"Computer Program Learns Language Rules and Composes Sentences, All Without Outside Help"
Cornell News (08/30/05); Lang, Susan S.

Cornell University psychology professor and computer scientist Shimon Edelman and Tel Aviv University researchers have developed Automatic Distillation of Structure (ADIOS), a technique enabling a computer program to scan text, then autonomously extract language rules and compose new sentences. "This is the first time an unsupervised algorithm is shown capable of learning complex syntax, generating grammatical new sentences and proving useful in other fields that call for structure discovery from raw data, such as bioinformatics," Edelman says. ADIOS repeatedly aligns sentences and scans for overlapping segments in order to uncover complex patterns in raw text. The ADIOS algorithm has been tested on the full text of the Bible in multiple languages, musical notation, biological data, such as protein sequences, and artificial context-free languages with massive sets of rules. Experiments demonstrated that ADIOS, using structured generalization and statistical pattern extraction methodology, can discover complex structures from transcripts of parents' speech directed at very young children. Edelman says this ability may ultimately help researchers learn how children eventually become adept at speaking their native languages. The U.S.-Israel Binational Science Foundation partly sponsored the ADIOS collaboration.
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"By George, You've Won!"
Guardian Unlimited (UK) (09/21/05); Burkeman, Oliver

Computer scientist Rollo Carpenter won the 2005 Loebner prize for George, a software program that was deemed the year's most convincing conversationalist. George differs from most previous programs in that its responses are not based on a few preprogrammed language rules; rather, it has "learned" to make sensible conversation by participating in over 5.7 million exchanges with thousands of people who visited Carpenter's Jabberwacky.com Web site. Carpenter says some visitors talk with George for as long as seven hours. George is all the more fascinating in that it is given to bouts of distemper and is generally curmudgeonly, which may encourage those who converse with the program to identify it as human, at least on a semi-conscious level. Carpenter says George thinks, from a certain perspective. "My program would know precisely nothing about language, had it not learned," he explains. "So, to a reasonable degree, you could say that it's building a non-human form of understanding." The methodology used to determine the Loebner prize winner is the Turing test,

a measure for machine intelligence based on the assumption that a machine can converse so convincingly as to be mistaken for a human by another human.
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"Even a Chatbot Can Turn Nasty"
New Scientist (10/15/05) Vol. 188, No. 2521, P. 26; Graham-Rowe, Duncan

It has long been the challenge of software programmers seeking to create devices capable of human interaction to impart to machines the ability to glean the subtleties of human communication, but insults and swear words also pose a unique challenge to make artificial intelligence agents with practical applications. Central to this endeavor is the ability to curb the human frustration with technology that so often manifests itself in cursing at the computer for its slow speed or the television for its poor reception. The chatbot George recently won the Loebner prize for the program that converses most like a human, though when engaged with actual people, up to 11 percent of the language directed toward George was abusive, and some of the invective was considered downright pornographic. Jabberwacky, the program that powers George, filters out much of the offensive and insulting language it hears, so as not to incorporate it into its own vocabulary, which is an especially important feature as more corporations are turning to chatbots to power their automated telephone services. The fact that poor spelling correlates to abusive language helps prevent chatbots from absorbing it, though a recent study found that some commercial chatbots responded to profanity and sexual propositions with language that was equally inappropriate. Traditional call center techniques of calming frustrated customers can be applied to chatbots, as can the zero-tolerance approach that warns the customer that the conversation will be terminated unless he stops being rude. It has been shown that people are more willing to be rude to a machine than to a person, a psychological factor that is evident in the contrast between terse emails and polite phone conversations. Advances in social intelligence could address this problem, as chatbots that more closely simulate humans would not be as likely to arouse the ire of customers on the phone.
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"How Bots Can Earn More Than You"
New Scientist (08/20/05) Vol. 187, No. 2513, P. 26; Graham-Rowe, Duncan

It has been demonstrated, both in simulation and in the real world, that software robots or bots can outperform and even out-earn humans in areas such as the stock market. Such bots vied against each other in an agent trading competition at the International Joint Conference on Artificial Intelligence, where the task was to purchase computer components from multiple made-up vendors, assemble the machines in response to orders from imaginary customers, and deliver the final products. The University of Michigan's Michael Wellman says bots can keep track of prices and react much faster than humans, while Nick Jennings with the University of Southampton's Intelligence, Agents, and Multimedia group says the only thing keeping the agents demonstrated at the conference from immediate use is software's inability to automatically procure supplies and take customer orders. Dave Cliff with Deutsche Bank's Complex Risk Group notes that bots are now routinely employed in financial markets: Important strategic decisions are still left to flesh-and-blood traders in the equities market, but the bots can decide the exact time to buy and sell shares. Studies show that human traders only examine a handful of variables before making a decision, whereas bots can analyze hundreds of variables and refer back to historical trading trends data. A 2001 trial by IBM not only showed that trading bots bought and sold commodities better than people when trading against each other, but also raised the average profit margin in a simulated commodities market. Jennings expects to see people using bots to make decisions in how they purchase gas and electricity or choose mobile phone companies in a few years.

"Robots of Arabia"
Wired (11/05) Vol. 13, No. 11, P. 188; Lewis, Jim

The creation of robot camel jockeys is seen as a significant achievement from both a technical and social perspective. The machines were developed in an attempt by Qatar's emir, Hamad Bin Khalifa Al-Thani, to win the respect of the developed world by eliminating the practice of using children, imported from poor nations and trained and housed under less than humanitarian conditions, as jockeys. The 35-pound prototypes were developed by Swiss company K-Team under the guidance of project and services manager Alexandre Colot. The remote-controlled devices fit into

specially designed saddles and feature two hands--one to pull the reins and one to bear the whip. The robots were also designed with a ruggedized aluminum frame and shock absorbers; a GPS-enabled monitor that tracks the camel's heart rate; and a 400 MHz processor running Linux and communicating at 2.4 GHz. A plastic head adds an anthropomorphic touch that makes the camels more accepting of the robots, but this feature is frowned upon by Arabic culture, which considers representations of the human form taboo. Qatar's prime minister has mandated that the heads must be removed before the commencement of the racing season.
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"On the Internet, Nobody Knows You're a Bot"
Wired (09/05) Vol. 13, No. 9, P. 96; Kushner, David

Controversy is brewing over the emergence of poker-playing software robots, which many people complain give the players who use them an unfair advantage. Poker Web sites publicly downplay the threat of poker bots while discretely scanning for and ejecting suspicious accounts, but Ray Bornert II, creator of the WinHoldEm bot, says attempts to prevent bots from infiltrating such sites are futile: Online poker is already riddled with cheaters and bots, and Bornert claims the only sensible recourse for players in this situation is to acquire a superior poker bot--namely, his. Bornert contends that the odds are stacked against players at poker sites, which falsely claim the game is as safe and protected as one at any Vegas casino, when in reality cheating via bots and bot-assisted collusion is unavoidable; exposing this lie and evening the odds between players and card sharks was his rationale for creating and selling WinHoldEm. The cheaper version of WinHoldEm offers garden variety poker-hand analysis software, while the costlier package buys a one-year subscription to the team edition, complete with the autoplaying bot and a card-sharing module that facilitates collusion between multiple players. Most users feed the software a batch of rules to tailor it to their own specifications. Though poker bots cannot maintain a winning streak against opponents with better hands, their tirelessness and cunning can enable users to amass tidy sums at low-limit tables habituated by less-experienced players. One player says poker bots' inability to converse can give them away, but bot users have started taking precautions of their own, such as restricting their time at any one table, or controlling the bots remotely to avoid detection.
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"Computer Users Move Themselves With the Mind"
Nature (09/27/05); Hopkin, Michael

A new brain-computer interface developed by Gert Pfurtscheller of Austria's Graz University of Technology provides a non-invasive way to detect neuronal signals associated with movement and translate those signals into movement within a virtual environment. The interface consists of an electrode-studded "thought cap" that picks up brain waves along the surface of the scalp, and is connected to a computer that determines which movements those signals correspond to. The device was unveiled at last week's Presence 2005 technology conference, where participants used it to navigate a 3D virtual-reality studio. It can take several hours of training for a user to become proficient with Pfurtscheller's interface, notes Graz entrepreneur Christoph Guger. Paralysis victims could potentially use the interface to move robotic limbs, while motor neuron disease sufferers might employ the technology to type out words on a virtual keyboard. Pfurtscheller thinks the device could even help stroke patients regain movement by enabling them to exert the motor centers of their brain. Detecting local brain activity accurately was previously achievable only through electrodes implanted directly within the brain.
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"In Chess, Qualified Respect for Computers"
Los Angeles Times (09/26/05) P. A19; Hiltzik, Michael

The skill of chess-playing computers has long been a yardstick by which the progress of artificial intelligence is measured, and has developed in parallel with most hardware advances. IBM's Deep Blue chess computer trounced world champion Garry Kasparov eight years ago, but experts are still deliberating whether Deep Blue truly won or had an unfair advantage; the issue has resurfaced with the opening of a new exhibit, "Mastering the Game: A History of Computer Chess," at the Computer History Museum this month. The exhibit was launched with a panel debate among notable computer chess and AI personages. AI pioneers such as Herbert Simon were convinced that hardware and software could reproduce the expertise, discernment, learning ability, and even psychology of a master chess player, but Simon incorrectly predicted that computers would solve chess by learning the game through accumulated knowledge and experience. Instead, Deep Blue vanquished Kasparov through brute computing power that enabled the machine to probe as many as 200 million possible positions per second and choose the correct maneuver by measuring them against specifications preprogrammed by people. IBM researcher and panelist

Murray Campbell said Deep Blue possessed no actual learning ability, and AI professionals consider the machine's victory rather hollow in light of this fact. Panelist and Stanford University computer science professor Edward Feigenbaum said that, beyond computer chess, artificial knowledge and learning algorithms outmatch brute force in every instance.
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The Young and the Restless: Allison Okamura, Johns Hopkins University

By Rob Wright, *VARBusiness*

1:14 PM EST Thu. Dec. 07, 2000

Imagine you're an online shopper. Pretend for a second that instead of settling for an image on a screen you could actually touch the merchandise and feel the texture of that antique wooden chair--all without leaving your computer screen.

