

COMPUTER SCIENCE & ENGINEERING

Vision, Mission & PEOs of Department

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VISION

Engineering the future of the nation by transforming the students to be skilled technocrats, innovative leaders and environmentally receptive citizens. The Vision of the department is to carve the youth as dynamic, competent, valued and knowledgeable professionals who shall lead the Nation to a better future.

MISSION

- To flourish the SRMS as the World Leader in Computer Science & Engineering through continuous research & development directed towards the betterment of the society.
- To establish the cooperative learning environment for facilitating the quality academics, state-of-the art research and remarkable development activities.
- To establish World Class resources especially Research & Development Laboratories, Value Addition courses etc. for the in-house up gradation & community services.
- To groom the students into Industry – Ready Professionals through arigorous training in a self- disciplined environment.
- To groom the learned pool of faculty in accordance with the recent advancements in the field of Computer Science & Engineering.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- To encourage students to use their practical, computer and analytical skills to build industry ready engineers to solve multi-disciplinary sustainable projects.
- To keep abreast the students with the use of modern tools, equipments and software and inculcating the habit of lifelong learning.
- To foster team work and professional ethics among students towards devising feasible solutions to problems and project work.
- To augment the existing facilities: Library, Labs and efforts excel classroom teaching, thereby arousing curiosity, ultimately resulting in innovative ideas.
- To enhance technical skills of laboratory staff, provision to train the lab staff, encouraging staff to improve qualifications offering incentives.

Department of Computer Science & Engineering

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—Education is the passport to the future, for tomorrow belongs to those who prepare for it today.¶

-Malcolm X

—Be miserable or motivate yourself. Whatever has to be done, it's always your choice.¶

-Wayne Dyer

—You will either step forward to growth, or you will step backward into safety.¶

-Abraham Maslow

—If a man empties his purse into his head, no man can take it away from him.

An investment in knowledge always pays the best interest.¶

-Ben Franklin

—If people did not do silly things, nothing intelligent would ever get done.¶

-Ludwig Wittgenstein

—Example is not the main thing in influencing others. It is the only thing.¶

-Albert Schweitzer

—Education is simply the soul of a society as it passes from one generation to another.¶

-G.K. Chesterton

SPIRITUAL CORNER



अग्ने नय सुपथा राय अस्मान् विश्वानि देव वयुनानि विद्वान्।

युयोध्यस्मज्जुहुराणमेनो भूयिष्ठां ते नम उक्तिं विधेम् ॥

शब्दार्थ :-

हे देव- आनन्द के देने वाले

अग्ने- स्वप्रकाश-स्वरूप

विद्वान्- कल शात्रों के ज्ञाता परमेश्वर! आप

अस्मान्- हम मोक्ष चाहने वाले लोगों को

राये- धनादि ऐश्वर्य की प्राप्ति के लिये

सुपथा- धर्मयुक्त सरल मार्ग से

विश्वानि- समस्त

वयुनानि- उत्तम-उत्तम ज्ञानों को

नय- प्राप्त कराइए।

जुहुराणमेनः- कुटिलता से उत्पन्न पाप को

अस्मत्- हम से

युयोधि- अलग कीजिए जिसमें हम

ते- आपकी

भूयिष्ठाम्- बहुत अधिक

नम उक्तिम्- सल्कार के साथ स्तुति का

विधेम्- विधान करें।

भावार्थ :- हे प्रकाशस्वरूप ईश्वर ! आप हमारी मनोवृत्तियों को जानते हैं। आप हमारे कल्याण के लिए हम को ठीक मार्ग पर चलाइये। हम से उन पापों को दूर रखिये जो हमारी उन्नति में बाधक हैं। हम आप को बहुत-बहुत नमस्कार करते हैं।

LATEST UPDATES WORLD ENGINEERING & TECHNOLOGY

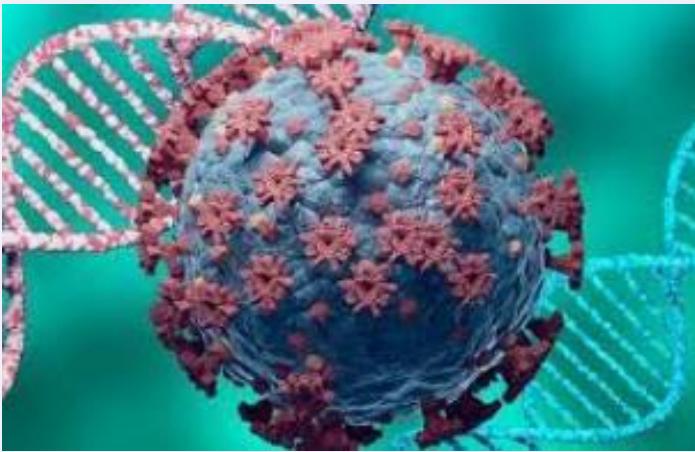
CLASSIFICATION OFOMICRON (B.1.1.529): SARS-COV-2 VARIANT OF CONCERN

The Technical Advisory Group on SARS-CoV-2 Virus Evolution (TAG-VE) is an independent group of experts that periodically monitors and evaluates the evolution of SARS-CoV-2 and assesses if specific mutations and combinations of mutations alter the behaviour of the virus. The TAG-VE was convened on 26 November 2021 to assess the SARS-CoV-2 variant: B.1.1.529.



The B.1.1.529 variant was first reported to WHO from South Africa on 24 November 2021. The epidemiological situation in South Africa has been characterized by three distinct peaks in reported cases, the latest of which was predominantly the Delta variant. In recent weeks, infections have increased steeply, coinciding with the detection of B.1.1.529 variant.

The first known confirmed B.1.1.529 infection was from a specimen collected on 9 November 2021.



This variant has a large number of mutations, some of which are concerning. Preliminary evidence suggests an increased risk of reinfection with this variant, as compared to other VOCs. The number of cases of this variant appears to be increasing in almost all provinces in South Africa. Current SARS-CoV-2 PCR diagnostics continue to detect this variant. Several labs have indicated that for one widely used PCR test, one of the three target genes is not detected (called S gene dropout or S gene target failure) and this test can therefore be used as marker for this variant, pending sequencing confirmation. Using this approach, this variant has been detected at faster rates than previous surges in infection, suggesting that this variant may have a growth advantage.

