Emotional robot pets

September 17 2010

Designers of robot pets are fighting a never-ending battle with consumers to provide entertaining and realistic gadgets that respond to human interaction in ever more nuanced ways, mimicking the behavior of real pet animals or even people. Researchers in Taiwan are now looking at a new design paradigm that could see the development of a robot vision module that might one-day recognize human facial expressions and respond appropriately.

Part of the problem is that robot design takes a long time, while the consumer life cycle of any given product is very short. Moreover, fixed prototypes and repetitive behavior in domestic robots for entertainment is no longer of interest to sophisticated users. Today, they expect their robot pets to be almost as good as the "robots" they see in 3D movies and games.

The researchers, Wei-Po Lee, Tsung-Hsien Yang and Bingchiang Jeng of National Sun Yat-sen University, have now turned to neural networks to help them break the cycle of repetitive behavior in robot toys and to endow them with almost emotional responses to interactions.

"We have developed a user-centric interactive framework that employs a neural network-based approach to construct behavior primitives and behavior arbitrators for robots," the team explains in the current issue of the *International Journal of Modelling, Identification and Control*. Their evaluation of the approach should allow them to construct an emotion-based pet robot much more quickly than current design and manufacturing prototyping allows.

Building fully autonomous artificial creatures with intelligence akin to humans is a very long-term goal of robot design and computer science. On the way to such machines, home entertainment and utility devices such as "Tamagotchi" digital pets and domestic toy robots such as Aibo, the robotic dog and even the Roomba robotic vacuum cleaner, have been developed. At the same time, popular science fiction culture has raised consumer expectations.

"With current technologies in computing and electronics and knowledge in ethology, neuroscience and cognition, it is now possible to create embodied prototypes of artificial living toys acting in the physical world," Wei-Po Lee and colleagues at the National Sun Yat-sen University, Kaohsiung, explain.

There are three major issues to considered in robot design, the team explains. The first is to construct an appropriate control architecture by which the robot can behave coherently. The second is to develop natural ways for the robot to interact with a person. The third is to embed emotional responses and behavior into the robot's computer.

The researchers hope to address all three issues by adopting an approach to behavior-based architecture - using a neural network - that could allow the owner of a robot pet to reconfigure the device to "learn", or evolve new behavior and at the same time ensure that the robot pet functions properly in real time.

The team has evaluated their framework by building robot controllers to achieve various tasks successfully. They, and countless other research teams across the globe, are currently working on vision modules for robots. The technique is not yet fully mature, but ultimately they hope to be able to build a robot pet that could recognize its owner's facial expressions and perhaps respond accordingly. Such a development has major implications for interactive devices, computers and functional

robots of the future.

More information: "Building neural network-based behavior systems for emotion-based pet robots" in *Int. J. Modelling, Identification and Control,* 2010, 11, 115-123

Provided by Inderscience Publishers