



Center of Excellence

WIRELESS AND INFORMATION TECHNOLOGY

AT STONY BROOK UNIVERSITY

NEWSLETTER

DECEMBER 2016

Hack@CEWIT: Innovation is Here, The Third Revolution in Medicine, Aligning Business Incentives, Tracking Dark Data, Interdisciplinary Tech Talks

CEWIT is an unparalleled resource, advancing the science and technology underlying the next epoch of the information revolution.

DECEMBER COVERAGE: HACK@CEWIT: INNOVATION IS HERE, THE THIRD REVOLUTION IN MEDICINE, ALIGNING BUSINESS INCENTIVES, TRACKING DARK DATA, TECH TALKS

Hack@CEWIT: CEWIT's inaugural, region-wide, interdisciplinary student hackathon kicks off President's Day Weekend, February 17-19, 2017. Calling all Long Island and NYC undergraduate and graduate students to join the challenge, limited to 150 hackers. Pre-register, sponsor, or get involved at www.cewit.org/hack.

CEWIT Research: Charting a visual course, the University-wide effort to advance the third revolution in medicine — the convergence of the life sciences with physical sciences, mathematics, big data and engineering — is aimed at tackling human health issues so complex, they cannot be solved by any individual research discipline.

CEWIT Business Insights: Softheon, the CEWIT-based healthcare technology company, ranked 34th on the Healthcare Informatics 100 List of the healthcare IT vendors with the highest revenues, attributes its success to aligning business incentives with those of their customers.

Interdisciplinary Tech Talks: Watch Dr. Manos Antonakakis of Georgia Institute of Technology talk studying internet abuse and cyber attacks through the use of DNS and not-to-miss upcoming presentations at the New York Academy of Sciences' 11th Annual Machine Learning Symposium, guaranteed to sell out.

Technology Frontiers: ModelizeIT, the Stony Brook University tech startup and Clean Energy Business Incubator Program member, is tracking enterprise data's "unknown unknowns," or dark data.



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The Next Big Thing:
Hack@CEWIT

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HACK@CEWIT IoT & MICROSERVICES

The Center of Excellence in Wireless and Information Technology

INNOVATION IS HERE:

Hack@CEWIT is the Center of Excellence in Wireless and Information Technology (CEWIT)'s inaugural region-wide, interdisciplinary student hackathon focusing on industry-relevant internet of things (IoT) and microservices challenges in the Center's 100,000 s.f., next-generation research and education facility — at Stony Brook University.

Open to all Long Island & NYC graduate/undergraduate students, Hack@CEWIT will feature an interactive speaker series, hands-on, deep dive workshops, industry hacker guru program, multimedia experiences, and specialized opportunities for recruitment with top industry prizes for the most intuitive, most learning (0-100), most original, and most ambitious IoT hacks.

43 HOUR HACK · FEBRUARY 17-19, 2017

www.cewit.org/hack | Sponsor Prospectus & Student Pre-Registration, Limited Space | #HackATCEWIT



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Stony Brook University

CEWIT RESEARCH: THE THIRD REVOLUTION IN MEDICINE CHARTS A VISUAL COURSE

CEWIT'S REALITY DECK, ONE OF THE LATEST MILESTONES ADVANCING THE CONVERGENCE OF LIFE SCIENCES WITH PHYSICAL SCIENCES

Dr. Arie Kaufman, CEWIT Chief Scientist and Chair of the Department of Computer Science, stepped inside the Reality Deck at the Center for Excellence in Wireless and Information Technology at Stony Brook University. Composed of 416 super-high-resolution screens that cover its 11-foot-tall walls, this spacious 30 x 40 foot immersive theater is operated by an 80-graphics-processor cluster that crunches the background data into billions of pixels.

As the door closed behind him, the lights turned off and the screens lit up with the University's logo — but not for long. From a console in the middle of the room, Kaufman, chair of the Department of Computer Science at Stony Brook, loaded an image and the walls around him turned the color of burnt orange laced with undulating black swirls. The eerie glow looked like a humongous smoky campfire, but it was actually an inside view of a human colon. The image is a useful



tool for radiologists as they scan the intestine looking for potentially dangerous growths that may turn cancerous.

