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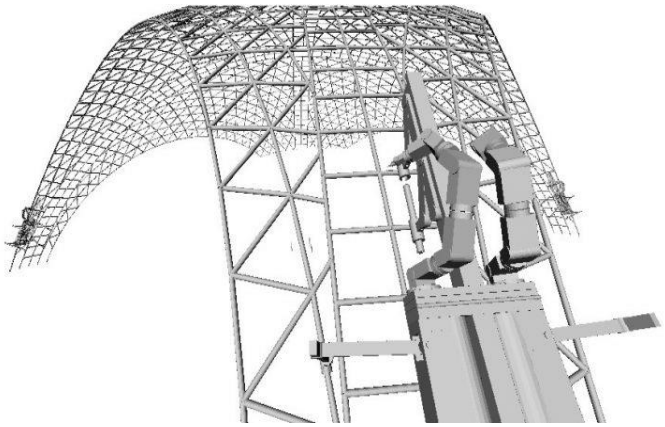
ROBOTIC TUBULAR STEEL BUILDING CONSTRUCTION

For some time robots have been put to work in factories to manufacture many of the products to use. Right now Revcad Ltd, a specialised engineering CAD software company based in the UK, look set to open a whole new chapter on robotic manufacture by developing their software to manufacture and erect spectacular tubular steel buildings.



This means huge robots that look like giant ants or termites are fitted with a car size electric battery and unleashed from their moorings to climb and build these structures. The robots are used to cut and manufacture the tubes, and then climb the structure, carrying the tubes with on-board welding equipment to actually erect the building, setting each tube steel component in place one by one.

For decades now Revcad have been developing complex geometrical software for design and manufacture in the sheet metal and construction steel industries. Their software is used around the world by many companies ranging from the small metal shops to the large corporates, often as the very basis of their business. At the same time, over this period, Revcad have often taken on major contractual challenges for clients developing software for complex mechanisms, such as the virtual design and analysis of engines and gearboxes for the automotive industry.

The main challenge to accomplish the robotic construction of buildings is the need for really intelligent software to design and drive the robots, and for these robots to have intelligence about the designs they are building. Revcad have been able to bring all their areas of expertise together to make this possible and they have now developed the software to the point of proof-of-concept so the movement of robots and all the actions necessary to manufacture and build can be virtually demonstrated. The next step is to develop the software on to achieve a build solution for their first building which they are proposing to be a building they call the Canopy or River Canopy.

The Canopy is a huge structure with a square base size of 100-200 metres or more. It looks like the base of the Eiffel Tower with four foundational legs and arches through the four sides, with its overall shape a perfect spherical cap or dome. The Canopy is designed to be a very elegant and iconic building to

enhance a city's skyline but it also has a functional purpose. It can be used as a river crossing with shops and restaurants slung beneath it, or, with the addition of a roofing layer, it can be placed in a park as a huge covered area for outdoor events such as sports or concerts, ideal for a rainy country.

What is likely to be most attractive to any developing city is that the whole build process will become a high-tech tourist attraction for the duration of the build, really enhancing the high-tech profile of the city. Then when the building is complete robots can still continue to climb and navigate the structure performing coordinated choreographed movement, such as dance, or the raising of the national flag, or even offer rides to the public if the health and safety concerns can be suitably addressed. Imagine being carried up the Empire State building by a huge robotic King Kong. The possibilities are mind boggling.

Revcad are now looking for industrial partners and investors. First to advance the software to complete the first build solution and then to construct the robots ready to put them to work on their first buildings. Once a build solution is achieved it can be repeated on different scales around the world. The builds will be quick and relatively inexpensive because robots work together continuously in a coordinated way to produce the result that has been planned down to the fine detail, including every minute robotic movement.

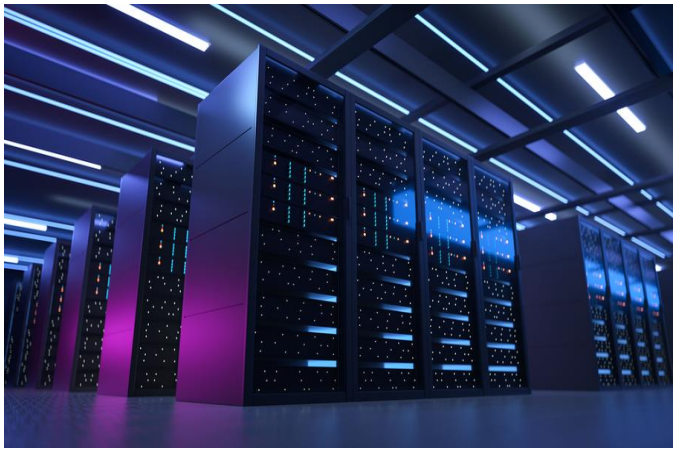
Once the foundations are set which for the Canopy has a very small ground signature, the main investment is in robotic plant. The robots assemble and disassemble their own scaffolding (also tubular steel) and the need for cranes is eliminated. This means the sky is literally the limit and many new things become possible such as a whole sports stadium built above a city with a minimum ground signature in its supporting foundation. Revcad are now actively looking for a partner in the development of this new technology, first to complete the software and then to get involved in building the robots.

R. JANANI
II B.Sc. (Computer Technology)

A NEW PROGRAMMING LANGUAGE FOR HIGH-PERFORMANCE COMPUTERS

High-performance computing is needed for an ever-growing number of tasks such as image processing or various deep learning applications on neural nets through the immense piles of data and reasonably quickly or else it could take ridiculous amounts of time. It's widely believed that, in carrying out operations of this sort, there are unavoidable trade-offs between speed and reliability. If

speed is the top priority, according to this view, then reliability will likely suffer and vice versa.



