

New tech uses hardware, software to train dogs more efficiently

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North Carolina State University researchers have developed and used a customized suite of technologies that allows a computer to train a dog autonomously, with the computer effectively responding to the dog based on the dog's body language.

"Our approach can be used to train dogs efficiently and effectively," says

David Roberts, an assistant professor of computer science at NC State and co-author of a paper on the work. "We use sensors in custom dog harnesses to monitor a dog's posture, and the computer reinforces the correct behavior quickly and with near-perfect consistency."

"Because the technology integrates fundamental principles of animal learning into a computational system, we are confident it can be applied to a wide range of canine behaviors," says Alper Bozkurt, an assistant professor of electrical and computer engineering and co-author of the paper. "For example, it could be used to more quickly train service dogs. Ultimately, we think the technology will be used in conjunction with human-directed training."

The dog harness fits comfortably onto the dog and is equipped with a variety of technologies that can monitor the dog's posture and [body language](#). Each harness also incorporates a computer the size of a deck of cards that transmits the sensor data wirelessly. The researchers published a paper about the harness's potential applications in late 2014.

For the current study, the researchers wrote an algorithm that triggered a beeping sound and the release of dog treats from a nearby dispenser whenever the dog's harness sensors detected that the dog went from standing to sitting.

The researchers had to ensure that the reinforcement was given shortly after the desired posture was exhibited, and also ensure that rewards were only given for the correct posture. This required a trade-off. If the algorithm ran long enough to ensure the correct posture with 100 percent certainty, the reinforcement was given too late to be effective for training purposes. But if the reinforcement was given immediately, there was a high rate of rewarding the wrong posture.

To address this, the researchers worked with 16 volunteers and their

dogs to optimize the algorithm, finding the best possible combination of speed and accuracy. The researchers then compared the algorithm's timing and accuracy to that of an expert human trainer.

The algorithm was highly accurate, rewarding the appropriate behavior 96 percent of the time. But the human trainer was better - with a 100 percent accuracy rate.

However, while the average response time was about the same for both algorithm and trainer, there was a lot of variation in the time of response from the trainer. The [algorithm](#) was incredibly consistent.

"That variation matters, because consistency is fundamentally important for all animal training," Roberts says.

"This study was a proof of concept, and demonstrates that this approach works," Bozkurt says. "Next steps include teaching dogs to perform specific behaviors on cue, and integrating computer-assisted training and human-directed training for use in various service dog applications."

"In the long term, we're interested in using this approach to animal-computer interaction to allow dogs to 'use' computers," Roberts says. "For example, allowing an explosive detection dog to safely and clearly mark when it detects components of a bomb, or allowing diabetic alert [dogs](#) to use their physical posture and behaviors to call for help."

More information: John Majikes et al, Balancing Noise Sensitivity, Response Latency, and Posture Accuracy for a Computer-Assisted Canine Posture Training System, *International Journal of Human-Computer Studies* (2016). [DOI: 10.1016/j.ijhcs.2016.04.010](https://doi.org/10.1016/j.ijhcs.2016.04.010)

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