Self-flying Stanford robocopter learn tricks though observation

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Brow clenched in focus, expert radio-control pilot Garett Oku, of Mountain View, Calif., guided a 4-foot-long model helicopter through a dizzying sequence of aerobatic tricks, punctuated by an upside-down tailspin called an ``inverted hurricane.'' Then he dropped the controls.

Try that with an ordinary model, and you're likely to find yourself in the market for a new one very shortly. But a team of Stanford University computer scientists had imbued this craft with a special gift: the ability to learn from experience.

As Oku let go of the remote, the helicopter pulled itself into a stable hover above a field on the Stanford campus. After a moment's pause, it launched into its own version of the routine he had just put it through, executing each pirouette with confident precision.

When the airshow was complete, it landed itself as gently as any human could have done.

The autonomous helicopter is a demonstration of the power of ``apprenticeship learning,'' said its creators, a team of four doctoral students overseen by professor Andrew Ng. Rather than following a set of exact instructions, it uses telemetry to ``watch'' itself being flown by an expert, then attempts to pilot itself in the same way.

The researchers - Pieter Abbeel, Adam Coates, Timothy Hunter and Morgan Quigley - said they believe it's a model that could someday be

applied to dangerous tasks like wilderness firefighting and land-mine detection.

The learning method is well-suited to helicopters, Coates said, because their flight dynamics are too complex for programmers to simply write out a list of instructions. It's affected by everything, from the slightest cross breeze to the amount of gas in the tank, which changes the craft's weight.

That means every flight is different - so the robot can't simply replicate Oku's controls and expect the same result. Instead, it must watch repeatedly to gain an ideal concept of each maneuver.

``In essence, it tries to figure out what the goal or what the intent of the human is,'' Ng said. Then it hones its own technique in a series of practice flights.

That's a new level of sophistication for an apprentice learning system, Ng added. It's a step toward building robots that can be trusted to perform important tasks as reliably as humans.

Oku said the autonomous helicopter has gotten so good that it now flies more smoothly and consistently than he can.

That's not to say it has eclipsed human capacities in every way. With no way to sense wind, it can still be thrown off by a sudden gust. And on a recent Monday, shifting clouds caused its tracking camera to lose sight of the helicopter, rendering it effectively blind.

The computer beeped in alarm, and the researchers retook control of the small chopper. Back under human control, it landed safely, and the team waited for the sky to clear to try again.