Sound like science fiction or technological theory? It's more than that, thanks, in part, to Allison Okamura, director of the Haptic Research Laboratory at Johns Hopkins University, Baltimore. Okamura, 28, specializes in robotic exploration through haptic interfaces, which add the sense of touch to virtual environments. Her goal is adding more realism to a virtual environment.

"Rather than just create a virtual wall, you can give it some material properties so when you tap on it, it feels like wood or rubber," Okamura says.

Currently, Okamura is working on developing robotic "fingers" and testing materials such as wood, metal and rubber and mimicking their touch vibrations through computers. While the possibilities for e-commerce are tantalizing, there are larger applications for this technology, Okamura says, such as space or deep-sea exploration and computer-simulated surgery.

"You'd prefer to have surgeons do [a procedure] 30 times on a simulator just to increase their chances that they'll be successful for the first time on a real person," Okamura says.

Before Okamura arrived at Johns Hopkins University, there was no Haptic Exploration Lab. She had earned a Ph.D in mechanical engineering at

Stanford University this year and jumped right into her role as assistant professor at JHU's mechanical engineering department to start the lab.

Okamura is just getting started, she says. She has a definitive three-year plan for her projects and is also trying to secure grants to fund her research.

"It's been a lot of work, and I've been in school a lot of time," she says, "but I think I'm one of the few graduate students that was always happy with what they're doing."

There's a Chip in My Pants
Discover (03/06) Vol. 27, No. 3, P. 26; Johnson, Steven

As the price of digital processors continues to drop and researchers develop materials that can transmit digital signals, the reality of smart clothing appears to be at hand. Adidas is at the forefront of this development with its athletic shoe designed to sense environmental conditions and adjust its cushioning level accordingly. A microprocessor receives 1,000 reports a second of compression level data from magnetic sensors, which it then relays to a motor that either tightens or loosens the shoe's cushioning support. Adidas is developing a new model for basketball that will adjust in response to the player's movements of jumping, running, and cutting and generate a profile based on the player's patterns of motion. Other smart clothing products can look inside the wearer, monitoring heart rate, respiration rate, and body temperature. ViviMetrics has developed a shirt to monitor the state of sleep apnea sufferers, a technology that could also be used to prevent sudden infant death syndrome. The MEMSwear device is a miniature silicon-based sensor that can be embedded in a shirt that conveys an alert to a cell phone or a computer through the wireless Bluetooth standard if the wearer falls. Though many of the potential applications of smart clothing may seem farfetched for the average consumer, the rapidly declining cost of hardware could lead to their widespread use anyway. Looking forward, smart clothing could interface with navigation services to provide walking directions based on the wearer's current position.
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A Case of Mind Over Matter
Boston Globe (04/02/06) Heuser, Stephen

After decades of promising results in the lab and millions of dollars in research funding, the field of brain-computer interaction still has yet to live up to its promise and bring a product to market. At the Upstate New York public health laboratory, neuroscientist Jonathan Wolpaw has been developing an electrode-studded mesh cap that can relay brain signals to external devices as instructions, offering greater independence for the severely disabled. Other systems in development surgically implant electrodes to glean instructions directly from a person's neural cells. Wolpaw's cap detects electrical waves outside the brain, similar to the type that electroencephalograms have read for decades, though it interprets them with sophisticated software that Wolpaw and his team developed. "We're not talking here about mind reading in the science fiction sense of the word," said Emanuel Donchin, a brain researcher who developed the spelling application used in Wolpaw's device. "You can't listen in on the conversations of the brain. You just make inferences about the state of the brain." Sophisticated computers and scientists' growing experience are bringing the technology closer to the market. Wolpaw expects to have his devices in use by four or five patients by June, and is investigating commercial avenues. The National Institutes of Health are stepping up funding for brain-computer interface research, and Wolpaw, who had been working largely under government grants, won an international prize from the Altran Foundation for Engineering after he and a colleague published a paper detailing how his device enabled a patient to move a cursor in two dimensions. With the prize came more than $1 million worth of help from engineers, who have worked with Wolpaw to improve and simplify the design of his cap and bring the cost down, though limited demand could still be an obstacle to commercialization.
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Algorithm Turns Photos Into Digital Art
IDG News Service (08/28/06); Kirk, Jeremy

A group of researchers has developed an "empathic painting" program that converts facial expressions into digital art using sophisticated algorithms. The program, an advance in the emerging field of non-photorealistic computer graphics, produces a stylized version of an existing photograph that adapts based on a person's mood. "We're interested in the borderline of computer graphics--the output of images, and computer vision--the input of images, and these two disciplines are converging," said John Collomosse of the computer science department at England's University of Bath. The researchers started with an off-the-shelf Web camera and a machine with a

Pentium processor and a GeForce graphics accelerator. The software breaks a real photograph into segments, which are then converted into 3D brush strokes. The program interprets a person's face in the framework of an "x" and "y" axis, mapping emotions based on the expression. The algorithm responds to changes in the Web camera, adjusting the painting according to a change in the curl of the person's mouth or the wideness of the eyes. If it detects sadness, it floods the image with darkness; if it perceives the subject as happy, it gives the painting a brighter tint. The researchers acknowledge that there are some limitations to the system, such as the effect that differences in culture could have on the perception of a subject's emotional state, as well as the painting algorithm's parameters and the inherent subjectivity involved in mapping a person's mood.
http://www.infoworld.com/article/06/08/28/HNalgorithmphoto_1.html

These Robots Are Inspired by Ants
Newark Star-Ledger (NJ) (03/08/07) Washington, George C.

MIT Ph.D. candidate James McLurkin studies ants to better develop his robots' ability to communicate with one another. In his office at the school's Computer Science ad Artificial Intelligence Lab, McLurkin has an ant farm of about 500 ants, which he says "are on version 8 billion," referring to the evolution the insects have gone through to improve their communication systems, which rely mostly on tactile and olfactory senses. Ants are divided into soldiers and workers, and are divided even more so within these groups. Separate interactions comprising complex group behavior is known as distributed systems, or swarm behavior. McLurkin's biggest challenge is developing robots with the communication abilities necessary for swarm behavior. So far, software has been written that allows the robots to simulate locating an object on another planet, with some robots creating a safety perimeter and others conducting the search. The robots can cluster, spread, form a line in sequential order, and even sense when their battery life is running low and return to a recharging station. Once communication is perfected, "You could send a group of small robots into an earthquake, fire or disaster zone and they would be able to locate survivors or hot zones," McLurkin says. "They then could relay that information to larger robots who would go about clearing the area and save the survivors."

Robots Evolve to Deceive
Technology Review (03/08/07) Duncan, David Ewing

A University of Laussanne researcher has developed simple robots that mimic evolutionary processes, providing a unique perspective on human behavior. Laurent Keller designed his seven-inch "s-bots," with a life span of two minutes, to find "food" and avoid "poison." The s-bots are equipped with wheels, cameras, ground sensors, a light, and a programmed "genome" that determines their response to surroundings. If the robots find food they can "mate," passing along their "genome," but if they do not find food they "die off" along with their genes. The research was intended to compress thousands of years of development, or 500 generations, into one week. Keller found that bots would eventually blink their light to signal to those sharing their genes that they had found food. The bots would also blink their lights far away from food to trick those not sharing their genes. Keller hopes to use the s-bots to gain insight into many questions about human nature, such as reasons for altruism and self-destructive behavior.

Scientists Show Thought-Controlled Computer at Cebit
IDG News Service (03/15/07) Niccolai, James

G.tec of Austria demonstrated a brain-computer interface (BCI) at the Cebit trade show that allows the user to control a computer--albeit in a limited capacity--by measuring the electrical voltage fluctuations in the user's brain via a cap studded with electrodes. The electrodes rest on the scalp and are linked via cables to a "biosignal amplifier," which sends the signals from the brain to a computer. The BCI uses software that must be painstakingly trained to interpret the brain signals so that they can be translated into the proper actions. Functions the g.tec BCI can perform include writing letters, operating prosthetic limbs, and steering a wheelchair. Such technology could become very useful for people who are movement- or speech-impaired. "Ultimately you could have wireless contacts embedded in the brain, and communicate with others just by thinking," said g.tec CEO Christoph Guger. He explained that BCI research is currently a focus of 300 laboratories.

