VIDYAVARDHINI'S COLLEGE OF ENGINEERING AND TECHNOLOGY

BYTE

THE NEWSLETTER OF COMPUTER ENGINEERING DEPARTMENT

STAFF INCHARGE : MR. VIKRANT A. AGASKAR

EDITORS : MS. PRIYANKA DHAYADE

MR. KUNAL SINGH PADAM

Brain-computer interface allows completely locked-in people to communicate

Completely locked-in participants report being "happy"

A computer interface that can decipher the thoughts of people who are unable to communicate could revolutionize the lives of those living with completely locked-in syndrome, according to a new article. Counter to expectations, the participants in the study reported being "happy," despite their extreme condition.

A computer interface that can decipher the thoughts of people who are unable to communicate could revolutionize the lives of those living with completely locked-in syndrome, according to a new paper publishing January 31st, 2017 in PLOS Biology.
Counter to expectations, the participants in the study reported being "happy," despite their extreme condition. The research was conducted by a multinational team, led by Professor NielsBirbaumer, at the Wyss Center for Bio and Neuroengineering in Geneva, Switzerland.

Patients suffering from complete paralysis, but with preserved awareness, cognition, and eye movements and blinking are classified as having locked-in syndrome. If eye movements are also lost, the condition is referred to as completely locked-in syndrome.
In the trial, patients with completely locked-in syndrome were able to respond "yes" or "no" to spoken questions, by thinking the answers. A non-invasive brain-computer interface detected their responses by measuring changes in blood oxygen levels in the brain

The results overturn previous theories that postulate that people with completely locked-in syndrome lack the goal-directed thinking necessary to use a brain-computer interface and are, therefore, incapable of communication.

Extensive investigations were carried out in four patients with ALS (amyotrophic lateral sclerosis, also known as Lou Gehrig's disease) -- a progressive motor neuron disease that leads to complete destruction of the part of the nervous system responsible for movement.

Professor Birbaumer said: "The striking results overturn my own theory that people with completely locked-in syndrome are not capable of communication. We found that all four patients we tested were able to answer the personal questions we asked them, using their thoughts alone. If we can replicate this study in more patients, I believe we could restore useful communication in completely locked-in states for people with motor neuron diseases."

The question "Are you happy?" resulted in a consistent "yes" response from the four people, repeated over weeks of questioning.

Skinput Technology

The Microsoft company have developed Skinput , a technology that appropriates the human body for acoustic transmission, allowing the skin to be used as an input surface. In particular, we resolve the location of finger taps on the arm and hand by analyzing mechanical vibrations that propagate through the body.

We collect these signals using a novel array of sensors worn as an armband. This approach provides an always available, naturally portable, and on-body finger input system. We assess the capabilities, accuracy and limitations of our technique through a two-part, twenty-participant user study. To further

byteforcomputers

byteforcomputers

illustrate the utility of our approach, we conclude with several proof-of-concept applications we developed.

The primary goal of SkInput is to provide an alwaysavailable mobile input system - that is, an input system that does not require a user to carry or pick up a device. A number of alternative approaches have been proposed that operate in this space.
Techniques based on computer vision are popular These, however, are computationally expensive and error prone in mobile scenarios (where, e.g., non-input optical flow is prevalent).
Speech input is a logical choice for always-available input, but is limited in its precision in unpredictable acoustic environments, and suffers from privacy and scalability issues in shared environments.
Other approaches have taken the form of wearable computing.

This typically involves a physical input device built in a form considered to be part of one's clothing.
For example, glove-based input systems allow users to retain most of their natural hand movements, but are cumbersome, uncomfortable, and disruptive to tactile sensation.

Post and Orth present a "smart fabric" system that embeds sensors and conductors into abric, but taking this approach to always-available input necessitates embedding technology in all clothing, which would be prohibitively complex and expensive.

