Salt Lake City, UT, USA

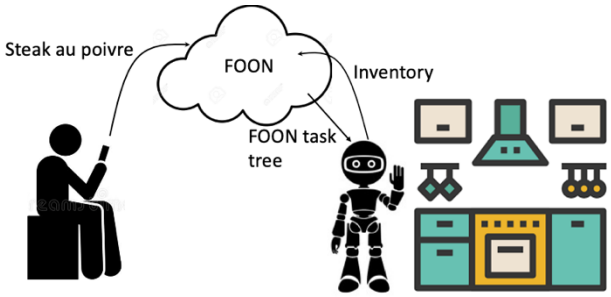
M.S. Control Theory and Engineering, 1997-2000, Dalian Univ. of Tech., China

B.S. Electrical Engineering, Minor in Mathematics, 1993-1997, Dalian Univ. of Tech., China

Project Summary (Last 5 Years)

Functional object-oriented network (FOON) for manipulation learning (Role: Principal Investigator (PI))

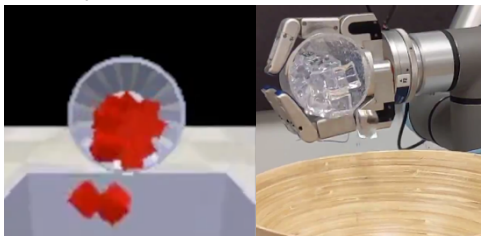
- Invented FOON for sophisticated manipulation task representation focusing on action and objects.
- Obtain human-level knowledge without explicit programming and modeling.
- Knowledge retrieval from graph to PDDL instance and then execution.
- Areas: robotics, AI, deep learning, knowledge representation, human robot collaboration, computer vision)



- Outcomes:
  - FOON can generate cooking instructions at 100% correct rate for 80% of 1M receipts (Dataset 1M)
  - Automated generated PDDL instances can be executed by robots or human-robot collaboration
  - One patent and nine technical papers.
- Future directions: quality monitoring and control, applications in flexible manufacturing and service

Generalizing learned manipulation skills to unseen situations (Role: PI)

- Learning the dynamics and unseen variables in manipulations.
- Generalizing manipulation skills through safe practice and reiterative recurrent neural networks
- Areas: robotics, manipulation, motion planning, control, deep learning, recurrent neural networks, reinforcement learning, computer vision



- Outcomes:
  - Learn and generalize pouring and aiming skill for different setups
  - Can pour water, syrup, salt, rice, beans, ice cubes, vegetable chunks precisely and without spillage
  - Three patents and five technical papers.
- Future directions: Expand to other manipulation skills and handle anomalies.

Robotic grasping of multiple objects to improve efficiency (Role: PI)

- Developed stochastic multi-object grasping strategies for multi-finger hand.
- Developed vision+tactile perception models for multi-object grasping
- Developed reinforcement learning approach to learn finger motion to grasp multiple objects
- Areas: robotic grasping, deep learning, reinforcement learning, computer vision
- Outcomes:
    - Generated grasping strategies can grasp two and more objects at once
    - Improve batch picking efficiency by 2.5 to 3 times
    - Can handle different object size and shapes
    - Two patents and five technical papers
- Future directions: Optimize robotic hand designs for multi-object grasping, applications in logistics, manufacturing, and constructions.

State-dependent measurement model for localization (Role: PI)

- Model and dynamically predict the bias and noise of proximity sensors for more accurate localization.
- Areas: robotics, SLAM, deep learning, mixture density networks

Outcomes:

- Approach that can model the noise and bias in proximity sensors
- Approach that can dynamically adjust the models using minimum real-time data
- Reduce localization error by 30-50%
- Two patents and two technical papers

- Future directions: Application for autonomous agents, applications in pose estimation.

Robotic grasping and manipulation benchmarking (Role: Chair)

- Developed evaluation benchmarks and standardized tasks for robotic grasping and manipulation competitions.
- Areas: robotics, benchmarking, competitions

Outcomes:

- Organized five robotic grasping and manipulation competitions at IROS/ICRA since 2016
- Organized two RA-L special issues
- Developed a set of benchmarking protocols and benchmarks for evaluation
- Six technical papers

Future directions: Establish RGMC umbrella for more diverse competitions and move competition results to commercialization.

Multimodal approach for monitoring prolonged acute pain in neonates (Role: PI)

- Multi-disciplinary team: four medical doctors, two med school professors, two nurses, two computer science professors.
- Multi-institution team: USF, Stanford University, Tampa General Hospital, Stereology Resource Center, Inc.
- Multi-modal approach assessing infant pain automatically using computer vision (facial expression and body motion) and signal processing (crying sounds and vital signs).
- Areas: computer vision, motion analysis, face recognition, deep learning

Outcomes:

- A system that can monitor infant's status continuously and detect infant pain timely
- The system has high accuracy and maintains good accuracy with missing modalities
- The system fits in the nurse's workflow
- Two patents and ten technical papers

Future directions: Predict infant pain before it occurs.

Grants (Summary)

Seven NSF grants as PI, One NIH grant as PI, grants and gifts from Microsoft, Alibaba, and Evatech, one ARMY-CDMRP grant as Co-PI, multiple USF internal grants as PI.

Contributions to Science and Technology (Summary)

- More than 100 peer-reviewed technical papers published in prestigious robotics and computer science journals and conferences, including Intl. Journal of Robotics Research (IJRR), IEEE Transactions on Robotics (TRO), IEEE Robotics and Automation Letters (RA-L), IEEE Transactions on Affective Computing, IEEE Transactions on Multimedia, RSS, ICRA, IROS, and CVPR.

- Fifteen issued U.S. patents and five pending patents.

Contribution to Education (Summary)

- Advisor of 15 Ph.D. students (9 graduated), 10 Master thesis students (8 graduated), 30+ REU students.
- Taught grad and undergrad CS/robotics/AI/Deep Learning courses:
    - Robotics: CIS 6930 Advanced Robotics, CAP 4660 Intro to Robotics, CIS6930/4930 Algorithms for Robotics
    - AI/Deep Learning: CAP 5625 Introduction to A.I., CIS 4930 Deep learning fundamentals, CIS6930 Neural Networks and Deep Learning
    - CS: COP3331 Object Oriented Design

Contributions to Institution and Societies (Summary)

- Institutional Service, including Associate Chair, Council member, committee members
- Service for IEEE Robotics and Automation Society (RAS) including Editor for ICRA, IROS, and UR, Associate Editor for RA-L, TRO and RAM, RAS Board member, committee member.
- Established a RAS Technical committee
- Organized multiple conferences, workshops, and competitions
- Served on review panels for NSF, NIH and other funding agencies.
- Volunteer for many social and educational events

Awards and Honors

USF Excellence in Innovation Award, 2018
USF Neuroscience Collaborative Award, 2010
Plenary talks in many conferences and workshops
Invited talks at different Universities and companies, including UMass-Amherst, Texas A&M, Google, etc.

More Detailed Information

Full CV: https://cse.usf.edu/~yusun/cv.pdf
Home page: https://cse.usf.edu/~yusun/
Lab: https://rpal.cse.usf.edu/
Google Scholar: https://scholar.google.com/citations?user=MNzZ3mYAAAAJ&hl=en
LinkedIn: https://www.linkedin.com/in/yu-sun-roboticist/