However, a team of researchers, based mainly at MIT, is calling that notion into question, claiming that one can, in fact, have it all. With the new programming language, which they've written specifically for high-performance computing, says Amanda Liu, a second-year PhD student at the MIT Computer Science and Artificial Intelligence Laboratory (CSAIL). Liu along with University of California at Berkeley postdoc Gilbert Louis Bernstein, MIT Associate Professor Adam Chlipala, and MIT Assistant Professor Jonathan Ragan-Kelley described the potential of their recently developed creation, "A Tensor Language" (ATL), last month at the Principles of Programming Languages conference in Philadelphia.

"Everything in our language," Liu says, "is aimed at producing either a single number or a tensor." Tensors, in turn, are generalizations of vectors and matrices. Whereas vectors are one-dimensional objects (often represented by individual arrows) and matrices are familiar two-dimensional arrays of numbers, tensors are *n*-dimensional arrays, which could take the form of a 3x3x3 array, for instance, or something of even higher (or lower) dimensions.

The whole point of a computer algorithm or program is to initiate a particular computation. But there can be many different ways of writing that program "a bewildering variety of different code realizations," as Liu and her co authors wrote in their soon-to-be published conference paper some considerably speedier than others. The primary rationale behind ATL is this, she explains "Given that high-performance computing is so resource-intensive, you want to be able to modify, or rewrite, programs into an optimal form in order to speed things up. One often starts with a program that is easiest to write, but that may not be the fastest way to run it, so that further adjustments are still needed."

As an example, suppose an image is represented by a 100x100 array of numbers, each corresponding to a pixel and you want to get an average value for these numbers. That could be done in a two-stage computation by first determining the average of each row and then getting the average of each column. ATL has an associated toolkit what computer scientists call a "framework" that might show

how this two-step process could be converted into a faster one-step process.

"To guarantee that this optimization is correct by using something called a proof assistant," Liu says. Toward this end, the team's new language builds upon an existing language, Coq, which contains a proof assistant. The proof assistant, in turn, has the inherent capacity to prove its assertions in a mathematically rigorous fashion.

Coq had another intrinsic feature that made it attractive to the MIT-based group: programs written in it, or adaptations of it, always terminate and cannot run forever on endless loops (as can happen with programs written in Java, for example). "To run a program to get a single answer a number or a tensor," Liu maintains. "A program that never terminates would be useless, but termination is something to get for free by making use of COQ."

The ATL project combines two of the main research interests of Ragan-Kelley and Chlipala. Ragan-Kelley has long been concerned with the optimization of algorithms in the context of high-performance computing. Chlipala, meanwhile, has focused more on the formal (as in mathematically-based) verification of algorithmic optimizations. This represents their first collaboration. Bernstein and Liu were brought into the enterprise last year and ATL is the result.

It now stands as the first and so far the only, tensor language with formally verified optimizations. Liu cautions, however, that ATL is still just a prototype albeit a promising one that's been tested on a number of small programs. In the past, optimizations of these programs have typically been done by hand, on a much more ad hoc basis, which often involves trial and error, and sometimes a good deal of error. With ATL, Liu adds, "people will be able to follow a much more principled approach to rewriting these programs and do so with greater ease and greater assurance of correctness."

G. AAKASH
I B.Sc. (Information Technology)

PROS & CONS OF ARTIFICIAL INTELLIGENCE IN MEDICINE

No matter the industry, artificial intelligence (AI) has become commonplace. When it comes to medicine, AI helps health practitioners to streamline tasks, improve operational efficiencies and simplify complex procedures. Large tech companies are investing more funding into AI healthcare innovations. For instance, Microsoft announced a five-year $40 million program in 2020 to address healthcare challenges. Although AI is doubtlessly changing the healthcare industry, this technology is still relatively new. As AI

adoption expands throughout the healthcare sector, questions about the advantages and limitations of this technology become ever more pertinent.

Role of AI in Healthcare

1. Provides Real-Time Data

A critical component of diagnosing and addressing medical issues is acquiring accurate information in a timely manner. With AI, doctors and other medical professionals can leverage immediate and precise data to expedite and optimize critical clinical decision-making. Generating more rapid and realistic results can lead to improved preventative steps, cost-savings and patient wait times. Real-time analytics can help improve physician-patient relationships. Making vital patient data available through mobile devices can engage patients in their treatments. Mobile alerts can inform doctors and nurses of urgent changes in patient statuses and emergencies.

2. Streamlines Tasks

Artificial intelligence in medicine has already changed healthcare practices everywhere. Innovations include appointment-scheduling, translating clinical details and tracking patient histories. AI is enabling healthcare facilities to streamline more tedious and meticulous tasks. For example, intelligent radiology technology is able to identify significant visual markers, saving hours of intense analysis. Other automated systems exist to automate appointment scheduling, patient tracking and care recommendations.

One specific task that is streamlined with AI is reviewing insurance. AI is used to minimize costs resulting from insurance claim denials. With AI, health providers can identify and address mistaken claims before insurance companies deny payment for them. Not only does this streamline the claims process, AI saves hospital staff the time to work through the denial and resubmit the claim.

Enabling faster payments and greater claims accuracy, hospitals can be more confident about reimbursement time frames, making them more willing to accept a larger number of insurance plans. AI essentially allows hospitals to accept a wide array of plans, benefiting potential and existing patients.