The SixthSense project proposes a mobile, alwaysavailable input/output capability by combining projected Information with a color-marker-based vision tracking system. This approach is feasible, but suffers from serious occluslon and accuracy limitations.
For example, determining whether, e.g., a finger has tapped a button, or is merely hovering above it, is extraordinarily difficult

Skinput leverages the natural acoustic conduction properties of the human body to provide an input system, and is thus related to previous work in the use of biological signals for computer input.
Signals traditionally used for diagnostic medicine, such as heart rate and skin resistance, have been appropriated for assessing a user's emotional state.
These features are generally subconsciouslydriven and cannot be controlled with sufficient precision for direct input.

Simllarly, brain sensing technologies such as electroencephalography (EEG) & functional near-infrared spectroscopy (fNIR) have been used by HCI researchers to assess cognitive and emotional state; this work also primarily looked at involuntary signals.

Video fingerprinting offers search solution

The explosive growth of video on the internet calls for new ways of sorting and searching audiovisual content. A team of European researchers has developed a groundbreaking solution that is finding commercial applications.

Most video search technologies currently rely on semantic annotation in which videos have to be manually tagged with keywords so they can be found via a text-based search. As most YouTube users will attest, tagging one or two videos in this way is not particularly problematic. However, manually annotating thousands of clips, as content providers and media libraries regularly do, can be extremely time consuming and costly.

A faster alternative is to use software to automatically extract snippets of a video and create a unique identifier based on a variety of audiovisual features, such as scene, motion and music changes. These so-called digital media fingerprints can then be used to index and search full audio/video content. The technology works well for uncompressed, raw audio and video, but it has not been used effectively with the far more common, space-saving compressed files that stream from websites, are stored in media libraries or are broadcast by TV stations. Until now, that is.

"We wanted to develop a way of indexing and searching compressed video files quickly and easily regardless of their compression format or how or where they are stored," says Nick Achilleopoulos who oversaw development of the technology as manager of the EU-funded DIVAS project.

To achieve that goal, the DIVAS researchers developed two advanced software engines: one to create fingerprints from compressed audio and/or video and another to use these unique identifiers to carry out content-based searches of audiovisual material.

Unlike most digital fingerprinting systems, the DIVAS indexing software does not require video to be uncompressed, reducing the need for computer processing power and storage space, while greatly accelerating the indexing process. For example, whereas other systems would have to generate a fingerprint from 60 gigabytes of raw video, the DIVAS technology can create a fingerprint from the 4GB DVD-quality compressed version. Crucially, it works across most popular video formats, from the DVD and TV broadcast MPEG standard to Microsoft's WMV and also with standalone audio files in formats such as MP3 and AAC.

"The fingerprint extraction software defines audio and video features much as a human viewer perceives audiovisual elements... It builds the fingerprint based on visual features, such as scene changes, the way the camera cuts and moves, the brightness level, and the movement of people and objects," the project manager explains.

Audio features such as speech and music also form part of the fingerprint -- providing crucial additional information to differentiate between visually similar video content like lectures or music concerts.

The audiovisual fingerprints, each just a tiny fraction of the size of original content, are stored in the XML file format in combination with the MPEG 7 multimedia content description standard, creating an easily accessible and rapidly searchable video index.

"Say you saw a short clip of a TV series and wanted to see more of it but did not know the name. You could easily upload the clip to a DIVAS search engine and then use this to find not only the series, but also the season, episode and the exact minute of a scene the clip is from," Achilleopoulos explains.

Human intuition added to planning algorithms

"Incorporating strategies from skilled human planners improves automatic planners' performance"

Researchers are trying to improve automated planners by giving them the benefit of human intuition. By encoding the strategies of high-performing human planners in a machine-readable form, they were able to improve the performance of planning algorithms by 10 to 15 percent on a challenging set of problems.

Researchers from MIT's Computer Science and Artificial Intelligence Laboratory are trying to improve automated planners by giving them the benefit of human intuition. By encoding the strategies of high-performing human planners in a machine-readable form, they were able to improve the performance of competition-winning planning algorithms by between 10 and 15 percent on a challenging set of problems.

