

Robotics Overview

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Abstract—A brief summary on top-conferences(ICRA, IROS, RSS, CoRL), top transactions/journals such as International Journal of Robotics Research (IJRR), IEEE Transactions on Robotics (TRO) and hot research topics.

I. ICRA

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A. Themes:

- Soft Robot Applications
- Design of Mechanisms
- Planning
- Reinforcement Learning
- Marine and Field Robotics.
- Modeling, Control, and Learning for Soft Robots
- Compliant Mechanisms
- Path Planning and Collision Avoidance
- [Deep Learning and Neural Networks in Robotics](#)
- Manipulation and Grasping
- Human Centred and Inspired Robotics
- [Deep Learning for Visual Perception](#)
- Human-Robot Interaction/Collaboration
- [Computer Vision and Visual Servoing](#)
- [Optimal Control and Object Detection](#)

B. Selected papers in 2023

- Code as policies: Language model programs for embodied control [1].

II. IROS

Page limit: 6, two-column format.

A. Themes and Selected papers

1) Cognitive robotics:

- (Winner) Gesture2Vec: Clustering Gestures using Representation Learning Methods for Co-speech Gesture Generation.
- Learning on the Job: Long-Term Behavioural Adaptation in Human-Robot Interactions.
- Intuitive & Efficient Human-robot Collaboration via Real-time Approximate Bayesian Inference.

2) Robot Mechanisms and Design:

- (Winner) Aerial Grasping and the Velocity Sufficiency Region.
- 1-degree-of-freedom robotic gripper with infinite self-twist function.

3) Entertainment and Amusement:

- (Winner) Robot Learning to Paint from Demonstrations.
- Robot Dance Generation with Music Based Trajectory Optimization.

4) Mobile Manipulation:

- (Winner) Robot Learning of Mobile Manipulation with Reachability Behavior Priors.
- Mobile Manipulation Leveraging Multiple Views.

III. RSS

Page limit: no limit, typically 8. Single-track, all aspects of robotics including scientific foundations, mechanisms, algorithms, applications, and analysis of robotic systems.

A. Paper Sessions:

- Human-Centered Robotics
- Manipulation from Demonstrations and Teleoperation
- Self-supervision and RL for Manipulation
- Large Data and Vision-Language Models for Robotics
- Simulation and Sim2Real
- Grasping and Manipulation
- Mobile Manipulation and Locomotion
- Robot Planning
- Robot State Estimation
- Robot Perception
- Control & Dynamics
- Robot Mechanisms & Control
- Autonomous Vehicles & Field Robotics
- Multi-Robot and Aerial Systems

IV. CoRL

A. Research areas

- Learning representations for robotic perception and control.
- Learning robot foundation models or general-purpose knowledge systems for robotics.
- Imitation learning for robotics, e.g. by behavioral cloning and/or inverse reinforcement learning.
- [Reinforcement learning for control of physical robots.](#)
- [Model-based and model-free learning for robotic control and decision-making.](#)
- Combination of learning- and planning-based approaches in robotics.
- Probabilistic learning and representation of uncertainty in robotics.
- Automatic robotic data generation for learning methods in robotics.
- Learning for Robot Task and Motion Planning.

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- Learning for multimodal robot perception, sensor fusion, and robot vision.
- Learning for human-robot interaction and robot instruction by natural language, gestures as well as alternative devices.
- Learning for hardware design and optimization.
- Applications of robot learning in robot manipulation, navigation, locomotion, driving, flight, and other areas of robotics.
- Robot systems, hardware, and sensors for learning and data-driven approaches.

B. Selected papers

- Do as i can, not as i say: Grounding language in robotic affordances [2].
- Training Robots to Evaluate Robots: Example-Based Interactive Reward Functions for Policy Learning [3].

V. POPULAR TOPICS APPEARED ON TOP TRANS/JOURNALS

A. IJRR

Dielectric Elastomer, Reinforcement Learning, Simultaneous Localization And Mapping, Grasping, Multi Agent Systems, Biped Robot, Deep Learning, Adaptive Control, Model Checking, Teleoperation.

1) Selected papers:

- how to train your robot with deep reinforcement learning lessons we have learned [4].
- Human motion trajectory prediction: A survey [5].

B. TRO

Multi Agent Systems, Biped Robot, Simultaneous Localization And Mapping, Dielectric Elastomer, Grasping, Parallel Manipulator, Teleoperation, Reinforcement Learning, Myxococcus Xanthus, Adaptive Control.

C. Annual Review of Control, Robotics, and Autonomous Systems

Multi Agent Systems, Myxococcus Xanthus, Biped Robot, Teleoperation, Reinforcement Learning, Linear Matrix Inequalities, Complex Networks, Simultaneous Localization And Mapping, Human-robot Interaction, Dielectric Elastomer

D. Science Robotics

Dielectric Elastomer, Myxococcus Xanthus, Human-robot Interaction, Flapping Wing, Stretchable Electronics, Biped Robot.

VI. RESEARCH DIRECTION

Robot Learning would be the focus. Specifically, aim at expanding robots' perception and physical interaction capabilities. Possible directions could be¹:

- Multi-Modal Perception: Harnessing vision, touch, audio, and language for fine-grained and effective manipulation.

- Embodied Intelligence: Focusing on long-horizon planning, generalization to diverse environments, and sim-to-real transfer [6].
- Intuitive Physics: Learning structured world models for robotic manipulation of objects with diverse physical properties.

APPENDIX

A. Selected Notes

1) SayCan [2]: LLMs combined with Value Functions (for task affordances): LLMs help robots understand the high-level instructions and iteratively select useful and practical skills (low-level commands) until the task is finished.

For example, given the task “I pilled my coke, can you bring me something to clean it up?”, SayCan successfully planned and executed the following steps: 1. Find a sponge 2. Pick up the sponge 3. Bring it to you 4. Done

2) PaLM-SayCan:

3) Sim-to-Real Transfer [6]:

4) Chain-of-Thought Prompting [7]: A simple mechanism for eliciting multi-step reasoning behavior in large language models. Motivated by using intermediate steps to solve reasoning problems and few-shot prompting.

- Does not positively impact performance for small models, and only yields performance gains when used with models of $\sim 100B$ parameters.
- Has larger performance gains for more-complicated problems.

5) Few-shot Prompting:

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