“See these black curves? These are the haustral folds of the colon; they’re completely fine,” Kaufman said, as his hands traced the dark eddies from one rectangular screen to another. He stopped to point out a little bulging spot in a place where it perhaps shouldn’t be. “This round thing looks like it’s protruding a bit. It appears odd. This may be a polyp.”

The Reality Deck is one of the latest milestones in Stony Brook’s efforts to advance the third revolution in medicine — the convergence of the life sciences with physical sciences, mathematics, big data and engineering — **aimed at tackling human health issues so complex, they can’t be solved by any individual research discipline.** These challenges require joint brainstorming of the best minds from multiple fields and the use of supercomputers and artificial intelligence software capable of chugging through terabytes of data with enormous speed.

It’s only logical that such a convergence is happening. After breakthroughs in molecular biology in the 1970s and human genome project discoveries in the 1990s, physicians gained previously unattainable insights into the human body, explained Fotis Sotiropoulos, Dean of the College of Engineering and Applied Sciences.

At the same time, supercomputers and artificial intelligence algorithms enabled scientists to model diseases and devise treatments in virtual (in silico) settings, as opposed to traditional in vitro or in vivo methods.

“We can model how cancers develop and assess what therapies may work best,” Sotiropoulos said. “And we can use imaging to reconstruct the heart of an individual and see the patient’s specific blood flow to optimize medical devices before you implant them.”

Medical imaging has been of special interest to Kaufman, a Distinguished Professor, for some time. He had worked in the field since the early 1980s and **developed a virtual alternative to the physical colonoscopy, which is recommended for early cancer detection in people over 50.** The standard procedure, which entails fasting, colon cleansing, sedation and insertion of a camera into the rectum, is so unpleasant that many people skip it despite doctors’ advice.

On the contrary, Kaufman said, “a virtual colonoscopy is a much more dignified procedure, which requires a less-intensive prep, no anesthesia and only a low-dose CT scan.”

Kaufman’s team is also **developing virtual pancreatography technology, which would enable doctors to zoom into the human pancreas searching for potentially malignant growths.** One of the deadliest diseases known to science, pancreatic cancer kills more than 40,000 Americans per year, according to the American Cancer Society.

What’s more, the National Cancer Institute’s Surveillance, Epidemiology and End Results Program estimates that about 53,000 people will be diagnosed with the disease in 2016, but only 7.7 percent will survive past five years.

“The tumors evolve from tiny cysts that grow in the pancreas and by the time they’re detected, it’s typically too late,” Kaufman explained.

His procedure would enable radiologists to detect the abnormalities they can’t identify with the naked eye. “When you take a CT scan, it’s either that the cysts are too small or not discernible,” he said. But his artificial intelligence algorithm can parse the suspicious formations to assess potential threats. “It’s like an electronic biopsy on the screen,” he added.

COMPUTING PARADIGM FOR WIRELESSLY POWERED INTERNET OF THINGS: DEVELOPING SMARTER DEVICES FOR HEALTHCARE, ENERGY EFFICIENCY

CEWIT affiliated faculty, Professor Milutin Stanacevic, Department of Electrical Engineering, is too, furthering the third revolution in medicine with his development of an electronic pill that one day will be able to communicate with doctors from inside a patient's body.

For people with life-threatening conditions, patients with psychiatric conditions or transplant recipients, it's imperative that medications be taken at specific times, as skipping even one dose can be dangerous. Yet, despite the preponderance of gadgets that can remind people to take their medications on time, many patients — especially older adults — often forget to do so.

Stanacevic is developing a pill that when ingested and dissolved inside the digestive tract, would send a signal using radio-frequency identification to notify doctors or caregivers that it had been taken. It's like texting from the patient's gut.

The technology behind the pill is akin to that of a supermarket scanner: A reader beams a signal from its antenna to a chip affixed to a product and the chip sends back a response. Stanacevic is working on other miniature electronic devices, such as a breathalyzer that can detect certain health issues based on the composition of the gases in a person's breath.