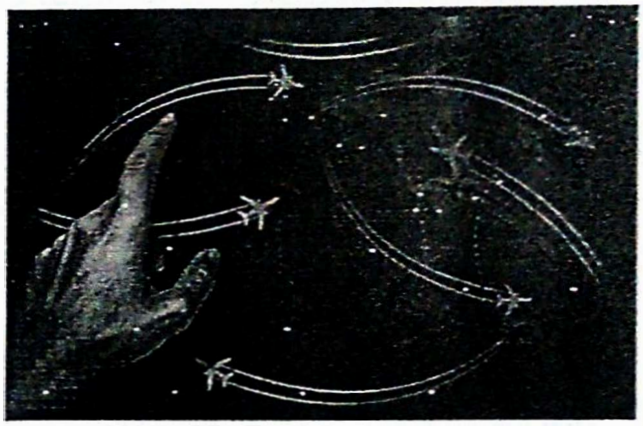
Every other year, the International Conference on Automated Planning and Scheduling hosts a competition in which computer systems designed by conference participants try to find the best solution to a planning problem, such as scheduling flights or coordinating tasks for teams of autonomous satellites.

On all but the most straightforward problems, however, even the best planning algorithms still aren't as effective as human beings with a particular aptitude for problem-solving -- such as MIT students.
Researchers from MIT's Computer Science and Artificial Intelligence Laboratory are trying to improve automated planners by giving them the benefit of human intuition. By encoding the strategies of high-performing human planners in a machine-readable form, they were able to improve the performance of competition-winning planning algorithms by 10 to 15 percent on a challenging set of problems.

The researchers are presenting their results this week at the Association for the Advancement of Artificial Intelligence's annual conference.

"In the lab, in other investigations, we've seen that for things like planning and scheduling and optimization, there's usually a small set of people who are truly outstanding at it," ," says Julie Shah, an assistant professor of aeronautics and astronautics at MIT. "Can we take the insights and the high-level strategies from the few people who are truly excellent at it and allow a machine to make use of that to be better at problem-solving than the vast majority of the population?"

The first author on the conference paper is Joseph Kim, a graduate student in aeronautics and astronautics. He's joined by Shah and Christopher Banks, an undergraduate at Norfolk State University who was a research intern in Shah's lab in the summer of 2016.



Algorithms entered in the automated-planning competition -- called the International Planning Competition, or IPC -- are given related problems with different degrees of difficulty. The easiest problems require satisfaction of a few rigid constraints: For instance, given a certain number of airports, a certain number of planes, and a certain number of people at each airport with particular destinations, is it possible to plan planes' flight routes such that all passengers reach their destinations but no plane ever flies empty?

A more complex class of problems -- numerical problems -- adds some flexible numerical parameters: Can you find a set of flight plans that meets the constraints of the original problem but also minimizes planes' flight time and fuel consumption?
Finally, the most complex problems -- temporal problems -- add temporal constraints to the numerical problems: Can you minimize flight time and fuel consumption while also ensuring that planes arrive and depart at specific times?

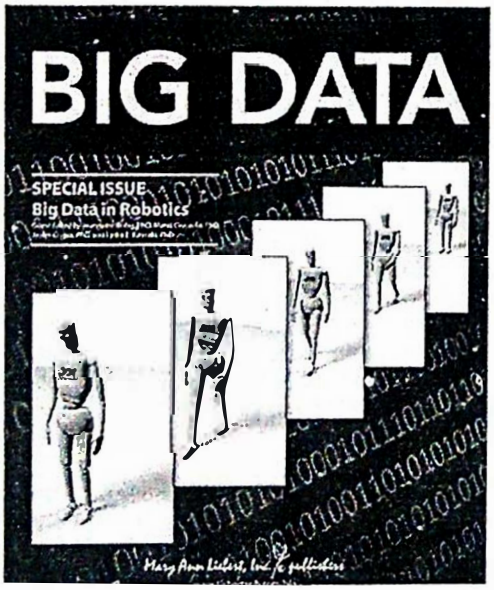
For each problem, an algorithm has a half-hour to generate a plan. The quality of the plans is measured according to some "cost function," such as an equation that combines total flight time and total fuel consumption.

