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Hack-Proofing Our Devices
Research@SMU (12/24/16) Sim Shuzhen

Singapore Management University (SMU) professor Li Yingjiu aims to make radio-frequency identification (RFID) and smartphones hackproof by incorporating better safeguards. Li and his team are designing and evaluating new RFID protocols with augmented security features, including adding unpredictability to the protocol's output, making two tags indistinguishable to the hacker, and barring hackers from acquiring useful information even if they manage to interact with the tags. Li also says there are many cases in which sharing such information would be beneficial, but lacking appropriate security controls makes most companies hesitant. Li's team is designing better access control mechanisms that shield RFID information when it is shared online. Li particularly focuses on detecting potential exploits in smartphone operating systems. "We see the opportunities to work with industry in this area because it is important for smartphone manufacturers to make their products better in terms of security," he says. In addition, Li is working with SMU professor Robert Deng to devise new solutions for attribute-based encryption. Li cites a yawning gap between industry and academia as a key challenge to bringing new data security solutions to market. He says success lies in bridging the communities, "which have completely different incentives and evaluation criteria."

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Singapore Unveils Its First Petascale Supercomputer
Asian Scientist (12/22/16) Rebecca Tan

The unveiling of the National Supercomputing Center Singapore's (NSCC) Advanced Supercomputer for Petascale Innovation, Research, and Enterprise (ASPIRE 1) marks Singapore's entry into the ranks of countries with petascale computing capability. The one-petaFLOPS system that debuted on Dec. 20 is based on x86 architecture from Fujitsu Asia and features 1,288 nodes and 30,912 cores. ASPIRE 1 has 13 petabytes of storage with an input/output burst rate of 500 Gbps and a total memory of 229 terabytes. It provides supercomputing resources to both academic and industrial high-performance computing (HPC) users, including the Technology Center for Offshore and Marine Singapore (TCOMS). The TCOMS core drives the next-

generation Deepwater Ocean Basin facility, which employs advanced wave and current generation systems to simulate ocean environments. "NSCC's long-term vision is to continually make HPC accessible by all, thereby democratizing HPC and building a healthy ecosystem of supercomputing users," says NSCC's Jon Lau. "We aim to play a leading role in global efforts to build an integrated research platform that will support research at the speed of thought."

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Improvements to a Decision-Making Algorithm
Phys.org (12/27/16)

Researchers at the University of Electro-Communications (UEC) in Japan have made improvements to the way in which decision-making algorithms search and present solutions. Highly specialized computer algorithms are needed to find the best possible solutions to multi-objective problems (MOPs) in fields such as engineering, economics, and finance. The multi-objective evolutionary algorithm based on decomposition (MOEA/D) works by decomposing MOPs into individual sub-problems and selecting an optimal set of possible solutions known as the Pareto frontier. UEC's Hiroyuki Sato devised a new method that improves the diversity of solutions presented by MOEA/D searches. Sato says the chain reaction solution update avoids duplicated solutions within a search, enhancing the variable diversity in the solution population. The proposed method also determines the order of existing solutions and does not automatically delete solutions if another solution is deemed better. Sato says initial trials using the updated method showed improvements in its searching ability, but further investigations are required to assess the computational costs.

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How Much Are You Worth to Facebook? A Free Tool Now Provides the Answer
CORDIS News (12/23/16)

Researchers at Spain's University of Madrid have developed a tool that can identify a Facebook user's economic value on the advertising market in real time. Facebook users enter some basic identity data, including their age, gender, relationship status, interests, and country into the Facebook Data Visualization Tool (FDVT), which can be downloaded as a free extension for Google Chrome and soon for Firefox and Opera. The tool indicates people in the U.S. are worth twice as much to advertisers as Facebook users in Spain. The researchers also note FDVT found Facebook continually makes a profit, whether users click on ads or not. Based on their Web activity and identity data, Facebook users receive increasingly personalized ads so as to improve the advertiser's return on investment. The work is part of the Horizon 2020-funded TYPES project, which supports the development of tools that will help guarantee privacy and transparency. Such tools would enable people to gain greater control over the information they share.