Amoebalike Robots for Search and Rescue
Technology Review (03/29/07) Graham-Rowe, Duncan

Virginia Tech roboticists are working on a robot that moves using its outer skin as a way to navigate areas that would prohibit robots with legs, wheels, or tracks. The robot's shape is known as "toroidal," an elongated cylinder, which has actuator rings that run the length of the robot's body and around through the middle of the cylinder. The robot would be able to flatten itself

out to squeeze into tight spaces during search and rescue missions. When the rings are contracted at the rear of the robot, they expand near the front, generating movement. The design was inspired by the pseudopods that amoebas use to move, explains VT mechanical engineering professor and lead researcher Dennis Hong. After beginning with flexible toroidal membranes lined with propulsion rings made of electroactive polymer or pressurized hoses, Hong has decided to use a more rugged construction, which he describes as "a 3D tank tread." Although toroids have been tested as propulsion systems before, Hong's research is pioneering in its use of electroactive polymers to generate propagating waves of contractions. "These experimental designs open new and exciting perspectives in soft-bodied robotics." One challenge facing this design is how the power supply, computerized controllers, and sensors would be integrated, but Hong suggests placing these components in the center of the toroid. He also envisions using a wireless controller to activate the contractions of the rings using inductive loops for power.

A Smarter Car
Technology Review (07/06/07) Boyd, Clark

IBM's collaborative driving research effort is an initiative spearheaded by its Haifa, Israel, lab to cut traffic congestion and prevent accidents by tapping sensors and communications technologies that should be embedded in roads and vehicles within a relatively short timeframe. IBM researcher Oleg Goldschmidt says the company can integrate computer modeling and driving simulations to better ascertain how all the data produced by present-day high-tech cars and roadways can be collected and structured, and then processed and prioritized in a way that best helps the motorist. Jim Misener with Partners for Advanced Transit and Highways explains that the field of information arbitration covers this kind of research, but the prioritization of the road data is no simple feat, according to Motorola Intelligent Systems Research director Mike Gardner. "A smart vehicle has to collect all this raw sensor data, fuse it, and then analyze it with something like pattern recognition," he notes. "Then it has to decide, 'Is that a person in front of the car, or is that just fog?'" Tim Brown of the University of Iowa's National Advanced Driving Simulator stresses the importance of integrating different warning systems. "Trying to figure out communication between warning systems such that certain warnings get suppressed under certain circumstances is critical to providing the driver with the information he needs to respond appropriately in a collision event," he says.

Smart Suit Doesn't Miss a Beat
University of South Australia (07/03/07)

Scientists at the University of South Australia (UniSA) are developing smart clothes that incorporate integrated electronic technology. When placed on electronic hangers, the smart garments can download stored data such as heart and respiration rates to a computer and be recharged for continued wearing. "For continuous monitoring, you can take off one garment and put on another smart garment so, instead of having just one heart monitor, you can have a wardrobe of them," says professor Bruce Thomas, researcher and director of UniSA's Wearable Computer Laboratory. A special cabinet for the clothes features a touch screen on the outside as well as a hanging rail with conductive metal bands, all linked to a computer at the base of the cabinet. Electronic hangers that are placed on the rail are detected by the computer as well as the smart clothes. For instance, the computer can identify that a particular hanger has a particular coat on it that has heart monitoring data that needs to be downloaded. The smart wardrobe can monitor people's vital statistics and energy levels as well as faulty equipment and cleaning schedules, and can also preload news, schedules, and music into smart garments.

Scientists Study How to Make Humanoid Robots More Graceful
Stanford News (07/05/07) Young, Chelsea Anne

Researchers at Stanford University have developed a computer prototype of a robot that can move without clearly computing its trajectories in advance, unlike conventional robots. The approach of computer science professor Oussama Khatib and his team at the Stanford Artificial Intelligence Laboratory is to have robots act more like humans. The team has developed an energy-minimization strategy that is based on the way humans, as infants, learn to interact with the world around them--by touching, pushing, and moving objects, and ultimately avoid movements and positions that lead to physical discomfort. Bioengineering and mechanical engineering professor Scott Delp filled a key role in helping Khatib study how humans move by attaching sensors to test subjects, and then devising a multivariable model based on the least amount of physical exertion for every position. StanBot is a simulation, but Khatib wants to implement the energy-minimization strategy in Honda's humanoid ASIMO robots in about a year. "The goal is to provide these robots with human-like manipulation skills," says Khatib. "All of this is going to give ASIMO new capabilities to have advanced behavior like a human and to interact with the world."

Using a Robot to Teach Human Social Skills
Wired News (07/09/07) Cole, Emmet

A humanoid robot designed to teach autistic children social skills is being tested in British schools. Autistic children frequently exhibit robot-like behavior, including a lack of emotion, obsessive and repetitive behavior, and difficulty communicating and socializing. The robot, known as KASPAR, for Kinesics and Synchronization in Personal Assistant Robotics, can smile, simulate surprise and sadness, gesticulate, and, hopefully, encourage social interaction with autistic children. KASPAR has two eyes with video cameras and a mouth that can open and smile. The robot was developed as part of the pan-European Interactive Robot Social Mediators as Companions (IROMEC) project. "Human interaction can be very subtle, with even the smallest eyebrow raise, for example, having different meanings in different contexts," says University of Hetfordshire senior research fellow Ben Robins. "It is thought that autistic children cut themselves off from interacting with other humans because, for them, this is too much information and it is too confusing for them to understand." KASPAR was designed to express emotion consistently and with minimal complexity. The researchers hope the human-like robot will act as a "social mediator" for autistic children, and improve their social interaction with other children and adults. "KASPAR provides autistic children with reliability and predictability," Robins says. "Since there are no surprises, they feel safe and secure."

Robot Unravels Mystery of Walking
BBC News (07/12/07)

A group of scientists from across Europe used knowledge gained by a 1930s human physiologist to build Runbot, the world's fastest walking bipedal robot. Runbot can move at speeds just over three leg lengths per second, slightly slower than the fastest walking human. The scientists based the robot's design on the theories of Nikolai Bernstein, who said that animal movement is not under the total control of the brain, but "local circuits" were primarily responsible for movement. Bernstein said the brain only managed tasks such as walking when the understood parameters changed, like switching from one type of terrain to another or dealing with uneven surfaces. Runbot uses local neural loops to monitor information from peripheral sensors on the joints and feet of the robot, as well as an accelerometer that monitors the robot's pitch. The local neural loops analyze the information from the sensors and the accelerometer to make adjustments to the gait of the robot in real time to ensure joints are not overstretched before the next step begins. If the robot encounters an obstacle, only then is the robot's higher learning function utilized. Runbot is different from other robots such as Asimo, because those robots are kinematic walkers that have every step and movement calculated for them, while Runbot is designed to walk more naturally and adapt to new challenges, like a human.

At Checkers, Chinook Is Unbeatable
Baltimore Sun (07/20/07) O'Brien, Dennis

University of Alberta computer scientist Jonathan Schaeffer spent six years working on a network of up to 200 computers to develop a program that will never lose at checkers. The best any opponent, human or computer, could hope to achieve is a draw. The program, called Chinook, was designed with help from some of the world's best checkers players and analyzes 64 million positions on the board every second. "We've taken things to beyond what humans can do," Schaeffer says. "What's amazing is there are so many possible situations in checkers, and they were able to explore all of the ones that mattered," says Johns Hopkins University computer science professor Jason Eisner. While checkers is commonly considered a simple game, there are a massive number of variations to try to predict when creating a program like Chinook. In checkers, each player has 12 pieces, and with 64 squares on the board, the possible number of positions reaches 500 quintillion. Schaeffer did not try to examine every possible outcome but narrowed the search by identifying any moves that would put a player in a losing position as the game reached its finish. "It's really a profound scientific discovery," says Ed Trice, who has worked on computer programs that play both checkers and chess. "In 2007, if we're just solving the game of checkers, think about trying to create programs that can help determine the right course of treatment for a patient, and how complicated things like that can get."

Playing Piano With a Robotic Hand
Technology Review (07/25/07) Singer, Emily

Scientists at Johns Hopkins University have demonstrated that it is possible to control fingers on a robotic hand by directly tapping into the brain's electronic signals using a neural interface. To create the neural interface, researchers recorded brain-cell activity from monkeys as they moved their fingers. Previous research showed that a particular part of the motor cortex controls finger movement. The recorded brain activity was used to create algorithms that decode the brain signals by identifying the specific activity patterns associated with specific movements. When the algorithm was connected to the robotic hand and given a new set of neural patterns, the robotic hand performed the correct movement 95 percent of the time. These initial experiments were performed "off-line," meaning the system was receiving pre-recorded neural activity, but the researchers are planning a demonstration with a live neural feed within the next six months. Monkeys implanted with an array of recording electrodes will be connected to a virtual version of the prosthetic arm and monitored to see how well they can use

brain activity to control the virtual hand. The preliminary results are encouraging, but the scientists know it will be a long time before the system has the dexterity of a real hand and that a practical human version of the neural interface is still a long way off. "We would hope that eventually, we'll be able to implant similar arrays permanently in the motor cortex of human subjects," says University of Rochester neurologist and project researcher Mark Schieber. Schieber says the long-term objective is to get the robotic hand to move however the user wants it to in real time, but getting the decoding algorithm to understand unscripted and general movements will be the challenge.