Based on the evidence presented indicative of a detrimental change in COVID-19 epidemiology, the TAG-VE has advised WHO that this variant should be designated as a VOC, and the WHO has designated B.1.1.529 as a VOC, named Omicron.

As such, countries are asked to do the following:

- Enhance surveillance and sequencing efforts to better understand circulating SARS-CoV-2 variants.
- Submit complete genome sequences and associated metadata to a publicly available database, such as GISAID.
- Report initial cases/clusters associated with VOC infection to WHO through the IHR mechanism.
- where capacity exists and in coordination with the international community, severity, effectiveness of public health and social measures, diagnostic methods, immune responses, antibody neutralization, or other relevant characteristics.

Individuals are reminded to take measures to reduce their risk of COVID-19, including proven public health and social measures such as wearing well-fitting masks, hand hygiene, physical distancing, improving ventilation of indoor spaces, avoiding crowded spaces, and getting vaccinated.

A SARS-CoV-2 VOI is a SARS-CoV-2 variant: with genetic changes that are predicted or known to affect virus characteristics such as transmissibility, disease severity, immune escape, diagnostic or therapeutic escape; AND that has been identified as causing significant community transmission or multiple COVID-19 clusters, in multiple countries with increasing relative prevalence alongside increasing number of cases over time, or other apparent epidemiological impacts to suggest an emerging risk to global public health.

A SARS-CoV-2 VOC is a SARS-CoV-2 variant that meets the definition of a VOI (see above) and, through a comparative assessment, has been demonstrated to be associated with one or more of the following changes at a degree of global public health significance: increase in transmissibility or detrimental change in COVID-19 epidemiology; OR decrease in effectiveness of public health and social measures or available diagnostics, vaccines, therapeutics.



HUNKAAR 2021

The three-day sports fest “#Hunkaar” kickstarted on 17th November with all vim and vigour. It saw massive participation from all the #SRMSinstitutions. The #inauguralceremony began with the welcoming of guests by MOC, Ayushi Gupta and Sarthak Khandelwal. Next, saplings and badges were presented. Gaurang Agarwal then threw light on the importance of #sports. Sir Aditya Murti declared Hunkaar open by releasing the balloons. It was followed by an enchanting #drillformation and dance performance. Sir Subhash Mehra also enlightened the students with his words of wisdom. Finally, the inaugural was concluded with the vote of thanks by #TyroSecretary, Hutanash Shrivastava. **#Hunkaar2021**



Brace yourself as students of #SRMSTrustInstitutions play it hard at the playground and fight for the coveted title of the winners at #HUNKAAR - Intra trust #SportsChampionship. From Kho-Kho, athletics, cricket, football, we have all riveting games lined up for this 3-day mega sports fest.





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ZEST 2021

AAROHAN....TO RISE



Shri Dev Murti Sir, Chairman, SRMS Trust Institutions, delivers an inspiring address during the annual cultural fest, Zest 2021, thanking the Tyro Club for organizing the event after a 2-year gap, and highlighting the efforts of SRMS Trust Institutions towards fighting COVID-19.



120 teams of 800 students from all the institutes of SRMS Trust competed in the one day annual cultural program Zest Aarohan in 24 events. Where the participants win prizes and have fun on DJ Night till late in the evening. In the memorable event, the chairman of the trust, Shri

Dev Murti sir also gave tips for success in the struggle of life to the students. Trust chairman Shri Dev Murti sir and secretary Aditya Murti sir announced the commencement of ZEST- 2021 at 9.30 am on Saturday morning at Shri Ram Murti Memorial Shatik Auditorium by lighting the lamp.

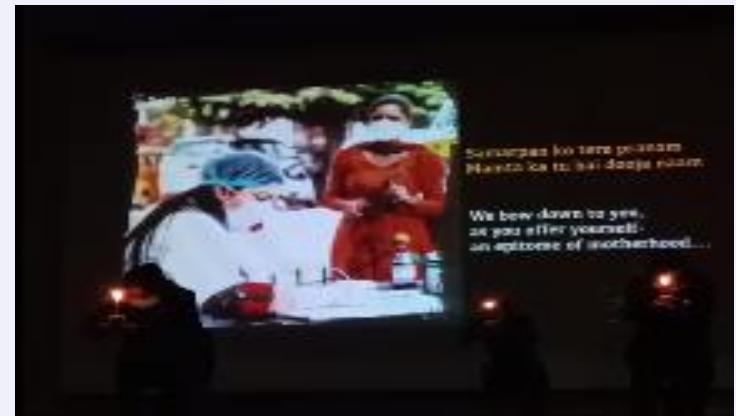
Shri Dev Murti sir dedicated this year's festival to the Corona Warriors. He said that during the last two years, the whole world fought against the global pandemic of Corona. At such a time, the Corona Warriors of our Medical College protected people from this pandemic like a soldier. After this, the audience was enthralled by presenting a dance based on the theme of the program Aarohan. The students danced to the tunes of the DJ till late in the evening. On this occasion, Trust Secretary Aditya Murti sir, Trust Advisor Er. Subhash Mehra sir , Dean Academics SRMSCET, Dr. Prabhakar Gupta sir , Director Training and Placement Cell Dr. Anuj Kumar sir , SRMS IMS Principal



Dr. SB Gupta sir , Dr. Atul Singh sir, Dean Student Welfare (CET) Mr. Kapil Bhushan sir and all the heads of the departments were present.



A fitting tribute to COVID-19 warriors and their untiring efforts to protect our lives at the expense of theirs. The tribute was part of the inaugural address of Zest 2021, the annual cultural fest of SRMS Trust Institutions.