3. Saves Time and Resources

As more vital processes are automated, medical professionals have more time to assess patients and diagnose illness and ailment. AI is accelerating operations to save medical establishment precious productivity hours. In any sector, time equals money, so AI has the potential to save hefty costs.

It’s estimated around $200 billion is wasted in the healthcare industry annually. A good portion of these unnecessary costs are attributed to administrative strains such as filing, reviewing and resolving accounts. Hours

of reviewing patient history and information are traditionally needed to properly assess medical necessity. New Natural Language Processing (NLP) and Deep Learning (DL) algorithms can assist physicians in reviewing hospital cases and avoiding denials. By freeing vital productivity hours and resources, medical professionals are allotted more time to assist and interface with patients.

4.Assists Research

AI enables researchers to amass large swaths of data from various sources. The ability to draw upon a rich and growing information body allows for more effective analysis of deadly diseases. Related to real-time data, research can benefit from the wide body of information available, as long as it's easily translated.

Medical research bodies like the Childhood Cancer Data Lab are developing useful software for medical practitioners to better navigate wide collections of data. AI has also been used to assess and detect symptoms earlier in an illness's progression. Telehealth solutions are being implemented to track patient progress, recover vital diagnosis data and contribute population information to shared networks.

5. May Reduce Physician Stress

Some latest research reports over half of primary physicians feel stressed from deadline pressures and other workplace conditions. AI helps streamline procedures, automate functions, instantly share data and organize operations, all of which help relieve medical professionals of juggling too many tasks.

Yang explains, "The most significant contributor to physician burn out is patient load and the nature of the profession. However, as AI can assist with more time-intensive operations, explaining diagnoses for example, medical professionals may experience some stress alleviation."

Limits of AI in Medicine

1. **Needs Human Surveillance**

Although AI has come a long way in the medical world, human surveillance is still essential. For example, surgery robots operate logically, as opposed to empathetically. Health practitioners may notice vital behavioural observations that can help diagnose or prevent medical complications.

"AI has been around for a few decades and continues to mature. As this area advances, there is more interaction between healthcare professionals and tech experts," Yang explains. AI requires human input and review to be leveraged effectively.

As AI develops, the tech and medical fields are increasingly communicating to improve the technology. Yang adds, "Years of

education are required for medical professionals to operate in their fields. Essential information gathered from Subject Matter Experts (SMEs) enriches the data available and improves explainable AI (XAI) to provide healthcare workers with trusted and valuable insights."

2. May Overlook Social Variables

Patient needs often extend beyond immediate physical conditions. Social, economic and historical factors can play into appropriate recommendations for particular patients. For instance, an AI system may be able to allocate a patient to a particular care center based on a specific diagnosis. However, this system may not account for patient economic restrictions or other personalized preferences.

Privacy also becomes an issue when incorporating an AI system. Brands like Amazon have free reign when it comes to collecting and leveraging data. Hospitals, on the other hand, may face some set backs when attempting to channel data from Apple mobile devices, for instance. These regulatory and social restrictions may limit AI's ability to facilitate medical practices.

3. May Lead to Unemployment

Although AI may help cut costs and reduce clinician pressure, it may also render some jobs redundant. This variable may result in displaced professionals who invested time and money in healthcare education, presenting equity challenges.

A 2018 World Economic Forum report projected AI would create a net sum of 58 million jobs by 2022. However, this same study finds 75 million jobs will be displaced or destroyed by AI by the same year. The major reason for this elimination of job opportunities is, as AI is more integrated across different sectors, roles that entail repetitive tasks will be redundant.

Though AI promises to improve several aspects of healthcare and medicine, it's vital to consider the social ramifications of integrating this technology.

4. Inaccuracies Are Still Possible

Medical AI depends heavily on diagnosis data available from millions of catalogued cases. In cases where little data exists on particular illnesses, demographics, or environmental factors, a misdiagnosis is entirely possible. This factor becomes especially important when prescribing particular medicine.

Remarking on this data gap, Yang says, "No matter the system, there is always some portion of missing data. In the case with prescriptions, some information regarding certain populations and reactions to treatments may be absent. This occurrence can lead to

issues with diagnosing and treating patients belonging to certain demographics."

AI is constantly evolving and improving to account for data gaps. However, it's important to note that specific populations may still be excluded from existing domain knowledge.

5. Susceptible to Security Risks

As AI is generally dependent on data networks, AI systems are susceptible to security risks. The onset of Offensive AI, improved cyber security will be required to ensure the technology is sustainable. According to Forrester Consulting, 88% of decision-makers in the security industry are convinced offensive AI is an emerging threat.

As AI uses data to make systems smarter and more accurate, cyberattacks will incorporate AI to become smarter with each success and failure, making them more difficult to predict and prevent. Once damaging threats out-maneuver security defenses, the attacks will be much more challenging to address.

Should Artificial Intelligence be Used in Healthcare?

AI has doubtless potential to improve healthcare systems. Automating tedious tasks can free up clinician schedules to allow for more patient interfacing. Improving data accessibility assists healthcare professionals in taking the/ right steps to prevent illness. Real-time data can better and more rapidly inform diagnoses. AI is being implemented to reduce administrative errors and save vital resources. SMEs are increasingly involved in AI development, making the technology more applicable and better-informed. AI is increasingly applied to healthcare, and limits and challenges continue to be confronted and overcome. AI still requires some human surveillance, may exclude social variables, experiences gaps in population information and is susceptible to increasingly-calculated cyberattacks. Despite some of the challenges and limits AI faces, this innovative technology promises extraordinary benefits to the medical sector. Whether a patient or physician, lives everywhere are improving thanks to AI.

