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NEW NEURAL NETWORK DIFFERENTIATES MIDDLE AND LATE STONE AGE TOOLKITS

The change from Middle Stone Age (MSA) to Later Stone Age (LSA) marks a major cultural change amongst our hunter-gatherer ancestors, but distinguishing between these two industrial complexes is not straightforward. New research demonstrates how machine learning can provide a valuable tool for archaeologists and identify what differentiates the MSA and LSA.

MSA toolkits first appear some 300 thousand years ago, at the same time as the earliest fossils of Homo sapiens, and are still in use 30 thousand years ago. However, from 67 thousand years ago, changes in stone tool production indicate a marked shift in behaviour, the new toolkits that emerge are labelled LSA and remained in use into the recent past. A growing body of evidence suggests that the transition from MSA to LSA was not a linear process, but occurred at different times in different places. Understanding this process is important to examine what drives cultural innovation and creativity, and what explains this critical behavioural change. Defining differences between the MSA and LSA is an important step towards this goal.

"Eastern Africa is a key region to examine this major cultural change, not only because it hosts some of the youngest MSA sites and some of the oldest LSA sites, but also because the large number of well excavated and dated sites make it ideal for research using quantitative methods," says Dr. Jimbob Blinkhorn, an archaeologist from the Pan African Evolution Research Group, Max Planck Institute for the Science of Human History and the Centre for Quaternary Research, Department of Geography, Royal Holloway. "This enabled us to pull together a substantial database of changing patterns of stone tool production and use, spanning 130 to 12 thousand years ago, to examine the MSA-LSA transition."

The study examines the presence or absence of 16 alternate tool types across 92 stone tool assemblages, but rather than focusing on them individually, emphasis is placed on the constellations of tool forms that frequently occur together. "We've employed an Artificial Neural Network (ANN) approach to train and test models that differentiate LSA assemblages from MSA assemblages, as well as examining chronological differences between older (130-71 thousand years ago) and younger (71-28 thousand years ago) MSA assemblages with a 94% success rate," says Dr. Matt Grove, an archaeologist at the University of Liverpool.

Artificial Neural Networks (ANNs) are computer models intended to mimic the salient features of information processing in the brain. Like the brain, their considerable processing power arises not from the complexity of any single unit but from the action of many simple units acting in parallel. Despite the widespread use of ANNs today, applications in archaeological research remain limited. "ANNs have sometimes been described as a 'black box' approach, as even when they are highly successful, it may not always be clear exactly why," says Grove. "We employed a simulation approach that breaks open this black box to understand which inputs have a significant impact on the results. This enabled us to identify how patterns of stone tool assemblage composition vary between the MSA and LSA, and we hope this demonstrates how such methods can be used more widely in archaeological research in the future."

"The results of our study show that MSA and LSA assemblages can be differentiated based on the constellation of artefact types found within an assemblage alone," Blinkhorn adds. "The combined occurrence of backed pieces, blade and bipolar technologies together with the combined absence of core tools, Levallois flake technology, point technology and scrapers robustly identifies LSA assemblages, with the opposite pattern identifying MSA assemblages. Significantly, this provides quantified support to qualitative differences noted by earlier researchers that key typological changes do occur with this cultural transition."

The team plans to expand the use of these methods to dig deeper into different regional trajectories of cultural change in the African Stone Age. "The approach we've employed offers a powerful toolkit to examine the categories we use to describe the archaeological record and to help us examine and explain cultural change amongst our ancestors," says Blinkhorn.

S.T.SANTHOSH
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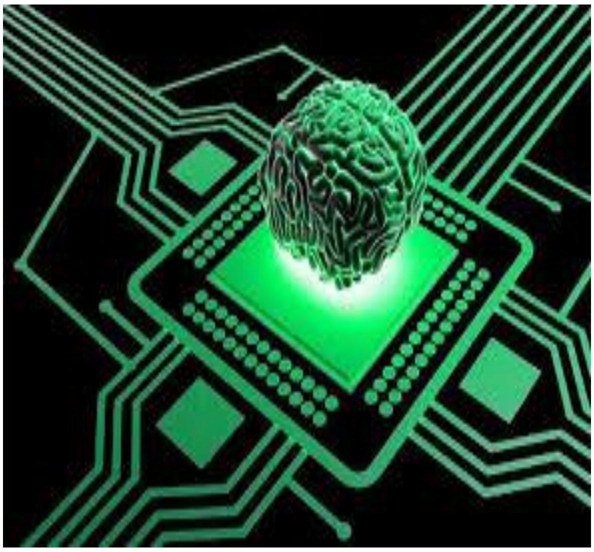
BRAIN-ON-A-CHIP