This smart IoT device development stems from Stanacevic and Professor Emre Salman's, also with the Department of Electrical and Computer Engineering and CEWIT affiliated faculty member, joint research, **CPS: Breakthrough: Charge-Recycling based Computing Paradigm for Wirelessly Powered Internet of Things**, recently the recipient of a prestigious three-year award from the National Science Foundation (NSF).

The goal of their research is to develop a novel computing paradigm for wirelessly powered Internet-of-Things (IoT) based devices and to **enhance the computational capability by more than an order of magnitude**. It's a significant improvement, considering energy cost is often a barrier that slows down the global scalability of IoT devices.

The proposed approach will enable powerful on-site processing capability for wirelessly powered IoT devices, allowing for local decision-making mechanisms.

This work will also provide new opportunities in utilizing ambient wireless energy for meaningful applications. The results will help develop **smarter IoT devices with applications for healthcare, energy, structural and environmental monitoring** with substantial benefits to science, industry, and society at large.

STONY BROOK UNIVERSITY MAGAZINE, CEAS • NOV 2016

CEWIT BUSINESS INSIGHTS: ALIGNING INCENTIVES

CEWIT MEMBER COMPANY, SOFTHEON, ALIGNS BUSINESS INCENTIVES WITH THOSE OF THEIR CUSTOMERS

Eugene Sayan is not afraid to fail. Perhaps that is why his Stony Brook University, CEWIT-based healthcare technology company, Softheon, has been so successful. In 2016, the company was ranked 34th on the Healthcare Informatics 100 List of the health care IT vendors with the highest revenues, among many other achievements.

"If you're not failing, you're not growing," Sayan explains. "Failure teaches you what not to do."

As a leader in cloud-based health insurance exchange integration and remediation, Softheon works as a supply chain manager on behalf of, or in partnership with, some 60 insurance companies nationwide to deliver products and services to nearly 2 million Affordable



Care Act (ACA) enrollees. “On a daily basis, we manage 20 percent of the supply and roughly 15 percent of consumer demand,” Sayan says. “And we are indirectly responsible for generating approximately \$400 million in revenue each month.”

Though Softheon dates back more than 16 years, Sayan says the company reinvented itself four years ago to focus on the ACA, also referred to as Obamacare, by hiring a young, talented staff of computer scientists, data engineers, MBAs and other professionals. Today the company, which played a key role in the implementation of RomneyCare, the Massachusetts health care reform laws passed in 2006, works with every state exchange as well as the federally facilitated exchange. “Our technology solutions and platforms help health care payers, providers and government agencies meet ACA milestones,” Sayan explains.

“Our incentives are aligned with our customers’ incentives,” he adds. “When they succeed, we succeed.”

Asked to describe Softheon in a single word, Sayan doesn’t hesitate for an instant. “Passionate.” The company is passionate about data, its “core competency and the cornerstone of [its] engagements.” It is passionate about innovation. And it has a “passion and a drive to make health care affordable and meaningful for everyone,” with an emphasis on reducing the system’s focus on “sick care” in favor of “well care.”

“At Softheon, we are extremely passionate about everything we do,” Sayan says. “And our results prove our success is not just a coincidence but the result of a series of well-designed, well-thought-out strategies, and the somewhat nontraditional way in which we have built our organization.”

Softheon, the CEWIT-based company, fulfills in passion for innovation in more ways than one. The team will co-host Hack@CEWIT this February, 2017 leveraging student brainpower to explore unique and cutting-edge interpretations of pre-existing technology and drive targeted innovations in IoT and microservices.