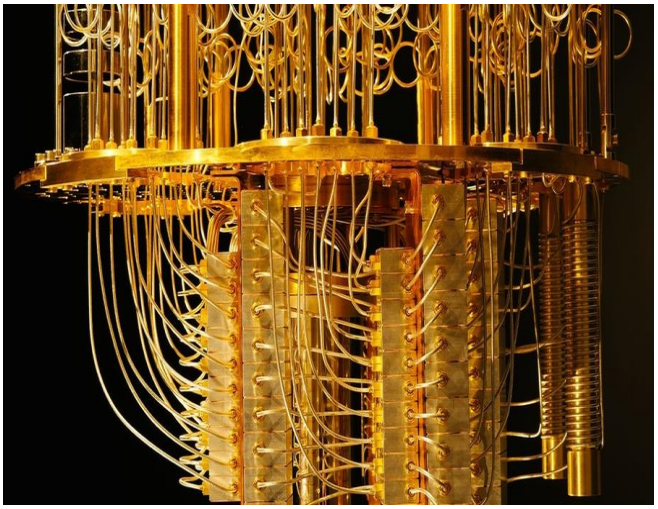
B. THARANIKA
II B.Sc. (Information Technology)

TWIST - A NEW PROGRAMMING LANGUAGE FOR QUANTUM COMPUTING

Scientists from MIT's Computer Science and Artificial Intelligence (CSAIL) have developed a new programming language for quantum computing. Called "Twist", the language is specifically aimed at addressing data entanglement issues. If adopted by the

developer community, Twist could help reduce bugs, errors and improve the quality of data.

Quantum Computing is considerably more complex than traditional computing. However, just like any computer in existence today, even quantum computers need a programing language for developers to take advantage of their capabilities. The right language could help propel the technology from being an experimental science to mainstream usage.



Quantum computers don't work well with traditional programming languages. These machines use qubits to encode information as zeros or ones, or both at the same time. Quantum computing deals primarily with "entanglement", a computational multiplier for qubits of sorts, which translates to a lot of power. Technical jargon aside, this means these computers have a lot more complex way of crunching data in a very short amount of time.

While working with qubits, quantum computers have to deal with data entanglement. MIT claims that the Twist language can describe and verify which pieces of data are entangled in a quantum program. Fortunately, Twist uses syntax that a classical programmer can understand with ease.

Twist could help bring down the complexity associated with quantum computing. It could help developers, who are proficient with mainstream programming languages, work with quantum computers without getting into the complexities of the technology.

By incorporating Twist, the runtime of programs that ran on a quantum computer increased by only four percent, claimed MIT researchers. However, the ability of the language to detect bugs and "purify" the data is far more valuable.

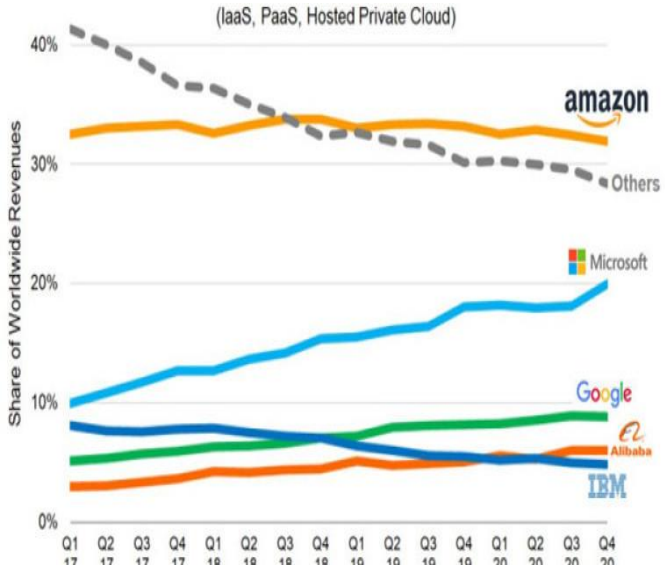
A new language is one of the many steps researchers are actively taking to bridge the gap between conventional computing and quantum computing while keeping matters simple and understandable for the average developer.

A. K. SUJA

II B.Sc. (Information Technology)

AMAZON NOW SERVES FILES AT SUB-MILLISECONDS SPEEDS

Microsoft Azure has been chipping away at Amazon's share of cloud services since its inception. While Amazon was first to the party, it can't compete with Microsoft's industry leading AD and mail services. But as the progenitor of elastic, flat file systems in the cloud, it can compete in storage and its latest announcement is bound to ruffle some feathers in Redmond.



Amazon is announcing an enormous increase in read speeds. According to an AWS blog post, EFS read operations have typically hovered in the low 1ms range, but after they "flipped the switch", read operations are now halved. Users can now expect read speeds as low as 600 micro-seconds. I'm not a scientist, but online calculators seem to indicate light can travel roughly 113 miles every 600 microseconds. This begs the question how close will you need to be to a data center to get this performance benefit? Either way, it's worth noting that this is not a new performance tier. Users of EFS will see this benefit at no extra cost.

G. CHANTHRU

II B.Sc. (Computer Technology)

NEW COMPUTER VISION SYSTEM DESIGNED TO ANALYSE CELLS IN MICROSCOPY VIDEOS

Researchers at the Universidad Carlos III de Madrid (UC3M) have developed a system based on computer vision techniques that allows automatic analysis of biomedical videos captured by microscopy in order to characterise and describe the behaviour of the cells that appear in the images.