In Poker Match Against a Machine, Humans Are Better Bluffers
New York Times (07/26/07) P. C1; Markoff, John

In the "First Man-Machine Poker Championship," a poker competition between two professional poker players and a software program running on an ordinary laptop, the human players won, largely due to their superior ability to bluff. The contest pitted professional poker players Phil Laak and Ali Eslami against Polaris, a poker program written by a team of artificial intelligence researchers from the University of Alberta. In the past, computer researchers have focused on chess and checkers computer programs, but poker is believed to be a more difficult challenge for software designers. Poker requires computer scientists to develop different strategies and algorithms to compensate for the uncertainties introduced by not knowing the other player's cards and difficult-to-interpret, risky behaviors such as bluffing. University of Alberta computer science department chairman Jonathan Schaeffer, who initiated the poker playing research effort 16 years ago, says the advancements being made in poker software are more likely to have a real-world application than chess research. Research interest have generally shifted away from chess in favor of poker, partly because of the rapid progress being made in developing new algorithms that could have broad, practical applications in areas like negotiation and commerce, says Carnegie Mellon University computer scientist Tuomas Sandholm. Unlike chess programs, which require massive amounts of computing power to calculate every possible outcome while the game is being played, Polaris performs a lot of precomputing, running calculations for weeks before a match to build a series of bots that have different playing styles. In the first two rounds of the poker match, the program ran a single bot, but in the third round the programmers used a "coach" program that allowed them to move bots in and out, like athletes on a roster.

Sing to Computer to Download Song
ABC Science Online (Australia) (07/25/07) Cooper, Dani

RMIT University computer scientist Sandra Uitdenbogerd predicts that the next generation of search engines will enable users to find a song by simply singing it to a computer. "In the next three or four years it should be on the computer of everyone who is a music fanatic," Uitdenbogerd said at a recent Human Communication Science Network forum at Macquarie University. One way to retrieve audio by singing will have users visit a Web site and sing a tune or lyrics into a computer microphone, although the quality of the user's voice will affect the search. "The more in tune and accurate you are the less you will have to sing," Uitdenbogerd said, adding that no matter how bad someone's voice is, most people can get the "ups and downs" of a tune in the correct spots. The problem with current text-based music searches is that the same lyrics may exist in multiple songs, or as with classical music, not at all. The major problems a music search system needs to overcome are the diversity of music and the effect interference can have on the program's ability to detect notes. Uitdenbogerd said it is easier to solve retrieval problems by focusing on one genre of music, but that this could lead to a retrieval system that only searches a limited range of music. Uitdenbogerd's research team is also exploring the possibility of searching by instrument timbre and mood.

Sharing a Joke Could Help Man and Robot Interact
New Scientist (08/01/07) Reilly, Michael

University of Cincinnati artificial intelligence researcher Julia Taylor demonstrated a computer program that is able to understand when someone is joking at last week's American Association for Artificial Intelligence conference in Vancouver, Canada. Taylor teamed with UC AI researcher Lawrence Mazlack to create the bot, which makes use of a database of words, knows how words can be used in different ways to create new meanings, and can determine the likely meaning of new sentences. Robots will need to determine whether someone has said something that was meant to be funny if humans are to accept them as companions or helpers. Taylor and Mazlack developed the bot to recognize jokes that turn on a simple pun, and they are now working to personalize its sense of humor so it can take the experiences of people into consideration when assessing whether their words were meant to be funny. "If you've been in a car accident, you probably won't find a joke about a car accident funny," Taylor explains. Meanwhile, Rada Mihalcea is working with other experts at the University of North Texas in Denton on a bot that is able to determine humor through the frequency of certain words that are used in jokes.

Biology Proves a Natural for Robotic Design
Bend Weekly (07/27/07) LaFee, Scott

Designers of robotics technology are being inspired by biology, basing machines and their functions on "fundamental physical principles," says Vassar College professor John Long. Under development at Carnegie Mellon University is the HeartLander, a minuscule medical robot designed to perform delicate heart operations--measurement readings, drug delivery, device installation, etc.--via remote control while moving like an inchworm on suction cups, obviating the need for invasive surgery. Another biologically inspired machine is Clemson University's OCTOR (sOft robotiC manipulaTORs), a robot with a flexible tubular appendage that mimics the grasping abilities of an elephant's trunk to manipulate objects; the appendage is driven by compressed air and outfitted with sensors and a camera. The Defense Advanced Research Projects Agency, which is funding OCTOR, is also interested in BigDog, a quadrupedal, semi-autonomous robot that has potential as a tool for carrying supplies for troops. Vassar researchers have developed Madeleine, a robot that swims using remote-controlled polyurethane flippers modeled after those of a marine reptile. The robot, which is also equipped with sonar, cameras, an accelerometer, and an altimeter, has been used in experiments to determine whether two-flipper or four-flipper locomotion is more efficient. Other robots patterned after organisms include arthropod-inspired six-legged machines that can run, leap over obstacles, negotiate stairs, and scale walls and trees, while University of Southern California researchers are working on a system of modular robots that can link up like hive insects into cooperative machines capable of standing, crawling, wiggling, climbing, rolling, and flying.

The Blade Runner Generation
Times (UK) (07/22/07) Hunt-Grubbe, Charlotte

A convergence of biomechanics, computer science, neuroscience, mathematics, nanotechnology, materials science, tissue engineering, and robotics is expected to yield technologies that will enhance our bodies far beyond more efficient and natural prosthetics for the disabled. For instance, North Carolina pain-relief surgeon Dr. Stuart Meloy discovered quite by accident that orgasms could be triggered by stimulating nerves via electrodes placed parallel to the spine. Other notable innovations include new prosthetic legs that offer more natural movement; "bionic" limbs that operate through the relocation of nerve endings; cochlear implants that directly interface with nerves in the brain to restore hearing; and deep brain stimulation (DBS) implants that blot out defective neural signals that inhibit and distort normal bodily functions by continually sending electrical current into specific regions of the brain. A next-generation DBS device is under development that promises to send current into the brain only when needed. Also making waves is the BrainGate, a brain-machine interface that allows users to control a computer by thought via a microchip implanted in the

motor cortex. Even more ambitious goals include direct brain-to-brain transmission of thoughts and impulses, Internet-linked implants, and the augmentation of our senses through technology within the body. There are many ethical concerns revolving around smart robotic prostheses, and Georgia Institute of Technology professor Henrik Christensen says the solution is to split accountability between the user and the technology producer. A similar issue surrounds the eligibility of athletes with prosthetics in sporting events, based on

Tiny 'GlowBots' Hint at Future of Robotics
Discovery News (08/02/07) Steadter, Tracy

European ECAgents project researchers are examining how robots interact with each other and with their owner. The robots, called GlowBots, are small, round robots about the size of a coffee mug. Each one has eight infrared sensors, 148 light-emitting diodes, a camera, microphones, a computer, and a Bluetooth connection. The GlowBots "express" themselves by displaying intricate patterns of flashing lights. Viktoria Institute Future Applications Lab research assistant Mattias Jacobsson says interacting with a GlowBot would be less like the interaction between a person and a dog or a cat and more like interacting with a pet spider or lizard. The purpose of the project is to see if the interactions the robots have with humans, and each other, could lead to unconventional roles for future devices, like machines that guide a person through an airport or heighten the experience on an amusement park ride.

Evolutionary Algorithms Now Surpass Human Designers
New Scientist (07/28/07) Vol. 195, No. 2614, P. 26; Marks, Paul

Evolutionary algorithms (EAs) imitate the processes of natural selection and random mutation by blending elements of designs, and then choosing and "rebreeding" the best combinations to produce designs over thousands of generations that utilize components in ways that would probably not have occurred to a human designer. Advocates say EAs could supplant traditional design techniques in numerous fields, while opponents claim that this method could generate designs incapable of proper assessment since no human comprehends which trade-offs were made and thus where failure is probable. EAs have been relegated to niche applications due to their reliance on super-fast computers, but this is changing thanks to the increasing availability of powerful computers, the emergence of distributed computing "grids," and the arrival of multicore chips. "To mainstream engineers there is a disbelief that a self-organizing process like an EA can produce designs that outperform those designed using conventional top-down, systematic, intelligent design," notes Cornell University computer scientist Hod Lipson.

"That tension mirrors the tension between evolutionary biology and ID. That's the challenge we need to rise to in winning people over." Lipson and fellow colleagues in the ACM's Special Interest Group on Genetic and Evolutionary Computation (SIGEVO) are concerned that their failure to promote the use of EAs by engineers could result in the loss of evolved systems, software, and machines. SIGEVO runs the yearly Human Competitiveness Awards, which rewards EA-produced designs that are "competitive with the work of creative and inventive humans."

Stanford University's EyePoint: Web Surfing With Eye Gaze
Computerworld (08/20/07) Robb, Drew

Stanford University doctoral researcher Manu Kumar has improved the accuracy of eye-tracking technology by using more computing power. Kumar has developed the EyePoint system, which allows people to use their hands and eyes to interact with computers. The technology could potentially serve as an alternative to the use of the mouse. "Using gazed-based interaction techniques makes the system appear to be more intelligent and intuitive to use," says Kumar, who adds that some users say the system even seems to read their minds as they engaged in Web surfing or other everyday pointing and selecting tasks. EyePoint works by having a user magnify the area they are viewing on a screen by pressing a hot key on the keyboard, look at the link within the enlarged area, then activate the link by releasing the hot key. Headsets or monitor frames with infrared capabilities are typically used for eye tracking, but following eye movements alone only results in an accuracy to about one degree of visual angle. "What is really exciting is that the processing power of today's computers is completely changing the kinds of things we can use for computer interfaces," says Ted Selker, associate professor at the MIT Media and Arts Technology Laboratory. Selker expects eye tracking to become a standard computer interface in five years.