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INTERDISCIPLINARY TECH TALKS

WATCH: THE USE OF DNS TO STUDY INTERNET ABUSE & CYBER ATTACKS

Dr. Manos Antonakakis, Assistant Professor, School of Electrical and Computer Engineering, Georgia Institute of Technology at the Department of Computer Science, December 6, 2016: The Domain Name System (DNS) is a critical component of the Internet. The critical nature of DNS often makes it the target of direct cyber-attacks and other forms of abuse. Cyber-criminals rely heavily upon the reliability and scalability of the DNS protocol to serve as an agile platform for their illicit network operations. For example, modern malware and Internet fraud techniques rely upon the DNS to locate their remote command-and-control (C&C) servers through which new commands from the attacker are issued, serve as exfiltration points for the information stolen from the victim's computer and to manage subsequent updates to their malicious toolset.

In this talk I will discuss how we can reason about Internet abuse using DNS and explore methods to reliably and systematically detect Internet abuse facilitated by Domain Name Generation Algorithms (DGAs).



THE NEW YORK ACADEMY OF SCIENCES' 11TH ANNUAL MACHINE LEARNING SYMPOSIUM

On Friday, March 3, 2017, from 9:00am-6:30pm, our partners and the New York Academy of Sciences will host its 11th Annual Machine Learning Symposium.

The Symposium is the latest in a highly successful series bringing together leading researchers from academia and industry to present **new algorithms for statistical learning and novel theoretical approaches and discuss applications of ML to real-world data.** In addition, the symposium will address limitations of existing techniques and solutions to overcome such shortcomings.

With a prestigious lineup of keynotes speakers, including **Kamalika Chaudhuri, University of California San Diego, Tim Roughgarden, Stanford University, and Suchi Saria, Johns Hopkins University** for the 2017 program, the event continues to sell out every year. Register now to reserve your seat.

Interested in submitting an abstract for a **Spotlight Talk**? The **Deadline is January 13, 2017.** Abstract submissions will be considered for ten short Spotlight Talks as well as presentation in a poster session. For complete submission instructions, email ml2017@nyas.org with the words "Abstract Information" in the subject line.

TECH FRONTIERS: DARK DATA

STONY BROOK UNIVERSITY STARTUP MODELIZEIT IS TRACKING DARK DATA AND OTHER INFO-STORAGE INEFFICIENCIES IN ENTERPRISE IT



Enterprise data centers are today's factories, but they are unprecedentedly chaotic and complex. Heterogeneous with millions of components depending on each other in a variety of ways, enterprise IT is a rapidly changing environment.

ModelizeIT, the Stony Brook University tech startup and Clean Energy Business Incubator Program member with a hard-science history, is **tracking enterprise data's "unknown unknowns," or dark data**, as well as other costly and potentially dangerous information-storage inefficiencies.

Unlike structured data, **dark data – generally defined as operational data that is not being used** – are information assets that organizations collect, process and store in the course of their regular business activity, but generally fail to use for other purposes, of which can be a security risk, among other challenges to IT managers.

ModelizeIT, the 2012 startup launched by CEO Nikolai Joukov, is a cyber detective of sorts, fine-toothed-combing servers to discover dark data left unprotected or unexplored, or both, because nobody knew it was there.

"In a data center, it comes with so many different components and millions of interdependencies," Joukov told InnovateLI. **"Realistically speaking, there is no complete knowledge of what's going on there."**

"Complexity," Joukov noted, **"is the general problem we are solving."** ModelizeIT's software platform automatically models corporate IT environments and solves large-scale real-life problems ranging from power optimizations to cloudifications, better technical support, reliability and security optimizations, and business analytics.

While identifying unknown and unused IT resources and de-risking cloud migrations are primary functions,

ModelizeIT also has true green-tech ambitions – “practical green IT,” Joukov said, folding electricity savings and other energy-related efficiencies in with the data discovery and analysis.

“Optimizing hardware and floor space, security, disaster recovery – there are many factors,” he said. “We want it to be a practical solution, not just a scientific exercise.”

Servers consume 1-2% of all electricity in the US. Estimates show that 30% of corporate servers are comatose (running servers with no business use). ModelizeIT's topological IT modeling system can be used to **identify such servers automatically and can help to plan relocations of data centers to other regions with cheaper electricity, consolidate many data centers into fewer data centers, cloudify and virtualize servers.** Said projects are expensive and risky for the businesses, though proper automated planning can make these undertakings a lot more attractive.

