



ANTS 2024 Special Issue

Editorial

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This special issue of the *Swarm Intelligence* journal is dedicated to the publication of extended versions of some of the best papers presented at *ANTS 2024, Fourteenth International Conference on Swarm Intelligence*, which took place in Konstanz, Germany, October 9–11, 2024.

ANTS is the first and most established conference series dedicated to the dissemination of swarm intelligence research. Its first edition took place in 1998, at the Université Libre de Bruxelles, Brussels, Belgium. Since then, it has been held every other year and, since

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2010 (i.e., starting with the seventh edition of the conference), the authors of full conference papers have been invited to submit extended versions for possible inclusion in a dedicated special issue of the *Swarm Intelligence* journal.

Four papers from the 2024 edition of the ANTS conference were accepted for publication in the special issue after at least two rounds of reviews with comments by at least three referees. In the following, each paper is briefly introduced by the guest editor who managed it.

In *Swarm-inspired controllers: a comparative study of decentralized behaviors for distributed manipulation surfaces*, Nicolas Bessone, Kasper Stoy, and Payam Zahadat examine how simple local rules can drive planar manipulation on actuator arrays. They introduce four decentralized behaviors and compare them against a centralized baseline across diverse object shapes. Despite using only local sensing and neighbor communication, several variants achieve positioning and orientation performance comparable to, and sometimes exceeding, the baseline, while maintaining robustness under actuator failures. The study shows that controllers using only local interaction can yield scalable manipulation capabilities without global feedback.

With the paper *Evidence Accumulation with Adaptive Weighting of Social and Personal Information for Collective Perception*, Gal Sajko and Jan Babič work on the challenge of collective decision-making through diffusion models. The authors propose aSODM, an “automated swarm diffusion model,” that automatically adjusts and balances the influences of personal and social information. This self-adapting model achieves performances similar to that of manually tuned swarm diffusion models, eliminating the need of a-priori knowledge to find a good tuning.

In the paper *Optimization of Collective Bayesian Decision-Making in a Swarm of Miniaturized Vibration-Sensing Robots*, Thiemen Siemensma and Bahar Haghighat contribute to moving collective perception research toward more realistic, application-driven scenarios. They extend a widely used benchmark in collective sensing, typically studied on idealized black–white grids, by incorporating vibration sensing, noisy and spatially structured environments, and robot-specific hardware variability, bringing the model closer to conditions encountered in real inspection tasks. Building on a Bayesian decision-making framework, the authors introduce a soft-feedback information-sharing strategy that accelerates consensus formation. Using carefully calibrated high-fidelity simulations alongside extensive real-world experiments, they show that their approach reduces decision times while maintaining robust performance even in challenging and heterogeneous environments.

In the paper *Swarm Robotics Localization: Comparing Methods from Infrared to Foundation Models*, Ali Imran, Vivek Shankar Varadharajan, Rafael Gomes Braga, Giovanni Beltrame, and David St-Onge address the challenge of localization in GNSS-denied environments. The authors implement and compare localization protocols based on infra-red sensors, ultrawideband communication, visual odometry and visual foundation models. Their experiments shows the advantages and challenges of these approaches and highlights the need to carefully select localization methods for the robot platform and scenario under consideration.

The high quality of the four papers contained in this special issue is the result of the collaboration of a large number of people: the authors, who submitted their best work to the journal; the referees, who helped in the selection of the published papers; and finally, the numerous colleagues at Springer who assisted us in the production phase. We extend our sincere thanks to all of them for helping make this special issue possible.

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