These new techniques developed by the UC3M engineering team have been used for measurements on living tissues, in research

carried out with scientists from the National Centre for Cardiovascular Research (CNIC in its Spanish acronym). As a result, the team discovered that neutrophils (a type of immune cell) show different behaviours in the blood during inflammatory processes and have identified that one of them, caused by the FGR molecule, is associated with the development of cardiovascular disease. This work, recently published in the journal Nature, could allow the development of new treatments to minimise the consequences of heart attacks. Researchers from the Vithas Foundation, the University of Castilla-La Mancha, the Singapore Agency for Science, Technology and Research (ASTAR) and Harvard University (USA), among other centres, have participated in the study.

This new system has several advantages, according to the researchers, in terms of time and precision. Generally speaking, "it is not feasible to keep an expert biologist segmenting and tracking cells on video for months. On the other hand, to provide an approximate idea (because it depends on the number of cells and 3D volume depth), our system only takes 15 minutes to analyse a 5-minute video," says another of the researchers, Ivan González Díaz, Associate Professor in the Signal Theory and Communications Department at UC3M.

M. JEEVAGAN

II B.Sc. (Computer Technology)

STUDYING THE BIG BANG WITH ARTIFICIAL INTELLIGENCE

Artificial intelligence is being used for many extremely complex tasks. As it turns out, this is not easy, because of some special mathematical properties of particle physics. But now, a neural network has been developed that can be used to study quark gluon plasma, the state of the universe after the Big Bang.

It could hardly be more complicated: tiny particles whir around wildly with extremely high energy, countless interactions occur in the tangled mess of quantum particles, and this results in a state of matter known as "quark-gluon plasma." Immediately after the Big Bang, the entire universe was in this state; today it is produced by high-energy atomic nucleus collisions, for example at CERN.

Such processes can only be studied using high-performance computers and highly complex computer simulations whose results are difficult to evaluate. Therefore, using artificial intelligence or machine learning for this purpose seems like an obvious idea. Ordinary machine-learning algorithms, however, are not suitable for this task. The mathematical properties of particle physics require a very special structure of neural networks. At TU Wien (Vienna), it has now been shown how neural networks can be successfully used for these challenging tasks in particle physics.

Neural networks

"Simulating a quark-gluon plasma as realistically as possible requires an extremely large amount of computing time," says Dr. Andreas Ipp from the Institute for Theoretical Physics at TU Wien. "Even the largest supercomputers in the world are overwhelmed by this." It would therefore be desirable not to calculate every detail precisely, but to recognise and predict certain properties of the plasma with the help of artificial intelligence.

Therefore, neural networks are used, similar to those used for image recognition: Artificial "neurons" are linked together on the computer in a similar way to neurons in the brain and this creates a network that can recognise, for example, whether or not a cat is visible in a certain picture.

While applying this technique to the quark-gluon plasma, however, there is a serious problem: the quantum fields used to mathematically describe the particles and the forces between them can be represented in various different ways. "This is referred to as gauge symmetries," says Ipp. "The basic principle behind this is something we are familiar with: if I calibrate a measuring device differently, for example to use the Kelvin scale instead of the Celsius scale for thermometer, to get completely different numbers, even though it is describing the same physical state. It's similar with quantum theories except that there the permitted changes are mathematically much more complicated." Mathematical objects that look completely different at first glance may in fact describe the same physical state.

Gauge symmetries built into the structure of the network

“To take the gauge symmetries into account, it cannot meaningfully interpret the results of the computer simulations," says Dr.David I. Müller. "Teaching a neural network to figure out these gauge symmetries on its own would be extremely difficult. It is much better to start out by designing the structure of the neural network in such a way that the gauge symmetry is automatically taken into account so that different representations of the same physical state also produce the same signals in the neural network," says Müller. "That is exactly what to have now succeeded in doing: to developed completely new network layers that automatically take gauge invariance into account." In some test applications, it was shown that these networks can actually learn much better how to deal with the simulation data of the quark-gluon plasma.

"With such neural networks, it becomes possible to make predictions about the system for example, to estimate what the quark-gluon plasma will look like at a later point in time without really having to calculate every single intermediate step in time in detail," says

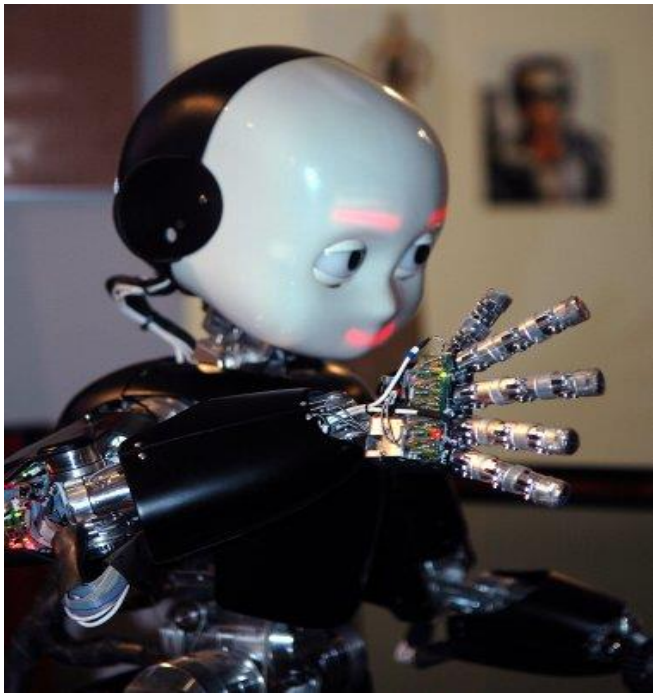
Andreas Ipp. " At the same time, it is ensured that the system only produces results that do not contradict gauge symmetry in other words, results which make sense at least in principle."