Direct Brain-to-Game Interface Worries Scientists
Wired News (09/05/07) Cole, Emmet

Brain-computer interfaces (BCIs) are being tested as virtual controllers for video games, but scientists are concerned that the games may end up controlling the user. For example, sometimes the devices force users to slow down their brain waves, often leaving the user unable to focus. "Imagine that somebody uses a game with slow brain-wave activity and then drives a car while still in that state," says Niels Birbaumer, a leading independent research in medical applications of BCIs. "You could have an accident. I think it's a rare possibility, but it should be tested before people do this." Although the technology has been successfully tested with quadriplegics, scientists worry that its use for casual entertainment could cause gamers to

experience the effects of neurofeedback, a technique that heightens awareness and control of brain waves by providing real-time graphic representation of the user's brain wave activity similar to how physiological information can be used to control a patient's blood pressure, skin temperature, and heart rate in a process known as biofeedback. For example, Smart BrainGames has developed a racing game that requires users to be calm to reach optimum speed, but the game is intended only for medical purposes and the FDA has approved the device only for relaxation and "muscle re-education." "From a clinical perspective, we are super concerned about any use of this technology that's being touted as a toy or as entertainment," says Smart BrainGames co-founder Lindsay Greco. Michelle Hinn, chair of the International Game Developers Association's Game Accessibility Special Interest Group, says BCI games are great for people with disabilities, but they may not be appropriate for the general public.

Robots Surf the Web to Learn About the World
New Scientist (08/18/07) Vol. 195, No. 2617, P. 22; Reilly, Michael

Robots and computer programs are learning to associate words with objects by going online and Googling the words, using the retrieved images to make the connection. "If you give a robot visual capabilities, it could pretty much do anything," argues the University of Maryland in College Park's Alap Karapurkar. Carnegie Mellon University researcher Paul Rybski goes a step further. He says, "You could tell a robot, 'car,' and it could learn what a car looks like, that they're used for driving, then it could download a driver's manual, hop in the car and drive away." Rybski and colleague Alexei Efros put together the first Semantic Robot Vision Challenge at the annual American Association for Artificial Intelligence conference to test the theory. The competition involved instructing robots to search the Internet for images relevant to 20 object words, and then look for the objects in a 6-meter-square area. Robots were entered in the contest by five teams. The first step for the robots was converting the hundreds of images resulting from queries into descriptions that could be used to identify objects in the real world, and this was achieved through the use of software that analyzes the shading patterns in all of the resulting images to outline telltale characteristics and organize them into a sort of fingerprint. Several robots were equipped with stereo cameras to search for objects, which took snapshots for comparison to the fingerprint index. The robot that scored the highest--seven out of 20 found objects--was built by a team of University of British Columbia researchers. The software the robots run on could be applied to the significant improvement of Web image searches.

Science Fiction Becoming Science Fact
University at Buffalo Reporter (09/06/07) Vol. 39, No. 2, Fryling, Kevin

University of Buffalo's founding director of the Center for Unified Biometrics and Sensors (CUBS) Venu Govindaraju says it is entirely possible to live in a future where cameras automatically recognize passengers in an airport, touchless sensors scan fingerprints and detect chemicals, smart cards verify customer signatures at the point of sale, and search engines find ancient texts just a easily as a new Web page. "A lot of it feels like it's out of science fiction," Govindaraju says, "but 10 years ago, didn't you think it would be science fiction if you could watch a TV show on a cell phone? Today, you can just do it." Govindaraju's interest in biometrics started as an undergrad working on facial recognition, an area once considered primarily relevant to artificial intelligence that has since become a high-demand field due to increased interest in personal and national security. Now, Govindaraju and CUBS researchers explore different areas of biometrics, including facial recognition, voice recognition, fingerprint recognition, iris recognition, gait recognition, odor detection, hand geometry, and different combinations of these methods. Govindaraju says traditional safeguards such as keycards, passwords, and badges can be lost, stolen, or forgotten. "You can lose your keys or forget your PINs," says Govindaraju, "but you can't forget yourself." One of Govindaraju's projects is working to train computers to detect lies by recognizing micro-expressions in the face. Govindaraju is also working on developing algorithms that can comprehend handwritten Arabic, English, and Sanskrit, a project that has received funding from both private and federal sources, including the National Science Foundation.

'Smart Homes' Could Track Your Electrical Noise
New Scientist (09/10/07) Kleiner, Kurt

Instead of a house embedded with sensors, smart homes of the future may track a homeowner's movements by monitoring the electrical noise made by different devices throughout the house as they are turned on and off. "The problem I see with a lot of ubiquitous computing research is that it requires the creation of new infrastructure and technology," says Georgia Institute of Technology computer scientist Gregory D. Abowd. "A lot of what we have been focusing on is how you can achieve some of these things without requiring Joe Blow to buy new stuff." Abowd and colleagues have developed a device connected to a laptop that plugs into a standard wall socket and monitors noise in the electrical supply caused by turning devices on or off. Software analyses the frequencies of noise created in the power line and is trained to recognize noise from specific appliances. The system was tested on 19 different electrical devices in six different homes with 85 percent to 90

percent accuracy. The system could be used to automatically adjust temperature controls and sound systems as people move about the house, or monitor the activity levels of older people living alone. The only downside to the system is that it takes about four hours to calibrate a typical house, but installing networks of cameras and sensors takes a long time as well, Abowd says. The researchers also need to prove that the device can distinguish between multiple devices running at once. Abowd will present his research at next week week's International Conference on Ubiquitous Computing in Innsbrook, Austria.

'Pulp-Based Computing' Makes Normal Paper Smart
New Scientist (09/19/07) Inman, Mason

MIT researchers are developing technology that could be used to make paper embedded with wires, sensors, and computer chips, creating "pulp-based" computing. MIT researchers, working with colleagues at Concordia University in Montreal, Canada, are blending traditional paper-making techniques with electronic components. MIT researcher Marcelo Coelho says paper-making is an ancient process, but the ability to make paper responsive and interactive has only recently become available. The team first produces a layer of paper pulp and adds wires or conductive ink before adding another layer of pulp and pressing and drying, embedding the electronics in the paper. The electronics in the paper can create paper with speakers or touch sensors. Making paper with two layers of conductive ink allows the paper to sense when it is being bent, which could be used to add sounds to books, creating a more interactive form of story telling. This technique could also be used to make cardboard boxes that can sense how much weight is inside them by measuring the stress on their walls. "Paper-based computation is an expression of one future area for electronics--flexible and stretchable circuits," says Jean-Baptiste Labrune of the University of Paris-Sud in Orsay, France. "This means that we could think about computational objects without the traditional limits of electronics."

Tripedal Robot Swings Itself Into Action
New Scientist (09/20/07) Simonite, Tom

Researchers in the United States have built an unusual robot that has three legs and flips its body upside-down with each step. STriDER (Self-excited Tripedal Dynamic Experimental Robot) has a graceful and acrobatic gait, and saves energy with each stride. The tripedal robot shifts its weight on two of its legs to fall away from the third leg and to take a step forward, then flips its body 180 degrees as the third leg swings up between the other legs just in time to catch the ground and resume a tripod stance. STriDER is able to

change directions by using a different leg for swinging. "This is how humans walk, we do not actively control our knees, we just let them swing," says Dennis Hong, a researcher at Virginia Tech who heads the project. Although the prototype is 1.8 meters tall, the latest version of STriDER is 0.9 meters, and Hong says the robot could be used to place sensors in areas that are difficult to reach. Dave Barnes, a specialist in locomotion for planetary rovers at Britain's Aberystwyth University, describes the robot as a biped with a walking stick, and says it has its advantages. "A tripod stance is very stable, you can just lock the joints," he says.

Robot Snakes Slither Forward
CNet (06/24/08) Lombardi, Candace

Norwegian research company the SINTEF Group is developing an aluminum robot designed to crawl through pipes, both horizontal and vertical, using a snake-like squirming motion. "When the robot enters a vertical pipe, it lifts its head in the pipe and meets the pipe wall," SINTEF says. "It can then either move sideways with its abdomen against the pipe and twist itself upwards, or it can topple backwards, attach itself to the pipe wall, in the same way as we would put our feet against a shaft wall to hold on, and then roll upwards." The unfinished prototype, when completed, will contain about 11 modules connected by joints, reaching a total of about 1.5 meters in length. The researchers are using a Lego Mindstorms robot with an attached camera that navigates a pre-programmed pipe system, and are working on a visual system that will allow the robot to detect pipe turns so it can navigate itself as needed through any system of pipes. SINTEF's robot is similar to the ACM-R5, an amphibious robot developed at the Hirose-Fukushima Robotics Lab at the Tokyo Institute of Technology in Japan. Carnegie Mellon University roboticists are also working on a snake-like robot.
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Artificial Tongue Mimics Human Speech
New Scientist (07/29/08) Robson, David

Anton, a mechanical tongue and jaw that has successfully mimicked the muscular activity involved in producing certain vowel sounds will be presented at this year's International Society of Artificial Life conference. Robin Hofe of the University of Sheffield in the United Kingdom says Anton has the potential to help improve speech recognition software. Existing systems are working with larger databases of recorded speech, but their performance has not significantly improved because the way people talk is not steady and uniform. Speech can be affected by where people are and

what they are doing. The researchers believe Anton will be a key to learning more about how the mouth produces sounds, since obtaining data from inside the human mouth might not be the best approach. The researchers also want to embed artificial muscles in Anton to make it more realistic, and eventually have it produce sound. The previous test involved MRI scans to compare the movements of Anton with those of real mouths.
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Robots Learn to Move Themselves
BBC News (08/06/08)