Engineers put tens of thousands of artificial brain synapses on a single chip. The design could advance the development of small, portable AI devices. Engineers have designed a 'brain-on-a-chip,' smaller than a piece of confetti, that is made from tens of thousands of artificial brain synapses known as memristors silicon-based components that mimic the information-transmitting synapses in the human brain.



The researchers borrowed from principles of metallurgy to fabricate each memristor from alloys of silver and copper along with silicon. When they ran the chip through several visual tasks, the chip was able to "remember" stored images and reproduce them many times over, in versions that were crisper and cleaner compared with existing memristor designs made with unalloyed elements. Their results, published in the journal Nature Nanotechnology, demonstrate a promising new memristor design for neuromorphic devices electronics that are based on a new type of circuit that processes information in a way that mimics the brain's neural architecture. Such brain-inspired circuits could be built into small, portable devices, and would carry out complex computational tasks that only today's supercomputers can handle.

Wandering ions

Memristors, or memory transistors, are an essential element in neuromorphic computing. In a neuromorphic device, a memristor would serve as the transistor in a circuit, though its workings would more closely resemble a brain synapse, the junction between two neurons. The synapse receives signals from one neuron, in the form of ions, and sends a corresponding signal to the next neuron.

A transistor in a conventional circuit transmits information by switching between one of only two values, 0 and 1, and doing so only when the signal it receives, in the form of an electric current, is of a particular strength. In contrast, a memristor would work along a gradient, much like a synapse in the brain. The signal it produces would vary depending on the strength of the signal that it receives. This would enable a single memristor to have many values, and therefore carry out a far wider range of operations than binary transistors.

Like a brain synapse, a memristor would also be able to "remember" the value associated with a given current strength, and produce the exact same signal the next time it receives a similar current. This could ensure that the answer to a complex equation, or the visual classification of an object, is reliable a feat that normally involves multiple transistors and capacitors. Ultimately, scientists envision that memristors would require far less chip real estate than conventional transistors, enabling powerful, portable computing devices that do not rely on supercomputers, or even connections to the Internet.

Existing memristor designs, however, are limited in their performance. A single memristor is made of a positive and negative electrode, separated by a "switching medium," or space between the electrodes. When a voltage is applied to one electrode, ions from that electrode flow through the medium, forming a "conduction channel" to the other electrode. The received ions make up the electrical signal that the memristor transmits through the circuit. The size of the ion channel (and the signal that the memristor ultimately produces) should be proportional to the strength of the stimulating voltage.

The thinner a conduction channel, and the lighter the flow of ions from one electrode to the other, the harder it is for individual ions to stay together. Instead, they tend to wander from the group, disbanding within the medium. As a result, it's difficult for the receiving electrode to reliably capture the same number of ions, and therefore transmit the same signal, when stimulated with a certain low range of current.

Borrowing from metallurgy

Kim and his colleagues found a way around this limitation by borrowing a technique from metallurgy, the science of melding metals into alloys and studying their combined properties. "Traditionally, metallurgists try to add different atoms into a bulk matrix to strengthen materials, and we thought, why not tweak the atomic interactions in our memristor, and add some alloying element to control the movement of ions in our medium," Kim says.

Engineers typically use silver as the material for a memristor's positive electrode. Kim's team looked through the literature to find an element that they could combine with silver to effectively hold silver ions together, while allowing them to flow quickly through to the other electrode. The team landed on copper as the ideal alloying element, as it is able to bind both with silver, and with silicon. "It acts as a sort of bridge, and stabilizes the silver-silicon interface," Kim says. To make memristors using their new alloy, the group first fabricated a negative electrode out of silicon, then made a positive electrode by depositing a slight amount of copper, followed by a layer of silver. They sandwiched the two electrodes around an amorphous silicon medium. In this way, they patterned a millimeter-square silicon chip with tens of thousands of memristors.