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DEV UTHANI EKADASHI 2021 SRMS RADHA MOHAN MANDIR

As explained by a Jewish proverb mused from a mystic, “A little bit of light pushes away a lot of darkness.” with the same enthusiasm and consent an auspicious #deepomohatsav was held at Radha Krishna Temple by #SRMS. The ceremony was fragranced by the respectable presence of Chairman Shri Dev Murti Sir, Trust Secretary Aditya Murti Sir, Dean Academics Dr. Prabhakar Gupta, Dr. Asha Murti, Mrs. Richa Murti, Dr.SB Gupta, all HODs, and all faculty members. The veneration initiated by the consecration of #LordKrishna and first deep was #enlightened by Shri Dev Murti Sir. Comprehensively 3100 deeps were lightened throughout the ceremony. The whole plot was a great #success by the resemblance of Lords and the audience was embraced by the grace of #god.



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CHILDREN'S DAY 2021

#SRMSTrustInstitutions wishes all children a very Happy Children's Day! As leaders of the #future, let us, as adults, strive to impart values of #kindness, #courage, and #integrity so that they may create a better tomorrow.

SHRI RAM MURTI SMARAK
TRUST INSTITUTIONS
BAREILLY-LUCKNOW-UNNAO
SRMS

From having the purest soul
to the shiny twinkle in their eyes,
Children are the torchbearers of the future.
Celebrating the day of innocence and joy.

HAPPY CHILDREN'S DAY!

DIWALI 2021

This #Diwali, spark the flame of curiosity, fan it with learning, and spread your light wherever you go. #SRMSTrustInstitutions wishes you a Happy Diwali!

SHRI RAM MURTI SMARAK
TRUST INSTITUTIONS
BAREILLY-LUCKNOW-UNNAO
SRMS

**LIGHT UP
THE DIYA WITHIN.**

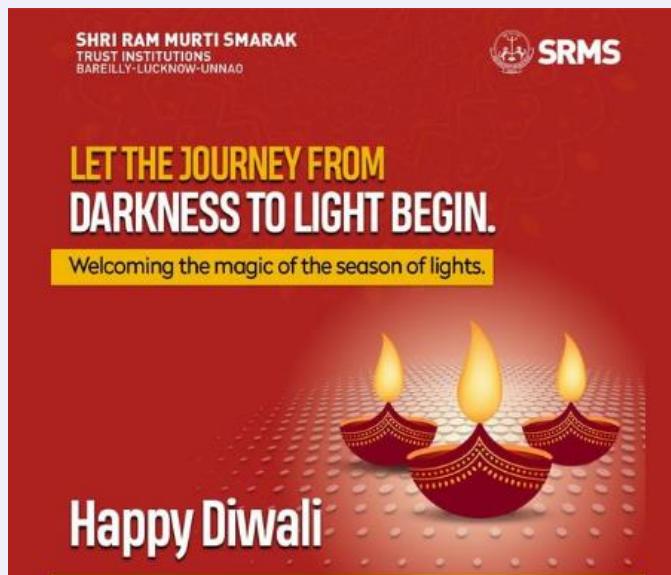
Illuminate the way
with your inner glow.
Light up the world
with your knowledge,
conviction and leadership.

Happy Diwali



Diwali or Deepavali is one of the biggest and auspicious festivals celebrated by Hindus all around the globe. The festival of lights signifies peace and joy, the victory of good over evil, and light over darkness every day. It is one of the most symbolic Hindu festivals, and all the communities in the country celebrate it with much pomp.

During this festival, people clean their homes, decorate every corner with lights, lamps, diyas, flowers, rangoli, and candles. Families also perform Lakshmi Puja and pray to the Goddess of wealth to bless them with health, wealth, and prosperity.



WEBINAR ON “CYBER CRIME AND SECURITY”



A webinar on “Cyber Crime and Security” successfully conducted at Computer Science and Engineering Department, SRMSCET, Bareilly on November 13th, 2021, 12:00 PM – 1:00 PM, where Special guest and Keynote speaker was Dr. H L Mandoria having more than 30+ yrs of experience in MNC. During the inaugural of the webinar, HOD of CSE Deptt. Dr. L. S. Maurya addressed the gathering, Dean Academics, Dr. Prabhakar Gupta addressed the participants, furthermore, Director Training & Placement Department, Dr. Anuj Kumar, share his valuable words. In the valedictory session vote of thanks was given by Mr. Amit Karmakar.



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Faculty Arena

TOWARD SPEECH RECOGNITION FOR UNCOMMON SPOKEN LANGUAGES

Reducing the complexity of a powerful machine-learning model may help level the playing field for automatic speech-recognition around the world.

Source: Massachusetts Institute of Technology

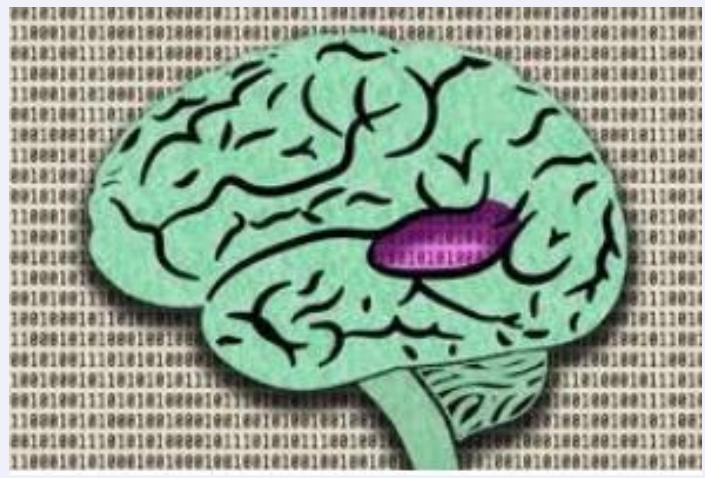


Summary: PARP "Prune, Adjust and Re-Prune for Self-Supervised Speech Recognition" is a new technique that reduces computational complexity of an advanced machine learning model so it can be applied to perform automated speech recognition for rare or uncommon languages, like Wolof, which is spoken by 5 million people in West Africa.

Many speech-recognition systems only perform well with the most widely spoken of the world's roughly 7,000 languages. Systems largely don't exist for less common languages, leaving millions of people cut off from many technologies that rely on speech.

MIT researchers have developed a simple technique that reduces the complexity of an advanced speech-learning model. Automatic speech-recognition systems are being

used to help students who are blind or have low vision and improve efficiency in medical and legal settings. They can also help users learn new languages and improve their pronunciation skills. Technology could be used to transcribe and document rare languages that are in danger of vanishing.