Shah, Kim, and Banks recruited 36 MIT undergraduate and graduate students and posed each of them the planning problems from two different competitions, one that focused on plane routing and one that focused on satellite positioning. Like the automatic planners, the students had a half-hour to solve each problem.
"By choosing MIT students, we're basically choosing the world experts in problem solving," Shah says. "Likely, they're going to be better at it than most of the population."

DOOMED.is new online learning approach to robotics modeling

Robotics researchers have developed a novel adaptive control approach based on online learning that allows for the correction of dynamics errors in real time using the data stream from the robot. The strategy is described in an article published in Big Data.

In the article entitled "DOOMED: Direct Online Optimization of Modeling Errors in Dynamics," the authors and developers of the DOOMED algorithms, Nathan Ratliff, Franziska Meier, Daniel Kappler, and Stefan Schaal, Lula Robotics (Seattle, WA), MPI for Intelligent Systems (Tubingen, Germany), and University of Southern California (Los Angeles), present their approach for minimizing the error between desired and actual accelerations in complex real-world motion systems. Based on data streaming from the robot, the online learning algorithms correct the "inverse dynamics model," updating a correction model until correct acceleration is achieved.



The article is part of a special issue of Big Data on "Big Data in Robotics" led by Guest Editors Jeannette Bohg, PhD, MateiCiocarlie, PhD, JaviewCivera, PhD, and Lydia Kavraki, PhD.

"A major challenge in robotics is designing systems that behave in predictable ways based on some analytical model of the process," says Big Data Editor-in-Chief VasantDhar, Professor at the Stern School of Business and the Center for Data Science at New York University. "However, in reality, even if such analytical models exist, they are rarely accurate enough in situations that represent all combinations of heat, wear and tear, cable stretch, etc.; situations that a system encounters in reality. In such situations, it is useful to complement models with data collected as a result of real-world operation. Real-world robotic systems need to be robust enough to correct "errors" on the fly. Ratliff et al. combined model-based approaches with machine learning in a novel way to make systems error correcting robust in real time. We are seeing increasing interest in combining analytical model-based approaches with machine learning and big data to create more robust motion systems. This paper makes a very significant contribution in this respect."

Is your big data messy? We're making an app for that

Like a teenager's bedroom, big data is often messy. Malfunctioning computers, data entry errors and other hard-to-spot problems can skew datasets and mislead people—everyone from data scientists to data hobbyists—trying to draw conclusions from raw data.Vizier, a software tool under development by a University at Buffalo-led research team, aims to proactively catch those errors.

The project, backed by a $2.7 million National Science Foundation grant, launched in January. Like Excel and other spreadsheet software, Vizier will allow users to interactively work with datasets. For example, it will help people explore, clean, curate and visualize data in meaningful ways, as well as spot errors and offer solutions.

"We are creating a tool that'll let you work with the data you have, and also unobtrusively make helpful observations like 'Hmm... have you noticed that two out of a million records make a 10 percent difference in this average?'" says Oliver Kennedy, PhD, assistant professor of computer science and engineering at UB, and the grant's principal investigator.
Co-principal investigators include Juliana Freire, professor of computer science and engineering at New York University, and Boris Glavic, assistant professor in the Department of Computer Science at the Illinois Institute of Technology. The award is from NSF's Data Infrastructure Building Blocks (DIBBs) program.

For years, companies like Google, Microsoft and Apple have utilized big data to improve their products and services. That same power is now spreading to the masses as government agencies in the United States and elsewhere publish massive amounts of public data on the internet.

For example, New York City and the federal government have open data portals making it possible for anyone with an internet connection to download information and ask questions about their government. When properly used, these portals can shed light on issues relating to health code violations, discrimination, bias and other matters, Kennedy said.Vizier will be released as free, open-source software.
"We want to make it easier for data scientists—and eventually data hobbyists—to discover and communicate not only what the data says, but why the data says that," he said.

Articles submitted by: Priyanka Dhayade
Bharvi Gharat
Aradhya Patil

Do share your views, feedbacks and articles by mailing to byteforcomputers@gmail.com