STEVENS INSTITUTE OF TECHNOLOGY 1870

IMPACT

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Social Media, Disinformation Can Cloud Disaster Response

Study examines online interactions around hurricanes, floods, fires, mass transit

When natural disasters strike, social networks can be powerful tools for public communication. But they can also hinder rescue and recovery efforts.

That's the conclusion of Stevens researcher Jose Ramirez-Marquez, who examined public safety messaging during four recent major hurricanes.

SAFETY MESSAGES OVERWHELMED

Working with Ph.D. candidate Yefang Liang, Ramirez-Marquez analyzed messages posted on the platform X (formerly known as Twitter) during hurricanes Harvey, Imelda, Laura and Florence, identifying clusters of tweets that attracted the most attention and engagement before, during and after those storms.

In many cases the topics that generated the most intense interest were completely unrelated to safety messaging or rescue work.

During Hurricane Harvey, for instance, about half the most active topics involved discussion of pets affected by flooding; less than 15% involved safety messages. During Hurricane Florence, more than half of the highest-engagement topics involved either animal-related chatter or politics.

More broadly, the study highlighted the drawbacks of social media as an information source. Bad actors often deliberately hijack or distort online conversations by spreading enticing but false information, as happened in the southern U.S. in the wake of Hurricane Helene's catastrophic flooding. To address that threat, he suggests, social networks should create mechanisms to verify sources and filter out false information during disasters.

The study was published in the International *Journal of Disaster Risk Reduction* [Vol. 113, 104849].

TRANSIT DISRUPTION, SOCIAL UNREST

Ramirez-Marquez has also conducted several other recent studies of social media during both real and simulated disasters, revealing how it spreads fear, confusion and unease during crisis situations.

In one investigation, published in *Reliability Engineering and System Safety*, he collaborated with doctoral student Ramin Talebi Khameneh and the University of Oklahoma to study weaponized disinformation and mass transit disruptions using AI models.

Those attacks can significantly disrupt transit, the team found, potentially causing widespread chaos and economic harm.

The group studied a mass transit system connecting New Jersey and New York used by more than 200,000 passengers daily, injecting scenarios into operations and modeling passengers' responses to false warnings and other misinformation. Huge, costly delays soon propagated in a ripple effect despite the absence of any threat. A station could be forced to close for up to 11% of active operational time by false warnings, the group found.

Ramirez-Marquez and Alex Gilgur Ph.D. '23 also studied the San Francisco Bay area's resilience to natural disasters. They found communities did not function as cohesively during higher-stakes events such as wildfires; heightened emotions on social media may have been partly to blame. The investigation was reported in *Socio-Economic Planning Sciences* [98 (2025); 102157].

INSIDE HIGHLIGHTS:

stevens.edu/research

‘Jekyll-and-Hyde’ Leaders Can Do Lasting Damage

There might be only one thing worse than an abusive boss — one who tries to make up for negative actions by turning on the charm. That’s the key finding of a new study showing employees’ morale and job performance decline sharply when leaders lurch unpredictably between good and bad behaviors.

“We already know that abusive leadership takes a serious toll on workers, but now we’re seeing that leaders who swing back and forth between abusive and ethical leadership do even more damage to employees,” says Haoying “Howie” Xu, the Stevens business professor who led the investigation with Wake Forest University and other collaborators.

The project used surveys and field experiments to examine the effects of Jekyll-and-Hyde-style leadership on more than 650 full-time employees based in the United States and Europe.

It turned out that ineffective supervisors reverting to ethical leadership styles did not erase the impact of bad behaviors; in some circumstances, it actually worsened employees’ perceptions of a boss. There were also indications that pendulum-swinging leadership style can be contagious, fostering volatility in one’s employees.

The research was published in the *Journal of Applied Psychology*.

Decoding Loneliness, Using AI

Stevens teams up with IBM, NIH, UCSD to spot signs of alienation in the elderly

A Stevens AI expert is working with IBM Research and two university partners to develop an AI-based system that detects and analyzes loneliness in the elderly.

Professor K.P. “Suba” Subbalakshmi collaborated with the University of California-San Diego, Jiangnan University and IBM to survey about 100 residents of a California continuing-care senior housing community. Subjects were assessed using both the widely employed UCLA loneliness questionnaire and also by a trained psychiatrist conducting in-person interviews at the facility.

The team then fed the interview transcripts and survey data into an AI system that quickly learned to tell the linguistic differences in responses between lonely and non-lonely people — and offer predictions about their states of mind.

The AI proved to be 89% accurate at correctly predicting whether people did indeed report feeling lonely or not.

The study, supported by IBM and the National Institutes of Health, was reported in *Psychiatry Research* [339, 16078].

