Special Issue: Autonomous Intelligence for Unmanned Systems

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Welcome to this special issue of *The International Journal of Intelligent Control and Systems* (*IJICS*), which is dedicated to Autonomous Intelligence for Unmanned Systems. In recent years, we have witnessed a rapid increase in the deployment of unmanned systems across a wide range of civilian and military applications, including unmanned aerial vehicles (UAVs), autonomous ground vehicles (AGVs), and unmanned surface vessels (USVs). It is critically important that effective analysis and control be carried out for these systems, especially when operating in complex and dynamic environments. The autonomous control capability has emerged as one of the key factors determining their success in task execution. Consequently, significant research efforts are now focused on enhancing the autonomy, robustness, and safety of unmanned systems, as well as exploring novel control strategies and advanced technical approaches to address these challenges.

Furthermore, distributed control and cooperative control of multi-agent systems (MASs) play a pivotal role in enabling sophisticated behaviors such as formation flight and cross-domain coordination. By designing appropriate control methods, efficient collaboration among multiple unmanned systems can be achieved, which enables dynamic behavioral adaptation to environmental changes and thereby ensures the effective accomplishment of control objectives. This special issue aims to bridge the gap between theoretical innovations and practical implementations, bringing together researchers to discuss the latest progress, new methodologies, and future directions in the field. It is our hope that this collection of articles will not only showcase cutting-edge advances but also inspire further interdisciplinary collaboration.

In this special issue of *IJICS*, we aim to highlight the latest research advances in Autonomous Intelligence for Unmanned Systems. Specifically, the accepted contributions are grouped into the following three sections.

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(1) Intelligent control and autonomous decision-making The essence of unmanned system intelligence lies in its ability to make real-time decisions without human intervention. Recent works have leveraged deep reinforcement learning, adaptive control, and cognitive architectures to enable systems to learn from interactions and improve their performances over time. These methods not only enhance operational efficiency but also ensure adaptability in complex environments.

In this context, the integration of vision-language-action (VLA) models into robotic systems opens new frontiers for human-machine collaborative creation, as explored in the framework of parallel art [1]. For trajectory tracking of quadrotor UAVs, an iterative linear quadratic regulator (iLQR) based model predictive control (MPC) strategy has been proposed to handle nonlinear dynamics effectively [2]. Similarly, model-free adaptive heading control incorporating an extended state observer (ESO) has been developed for USVs to cope with uncertainties and disturbances [3]. Further advancing learning-based control, residual reinforcement learning combined with weighted-sign baselines has been applied to achieve sequential synchronization under bounded disturbances [4].

(2) Cooperative control and swarm intelligence In many practical scenarios, a single unmanned system is insufficient to accomplish complex tasks. Multi-agent systems offer a promising solution through distributed coordination, consensus algorithms, and swarm behaviors. However, communication constraints and external disturbances pose a major challenge to achieving intelligent cooperative control among multiple unmanned systems.

Notably, fixed-time bipartite consensus schemes incorporating fuzzy optimization and quantized control have been proposed for nonlinear multi-agent systems with prescribed performance [5]. For multi-robot systems, a safety-critical finite-time cooperative control framework integrating discrete control Lyapunov and barrier functions (FT-DCLF/DCBF) has been developed to ensure both convergence and safety [6]. In the context of connected vehicles, a dynamic event-triggered platoon control strategy has been designed to maintain formation under denial-of-service (DoS) attacks [7]. Beyond conventional control, a smart-contract-driven multi-agent collaboration mechanism has been proposed to facilitate verifiable and decentralized cooperation in Web 3.0 environments [8].

(3) Resilience and reliable system design As unmanned systems increasingly operate in close proximity to humans or critical infrastructure, safety and operational reliability must be embedded throughout the control loop. Contributions in this area address fault-tolerant control, collision avoidance, risk-aware planning, and verification of autonomous behaviors using formal methods and barrier functions. These approaches are vital for building trust and ensuring the dependable deployment of unmanned systems in real-world settings.

To enhance system robustness under uncertainties, an unknown input observer based on Takagi-Sugeno fuzzy modeling has been designed for discrete-time nonlinear Markov jump systems, improving the accuracy of state estimation under unknown disturbances [9]. On the actuation front, finite element analysis has been applied to model the electromagnetic field characteristics of radial magnetic levitation bearings, supporting the design of more reliable physical actuation systems [10]. Together, these methods enhance the resilience and reliability of unmanned systems from state perception to physical actuation.

We would like to extend our sincere gratitude to all the authors, reviewers, and editorial team members who have made this special issue possible. It is our hope that this collection of articles will inspire further research and collaboration in the intelligent control of unmanned systems, paving the way for a new era of autonomous intelligence. Many thanks for your continued support and contributions to *IJICS*.

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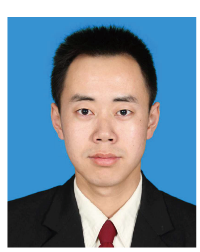

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