🤖 Academic Resources in Robotics

Top-tier Journals & Conferences Overview

📚 Top-tier Journals

Abbreviation	Cycle	Publisher	Description
IJRR	30d	SAGE	International Journal of Robotics Research
RAS	30d	Elsevier	Robotics and Autonomous Systems
RA-L	30d	IEEE	Robotics and Automation Letters
Science Robotics	30d	AAAS	Science Robotics Journal
T-RO	90d	IEEE	Transactions on Robotics
AURO	90d	Springer	Autonomous Robots
Nature Robotics	90d	Nature	Nature Machine Intelligence

Cycle indicates publication frequency in days

🏛️ Top-tier Conferences

Abbreviation	Cycle	Organization	Description
ICRA	365d	IEEE	Int'l Conf. on Robotics and Automation
IROS	365d	IEEE & RSJ	Int'l Conf. on Intelligent Robots and Systems
RSS	365d	RSS	Robotics: Science and Systems
CoRL	365d	PMLR	Conference on Robot Learning
ISRR	730d	IFRR	Int'l Symposium of Robotics Research

📊 Publication Frequency Statistics

- **High-frequency Journals** (30d): IJRR, RAS, RA-L, Science Robotics
- **Medium-frequency Journals** (90d): T-RO, AURO, Nature Robotics
- **Annual Conferences** (365d): ICRA, IROS, RSS, CoRL
- **Biennial Conference** (730d): ISRR

📋 Contents

Month	Year	Status	Papers	Highlights
July	2025	✅ Available	6 papers	IJRR special collection
August	2025	🔄 Coming Soon	TBD	ICRA & IROS selections
September	2025	📅 Planned	TBD	CoRL & RSS highlights

📄 July 2025 Paper Review

🔥 Featured Papers

No.	Venue	Title	Authors	Key Contribution
1	**IJRR**	RflyMAD: A Dataset for Multicopter Fault Detection and Health Assessment	Le et al.	Comprehensive fault detection dataset
2	**IJRR**	FusionPortableV2: A Unified Multi-Sensor Dataset for Generalized SLAM	Wei et al.	Multi-platform SLAM dataset
3	**IJRR**	BRNE: Mixed Strategy Nash Equilibrium for Crowd Navigation	Sun et al.	Bayesian Robot Navigation Engine
4	**IJRR**	Shared Visuo-Tactile Interactive Perception for Robust Object Pose Estimation	Murali et al.	Visuo-tactile shared perception framework
5	**IJRR**	Multi-Tactile Sensor Calibration via Motion Constraints	Yu et al.	Motion constraint calibration method
6	**IJRR**	JVS-SLAM: Joint Vector-Set Distribution SLAM	Inostroza et al.	Unified frontend-backend SLAM

📖 Paper 1: RflyMAD Dataset

RflyMAD: A Dataset for Multicopter Fault Detection and Health Assessment

IJRR | Le et al., Beihang University

🎯 Problem & Solution

- **Gap**: Lack of public fault detection datasets for multicopters
- **Solution**: Comprehensive dataset bridging simulation and real flight

📊 Dataset Overview

- **5,629 Flight Cases**: 2,566 SIL + 2,566 HIL + 497 Real flights
- **11 Fault Types**: Motor, Propeller, Sensors, Environmental
- **6 Flight Modes**: Hover, Waypoints, Velocity, Circling, Accel/Decel
- **3 Platforms**: X200/X450/X680 multicopters (200mm-680mm)

📈 RflyMAD Research Details

🔬 Data Composition & Scale

Component	SIL	HIL	Real	Description
Motor Faults	921	921	231	1-4 motors failure
Sensor Faults	690	690	182	IMU, GPS, Barometer
Environmental	320	320	-	Wind, Load changes
No Fault	200	200	84	Normal operations