NIH: $2M to Study Neuromuscular Disease

Neuromuscular disorders affect 1 million children worldwide, significantly affecting movement and gait; they can even be fatal. Pharmaceutical companies are testing therapies, but gauging their effectiveness can be difficult.

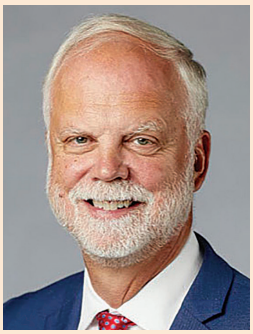
Now the National Institutes of Health (NIH) has granted a $2 million multi-principal investigator R01 award to professor Damiano Zanotto to tackle the challenge, in collaboration with three of the nation’s leading medical centers.

Zanotto and Columbia University Irving Medical Center (CUIMC) professor Jacqueline Montes will focus on spinal muscular atrophy, the world’s leading genetic cause of infant mortality, as well as Duchenne muscular dystrophy.

Their project will enroll up to 100 subjects across clinical sites at CUIMC, Boston Children’s Hospital and Stanford Medical School, evaluating changes in gait over one year’s time using AI-enhanced, in-shoe sensors developed in Zanotto’s lab.

The team will use those insights to discover new biomarkers for the diseases, monitor the effectiveness of therapies and train machine-learning models to forecast disease progression or improvement. The project extends through 2028.

ADDRESSING PRESSING SOCIETAL CHALLENGES IN SERVICE OF THE NATION



At Stevens, we often remark how we are both inspired by technology and powered by humanity. That's never been more apparent than in the research enterprise here, which is firing on all cylinders and achieving record metrics in research support as well as in research expenditure activity.

Each day in our laboratories and classrooms, students and faculty are tackling generational societal challenges such as environmental and human health, emergency planning, infrastructure safety, clean energy, resilience and health care — topics all appearing in this issue of **IMPACT**.

On the cover, we report on Professor Jose Ramirez-Marquez's fascinating examinations of social media behavior. Social media can be connective, assistive, even addictive; we are also learning, increasingly, it can be deceptive. During times of crisis, distortions created and amplified via social media can spiral out of control, siphoning attention away from life-saving messages. It will be critical for us to understand these new tools more closely.

Another study reported in this issue is Professor Philip Odonkor's work on solar and electric homes. It turns out that our homes possess "energy signatures" that can help us anticipate which ones are best prepared to stay powered during temperature extremes.

I'd also be remiss if I did not mention Professors K.P. Subbalakshmi and Samantha Kleinberg, two longtime Stevens research stars each working with NIH support to understand our health.

Professor Subbalakshmi collaborated with IBM and several universities to develop a system that accurately detects loneliness in the elderly by analyzing transcripts of their conversations. Professor Kleinberg worked with NYU to interpret images of meals captured by pregnant women and estimate their nutritional intake. I think we can all agree these are two vital groups to serve and care for as well as we possibly can.

To support outstanding research like this, we are communicating with sponsors, professional societies and Congressional representatives to position ourselves to respond ably to any changes in federal outlook. Ensuring that the broad sweep of research at Stevens continues to be vibrant and grow, inspired by societal needs and made possible by hard work from our talented researchers, is the imperative of me and my colleagues.

I wish you a productive spring semester and summer break.

All my best,

Ed Synakowski
Vice Provost for Research and Innovation

DOT Awards $1M to Monitor Pipeline Integrity

The U.S. Department of Transportation has awarded $1 million to Stevens to improve pipeline design and maintenance. The goal: reduce the number of catastrophic incidents.

More than 3.3 million miles of pipeline infrastructure transport energy resources in the U.S. However, stress and corrosion can create small cracks that may suddenly expand, leading to pipe failures and creating safety hazards and environmental threats.

The Stevens team will examine pressure and temperature factors that stress pipeline materials, developing innovative monitoring techniques integrating AI, ultrasonic and acoustic technologies to learn how temperature changes accelerate crack growth and how material properties influence crack resistance.

The group will also develop algorithmic techniques to analyze ultrasonic and acoustic signals and detect cracks at earlier stages, classifying their severity and predicting their growth.

Professor Yi Bao and Provost Jianmin Qu will lead the project. Rutgers University and North Dakota State University will collaborate.

Keeping ‘Green’ Homes Powered Year-Round

Study examines solar, electric homes’ reliability during temperature extremes

As winter storms and summer heat waves stress the nation’s power grids, Stevens researchers have developed a new way to identify homes more vulnerable to blackouts.

With more than a quarter of U.S. homes fully electric, and solar installations set to triple during the next five years, the research is timely.