Software that will enable robots to learn how to use their limbs has been developed by researchers in Leipzig. Similar to the interconnected sensing and processing of a brain in a neural network, the software sends out signals to move in a certain way and predicts where the robot should end up. Obstacles such as a wall can throw off the prediction, but the software enables a robot to learn about its environment and to try different moves. "It's like a newborn baby--it doesn't know anything but tries motions that are natural for its body," says Ralf Der at the Max Planck Institute for Mathematics in the Sciences. Der has tested the software on a simulated dog, which learned how to jump over a fence, and a humanoid, which learned how to stand upright and do back flips. He says his software offers more flexibility than planning movements with traditional programming, and adds that it can be used with any robot. Der's team wants to add long-term memory to enable a robot to know what to do when it encounters similar situations. Video demonstrations are scheduled for this week's Artificial Life XI conference in Winchester, England.
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A 'Frankenrobot' With a Biological Brain
Agence France Presse (08/13/08)

University of Reading scientists have developed Gordon, a robot controlled exclusively by living brain tissue using cultured rat neurons. The researchers say Gordon, is helping explore the boundary between natural and artificial intelligence. "The purpose is to figure out how memories are actually stored in a biological brain," says University of Reading professor Kevin Warwick, one of the principal architects of Gordon. Gordon has a brain composed of 50,000 to 100,000 active neurons. Their specialized nerve cells were laid out on a nutrient-rich medium across an eight-by-eight centimeter array of 60 electrodes. The multi-electrode array serves as the interface between living tissue and the robot, with the brain sending electrical impulses to drive the wheels of the robot, and receiving impulses from sensors that monitor the

environment. The living tissue must be kept in a special temperature-controlled unit that communicates with the robot through a Bluetooth radio link. The robot is given no additional control from a human or a computer, and within about 24 hours the neurons and the robot start sending "feelers" to each other and make connections, Warwick says. Warwick says the researchers are now looking at how to teach the robot to behave in certain ways. In some ways, Gordon learns by itself. For example, when it hits a wall, sensors send a electrical signal to the brain, and when the robot encounters similar situations it learns by habit.
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Magic Touch
The Engineer (08/17/08) Vol. 293, No. 7753, P. 16; Excell, Jon

How people relate to machines could be revolutionized with the emergence of haptic interfaces that give a tactile feel to digital objects, with applications ranging from innovative touch screens to medical training to driving simulators to product design to advanced robot exoskeletons. The feel of real buttons is mimicked by Nokia's Haptikos touch screen handheld Web browser demonstrator, which is equipped with vibration-generating piezoelectric actuators. Immersion research chief Christophe Ramstein believes Apple's iPhone handheld could play a crucial role in the mainstream penetration of haptic technology. He says the repertoire of haptic effects will be greatly widened over the next decade, noting that "mechanical switches are one thing, but we can begin to think about more sophisticated effects like adding vibrations to music as if you're at a concert." UK Haptics' Virtual Veins system is a haptic simulator used to train health workers in venepuncture techniques through the use of 3D goggles, a PC, and a SensAble Technologies end-effector that facilitates interaction with virtual objects. Another adaptation of SensAble technology by UK Haptics involves haptic cow, horse, and cat simulators to train surgeons at the Royal Veterinary Hospital. Meanwhile, Immersion is working on wearable force-feedback technology that allows people to pick up and handle virtual objects through muscular interfaces.
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Stanford's 'Autonomous' Helicopters Teach Themselves to Fly
Stanford University (08/29/08) Stober, Dan

Stanford University computer scientists have developed an artificial intelligence (AI) system that enables robotic helicopters to teach themselves how to fly and perform difficult stunts by watching other helicopters perform

the same maneuvers. Professor Andrew Ng says the stunts are by far the most complex aerobatic maneuvers flown by any computer-controlled helicopter. The helicopters learned how to perform the stunts by watching a helicopter controlled by expert radio control pilot Garett Oku. After observing the human-controlled helicopter, the AI-controlled helicopter performed a variety of stunts on its own. The air show is an important demonstration in "apprenticeship learning," in which robots learn by observing an expert instead of having software engineers attempt to write the instructions from scratch. "I think the range of maneuvers they can do is by far the largest," says Georgia Institute of Technology professor Eric Feron. "But what's more impressive is the technology that underlies this work." To teach the helicopter to fly, the researchers had Oku and other pilots fly entire air show routines while recording the movements of the helicopter. As maneuvers were repeated several times, the trajectory of the helicopter varied slightly with each flight, but the learning algorithms were able to discern the ideal trajectory the pilot was seeking, enabling the autonomous helicopter to learn to fly the same routine better and more consistently than the human pilots. During autonomous flight, a ground-based computer processes the data, makes quick calculations, and sends new instructions back to the helicopter 20 times per second.
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Talk of Future: Speech Translators Near Reality
Nikkei Weekly (09/08/08) Vol. 46, No. 2353, P. 17

The technology for automated speech translation, which blends speech recognition software with a database of linguistic resources made accessible by an Internet-enabled cell phone, may soon be available. The Japanese government's Council for Science and Technology Policy projects that Japanese travelers who are unfamiliar with English or Mandarin will be able to visit countries such as the United States and China without hitting a language barrier within five years, while within 10 years they will be able to converse in even more languages, thanks to advances in automated speech translation. The National Institute of Information and Communications Technology (NICT) has teamed with a number of private companies to build a practical automated speech translator by 2015, while NEC is testing a proprietary speech-recognition technology designed to compare audio input with a database of word cluster patterns to keep up with conversations. "If we combined that kind of speech recognition with a translation system, we would have an automated speech translator, providing something akin to simultaneous interpretation at meetings and lectures," says NEC's Akitoshi Okumura. In August, NICT tested automated speech translator technologies that enable two-way Japanese-Chinese translation. The translation is

performed on an online server so that the handheld's word database can be updated anytime. Through the use of the Internet, sentences taken from actual conversations can be uploaded to the database, and this month NICT will launch a forum to convene academic and private-sector researchers to develop an automated speech translator capable of supporting the concurrent translation of multiple languages. This group will permit researchers from various organizations and companies to share sample sentences and the technologies they have created.
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New Self-Steering Vehicle Designed to Mimic Movements of Ants
AlphaGalileo (09/17/08)

The way that ants find the shortest distance to their anthill or sources of food is serving as the model for keeping a self-steering vehicle on the correct path along a road. Engineers from the University of La Laguna (ULL) in the Canary Islands have developed a new algorithm, called Ant Colony Optimization (ACO), to resolve "problems of combinatory optimization" to help a driverless vehicle sense road surfaces. Ants leave a trail of pheromones as they move, and other members of the colony smell and follow the chemical substances. "The ACO technique is based, similarly, on a colony of artificial ants, in other words computational agents that work cooperatively and communicate with each other by means of artificial pheromone trails," says ULL's Rafael Arnay. The team is developing Verdino, a prototype driverless vehicle that uses a camera to gather visual data to apply the algorithms and an internal control system to process the data in real time. Verdino is being tested as an internal transport system for a housing development, and the team believes such a self-guided system could be used at tourist attractions, sporting venues, shopping centers, and also as part of remote security systems.
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Robot Assistant Gives Surgeons a Cutting Look
New Scientist (09/24/08)No. 2674, P. 21

Researchers from the Hamlyn Center for Robotic Surgery at Imperial College London have integrated eye-tracking technology into a da Vinci surgical robot in an effort to provide surgeons with additional assistance when positioning instruments such as endoscopes or lasers. Using the technology, a surgeon would be able to control instruments with their gaze. The device shines an infrared LED on each eye, uses cameras to track the movement of the pupil, and determines where the surgeon is looking based on the "glint"

of reflected light on the cornea. The data is calculated to move instruments to different positions on the patient. Surgeons would activate the device with a foot pedal. The team plans to improve on the eye-tracking technology's current accuracy rate of within 3 millimeters, and its results could be made available at the IROS 2008 conference in Nice, France, at the end of September. "It could be useful in cardiovascular or gastro-intestinal surgery, which requires lots of complex maneuvers," says researcher Guang-Zhong Yang.
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10 Future Shocks for the Next 10 Years
IDG News Service (09/23/08)

The next 10 years promise to contain many computer technology advancements and developments. As the cost of power and space continues to rise, cloud computing will play an increasingly large part in enterprise computing, as companies look to store their data in inexpensive technologies. Computing will become increasingly ubiquitous as consumers start wearing eyeglasses that superimpose a machine-enhanced view of the world and as technology is built into clothing and objects. Keyboards and traditional interfaces will become virtual, with keyboards being projected on surfaces or in the air. Computers will turn on instantly and run without delays or errors. Interfaces will be intuitive and sleek, and adapt to users based on what they are doing so they can easily access relevant features. Automation will continue to spread throughout industry, essentially eliminating the need for human-run manufacturing. Image recognition will improve to the point where a picture can be submitted to a search engine and the engine will be able to return relevant results based on the image. Smart phones will evolve into the preferred instrument for constant connectivity, with voice interaction, facial recognition, location awareness, constant video and sound input, and multitouch screens. Devices will always be connected, providing a constant stream of data on friends' activities, sports scores, and other topics without interrupting the user's current activities. Surveillance technology will improve to the point where it will be possible to track every human being, possibly through LoJack-style implants for personal safety, or through trackers in drivers' licenses and automobiles. Finally, technology will help us remember and strengthen social connections, recording every interaction to help people remember who they met and what they did.
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How Technology May Soon 'Read' Your Mind
CBS News (01/04/09) Stahl, Lesley