Researchers studied a powerful neural network that has been pertained to learn basic speech from raw audio. Wave2vec 2.0 is a self-supervised learning model, so it learns to recognize a spoken language after it is fed a large amount of unlabeled speech. When researchers pruned a speech-recognition neural network, they found it had 97 percent overlap with one another for French and Spanish speech. This is because each subnet work is adjusted for a specific language, and then pruned again. Researchers developed a simple technique to improve efficiency and performance of the neural network.

PARP can create one smaller sub network that can be fine-tuned for 10 languages at once, eliminating the need to separate sub networks for each language. The researchers put PARP to the test against other common pruning

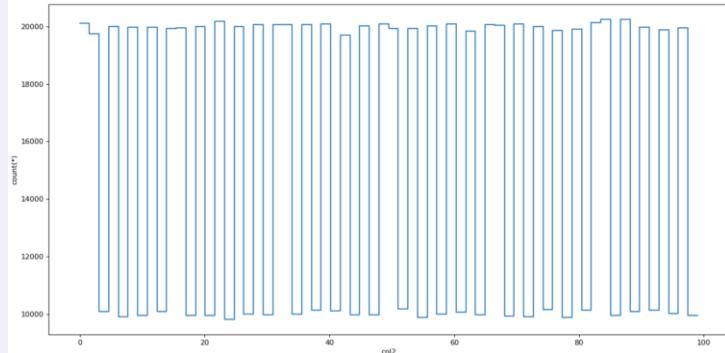
techniques and found that it outperformed them all for speech recognition. It was especially effective when there was only a very small amount of transcribed speech to train on.

Ms. Divya Joshi

Assistant Professor

HOW TO PROCESS A DATAFRAME WITH MILLIONS OF ROWS IN SECONDS?

Data Science is having its renaissance moment. It's hard to keep track of all new Data Science tools that have the potential to change the way Data Science gets done. I learned about this new Data Processing Engine only recently in a conversation with a colleague. We had a discussion about Big Data processing, which is at the forefront of innovation in the field, and this new tool popped up. While pandas is the de facto tool for data processing in Python, it doesn't handle big data well. With bigger datasets, you'll get an out-of-memory exception sooner or later. Researchers were confronted with this issue a long time ago, which prompted the development of tools like Dask and Spark, which try to overcome "the single machine" constraint by distributing processing to multiple machines.



Meet Terality

Terality is a Serverless Data Processing Engine that processes the data in the Cloud. There is no need to manage infrastructure as Terality takes care of scaling compute resources. Its target audiences are Engineers and Data Scientists.

What are the main steps of data processing with Terality?

1. Terality comes with a Python client that you import into a Jupyter Notebook.
2. Then you write the code in "a pandas way" and Terality securely uploads your data and takes care of distributed processing (and scaling) to calculate your analysis.
3. After processing is completed, you can convert the data back to a regular pandas DataFrame and continue with analysis locally.

What's happening behind the scenes?

Terality team developed a proprietary data processing engine. The goal was to avoid the imperfections of Dask, which doesn't have the same syntax as pandas, it's asynchronous, doesn't have all pandas functions and it doesn't support auto-scaling. Terality's Data Processing Engine solves these issues.

Is Terality FREE to use?

Terality has a free plan with which you can process up to 500 GB of data per month. It also offers a paid plan for companies and individuals with greater requirements.

What about Data Privacy?

When a user performs a read operation, the Terality client copies the dataset on Terality's secured cloud storage on Amazon S3. Terality has a strict policy around data privacy and protection. They guarantee that they'll not use the data and process it securely. Terality is not a storage solution. They will delete your data maximum within 3 days after

Terality's client session is closed. Terality processing currently occurs on AWS in the Frankfurt region.

Can Terality process Big Data?

At the moment, in November 2021, Terality is still in beta. It's optimized for datasets up to 100–200 GB. But the team plans to start to optimize for Terabytes soon.

Mr. Saurabh Banerjee

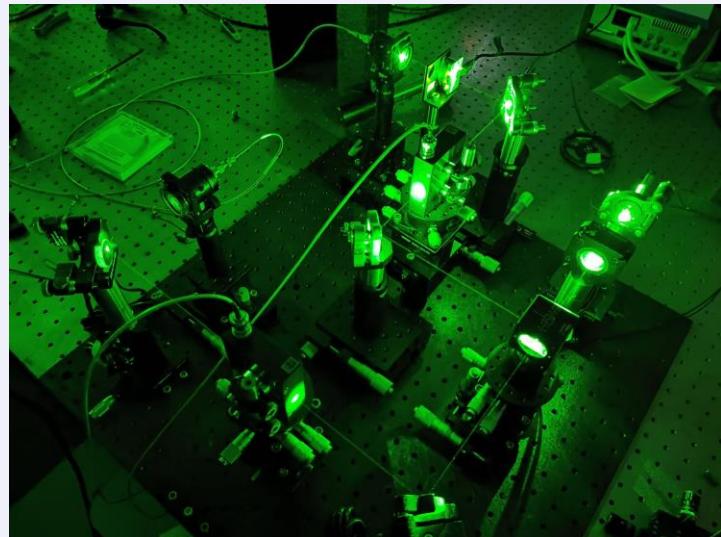
Assistant Professor

NEW HOLOGRAPHIC CAMERA SEES THE UNSEEN WITH HIGH PRECISION

Date: November 17, 2021

Source: Northwestern University

Northwestern University researchers have invented a new high-resolution camera that can see the unseen -- including around corners and through scattering media, such as skin, fog or potentially even the human skull.



Called synthetic wavelength holography, the new method works by indirectly scattering coherent light onto hidden objects, which then scatters again and travels back to a

camera. From there, an algorithm reconstructs the scattered light signal to reveal the hidden objects. Due to its high temporal resolution, the method also has potential to image fast-moving objects, such as the beating heart through the chest or speeding cars around a street corner.