The company's novel analytical software solution boasts a fairly impressive client list for an early-stage software firm and is attracting the attention of system integrators and other IT consultants, including Granite Construction Inc., a California-based titan anchoring the joint venture behind the \$3 billion Tappan Zee Bridge reconstruction project.

Joukov, the Stony Brook University graduate who was an award-winning IBM researcher before launching ModelizeIT and currently teaches a DevOps course at NYU, said companies that ignore the risks do so at great peril. “If you think about it, any major outage – whether it’s a security breach or some other IT-related situation – is caused by incorrect information about what’s really happening in the data center,” Joukov added.

“Our aspiration is that every single company will be using this technology in their ecosystem, because **IT complexity is something everybody fights with.**”

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INNOVATION IS HERE

MARGARET SCHEDEL: MAKING MUSIC WITH MATH AND SCIENCE

Stony Brook University professor, composer and performance artist Dr. Margaret Schedel is not only recognized for her prowess in the computational music scene, but for her ability to **foster cross-disciplinary collaborations that help further innovative ways of both exploring and translating complex ideas within the arts and sciences.**

Featured in Stony Brook University Magazine as a faculty spotlight, Dr. Schedel's campus-oriented STEAM (science, technology, engineering, arts, and mathematics) initiatives), in addition to the Artist-in-Residency Program in partnership with CEWIT, include cutting-edge data sonification research in collaboration with Brookhaven National Laboratory and the U.S.

Department of Energy Lab at Stony Brook University to investigate complex nanostructures, as well as with the University's Departments of Biomedical Informatics, Physical Therapy and Music and the Center for Advanced Technology in Diagnostic Tools and Sensor Systems to study provide mobility solutions for Parkinson's disease patients. Her interdisciplinary student group at the Consortium for Digital Arts, Culture, and Technology (cDACT) has also created a carbon cycle video game, The World of Carbon, with a grant from the Deep Carbon Observatory, affiliated with the Smithsonian Institution, aimed at raising children's awareness about the deep carbon cycle and how it relates to global warming.



At CEWIT, the three STEAM artists-in-residence, all grad students, include an artist interested in virtual reality, a musician interested in telematic music and custom sensors, and an applied math student who is using supercomputers to build better guitar pedals. The team will share their projects, pieces, and host a number of arts&tech workshops at the upcoming Hack@CEWIT, February 17-19, 2017. **Learn how to turn a plant into an interactive interface with a DIY sensor and Arduino, build a 3D prototype of a musical instrument, and a DIY Gametrak control system, as well as how to implement visual and sound elements into your IoT projects.**

UPCOMING EVENTS:

January 10, 2017 · LISTnet: Tech Together
Happy Hour Winter 2017

January 12, 2017 · NYIT & LICA Entrepreneur Education Seminar Series 2016-2017

January 18-18, 2017 · Center for Biotechnology: Intensive SBIR/STTR Workshop: NIH Focused

March 28, 2017 · Save the Date: CEWIT Symposium: Medical Technology Innovations

January, 2017 · Computer Science Distinguished Lecture Series

February 17-19, 2017 · Hack@CEWIT: IoT & Microservices

March, 2017 · Stony Brook Entrepreneurs Challenge 2017

June 8, 2017 · Stony Brook University 2017 Incubator Company Showcase

November 7 & 8, 2017 · CEWIT2017 Conference & Expo on Emerging Technologies for a Smarter World

OUR COMMUNITY:

The Advanced Energy Center

The Center for Advanced Technology in Diagnostic Tools and Sensor Systems (Sensor CAT)

The Center for Biotechnology

The Center for Corporate Education and Training at Stony Brook University

The Center for Dynamic Data Analytics (CDDA)

The Clean Energy Business Incubator Program (CEBIP)

The College of Business at Stony Brook University

The College of Engineering and Applied Sciences at Stony Brook University

Empire State Development: NYSTAR

IEEE Long Island Section

Long Island Forum for Technology (LIFT)

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