It will be some time before it is possible to fully simulate atomic core collisions at CERN with such methods but the new type of neural networks provides a completely new and promising tool for describing physical phenomena for which all other computational methods may never be powerful enough.

S.P. VISHVA
III B.Sc. (Information Technology)

HUMANOID ROBOT

A humanoid robot is a robot resembling the human body in shape. The design may be for functional purposes such as interacting with human tools and environments, for experimental purposes, such as the study of bipedal locomotion, or for other purposes. In general, humanoid robots have a torso, a head, two arms and two legs, though some humanoid robots may replicate only part of the body, for example, from the waist up. Some humanoid robots also have heads designed to replicate human facial features such as eyes and mouths. Androids are humanoid robots built to aesthetically resemble humans.



Humanoid robots are now used as research tools in several scientific areas. Researchers study the human body structure and behavior (biomechanics) to build humanoid robots. On the other side, the attempt to simulate the human body leads to a better understanding of it. Human cognition is a field of study which is focused on how humans learn from sensory information in order to acquire perceptual and motor skills. This knowledge is used to develop computational models of human behavior, and it has been improving over time.

Applications

Medical and research

Humanoid robots are a valuable resource in the world of medicine and biotechnology, as well as other fields of research such as biomechanics and cognitive

science. Humanoid robots are being used to develop complex prosthetics for individuals with physical disabilities such as missing limbs. The WABIAN-2 is a new medical humanoid robot created to help patients in the rehabilitation of their lower limbs.

Although the initial aim of humanoid research was to build better orthosis and prosthesis for human beings, knowledge has been transferred between both disciplines. A few examples are powered leg prosthesis for the neuro muscularly impaired, ankle-foot orthosis, biological realistic leg prosthesis, and forearm prosthesis.

Humanoid robots can be used as test subjects for the practice and development of personalized healthcare aids, essentially performing as robotic nurses for demographics such as the elderly. Humanoids are also suitable for some procedurally-based vocations, such as reception-desk administrators and automotive manufacturing line workers. In essence, since they can use tools and operate equipment and vehicles designed for the human form, humanoids could theoretically perform any task a human being can, so long as they have the proper software. However, the complexity of doing so is immense.

Entertainment

Humanoid robots have had a long history in the realm of entertainment, from the conception and ideas in the story of Prometheus to the application and physical build of modern animatronics used for theme parks. Current uses and development of humanoid robots in theme parks are focused on creating stuntronics. Stuntronics are humanoid robots built for serving as stunt doubles and are designed to simulate life-like, untethered, dynamic movement. Several Disney theme park shows utilize animatronic robots that look, move and speak much like human beings. Although these robots look realistic and no cognition or physical autonomy. Various humanoid robots and their possible applications in daily life are featured in an independent documentary film called Plug & Pray which was released in 2010.

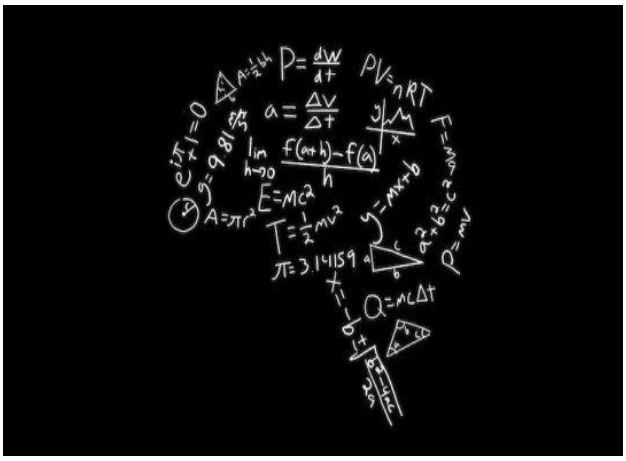
Demonstrative

Though many real-world applications for humanoid robots are unexplored, their primary use is to demonstrate up-and-coming technologies. Modern examples of humanoid robots, such as the Honda Asimo, are revealed to the public in order to demonstrate new technological advancements in motor skills, such as walking, climbing, and playing an instrument. Other humanoid robots have been developed for household purposes, however excel only in single purpose skills and are far from autonomous. Humanoid robots, especially those with artificial intelligence algorithms, could be useful for future dangerous and/or distant space exploration missions, without having the need to turn back around again and return to earth once the mission is completed.

S.BHARATH

III B.Sc. (Information Technology)

MATH NEURONS IDENTIFIED IN THE BRAIN



Most elementary school children probably already know that three apples plus two apples add up to five apples. However, what happens in the brain during such calculations is still largely unknown. The current study by the Universities of Bonn and Tübingen now sheds light on this issue.

The researchers benefited from a special feature of the Department of Epileptology at the University Hospital Bonn. It specializes in surgical procedures on the brains of people with epilepsy. In some patients, seizures always originate from the same area of the brain. In order to precisely localize this defective area, the doctors implant several electrodes into the patients. The probes can be used to precisely determine the origin of the spasm. In addition, the activity of individual neurons can be measured via the wiring.