The study will be published on Nov. 17 in the journal *Nature Communications*. The relatively new research field of imaging objects behind occlusions or scattering media is called non-line-of-sight (NLoS) imaging. Compared to related NLoS imaging technologies, the Northwestern method can rapidly capture full-field images of large areas with submillimeter precision. With this level of resolution, the computational camera could potentially image through the skin to see even the tiniest capillaries at work.



While the method has obvious potential for noninvasive medical imaging, early-warning navigation systems for automobiles and industrial inspection in tightly confined spaces, the researchers believe potential applications are endless. "Our technology will usher in a new wave of imaging capabilities," said Northwestern's Florian Willomitzer, first author of the study. "Our current sensor prototypes use visible or infrared light, but the principle is universal and could be extended to other wavelengths. For example, the same method could be applied to radio waves for space exploration or underwater acoustic imaging. It

can be applied to many areas, and we have only scratched the surface." Willomitzer is a research assistant professor of electrical and computer engineering at Northwestern's McCormick School of Engineering. Northwestern co-authors include Oliver Cossairt, associate professor of computer science and electrical and computer engineering, and former Ph.D. student Fengqiang Li. The Northwestern researchers collaborated closely with Prasanna Rangarajan, Muralidhar Balaji and Marc Christensen, all researchers at Southern Methodist University.

Intercepting scattered light

Seeing around a corner versus imaging an organ inside the human body might seem like very different challenges, but Willomitzer said they are actually closely related. Both deal with scattering media, in which light hits an object and scatters in a manner that a direct image of the object can no longer be seen. "If you have ever tried to shine a flashlight through your hand, then you have experienced this phenomenon," Willomitzer said. "You see a bright spot on the other side of your hand, but, theoretically, there should be a shadow cast by your bones, revealing the bones' structure. Instead, the light that passes the bones gets scattered within the tissue in all directions, completely blurring out the shadow image."

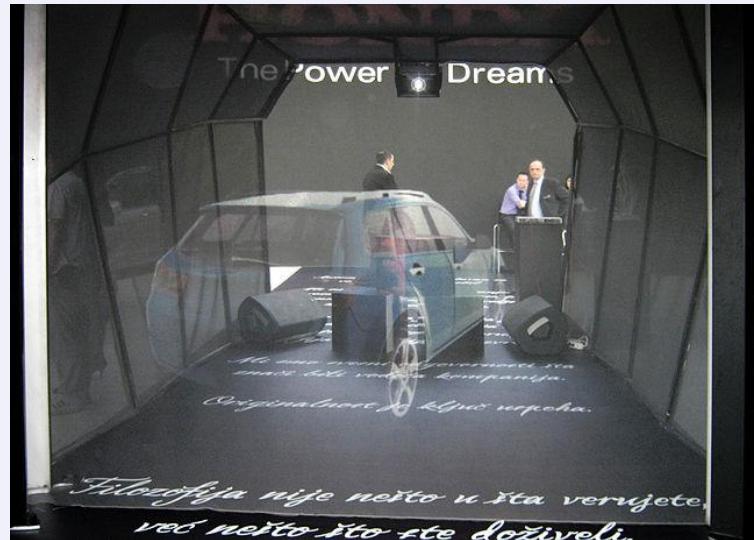
The goal, then, is to intercept the scattered light in order to reconstruct the inherent information about its time of travel to reveal the hidden object. But that presents its own challenge.

"Nothing is faster than the speed of light, so if you want to measure light's time of travel with high precision, then you need extremely fast detectors," Willomitzer said. "Such detectors can be terribly expensive."

Tailored waves

To eliminate the need for fast detectors, Willomitzer and his colleagues merged light waves from two lasers in order to generate a synthetic light wave that can be specifically tailored to holographic imaging in different scattering scenarios.

"If you can capture the entire light field of an object in a hologram, then you can reconstruct the object's three-dimensional shape in its entirety," Willomitzer explained. "We do this holographic imaging around a corner or through scatterers -- with synthetic waves instead of normal light waves." Over the years, there have been many NLoS imaging attempts to recover images of hidden objects. But these methods typically have one or more problems. They either have low resolution, an extremely small angular field of regard, require a time-consuming raster scan or need large probing areas to measure the scattered light signal.



The new technology, however, overcomes these issues and is the first method for imaging around corners and through scattering media that combines high spatial resolution, high temporal resolution, a small probing area and a large angular field of view. This means that the camera can

image tiny features in tightly confined spaces as well as hidden objects in large areas with high resolution -- even when the objects are moving.

Turning 'walls into mirrors'

Because light only travels on straight paths, an opaque barrier (such as a wall, shrub or automobile) must be present in order for the new device to see around corners. The light is emitted from the sensor unit (which could be mounted on top of a car), bounces off the barrier, then hits the object around the corner. The light then bounces back to the barrier and ultimately back into the detector of the sensor unit.

"It's like we can plant a virtual computational camera on every remote surface to see the world from the surface's perspective," Willomitzer said.

For people driving roads curving through a mountain pass or snaking through a rural forest, this method could prevent accidents by revealing other cars or deer just out of sight around the bend. "This technique turns walls into mirrors," Willomitzer said. "It gets better as the technique also can work at night and in foggy weather conditions."



In this manner, the high-resolution technology also could replace (or supplement) endoscopes for medical and industrial imaging. Instead of needing a flexible camera, capable of turning corners and twisting through tight spaces -- for a colonoscopy, for example -- synthetic wavelength

holography could use light to see around the many folds inside the intestines. Similarly, synthetic wavelength holography could image inside industrial equipment while it is still running -- a feat that is impossible for current endoscopes. "If you have a running turbine and want to inspect defects inside, you would typically use an endoscope,"

Willomitzer said. "But some defects only show up when the device is in motion. You cannot use an endoscope and look inside the turbine from the front while it is running. Our sensor can look inside a running turbine to detect structures that are smaller than one millimeter."



Although the technology is currently a prototype, Willomitzer believes it will eventually be used to help drivers avoid accidents. "It's still a long way to go before we see these kinds of imagers built in cars or approved for medical applications," he said. "Maybe 10 years or even more, but it will come."