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NIST Asks Public to Help Future-Proof Electronic Information
NIST News (12/20/16) Chad T. Boutin

The U.S. National Institute of Standards and Technology (NIST) has made an official public request for assistance from the world's cryptographers in developing strategies to stave off the decryption of digital information promised by the advent of quantum computers. NIST plans to dedicate the next several years to collecting, testing, and recommending new algorithms that would be less vulnerable to quantum hacking. In the collection stage, cryptographers can send proposed algorithms to the agency by Nov. 30, 2017. NIST's Dustin Moody says the primary issue should be about new algorithms for public key cryptography, noting, "we're looking to replace three NIST cryptographic standards and guidelines that would be the most vulnerable to quantum computers." The standards pertain to encryption, key establishment, and digital signatures. Following the November deadline, Moody says NIST will vet the submissions, and everyone whose proposal meets the acceptability requirements will be invited to present their algorithms at a workshop in early 2018. The assessment phase is expected to take about three to five years. "We will be doing our own internal review

of the algorithms, and we certainly want the public and crypto community to analyze the algorithms as well," Moody says.

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Apple's New Research Will Let AI Explore Virtual Worlds
Inverse (12/27/16) Mike Brown

Apple's first published academic research paper is intended to help artificial intelligence (AI) expand its knowledge by using virtual worlds to train computers to recognize a photo's contents more easily. Beginning with iOS 10, Apple scans a user's iPhone images to make them easier to locate without the use of tags; the new research enables the computer to show the AI an image, learn what it recognizes, and see how it compares to actual image contents. Because the pictures are simulated, the computer is already aware of their contents. Unlike previous approaches, Apple's strategy utilizes more realistic virtual pictures produced by Generative Adversarial Networks. With this strategy, neural networks compete against each other to "learn" how to maximize their images' realism. Apple says this gives the AI superior image processing capability. The paper represents a more open and collaborative approach with academia for Apple in terms of AI research, and the company hopes its new openness helps improve its internal technologies.

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Control Algorithms Could Keep Sensor-Laden Balloons Afloat in Hurricanes for a Week
UCSD News (CA) (12/23/16) Ioana Patringenaru

Researchers at the University of California, San Diego (UCSD) have engineered a swarm of sensor-equipped robotic balloons that can float within hurricanes and periodically transmit data. UCSD professor Thomas Bewley and colleagues developed a mechanism for large-scale coordination of the balloons by modeling predictive control, using the Weather Research and Forecasting Code (WRF). "The key idea…is to 'go with the flow,' commanding small vertical movements of the balloons and leveraging the strong vertical stratification of the horizontal winds within the hurricane to distribute the balloons in the desired fashion horizontally," Bewley says. Because WRF cannot predict intermediate-scale and small-scale fluctuations in hurricane turbulence, "we simply ride out the smaller-scale fluctuations of the flow," says UCSD researcher Gianluca Meneghello. "The smaller-scale flowfield fluctuations induce something of a random walk in the balloon motion. We model these fluctuations statistically, and respond with corrections only if a balloon deviates too far from its desired location in the formation." To apply the corrections, the researchers exert a finite shift to the vertical location of the displaced balloon for a short time. They say their goal is to improve hurricane forecasts and tracking in real time to better prepare people for their landfall.

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Electron-Photon Small-Talk Could Have Big Impact on Quantum Computing
Princeton University (12/22/16) Catherine Zandonella

Researchers at Princeton University have built a device in which a single electron can transmit its quantum information to a photon, which can function as a messenger to convey the information to other electrons, creating linkages that form the circuits of a quantum computer. "We are able to bring the energy of the electronic state into resonance with the light particle, so that the two can talk to each other," says Princeton professor Jason Petta. Each quantum bit (qubit) is comprised of an electron trapped below the surface of a silicon semiconductor chip, while nanometer-sized wires positioned atop the silicon structure deliver precise voltages to the qubit. Adjusting the voltages enables the team to isolate a single electron in a double quantum dot and modify its energy so it can send its quantum information to a nearby photon. The device's effectiveness resides in its unique circuit design, which brings the wires closer to the qubit and mitigates interference from other sources of electromagnetic radiation via filters. Consequently, the qubits are 100 to 1,000 times less noisy than those used in earlier experiments. Petta says the team intends to engineer the device "to make [an electron] spin qubit that can be electronically controlled."

Indiana University Researchers Launch Tool to Understand Spread of Fake News
IU Bloomington Newsroom (12/21/16) Kevin Fryling

Hoaxy, a new tool developed at Indiana University (IU), is helping researchers understand the spread of fake news on social media networks. Hoaxy builds upon previous work at IU's Observatory on Social Media, including programs that analyze the spread of hashtags and determine whether a Twitter account is run by a person or a computer. Users can enter a claim or news story into the Hoaxy website and see mentions of the claim in the media and attempts to fact-check it by independent organizations. The site's search results display headlines that appear on sites known to publish inaccurate or unverified claims. Hoaxy generates visualizations illustrating both temporal trends and diffusion networks. Temporal trends plot the number of Twitter shares over time, while diffusion networks map how claims spread from person to person. Twitter currently is the only social network tracked by Hoaxy. "If we want to stop the growing influence of fake news in our society, first we need to understand the mechanisms behind how it spreads," says IU professor Filippo Menczer. "Tools like Hoaxy are an important step in the process."