Some neurons fire only when summing up

Five women and four men participated in the current study. The electrodes implanted in the so-called temporal lobe of the brain to record the activity of nerve cells. Meanwhile, the participants had to perform simple arithmetic tasks. "To found that different neurons fired during additions than during subtractions," explains Prof. Florian Mormann from the Department of Epileptology at the University Hospital Bonn.

It was not the case that some neurons responded only to a "+" sign and others only to a "-" sign: "Even when to replaced the mathematical symbols with words, the effect remained the same," explains Esther Kutter, who is doing her doctorate in Prof. Mormann's research group. "For example, when subjects were asked to calculate '5 and 3', their addition neurons sprang back into action; whereas for '7 less 4,' their subtraction neurons did."

This shows that the cells discovered actually encode a mathematical instruction for action. The brain activity thus showed with great accuracy what kind of tasks the test subjects were currently calculating: The researchers fed the cells' activity patterns into a self-learning computer program. At the

same time, they told the software whether the subjects were currently calculating a sum or a difference. When the algorithm was confronted with new activity data after this training phase, it was able to accurately identify during which computational operation it had been recorded.

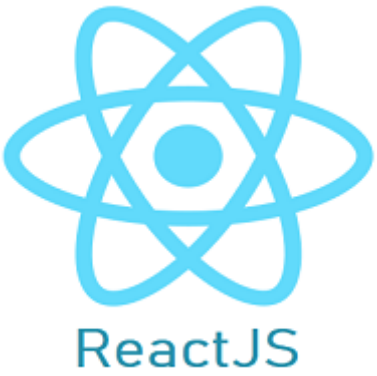
Prof. Andreas Nieder from the University of Tübingen supervised the study together with Prof. Mormann. "We know from experiments with monkeys that neurons specific to certain computational rules also exist in their brains," he says. "In humans, however, there is hardly any data in this regard." During their analysis, the two working groups came across an interesting phenomenon: One of the brain regions studied was the so-called parahippocampal cortex. There, too, the researchers found nerve cells that fired specifically during addition or subtraction. However, when summing up, different addition neurons became alternately active during one and the same arithmetic task. Figuratively speaking, it is as if the plus key on the calculator were constantly changing its location. It was the same with subtraction. Researchers also refer to this as "dynamic coding."

"This study marks an important step towards a better understanding of one of our most important symbolic abilities, namely calculating with numbers," stresses Mormann. The two teams from Bonn and Tübingen now want to investigate exactly what role the nerve cells found play in this.

M.HEMASRI
III B.Sc. (Information Technology)

ReactJS

ReactJS tutorial provides basic and advanced concepts of ReactJS. Currently, ReactJS is one of the most popular JavaScript front-end libraries which has a strong foundation and a large community.



ReactJS is a declarative**,** efficient and flexible JavaScript library for building reusable UI components. It is an open-source, component-based front end library which is responsible only for the view layer of the application. It was initially developed and maintained by Facebook and later used in its products like WhatsApp & Instagram.

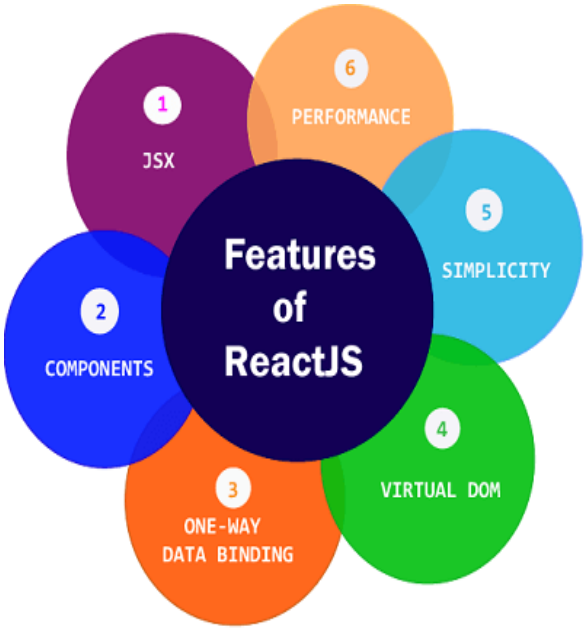
Importance of ReactJS?

The main objective of ReactJS is to develop User Interfaces (UI) that improves the speed of the apps. It uses virtual DOM (JavaScript object), which improves the

performance of the app. The JavaScript virtual DOM is faster than the regular DOM. To use ReactJS on the client and server-side as well as with other frameworks. It uses component and data patterns that improve readability and helps to maintain larger apps.

React Features

Currently, ReactJS gaining quick popularity as the best JavaScript framework among web developers. It is playing an essential role in the front-end ecosystem.



The important features of ReactJS are:

- JSX
- Components
- One-way Data Binding
- Virtual DOM
- Simplicity
- Performance

JSX

JSX stands for JavaScript XML. It is a JavaScript syntax extension. Its an XML or HTML like syntax used by ReactJS. This syntax is processed into JavaScript calls of React Framework. It extends the ES6 so that HTML like text can co-exist with JavaScript react code. It is not necessary to use JSX, but it is recommended to use in ReactJS.

Components

ReactJS is all about components. ReactJS application is made up of multiple components and each component has its own logic and controls. These components can be reusable which help you to maintain the code when working on larger scale projects.

K. GOWTHAM

III B.Sc. (Computer Technology)

HOW EYE IMAGING TECHNOLOGY HELP ROBOTS AND CARS

Using lessons learned from the eye-imaging technology optical coherence tomography (OCT), engineers have demonstrated a LiDAR system that is fast and accurate enough to potentially improve the vision of autonomous systems such as

driverless cars and robotic manufacturing plants.