**Mr. Ashish Agrawal
Assistant Professor**

Students' Corner

INCREASINGLY FREQUENT WILDFIRES LINKED TO HUMAN- CAUSED CLIMATE CHANGE



Research by scientists from UCLA and Lawrence Livermore National Laboratory strengthens the case that climate change has been the main cause of the growing amount of land in the western U.S. that has been destroyed by large wildfires over the past two decades.

Rong Fu, a UCLA professor of atmospheric and oceanic sciences and the study's corresponding author, said the trend is likely to worsen in the years ahead. "I am afraid that the record fire seasons in recent years are only the beginning of what will come, due to climate change, and our society is not prepared for the rapid increase of weather contributing to wildfires in the American West."

The dramatic increase in destruction caused by wildfires is borne out by U.S. Geological Survey data. In the 17 years from 1984 to 2000, the average burned area in 11 western states was 1.69 million acres per year. For the next 17

years, through 2018, the average burned area was approximately 3.35 million acres per year. And in 2020, according to a National Interagency Coordination Center report, the amount of land burned by wildfires in the West reached 8.8 million acres -- an area larger than the state of Maryland. But the factors that have caused that massive increase have been the subject of debate: How much of the trend was caused by human-induced climate change and how much could be explained by changing weather patterns, natural climate variation, forest management, earlier springtime snowmelt and reduced summer rain? For the study, published in the Nov. 9 edition of the journal Proceedings of the National Academy of Sciences, the researchers applied artificial intelligence to climate and fire data in order to estimate the roles that climate change and other factors play in determining the key climate variable tied to wildfire risk: vapor pressure deficit.

Vapor pressure deficit measures the amount of moisture the air can hold when it is saturated minus the amount of moisture in the air. When vapor pressure deficit, or VPD, is higher, the air can draw more moisture from soil and plants. Large wildfire-burned areas, especially those not located near urban areas, tend to have high vapor pressure deficits, conditions that are associated with warm, dry air. The study found that the 68% of the increase in vapor pressure deficit across the western U.S. between 1979 and 2020 was likely due to human-caused global warming. The remaining 32% change, the authors concluded, was likely caused by naturally occurring changes in weather patterns.

The findings suggest that human-induced climate change is the main cause for increasing fire weather in the western United States.

"And our estimates of the human-induced influence on the increase in fire weather risk are likely to be conservative," said Fu, director of UCLA's Joint Institute for Regional Earth System Science and Engineering, a collaboration with NASA's Jet Propulsion Laboratory.



The researchers analyzed the so-called August Complex wildfire of 2020, which burned more than a million acres in Northern California. They concluded that human-induced warming likely explains 50% of the unprecedentedly high VPD in the region during the month the fire began.



Fu said she expects wildfires to continue to become more intense and more frequent in the western states overall, even though wetter and cooler conditions could offer brief

respite. And areas where vast swaths of plant life have already been lost to fires, drought, heatwaves and the building of roads likely would not see increases in wildfires despite the increase of the vapor pressure deficit. "Our results suggest that the western United States appears to have passed a critical threshold -- that human-induced warming is now more responsible for the increase of vapor pressure deficit than natural variations in atmospheric circulation," Fu said. "Our analysis shows this change has occurred since the beginning of the 21st century, much earlier than we anticipated."

The paper's lead author is Yizhou Zhuang, a UCLA postdoctoral scholar; co-authors are Alex Hall, a UCLA professor of atmospheric and oceanic sciences and director of the UCLA Center for Climate Science; Benjamin Santer, a former atmospheric scientist at Lawrence Livermore National Laboratory; and Robert Dickinson, a UCLA distinguished professor in residence of atmospheric and oceanic sciences.

*Kanu Priya Agarwal
CS 2018*

'DANCING MOLECULES' SUCCESSFULLY REPAIR SEVERE SPINAL CORD INJURIES



In a new study, researchers administered a single injection to tissues surrounding the spinal cords of paralyzed mice. Just four weeks later, the animals regained the ability to walk.

By sending bioactive signals to trigger cells to repair and regenerate, the breakthrough therapy dramatically improved severely injured spinal cords in five key ways: (1) The severed extensions of neurons, called axons, regenerated; (2) scar tissue, which can create a physical barrier to regeneration and repair, significantly diminished; (3) myelin, the insulating layer of axons that is important in transmitting electrical signals efficiently, reformed around cells; (4) functional blood vessels formed to deliver nutrients to cells at the injury site; and (5) more motor neurons survived.

After the therapy performs its function, the materials biodegrade into nutrients for the cells within 12 weeks and then completely disappear from the body without noticeable side effects. This is the first study in which researchers controlled the collective motion of molecules through changes in chemical structure to increase a therapeutic's efficacy.

"Our research aims to find a therapy that can prevent individuals from becoming paralyzed after major trauma or disease," said Northwestern's Samuel I. Stupp, who led the study. "For decades, this has remained a major challenge for scientists because our body's central nervous system, which includes the brain and spinal cord, does not have any significant capacity to repair itself after injury or after the onset of a degenerative disease. We are going straight to the FDA to start the process of getting this new therapy approved for use in human patients, who currently have very few treatment options."

Stupp is Board of Trustees Professor of Materials Science and Engineering, Chemistry, Medicine and Biomedical Engineering at Northwestern, where he is founding director of the Simpson Querrey Institute for BioNanotechnology (SQI) and its affiliated research center, the Center for Regenerative Nanomedicine. He has appointments in the McCormick School of Engineering, Weinberg College of Arts and Sciences and Feinberg School of Medicine.

Life expectancy has not improved since the 1980s

According to the National Spinal Cord Injury Statistical Center, nearly 300,000 people are currently living with a spinal cord injury in the United States. Life for these patients can be extraordinarily difficult. Less than 3% of people with complete injury ever recover basic physical functions. And approximately 30% are re-hospitalized at least once during any given year after the initial injury, costing millions of dollars in average lifetime health care costs per patient. Life expectancy for people with spinal cord injuries is significantly lower than people without spinal cord injuries and has not improved since the 1980s. "Currently, there are no therapeutics that trigger spinal cord regeneration," said Stupp, an expert in regenerative medicine. "I wanted to make a difference on the outcomes of spinal cord injury and to tackle this problem, given the tremendous impact it could have on the lives of patients. Also, new science to address spinal cord injury could have impact on strategies for neurodegenerative diseases and stroke."