Carnegie Mellon University neuroscientist Marcel Just and colleague Tom Mitchell have combined functional MRI's (fMRI's) ability to observe a brain in action with computer science's ability to process massive amounts of data to see if it is possible to identify what occurs in the brain when people think specific thoughts. The researchers asked subjects to think about 10 objects, five tools, and five dwellings. The subjects' brain activity was recorded and analyzed for each object. The researchers were able to identify what object they were thinking about from their brain activation patterns. Similarly, researchers at the Bernstein Center in Berlin are working to use brain scans to identify people's intentions. Bernstein Center research subjects were asked to make a simple decision, whether to add or subtract two numbers, which they would be shown later. Researcher John Dylan-Haynes says he could read directly from the activity in a small part of the brain that controls intentions what the subjects intended to do. Haynes also is working on a system that would be able to tell where people have been. One experiment involves having subjects navigate through a virtual world, and then showing them images of places they have seen and places they have not seen. FMRI scanning already is being used to try to understand what consumers want to buy and how to best sell those products as part of a new field called neuromarketing.

http://www.cbsnews.com/stories/2008/12/31/60minutes/main4694713.shtml

Sign-Language Translator
Technology Review (01/12/09) Chu, Jennifer

Boston University researchers are developing an electronic sign language dictionary that will enable users to search for the definition of sign language gestures by demonstrating the gesture in front of a built-in camera. The technology could be used by parents of deaf children to better understand what their children are saying or by deaf people who want to use the Internet in their primary language. Boston University computer science professor Stan Sclaroff and linguistics professor Carol Neidle, who are developing the technology, say they hope to create a system that will allow anyone with a camera and an Internet connection to learn sign language and interact online using sign language. "This takes a lot of processing power, and trying to deal with sign language in different video qualities is very hard," says Georgia Institute of Technology Contextual Computing Group head Thad Starner, who is working on a sign language recognition system that uses sensors attached to gloves. To develop the system, Sclaroff and

Neidle asked multiple signers to sign through 3,000 gestures in a studio equipped with four high-speed cameras, which were used to record front and side views and facial expressions. Neidle says smiles, frowns, and raised eyebrows are an understudied part of American Sign Language that could provide strong clues to a gesture's meaning. The signing sessions are analyzed to mark the start and finish of each sign and to identify key subgestures. Sclaroff uses that information to develop algorithms that can distinguish a signer's hand from the background and recognize hand position, shape, and movement patterns.

http://www.technologyreview.com/communications/21944/?a=f

Using Neural Networks to Classify Music
Technology Review (06/03/10) Mims, Christopher

A neural network built for image recognition is now able to classify music. University of Hong Kong students trained a conventional "kernel machine" neural network to recognize characteristics such as tempo and harmony from a database of songs from 10 genres, but discovered that the optimal number of layers of nodes needed to identify the musical genre was three. The adapted convolutional network was able to correctly and quickly identify a song with greater than 87 percent accuracy. Although the convoluted neural network was not able to identify songs outside of its training library, the team believes its ability to recognize 240 songs within two hours suggests that it is scalable. Cats, which have unique visual cortexes, served as the inspiration for the project. The Hong Kong project is the latest convoluted neural network based on a mammal to show a high level of flexibility. The results raise the question as to why such neural networks have not been used to address other problems involving perception in artificial intelligence.

http://www.technologyreview.com/blog/mimssbits/25268/

Woven Electronics
ETH Life (07/02/10)

ETH Zurich researchers have developed intelligent textiles that have electronic components such as sensors and conductive filaments woven into the fabric. The researchers first developed technology that attaches thin-film

electronics and miniature chips to plastic fibers. The fibers were then integrated into the material's architecture using customary textile machines. The researchers say that despite the woven-in electronic components, the fabric looks good and is foldable. It also feels like normal material, and because the microchips are encapsulated, the material can be washed several times in a washing machine using a mild detergent without damaging the e-fibers. The researchers have already produced a tablecloth with temperature and humidity sensors and an undershirt that measures body temperature.

http://www.ethlife.ethz.ch/archive_articles/100701_smarte_textilien_per/index_EN

Smart Gadgets May One Day Anticipate Our Needs
San Jose Mercury News (07/06/10) Johnson, Steve

Silicon Valley researchers predict that future consumer gadgets, embedded with sophisticated sensors and carefully designed computer software, will be able to anticipate and fulfill users' needs without having to be told. Intel researchers say that gadgets will eventually be able to read their owner's emotions. For example, a recent Intel study explored gadgets that detect mood swings "while people are driving, singing, chatting with friends, attending a boring meeting, and even while going to the dentist." Researchers at Japan's Hokkaido University recently studied devices that could serve as "artificial companions for elderly and lonely people" and car navigation equipment that could "entertain drivers by talking and possibly by joking." Oregon Health & Science University researchers have developed a smart pill that can detect the onset of dementia in older people by recording whether the patient takes their medicine. Meanwhile, the U.S. Defense Advanced Research Projects Agency wants to develop computerized assistants for military personnel that "can reason, learn from experience, be told what to do, explain what they are doing, reflect on their experience, and respond robustly to surprise."

http://www.mercurynews.com/top-stories/ci_15450492?nclick_check=1

Self-Sustaining Robot Has an Artificial Gut
PhysOrg.com (07/20/10)

British researchers have developed an autonomous robot with an artificial stomach that enables it to fuel itself by eating and excreting. Bristol Robotics Laboratory researchers designed the robot, called Ecobot III, so that it

consumes partially processed sewage, using the nutrients within the mixture for fuel and excreting the remains. The robot also drinks water to maintain power generation. The meal is processed by 24 microbial fuel cells (MFCs), which are held in a stack of two tiers in the robot's body. Undigested matter passes via a gravity feed to a central trough from which it is pumped back into the feeder tanks to be reprocessed in order to extract as much of the available energy as possible. The bacteria in the MFCs metabolize the organic mixture, producing hydrogen atoms in the process, which help produce an electric current. The robot has maintained itself unaided for up to seven days, but is so far extremely inefficient, using only one percent of the energy available within the food.

http://www.physorg.com/news198817988.html

Acrobatic Robots
National Science Foundation (07/26/10) O'Brien, Miles

Researchers at the Virginia Polytechnic Institute and State University's Robotics and Mechanisms Laboratory (RoMeLa) are developing several different types of robots. For example, the Robotic Air Powered Hand with Elastic Ligaments robot uses compressed air to move and could help improve prosthetics. The Cable-suspended Limbed Intelligent Matching Behavior Robot was built for the National Aeronautics and Space Administration and can scale steep cliffs and is designed to handle Mars' rugged terrain. The Intelligent Mobility Platform with Active Spoke System robot features a circle of spokes that individually move in and out, enabling it to walk or roll, which gives it extreme mobility. The Hyper-redundant Discrete Robotic Articulated Serpentine robot snakes up dangerous scaffolding so human do not have to. RoMeLa also is developing a robot hose that fights fires. "It's a robot snake so it slithers and props up like a cobra and it can fight fires," says RoMeLa director Dennis Hong. The researchers also are building soccer-playing humanoid robots. "It has two cameras on the head, looks around, searches for the ball, figures out where it is, and based on that, it kicks the ball to the goal," Hong says.

http://www.nsf.gov/news/special_reports/science_nation/acrobaticrobots.jsp

Robot With Frog Egg Smell Sensor
PhysOrg.com (08/26/10) Edwards, Lin

University of Tokyo researchers have developed a method for improving a robot's sense of smell by using olfactory sensors containing frog eggs. The

immature eggs were injected with DNA from fruit flies, silk moths, and diamond back moths, which stimulated the eggs to produce the olfactory sensors of these insects. The eggs acted as a platform for the parts of the insect DNA that have been shown to be responsible for detecting gases, odors, and pheromones, says Tokyo researcher Shoji Takeuchi. The modified eggs were placed between two electrodes to form a detector. The system can detect solutions containing only a few parts per billion of the target molecules and can distinguish between molecules with only small differences.

http://www.physorg.com/news202027789.html

The Brain Speaks
University of Utah (09/07/10) Lee J. Siegel

University of Utah researchers have developed a technique for translating brain signals into words using two grids of 16 microelectrodes implanted beneath the skull but on top of the brain. "We have been able to decode spoken words using only signals from the brain with a device that has promise for long-term use in paralyzed patients who cannot now speak," says Utah professor Bradley Greger. The researchers used experimental microelectrodes to record brain signals as a volunteer patient with severe epileptic seizures read each of 10 words that might be useful to a paralyzed person. When the researchers examined all 10 brain signals at once, they were able to determine which signal represented a certain word 28 percent to 48 percent of the time. Greger says that people who have been paralyzed by stroke, Lou Gehrig's disease, and trauma could benefit from a wireless device that converts thoughts into computer-spoken words. The microelectrodes are considered safe because they do not penetrate brain matter.