"We're racing toward electrification to combat climate change, but we must also understand the risks," says Professor Philip Odonkor, who led the project. "Think about Texas in 2021, when millions lost power during a winter storm. As more homes go fully electric, we need to prepare for these scenarios.”

SUMMER STRENGTH, WINTER BLUES

Odonkor, working with Stevens master’s students Andrew Majowicz and Chetan Popli, leveraged AI and analyzed Department of Energy building-stock data to conduct the analysis. The team dug into the energy patterns of 129,000 single-family homes across eight states, looking for hidden signatures that distinguish fully electrified homes from those that use a mix of energy sources.

The study found that individual homes’ energy signatures are not only distinguishable, but grant critical insight into their resilience.

Solar-powered homes, for example, demonstrated impressive resilience during summer heat waves. However, they proved nearly three times more vulnerable to winter outages compared to those drawing power from mixed energy sources such as natural gas.

The team also developed important new machine-learning tools during the course of the study capable of identifying a home’s systems and vulnerabilities with more than 95% accuracy. Those tools could enable better pinpointing of at-risk households, helping prioritize response during outages and plan more resilient neighborhoods, says Odonkor.

The research was published in the *Journal of Smart Cities and Society* in January.

WHITE HOUSE AWARDS $1M PECASE FOR HIGH-SPEED PHYSICS RESEARCH

Stevens Professor Nick Parziale, a leading researcher in the boundary-layer physics affecting high-speed vehicles such as planes, spacecraft and projectiles, received a prestigious Presidential Early Career Award for Scientists and Engineers (PECASE) from the Biden Administration in January.

Established in 1996, the award recognizes and advances the research of early-career scientists and engineers who show exceptional potential and outstanding promise and carries $1 million in funding.

The five-year grant will help further Parziale’s investigations of high-speed fluid mechanics — the flows of gases and liquids — which become critically important to understand at high flight speeds.

HUNTING ‘FOREVER CHEMICALS’ WITH A QUANTUM ASSIST

EPA grants $1.5 million to four-university effort

Stevens has been tapped by the Environmental Protection Agency (EPA) to join a multi-university effort to detect and degrade persistent PFAS/PFOS substances in new ways that could cost less — and require far less energy consumption.

Professors Henry Du and Yuping Huang will collaborate with Clarkson University, the University of Nebraska and SUNY-Buffalo in the effort.

The group’s proposed SENSE-PFAS system deploys a suite of technologies. Specially designed and functionalized silver nanoparticles provide sites for robust adsorption and sensitive detection of PFAS chemicals. Those devices’ effectiveness will then be enhanced using the emerging tools of quantum science.

That combination, say the researchers, could help detection platforms achieve unprecedented sensitivity on the order of parts-per-quadrillion.

Another challenge will be to render detected PFAS substances safer for disposal. Certain graphene- and iron-based nanocompounds, printed into very thin layers, appear to speed degradation of PFAS into fluoride, acetate and other less-harmful substances by breaking apart strong carbon-fluorine bonds through catalytic reactions. SENSE-PFAS will integrate those detection and degradation functions into a single device before field-testing the system.

The project extends through 2027.

NEWS & NOTES

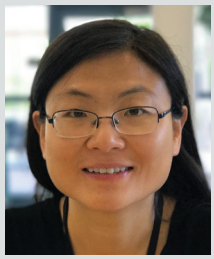
Senior research scientist **Victor Lawrence** was awarded a **National Medal of Technology and Innovation** by the **White House**. The medal was conferred by Office of Science and Technology Policy Director Arati Prabhakar during a January ceremony in Washington, D.C.

Andres Mansisidor co-authored "A nucleosome switch primes hepatitis B virus infection" in ***Cell*** with researchers from **Memorial Sloan Kettering, Weill Cornell Medicine, Rockefeller University** and the **University of Miami**.

Jinho Kim received $915,000 from the **Department of Defense** for his project "Leveraging Personalized Stem Cell Therapy to Overcome Airway Reconstruction," to be conducted in collaboration with **Mount Sinai**.

Brendan Englot and doctoral students **Ivana Collado-Gonzalez** and **Paul Szenher** co-authored "Large-Scale Dense 3-D Mapping Using Submaps Derived from Orthogonal Imaging Sonars" with the **U.S. Naval Academy** in the *IEEE Journal of Ocean Engineering* [Vol. 50, Issue 1].

Quantum physicist **Igor Pikovski** was awarded $670,000 by **NASA** to investigate "Atomic Quantum Networks on Curved Space-Time."



AI expert **Ying Wang** and doctoral student **Yifeng Peng** co-authored "HyQ2: A Hybrid Quantum Neural Network for NextG Vulnerability Detection" with collaborators from **Duke University** and **RPI** in *IEEE Transactions on Quantum Engineering*.