'Dancing molecules' hit moving targets

The secret behind Stupp's new breakthrough therapeutic is tuning the motion of molecules, so they can find and properly engage constantly moving cellular receptors.

Injected as a liquid, the therapy immediately gels into a complex network of nanofibers that mimic the extracellular matrix of the spinal cord. By matching the matrix's structure, mimicking the motion of biological molecules and incorporating signals for receptors, the synthetic materials are able to communicate with cells.

"Receptors in neurons and other cells constantly move around," Stupp said. "The key innovation in our research, which has never been done before, is to control the collective motion of more than 100,000 molecules within our nanofibers. By making the molecules move, 'dance' or even leap temporarily out of these structures, known as supramolecular polymers, they are able to connect more effectively with receptors."

Stupp and his team found that fine-tuning the molecules' motion within the nanofiber network to make them more agile resulted in greater therapeutic efficacy in paralyzed mice. They also confirmed that formulations of their therapy with enhanced molecular motion performed better during in vitro tests with human cells, indicating increased bioactivity and cellular signaling.

"Given that cells themselves and their receptors are in constant motion, you can imagine that molecules moving more rapidly would encounter these receptors more often," Stupp said. "If the molecules are sluggish and not as 'social,' they may never come into contact with the cells."

One injection, two signals

Once connected to the receptors, the moving molecules trigger two cascading signals, both of which are critical to spinal cord repair. One signal prompts the long tails of neurons in the spinal cord, called axons, to regenerate. Similar to electrical cables, axons send signals between the brain and the rest of the body. Severing or damaging axons

can result in the loss of feeling in the body or even paralysis. Repairing axons, on the other hand, increases communication between the body and brain.

The second signal helps neurons survive after injury because it causes other cell types to proliferate, promoting the regrowth of lost blood vessels that feed neurons and critical cells for tissue repair. The therapy also induces myelin to rebuild around axons and reduces glial scarring, which acts as a physical barrier that prevents the spinal cord from healing.

"The signals used in the study mimic the natural proteins that are needed to induce the desired biological responses. However, proteins have extremely short half-lives and are expensive to produce," said Zaida Álvarez, the study's first author and former research assistant professor in Stupp's laboratory.

Universal application

While the new therapy could be used to prevent paralysis after major trauma (automobile accidents, falls, sports accidents and gunshot wounds) as well as from diseases, Stupp believes the underlying discovery -- that "supramolecular motion" is a key factor in bioactivity -- can be applied to other therapies and targets.

"The central nervous system tissues we have successfully regenerated in the injured spinal cord are similar to those in the brain affected by stroke and neurodegenerative diseases, such as ALS, Parkinson's disease and Alzheimer's disease," Stupp said. "Beyond that, our fundamental discovery about controlling the motion of molecular assemblies to enhance cell signaling could be applied universally across biomedical targets."

Bhupendra Kumar
CS 2019

ARCTIC OCEAN STARTED GETTING WARMER DECADES EARLIER THAN WE THOUGHT

The Arctic Ocean has been getting warmer since the beginning of the 20th century -- decades earlier than records suggest -- due to warmer water flowing into the delicate polar ecosystem from the Atlantic Ocean.



Using the chemical signatures found in marine microorganisms, the researchers found that the Arctic Ocean began warming rapidly at the beginning of the last century as warmer and saltier waters flowed in from the Atlantic -- a phenomenon called Atlantification -- and that this change likely preceded the warming documented by modern instrumental measurements. Since 1900, the ocean temperature has risen by approximately 2 degrees Celsius, while sea ice has retreated and salinity has increased.

The results, reported in the journal *Science Advances*, provide the first historical perspective on Atlantification of the Arctic Ocean and reveal a connection with the North Atlantic that is much stronger than previously thought. The connection is capable of shaping Arctic climate variability, which could have important implications for sea-ice retreat

and global sea level rise as the polar ice sheets continue to melt.

All of the world's oceans are warming due to climate change, but the Arctic Ocean, the smallest and shallowest of the world's oceans, is warming fastest of all.

"The rate of warming in the Arctic is more than double the global average, due to feedback mechanisms," said co-lead author Dr Francesco Muschitiello from Cambridge's Department of Geography. "Based on satellite measurements, we know that the Arctic Ocean has been steadily warming, in particular over the past 20 years, but we wanted to place the recent warming into a longer context." Atlantification is one of the causes of warming in the Arctic, however instrumental records capable of monitoring this process, such as satellites, only go back about 40 years.



As the Arctic Ocean gets warmer, it causes the ice in the polar region to melt, which in turn affects global sea levels. As the ice melts, it exposes more of the ocean's surface to the sun, releasing heat and raising air temperatures. As the Arctic continues to warm, it will melt the permafrost, which stores huge amounts of methane, a far more damaging greenhouse gas than carbon dioxide.

The researchers used geochemical and ecological data from ocean sediments to reconstruct the change in water column properties over the past 800 years. They precisely dated sediments using a combination of methods and looked for diagnostic signs of Atlantification, like change in temperature and salinity.

"When we looked at the whole 800-year timescale, our temperature and salinity records look pretty constant," said co-lead author Dr Tesi Tommaso from the Institute of Polar Sciences of the National Research Council in Bologna. "But all of a sudden at the start of the 20th century, you get this marked change in temperature and salinity -- it really sticks out."

"The reason for this rapid Atlantification of at the gate of the Arctic Ocean is intriguing," said Muschitiello. "We compared our results with the ocean circulation at lower latitudes and found there is a strong correlation with the slowdown of dense water formation in the Labrador Sea. In a future warming scenario, the deep circulation in this subpolar region is expected to further decrease because of the thawing of the Greenland ice sheet. Our results imply that we might expect further Arctic Atlantification in the future because of climate change."