Astronauts to Get Help From Snake Robots
SINTEF (12/20/16)

Snake robots that can assist astronauts are being investigated by researchers at Norwegian independent research organization SINTEF as part of a project with the European Space Agency (ESA). "Right now, the most realistic projects are looking into how snake robots can assist [International Space Station (ISS)] astronauts in maintaining their equipment," says SINTEF research manager Aksel Transeth. He raises the possibility of robots performing inspections of experiments that are stacked in shelf sections, behind which corrosion can occur. To deal with the ISS' constant state of freefall, Transeth points to SINTEF's belief it "can design a robot that can hold on, roll itself up, and then extend its body in order to reach new contact points. Moreover, we believe that it can creep in among equipment components on the ISS and use equipment surfaces to gain traction in order to keep moving forward." Looking ahead, ESA says snakebots could help establish a lunar colony by inspecting lava tubes where settlers could live and work. ESA also wants to study comets, with Transeth noting the lack of gravity on a comet creates a case for snakebots designed to explore the surface while keeping themselves firmly anchored.

A Matter of Life or Death
UCI News (12/20/16) Pat Harriman

More than 2.5 million people from more than 160 countries have participated in an online survey called the Moral Machine since its launch in May. University of California, Irvine (UCI) professor Azim Shariff and colleagues created the online survey platform to help promote the discussion surrounding the ethics of algorithms used in autonomous vehicles. The Moral Machine gives people an opportunity to share their opinions about which algorithmic decisions are most ethical for a self-driving vehicle to make. Shariff notes although self-driving vehicles are expected to reduce the frequency of accidents, they will still occur. The survey presents 13 scenarios in which there will be at least one, if not multiple, fatalities, involving passengers and pedestrians characterized by sex, age, fitness level, and social status. The survey asks participants what they think a self-driving vehicle should do in each case. "At the end, participants have the option to help us better understand their judgments by choosing to answer additional questions about their personal trust of machines and willingness to buy a self-driving car," Shariff says. "The international reach of the Moral Machine allows us to vastly increase the breadth of this research and study a much wider array of societies that will be affected in a future dominated by self-driving cars."

Walking the Line: WPI Students Develop App as Sobriety Test
Worcester Telegram (MA) (12/19/16) Craig S. Semon

A smartphone application in development at Worcester Polytechnic Institute (WPI) tells users when they have had too much alcohol by monitoring changes in the way they walk. AlcoGait can predict a person's blood alcohol content with 90-percent accuracy. The app analyzes the user's gait for abnormalities and sends an alert when the person has surpassed the legal limit and should not drive. WPI professor Emmanuel Agu conceived of the idea to adapt the "walk the line" field sobriety test police use when evaluating suspected drunken drivers. To use AlcoGait, a sober user first walks normally for 30 seconds, letting the app record and analyze the motion data of the user's unimpaired gait. When going out for drinks, the user then turns on the app to run in the background and continuously gauges the person's movements. Agu says the app could be integrated with a car ignition kill switch or linked to a ride-sharing service that can automatically offer the impaired user a ride home. In addition to AlcoGait, Agu and his team have developed several smartphone-based healthcare apps, including weight-loss apps, an app to help people with alcohol dependence, and an app to support recovering heroin addicts.

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Use It or Lose It: The Search for Enlightenment in Dark Data
The Conversation (12/21/16) Shazia Sadiq

The growth of structured and unstructured data is proceeding exponentially, yet a recent IBM study estimated more than 80 percent of all data is "dark," or unmanaged and unstructured, writes Shazia Sadiq, a professor of Data and Knowledge Engineering at Australia's University of Queensland. She stresses the adage "use it or lose it" is particularly pertinent to the use of big data. "Defining the purpose is pivotal to ensure that big data investments are targeted towards meaningful problems, and data collection and storage is well justified," Sadiq says. She cites design thinking as a useful strategy to address problem formulation in big data, one that enables researchers to combine desirability and viability with technological feasibility, as a guide toward meaningful solutions. Sadiq says the principle of "garbage in, garbage out" remains applicable in the context of big data. A lack of scientifically credible knowledge for assessing the data's quality, as well as little knowledge on the underlying data, can lead to wrong conclusions and low-value data. "All this underscores the growing need for well-trained data scientists who have the ability to articulate a well-justified business, scientific, or social purpose and align it with the technological efforts for data collection, storage, curation, and analysis," Sadiq says.

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