🎯 Research Contributions

- **Comprehensive Coverage**: Bridges simulation and real-world data
- **Multi-modal Data**: ULog, ROS bag, Telemetry, Ground Truth
- **Transfer Learning**: Validates sim-to-real generalization
- **Benchmark Dataset**: First public multicopter fault detection dataset

📖 Paper 2: FusionPortableV2 Dataset

FusionPortableV2: A Unified Multi-Sensor Dataset for Generalized SLAM

IJRR | Wei et al., HKUST & UCL

🎯 Problem & Solution

- **Gap**: SLAM algorithms lack generalization across platforms and environments
- **Solution**: Unified multi-sensor dataset spanning diverse platforms and scenarios

📊 Dataset Overview

- **27 Sequences**: 2.5 hours total, 38.7 km distance
- **4 Platforms**: Handheld, Legged robot, UGV, Vehicle
- **Multi-sensors**: LiDAR, Stereo cameras, Event cameras, IMU, INS
- **12 Environments**: Campus, underground, highway, multi-layer parking

📖 Paper 3: BRNE Algorithm

BRNE: Mixed Strategy Nash Equilibrium for Crowd Navigation

IJRR | Sun et al., Northwestern Univ. & Honda Research Inst.

🎯 Problem & Solution

- **Pain Points**: Freezing robot (uncertainty), reciprocal dance (oscillation), real-time failure ($O(N^3)$ computation)
- **Solution**: BRNE with mixed strategy Nash equilibrium & Bayesian updates

🚀 Core Design

- **Game Model**: Captures human behavior uncertainty
- **Update**: Iterative Bayesian (prior: trajectory; likelihood: collision risk)
- **Theoretical Gain**: Provable global equilibrium
- **Real-time**: $O(TM^2N^2)$ (5 agents: Jetson; 8 agents: laptop)

📖 Paper 3: BRNE Algorithm

Engineering: From Theory to Deployment

Key Implementation & Validation

🔧 Technical Details

- **Strategy Representation**: Gaussian Process (GP) sampling (M=50-100 trajectories)
  - Mean: Robot (RRT) / Human (constant velocity)
  - Kernel: Smooth constraint (e.g., RBF)
- **Weight Update**: Init (1/M) → Likelihood ($L \propto \exp(-\gamma \sum R_{ik})$) → Posterior (normalized)

📊 Validation Results

- **Simulation (ETH/UCY)**: ↓30-50% collision rate, ↓15-25% navigation time
- **Hardware**: Quadruped (Jetson NX) + 3-5 humans (no freezing/oscillation)
- **Human-Level**: Matches real pedestrian trajectory consistency

📖 Paper 4: Visuo-Tactile Shared Perception

Shared Visuo-Tactile Interactive Perception for Robust Object Pose Estimation

IJRR | Murali, Porr, Kaboli

🎯 Problem & Solution

- **Pain Points**:
    i. Visual-only fails on transparent/specular objects; tactile-only is sparse/local.
    ii. Mono-modal shared perception can't handle cross-modal (vision+touch) mismatch.
- **Solution**: Two-robot shared visuo-tactile framework.

🚀 Core Design

- **Shared Perception**: UR5 + Franka Panda (Kinect) share scene data to declutter dense clutter.
- **S-TIQF**: Stochastic Translation-Invariant Quaternion Filter (Bayesian + stochastic optimization).
- **In Situ Calibration**: Visuo-tactile hand-eye calibration with arbitrary objects (no special targets).
- **Active Reconstruction**: Joint information gain criterion for NBV/NBT → reduce redundant actions.

📖 Paper 4: Visuo-Tactile Shared Perception

Key Implementation & Validation

Technical Details & Experimental Results

🔧 Technical Details

- **Scene Decluttering**: Declutter graph (edges = overlap/proximity; actions = grasp/push) → auto-singulate objects via semantic/grasp affordance networks.
- **Active Reconstruction**:
  - NBV: Hemisphere sampling (Panda reach: 855mm, radius: 550mm) → camera orientation toward object centroid.
  - NBT: Bounding box face sampling → touch direction = face normal.
  - Sensor Selection: Energy cost D(at) (prefer touch for transparent objects via IoU heuristic: IoUpc/rgb < ω).
- **S-TIQF Workflow**: Decouple rotation/translation → Bayesian update (prior: trajectory; likelihood: collision risk) → global optimal pose.