Philip Orton and **Laura Kerr** were awarded $475,000 for their project "Meeting Local Resilience Needs Through National and Pan-Regional Collaborations," to be conducted with the **University of Delaware**.

Materials expert **Jae Chul Kim** received approximately $410,000 from the **South Korean Ministry of Trade, Industry and Energy** for his project "Low-Expansion Mid-Nickel Material for Ultra-Long Cycle Life." He will collaborate with the Korean firm **POSCO Future M** on the project.

Doctoral candidate **Yewei Huang** was selected as a speaker in the "Future Leaders in Robotics and AI: Celebrating Diversity and Innovation Seminar Series" at the **University of Maryland**.

Do Pregnant Women Get Enough Nutrients?

Stevens-NYU study highlights potential shortfalls in diet

Approximately 10% of pregnant women are traditionally believed to struggle to meet nutritional needs — but the true number may be far higher, says new Stevens-NYU research.

Professor Samantha Kleinberg and the team analyzed dietary data from 150 pregnant women in the New York City metropolitan area, asking those women to capture before-and-after images of everything they ate during two 14-day periods. Nutritional experts then reviewed the images to assess the amounts and types of food and nutrients consumed. (Vitamins and supplements were not included in the study.)

Troublingly, 90% of the women in the study appeared not to consume the recommended amounts of iron, vitamin D or vitamin E. More than one-third did not seem to consume enough calcium, vitamin C or vitamin A, and almost two-thirds consumed less than the recommended amount of dietary folate — a key nutrient that helps prevent birth defects in infants.

The team next hopes to automate the process of assessing nutritional content based on images and is also developing AI models capable of asking follow-up questions about meals.

NYU professor Andrea Deierlein collaborated in the research, which was published in *The Journal of Nutrition*.

ABOUT STEVENS

Stevens Institute of Technology is a premier, private research university in Hoboken, New Jersey, overlooking the Manhattan skyline. Since its founding in 1870, technological innovation and entrepreneurship have been the hallmarks of Stevens' education and research. Academic and research programs spanning finance, computing, engineering and the arts expand the frontiers of science and leverage technology to confront the most challenging problems of our time. Stevens is home to multiple national centers of excellence as well as leading-edge scholarship and research centers in disciplines such as artificial intelligence, including the Stevens Institute for Artificial Intelligence (SIAI); business and finance, including the Center for Research toward Advancing Financial Technologies (CRAFT); energy and sustainability, including the Stevens Center for Sustainability (SCS); health and medicine, including the Center for Healthcare Innovation (CHI); quantum science and engineering, including the Center for Quantum Science and Engineering (CQSE); and urban and coastal resilience, including the Davidson Laboratory.

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Voice AI in Cars Shifts Into Focus

Chat assistants work well for some drivers — but not all

AI-based voice assistants for drivers are on the near horizon. In fact, the technology to provide automatically voiced warnings about road conditions, offer navigation help and cabin adjustments while we drive — even chat with us when we're bored or drowsy — already exists.

But would we actually listen to those voices in the car if we had them? Stevens researcher Sang Won Bae sought to find out.

In a new study co-sponsored by Hyundai and conducted with South Korea's Yonsei University, the team examined drivers' reactions to three types of AI assistants (known as PVAs, or proactive voice agents) as the volunteers operated lifelike driving simulators in a lab.

SOME LIKE CHATTER, SOME DON'T

The team began by using IBM Watson to design three types of voice agents: one that polls drivers about cabin temperature, navigation, radio options, text messages and other items; another that makes small talk to keep drivers alert; and a third that combines both those functions.

After loading road and highway routes and weather conditions into the simulator, the researchers conducted two studies with human subjects. The first insight: Participants were often uneasy with an automatic voice speaking as they drove, even feeling pressured in some cases to respond.

Among the three test agents, the task agent — which simply interacted with drivers to ask if they wanted adjustments — fared worst by a large margin. Adding small talk to the mix seemed to improve interactions with the voices, though only for certain drivers.

Less experienced drivers — who were also generally younger — responded much more favorably to assistance and chat than their experienced counterparts. Older and more experienced drivers, by contrast, basically only wanted PVAs to speak when they became bored or drowsy — and didn't want to receive even useful information or assistance when it was offered by the agents.

"This could be due to a comfort-with-technology gap," suggests Bae. "Or it could be that experienced, better drivers don't want or need help and even see it as an intrusion. This is consistent with previous findings that younger drivers have more trust in technology."

That insight could help tech developers tune their offerings to younger yet somewhat experienced drivers, who are probably the most likely adopters of AI-powered PVAs in the future, the group concluded.

The National Research Foundation of Korea (NRF) also supported the study, which was published in t*he International Journal of Human-Computer Interaction* in January.