AI-driven drones defeat human pilots in obstacle course

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Time-lapse illustrations of a high-performance racing drone controlled by our RL policy. Credit: Robotics and Perception Group, University of Zurich

In what is being called a milestone in mobile robotics, an AI-assisted drone has defeated drones controlled by humans in an obstacle course

testing precision flight patterns and speed.

AI-assisted machines have conquered humans in non-physical games such as chess, checkers, Go, Othello and StarCraft, but a drone competition held by researchers at the University of Zurich marks the first time an autonomous drone prevailed over human pilots in a physical challenge.

"First-person view" (FPV) has been soaring in popularity with the advent of more compact, faster drones sporting high-resolution cameras.

Competitions showcasing drone pilot acuity as the high-speed devices glide through challenging maneuvers are being held worldwide. Next month, 120 pilots from 30 countries will attend the 2023 World Drone Racing Championship at South Korea's Namwon Sports Town complex.

In an article published in *Science Robotics*, Zurich University researchers said their device, called Swift, took on three master drone pilots and defeated them in 15 out of 25 challenges.

According to Elia Kaufmann, a member of the Swift development team, "Our result marks the first time that a robot powered by AI has beaten a human champion in a real physical sport designed for and by humans."

The Swift system relies on an artificial neural network that optimizes the drone's course and speed. It gathers details in real time via onboard cameras. The human pilots rely on video feeds transmitted to headsets, thus providing their "first-person view."

The course consisted of seven square posts that drones had to fly through over a field roughly 27 years square. The goal is to complete the ask with no accidents and in the least amount of time. In addition to defeating the human pilots in more than a dozen trials, the Swift drone clocked the

fastest speed, though only by a half second.

The challenge was daunting. According to the paper, "This task requires pushing the aircraft to its physical limits of speed and acceleration. Tolerance for error is low: A small mistake can lead to a catastrophic crash or a strong penalty on lap time."

The slightest miscalculations by AI or humans "manifest themselves in reduced task performance, making drone racing a particularly demanding and instructive setting for testing the limits of control design paradigms," the study said.

The researchers noted that when small changes were made to the course, such as in lighting, Swift's efficiency dropped.

Smart drones offer great promise in a variety of fields, and for more than just delivering your latest Amazon purchase. Farmers can deploy drones to monitor their crops to check on growth progress, disease and bug infestations. Engineers can launch drones to inspect downed power lines or bridge damage, dangerous (for humans) but critical tasks needed to forestall worsening problems.

Search and rescue efforts for victims of natural disasters can be aided by a drone regimen scouring rubble or flooded areas. Police can launch drones to help track down fugitives.

As for sports, drones are being used to great effect in providing previously impossible aerial views of the game. The PGA Tour also utilizes drone photography.

For now, drones are on the sidelines at such sporting events. But when they are trained to carry a ball and tackle opponents, human players better start taking notice.

More information: Yunlong Song et al, Reaching the limit in autonomous racing: Optimal control versus reinforcement learning, *Science Robotics* (2023). DOI: 10.1126/scirobotics.adg1462