http://www.unews.utah.edu/p/?r=062110-3

How Football Playing Robots Have the Future of Artificial Intelligence at Their Feet
AlphaGalileo (09/13/10)

Research published in WIREs Cognitive Science details how robots designed to play football (which is called "soccer" in the U.S.) are propelling the development of robotic artificial intelligence that can be used for advanced applications. "Football is a useful task for scientists developing robotic

artificial intelligence because it requires the robot to perceive its environment, to use its sensors to build a model of that environment and then use that data to reason and take appropriate actions," says Claude Sammut, a scientist at the ARC Center of Excellence for Autonomous Systems. "On a football pitch that environment is rapidly changing and unpredictable, requiring a robot to swiftly perceive, reason, act, and interact accordingly." The sport also requires communication and collaboration between robotic players as well as learning capability as teams adapt their strategies to better challenge opponents. Competitions between robots are not restricted to football--there also are contests for urban search and rescue and residential robotic assistants. Search and rescue presents robotics developers with a new set of problems to overcome because such environments are highly disorganized, unlike a football pitch layout.

http://www.alphagalileo.org/ViewItem.aspx?ItemId=84941&CultureCode=en

Wheelchair Makes the Most of Brain Control
Technology Review (09/13/10) Duncan Graham-Rowe

Researchers at the Federal Institute of Technology in Lausanne used an artificial intelligence (AI) approach known as shared control to make it easier for paralyzed people to maneuver a robotic wheelchair with their thoughts. The wheelchair uses AI software that is capable of taking a simple command such as "go left" and assessing the immediate area to determine how to follow the instructions without hitting anything. The software also is capable of understanding when the driver wants to navigate around an object such as a table. Shared control requires the user to think a command only once, rather than continuously as with electroencephalography, and then the software handles the rest. "The wheelchair can take on the low-level details, so it's more natural," says project leader Jose del Millan. The wheelchair uses two Webcams for detecting and avoiding objects, and drivers can give an override command if they want to approach rather than navigate around an object. The prototype system is equipped with 16 electrodes for monitoring the user's brain activity.

http://www.technologyreview.com/biomedicine/26258/?a=f

Virginia Tech Researchers Develop Method to Stop Movie Villain Known as the Spoiler
Virginia Tech News (09/07/10) Steven D. Mackay

Virginia Tech researchers have developed a data-mining algorithm that uses linguistic cues to flag movie spoilers before they are read by the user. Movie Web sites such as Imdb.com flag spoilers as they catch them, "but the performance is very bad, and one of our work's target and evaluation criteria is to beat their method," says Virginia Tech Ph.D. student Sheng Guo. The program is designed to flag an entire article as a spoiler if the ending of a work is revealed. "The words have to be used in the right parts of speech and in specific relation to each other," says Virginia Tech professor Naren Ramakrishnan. The program does not delete content with spoilers, but flags them so users can decide whether to continue reading. The system also can warn writers that they have typed a spoiler. "As a poster is writing a review, the program can help analyze the relationships between the words in the review and tell him or her that the review has high probability of being ranked as a spoiler," Ramakrishnan says.

http://www.vtnews.vt.edu/articles/2010/09/090710-engineering-moviespoilers.html

DARPA Wants to Create Brainiac Bot Tots
Wired News (09/10/10) Katie Drummond

The U.S. Defense Advanced Research Projects Agency (DARPA) is funding scientist Shane Mueller's efforts to expand upon the Turing test as part of an attempt to determine the level of artificial intelligence in bot tots. DARPA is interested in developing robots with the capabilities of an average toddler. "There were many motivations for this target, but one central notion is that if one could design a system with the capabilities of a two-year-old, it might be possible to essentially grow a three-year-old, given realistic experiences in a simulated environment," Mueller says. DARPA's goal is for tot bots to become super smart by learning like a human. Mueller uses a testing schema that has categories for visual recognition, search abilities, manual control, knowledge learning, language and concept learning, and simple motor control. The artificial intelligence agents would initially operate much like a toddler, but they would gradually learn from their surroundings and an instructor, and eventually gain advanced cognitive capabilities.

http://www.wired.com/dangerroom/2010/09/darpa-robot-smarts/

Intel Will Teach Gadgets to Learn About You
CNet (09/15/10) Erica Ogg

Intel researchers are developing context-aware computing technology that

will enable gadgets to learn about their users and adapt to their preferences. The context is gathered through a combination of hard sensors, such as movement-detecting cameras, and soft sensors, such as calendar information or other data that users have entered into their devices. For example, Intel's Personal Vacation Assistant uses personal information to help travelers make decisions about what to do while on vacation. "Sensing is at the core of these context-aware devices," says Intel researcher Lama Nachman. In addition, Intel is developing a TV remote control that can sense who the user is by the way they hold the remote. Intel's Justin Rattner says the company also is developing a platform that users control for context-aware devices. "We need a cognitive framework for managing context," Rattner says. "So users can share what context is released, to whom, and when it expires."

http://news.cnet.com/8301-31021_3-20016541-260.html?tag=nl.e703

Fuzzy Thinking Could Spot Heart Disease Risk
ScienceDaily (09/16/10)

Anna University's Khanna Nehemiah and colleagues have used fuzzy logic, a neural network computer program, and genetic algorithms to create a medical diagnostic system for predicting the risk of cardiovascular disease in patients. They employed fuzzy logic to teach a neural network to examine patient data and identify correlations that would indicate a person's risk factor. The medical diagnostic system has produced a statistical model that improves on previous efforts and is accurate 90 percent of the time in determining patient risk, according to the researchers. "A clinical-decision support system should consider issues like representation of medical knowledge, decision making in the presence of uncertainty and imprecision, choice and adaptation of a suitable model," according to the researchers. They say the new model addresses all of these points. The fuzzy neural network could be further enhanced by modifying its architecture, and by extracting generic rules to find a more precise risk factor.

http://www.sciencedaily.com/releases/2010/09/100915094342.htm

Self-Organizing Traffic Lights
ETH Zurich (09/15/10)

Researchers at TU Dresden's Institute of Transport & Economics and ETH Zurich are working to ease traffic congestion by enabling traffic lights to organize their own on-off schedules using traffic-responsive operating rules.

The researchers developed traffic lights equipped with sensors that feed information about the traffic conditions at a given moment into a computer chip, which calculates the flow of vehicles expected in the near future. The system determines how long the lights should stay green in order to clear the road. The researchers designed the system so that what happens at one set of traffic lights would effect how the others respond. The traffic lights work together in monitoring traffic to prevent big jams from forming. Computer simulations show that lights operating this way would achieve a reduction in overall traffic times by 10 percent to 30 percent.

http://www.alphagalileo.org/ViewItem.aspx?ItemId=85211&CultureCode=en

Tiny MAVs May Someday Explore and Detect Environmental Hazards
Air Force Print News (09/14/10) Maria Callier

The next phase of high-performance micro air vehicles (MAVs) for the Air Force could involve insect-sized robots for monitoring and exploring hazardous environments. "We are developing a suite of capabilities which we hope will lead to MAVs that exceed the capabilities of existing small aircraft," says Harvard University researcher Robert Wood. His team is studying how wing design can impact performance for an insect-size, flapping-wing vehicle. The research also will shape the devices' assembly, power supply, and control systems. The team is constructing wings and moving them at high frequencies to recreate trajectories that are similar to an insect's. The researchers are able to measure multiple-force components, and monitor fluid flow around the wings flapping in excess of 100 times per second. The team also is conducting high-speed stereoscopic motion tracking, force measurements, and flow visualization to better understand these systems.

http://www.wpafb.af.mil/news/story_print.asp?id=123221248

BBS Team Evaluating Facial Recognition Techniques
University of Texas at Dallas (TX) (09/15/10) Emily Martinez

University of Texas at Dallas (UTD) researchers are working with the U.S. Department of Defense to find the most accurate and cost-effective way to recognize individuals who might post a security risk. UTD professor Alice O'Toole and her team are examining facial-recognition software to determine where the algorithms succeed and where they fail. The researchers are comparing the algorithms to human test subjects in how well they can correctly identify matching pairs of human faces. So far, the best algorithms

have performed better than humans at identifying faces, according to O'Toole. "Because most security applications rely primarily on human comparisons up until now, the results are encouraging about the prospect of using face recognition software in important environments," she says. However, combining the software with human evaluation methods produces the best results. By using the software to spot potential high-risk individuals and then combining that information with the judgment of a person, nearly 100 percent of matching faces were identified, O'Toole says.

http://www.utdallas.edu/news/2010/9/15-5471_BBS-Team-Evaluating-Facial-Recognition-Techniques_article.html

Emotional Robot Pets
EurekAlert (09/17/10)

Scientists in Taiwan are studying a new design paradigm that may eventually lead to the development of a robot vision module capable of recognizing its human owner's facial expressions and inducing appropriate responses in robot pets. The researchers are focusing on neural networks to help halt the cycle of repetitive behavior in robot toys and grant the pets simulated emotional responses to interactions. Their assessment of the design approach should enable them to build an emotion-based pet robot much faster than afforded by current design and manufacturing prototyping. Using a neural network, the researchers plan to adopt an approach to behavior-based architecture that could allow robot pet owners to reconfigure the robot to evolve new behavior--or learn--while concurrently guaranteeing that the device functions correctly in real time. "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," the scientists say.

http://www.eurekalert.org/pub_releases/2010-09/ip-erp091710.php