Even though robots don't have eyes with retinas, the key to helping them see and interact with the world more naturally and safely may rest in optical coherence tomography (OCT) machines commonly found in the offices of ophthalmologists.

One of the imaging technologies that many robotics companies are integrating into their sensor packages is Light Detection and Ranging, or LiDAR for short. Currently commanding great attention and investment from self-driving car developers, the approach essentially works like radar, but instead of sending out broad radio waves and looking for reflections, it uses short pulses of light from lasers.

Traditional time-of-flight LiDAR, however, has many drawbacks that make it difficult to use in many 3D vision applications. Because it requires detection of very weak reflected light signals, other LiDAR systems or even ambient sunlight can easily overwhelm the detector. It also has limited depth resolution and can take a dangerously long time to densely scan a large area such as a highway or factory floor. To tackle these challenges, researchers are turning to a form of LiDAR called frequency-modulated continuous wave (FMCW) LiDAR.

"FMCW LiDAR shares the same working principle as OCT which the biomedical engineering field has been developing since the early 1990s," said Ruobing Qian, a PhD student working in the laboratory of Joseph Izatt, the Michael J. Fitzpatrick Distinguished Professor of Biomedical Engineering at Duke. "But 30 years ago, nobody knew autonomous cars or robots would be a thing, so the technology focused on tissue imaging. Now, to make it useful for these other emerging fields, we need to trade in its extremely high resolution capabilities for more distance and speed."

OCT is the optical analogue of ultrasound which works by sending sound waves into objects and measuring how long to take to come back. To time the light waves return times, OCT devices measure how much the phase has shifted compared to identical light waves that have travelled the same distance but have not interacted with another object.

FMCW LiDAR takes a similar approach with a few tweaks. The technology sends out a laser beam that continually shifts between different frequencies. When the detector gathers light to measure its reflection time, it can distinguish between the specific frequency pattern and any other light source, allowing it to work in all kinds of lighting conditions with very high speed. It then measures any phase shift against unimpeded beams, which is a much more accurate way to determine distance than current LiDAR systems.

While OCT devices are used to profile microscopic structures up to several millimeters deep within an object, robotic 3D vision systems only need to locate the surfaces of human-scale objects. To accomplish this, the researchers narrowed the range of frequencies used by OCT, and only looked for the peak signal generated from the surfaces of objects. This costs the system a little bit of resolution, but with much greater imaging range and speed than traditional LiDAR.

The result is an FMCW LiDAR system that achieves sub millimeter localization accuracy with data-throughput 25 times greater than previous demonstrations. The results show that the approach is fast and accurate enough to capture the details of moving human body parts such as a nodding head or a clenching hand in real-time.

K. GOWTHAM

III B.Sc. (Computer Technology)

TECHNICAL QUESTIONS

1. From which company Steve Jobs took the idea for the graphical user interface with a mouse?

   i) Xerox

   ii) Microsoft

   iii) Amiga

   iv) IBM

2. When was the first electronic computer created and what is its name?

   i) in 1945 - Eniac

   ii) in 1943 - Colossus

   iii) in 1939 - Atanasoff-Berry ABC

   iv) in 1941 - Zuse's Z3 machine

3. What type of printers are typically used in cash registers?

   i) Inkjet printer

   ii) Thermal transfer printer

   iii) Thermal printer

   iv) Laser printer

4. What material is computer's processor made of?

   i) single crystal ruby

   ii) single crystal silicon

   iii) silicon polycrystal

   iv) pyrite crystal

5. Ubuntu is the most popular Linux distribution, developed by Canonical Software owned by Mark Shuttleworth. What else is Mark famous for?

   i) being a movie star

   ii) being an Olympic games attendant

   iii) being an astronaut

   iv) owning a submarine

6. Which large IT company doesn't have its headquarters in the Silicon Valley?

   i) IBM

   ii) AMD

   iii) Google

   iv) Apple

7. What was the first computer virus in the DOS system?

   i) Melissa virus

   ii) Storm Worm virus

   iii) I Love You virus

   iv) Brain virus

8. Who is the forerunner of virtual reality?

   i) Wang Ganchang

   ii) Palmer Luckey

   iii) Jules Verne

   iv) Myron Krueger

9. When was the first e-mail message sent?

   i) 2001

   ii) 1991

   iii) 1981

   iv) 1971

10. Who is credited as the first computer programmer?

    i) Ada Lovelace

    ii) Charles Babbage

    iii) Herman Hollerith

    iv) Konrad Zuse

11. The first text message (SMS) in history had content ...

    i) "best wishes "

    ii) "happy New Year"

    iii) "hello"

    iv) "**merry Christmas"**

12. Where does the symbol @ come from?

    i) from Arabic

    ii) from Greek

    iii) from Latin

    iv) this symbol was created for the needs of e-mail

13. The first PDA compatible with PCs from 1989. How long did it work on batteries?

    i) 20 minutes

    ii) 2 hours

    iii) 20 hours

    iv) 2 weeks

14. In case of fiber-optic cables, which transmission mode is used for transmitting data over long distances?

    i) Infrared

    ii) Multimode

    iii) Radio

    iv) Single mode

15. A robot's "arm" is also known as its

    i) End effector

    ii) Actuator

    iii) Manipulator

    iv) Servomechanism

G. GOWRI

III B.Sc. (Computer Technology)

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EVERYONE SHOULD HAVE THE OPPORTUNITY TO LEARN COMPUTER SCIENCE AT SCHOOL AND BEYOND

- SUNDAR PICHAI