📖 Paper 5: Multi-Tactile Sensor Calibration

Multi-Tactile Sensor Calibration via Motion Constraints with Tactile Measurements

IJRR | Yu et al., SJTU

🎯 Problem & Solution

- **Pain Points**: Multi-finger robots lack encoder-free calibration;No overlapping regions (no shared features like cameras); high-cost encoders unavailable for low-cost/soft hands.
- **Solution**: Calibrate via rigid object's shared motion.

🚀 Core Design

- **Key Constraint**: Grasped object is rigid (shared unique motion for all sensors).
- **Motion Estimation**: Each sensor (e.g., GelSlim) infers object motion via contact pt registration.
- **Calibration Target**: Homogeneous transform matrix X (rotation + translation) between sensors.
- **No Object Prior**: Works for arbitrary object shapes/sizes (no CAD/models needed).

📖 Paper 5: Multi-Tactile Sensor Calibration

Key Implementation & Validation

🔧 Technical Details

1. **Object Motion Estimation**:
   - Sensor: GelSlim (vision-based tactile sensor) → captures contact 3D point clouds.
   - Process: Perturb object slightly → improved ICP → get motion matrix M (R + T) per sensor.
2. **Calibration Workflow**:
   - For 2 sensors: M_1 (sensor1's motion), M_2 (sensor2's motion), X (sensor2→sensor1 pose).
   - Constraint: $M_1X = XM_2$ (rigid object motion consistency).
   - Solve: Collect multi-group (M_1,M_2) → overdetermined equations → least squares to get X.
3. **Extension**: 3+ sensors via pairwise calibration (e.g., $X_{12} \rightarrow X_{23} \rightarrow X_{13}$).

📖 Paper 6: JVS-SLAM

Combining the SLAM back and front ends with a joint vector-set distribution

IJRR | Inostroza, Adams

🎯 Problem & Solution

- **Pain Points**: Traditional SLAM splits frontend (heuristic association) & backend; frontend errors (e.g., low-light misassociation) cause convergence failure; no map cardinality/association uncertainty.
- **Solution**: JVS-SLAM – unify frontend-backend via Bayesian RFS + batch optimization.

🚀 Core Design

- **Joint State**: Trajectory (fixed vector) + map (RFS, random cardinality) → co-estimated.
- **RFS**: Handles ambiguous association/false alarms without heuristics.
- **Batch Integration**: Combines RFS with g2o-like solvers for global consistency.
- **No Separate Frontend**: Association/map management = part of joint Bayesian estimation.

📄 August 2025 Paper Review

Coming Soon - ICRA & IROS Selections

Stay tuned for comprehensive reviews of papers from:

- **ICRA 2025**: International Conference on Robotics and Automation
- **IROS 2025**: IEEE/RSJ International Conference on Intelligent Robots and Systems
- **Selected Journal Papers**: Latest publications in top robotics journals

Expected coverage areas:

- 🦾 **Manipulation & Grasping**
- 🚗 **Autonomous Navigation**
- 🤖 **Human-Robot Interaction**
- 🔬 **Learning & AI in Robotics**

📄 September 2025 Paper Review

Planned - CoRL & RSS Highlights

Upcoming comprehensive reviews from:

- **CoRL 2025**: Conference on Robot Learning
- **RSS 2025**: Robotics: Science and Systems
- **Specialized Workshops**: Focus on emerging robotics research

Anticipated research themes:

- 🧠 **Deep Learning for Robotics**
- 🌐 **Multi-Robot Systems**
- 🏗️ **Field & Service Robotics**
- ⚡ **Real-time Robotics Applications**