*Bhuvnesh Kumar
CS 2019*

RESEARCHERS REVEAL HOW TO TURN A GLOBAL WARMING LIABILITY INTO A PROFITABLE FOOD SECURITY SOLUTION

Like a mirage on the horizon, an innovative process for converting a potent greenhouse gas into a food security solution has been stalled by economic uncertainty. Now, a

first-of-its-kind Stanford University analysis evaluates the market potential of the approach, in which bacteria fed captured methane grow into protein-rich fishmeal. "Industrial sources in the U.S. are emitting a truly staggering amount of methane, which is uneconomical to capture and use with current applications," said study lead author Sahar El Abbadi, who conducted the research as a graduate student in civil and environmental engineering.



"Our goal is to flip that paradigm, using biotechnology to create a high-value product," added El Abbadi, who is now a lecturer in the Civic, Liberal and Global Education program at Stanford.

Two problems, one solution

Although carbon dioxide is more abundant in the atmosphere, methane's global warming potential is about 85 times as great over a 20-year period and at least 25 times as great a century after its release. Methane also threatens air quality by increasing the concentration of tropospheric ozone, exposure to which causes an estimated 1 million premature deaths annually worldwide due to respiratory illnesses. Methane's relative concentration has grown more than twice as fast as that of carbon dioxide since the beginning of the Industrial Revolution due in great part to human-driven emissions.

A potential solution lies in methane-consuming bacteria called methanotrophs. These bacteria can be grown in a chilled, water-filled bioreactor fed pressurized methane, oxygen and nutrients such as nitrogen, phosphorus and trace metals. The protein-rich biomass that results can be used as fishmeal in aquaculture feed, offsetting demand for fishmeal made from small fish or plant-based feeds that require land, water and fertilizer.

"While some companies are doing this already with pipeline natural gas as feedstock, a preferable feedstock would be methane emitted at large landfills, wastewater treatment plants and oil and gas facilities," said study co-author Craig Criddle, a professor of civil and environmental engineering in Stanford's School of Engineering. "This would result in multiple benefits, including lower levels of a potent greenhouse gas in the atmosphere, more stable ecosystems and positive financial outcomes."

Consumption of seafood, an important global source of protein and micronutrients, has increased more than fourfold since 1960. As a result, wild fish stocks are badly depleted, and fish farms now provide about half of all the animal-sourced seafood we eat. The challenge will only grow as global demand for aquatic animals, plants and algae will likely double by 2050, according to a comprehensive review of the sector led by researchers at Stanford and other institutions.

While methane-fed methanotrophs can provide feed for farmed fish, the economics of the approach have been unclear, even as prices of conventional fishmeal have nearly tripled in real terms since 2000. To clarify the approach's potential to meet demand profitably, the Stanford researchers modeled scenarios in which methane

is sourced from relatively large wastewater treatment plants, landfills, and oil and gas facilities, as well as natural gas purchased from the commercial natural gas grid. Their analysis looked at a range of variables, including the cost of electricity and labor availability.

Toward turning a profit

In the scenarios involving methane captured from landfills and oil and gas facilities, the analysis found methanotrophic fishmeal production costs -- \$1,546 and \$1,531 per ton, respectively -- were lower than the 10-year average market price of \$1,600. For the scenario in which methane was captured from wastewater treatment plants, production costs were slightly higher -- \$1,645 per ton -- than the average market price of fishmeal. The scenario in which methane was purchased from the commercial grid led to the most expensive fishmeal production costs -- \$1,783 per ton -- due to the cost of purchasing natural gas. If efficiencies like these could bring down the production cost for a methanotroph-based fishmeal by 20 percent, the process could profitably supply total global demand for fishmeal with methane captured in the U.S. alone, according to the study. Similarly, the process could replace soybean and animal feeds if further cost reductions were achieved.

"Despite decades of trying, the energy industry has had trouble finding a good use for stranded natural gas," said study co-author Evan David Sherwin, a postdoctoral researcher in energy resources engineering at Stanford. "Once we started looking at the energy and food systems together, it became clear that we could solve at least two longstanding problems at once."

Bhumesh Lalwani

CS 2019

FACULTY'S ACHIEVEMENT

FACULTY ACHIEVEMENT

Paper entitled "***Innovative approach to prevent wormhole attack on reactive routing of vehicular ad-hoc network by using clustering and digital signatures***" has been published in inderscience journal named as International Journal Vehicle Information and Communication Systems.

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Innovative approach to prevent wormhole attack on reactive routing of vehicular ad-hoc network by using clustering and digital signatures

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Abstract: Owing to the wireless nature and dynamic topology, vehicular ad-hoc network is sensitive towards various types of assaults, in which wormhole assault is one of them. This attack disturbs the route discovery process of any routing protocol. Here, an innovative approach is proposed to prevent the wormhole attack on reactive routing such as AODV, DSR of VANET by using the clustering and digital signatures concept. In this research work, SUMO 0.32.0 and NS-3.24.1 simulators are used. The simulation results show that the proposed approach is able to prevent the wormhole assault on reactive routing in VANET. The novelty of this research work is that till now the approach based on clustering and digital signatures to prevent the wormhole assault on reactive routing in VANET, is not used. By using this proposed approach the VANET can be made more secure. The secure VANET is essential to implement the intelligent transport system.

Keywords: vehicular ad-hoc network; routing; AODV; DSR; wormhole; SUMO 0.32.0; NS-3.24.1; digital signatures.

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STUDENT'S ACHIEVEMENT

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#PlacementUpdates2021

Hard work, sincerity, dedication coupled with excellent teaching support leads to a secure future for the students. Placements are in full swing at #SRMSEngineeringInstitutions, and recently 37 #students got placed at #**Coforge**. Wishing hearty congratulations to them and special applause to the #trainingandplacementcell & Faculty for their continued support. #Placements #happyfaces #hardworkpaid



**Computer Science
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STUDENT'S ACHIEVEMENT

STUDENT ACHIEVEMENT

SRMSCET, Bareilly, heartily congratulates B. Tech. students **Mr. Nikhil Kumar Gangwar**, **Ms. Simran Saxena**, **Mr. Tushar Saxena**, **Mr. Udit Chauhan** have been finally selected by “**Nagarro**”. We’re proud of their hardwork and hope their talent and determination helps them to achieve their dreams



Computer Science & ENGINEERING