As a first test of the chip, they recreated a gray-scale image of the Captain America shield. They equated each pixel in the image to a corresponding memristor in the chip. They then modulated the conductance of each memristor that was relative in strength to the color in the corresponding pixel. The chip produced the same crisp image of the shield, and was able to "remember" the image and reproduce it many times, compared with chips made of other materials.

P. VIJAYA SHREE
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E-ESTONIA: THE WORLD'S MOST ADVANCED DIGITAL SOCIETY

Estonia is a small country in Northern Europe. Due to its quiet and pacific nature, the Baltic nation does not often get too much attention. However, Estonia is by far the most advanced digital society on the planet. Geographically, Estonia is surrounded by the Baltic Sea and Gulf of Finland. It is one of the Baltic countries, together with Lithuania and Latvia.

Not everyone knows that the Skype software was created by three Estonian software developers after the company was founded in 2003 by Swedish technology investor and entrepreneur NiklasZennström and Danish entrepreneur Janus Friis. Microsoft bought Skype in 2011. From the total of employees working at Skype, 44 percent are based in Tallinn and Tartu. Tallinn has been dubbed the Silicon Valley of Europe due to having the continent's highest number of tech start ups.

According to UNESCO, Estonia has 99.8 percent of adult literacy rate, one of the highest in the world with only Latvia and North Korea being higher. A nation's advancement can also be measured by the way governments treat their citizens. As mentioned earlier, public transport is completely free for all residents in Tallinn; and to get access to all public transport available residents of the Estonian capital only have to show their electronic ID card.

Estonia is a pioneer in digital initiatives. The Estonian government-initiated Artificial Intelligence strategy counts with over 20 machine learning-based solutions live in the Estonian public sector. In Estonia, citizens are always the owners of their own data. None of this comes as a surprise in a country which has been recognized as the most advanced digital society in the world by so many.

The Estonian government believes and demonstrates that developing e-solutions is not just a matter of adding a digital layer but rather changing everything. The road map towards today's digital society began back in the year 1994. For the last 26 years, Estonia has never stopped innovating and using state-of-the-art technology to build its ambitious future. To understand how Estonia built the advanced digital society it is today, it is necessary to have a look at the visionary steps the country followed.

First draft of Principles of Estonian Information Policy

In 1994, the first draft of Principles of Estonian Information Policy was created. The strategic outline for IT development was ratified by the Estonian Parliament four years later. It was established that information technology (IT) was essential to solving the challenges facing society due to politically turbulent times. This resulted in one percent of the GDP earmarked as stable state funding for IT.

Launch of the Tiger Leap initiative

In 1996, the Tiger Leap country-wide IT infrastructure development initiative was launched. The challenge was to update local IT infrastructure and establish computer skills as a priority in schools. As a result of this initiative, 90 percent of the population uses the Internet regularly today and Estonia ranks first in the Digital Development Index.

First e-Banking service

In 1996, Estonian private banks developed the first online banking solutions. The low population density signifies a challenge, meaning high cost for a nationwide network of bank o-ices. Today, the early development of high-quality e-Banking services encouraged people to get online, to embrace government e-solutions, and to use e-ID.

e-Cabinet meeting

In 2000, the database and scheduler for streaming governmental decision-making processes were introduced. The challenge is to reduce government bureaucracy, making e-solutions part of decision-making. This resulted in the average length of cabinet meetings of the Estonian government being cut from 4-5 hours to as little as 30 minutes.

e-Tax board

Also in the year 2000, Estonia created the online tax declaration. The challenge was to maximize the state tax revenue to support the growing needs of the developing society. Now, 20 years later, declaring taxes online takes about three minutes; and 98 percent of the population in Estonia declare their income electronically.

m-Parking

It was the year 2000, too, when a system that enables drivers to pay for city parking via mobile phone was created. The innovative m-Parking system was intended to manage growing traffic in densely populated urban areas, creating a modern low-cost parking infrastructure. Today, 90 percent of parking fees are paid via mobile phones. Estonia's m-Parking solution has been adopted in other countries around the world.

X-Road

In 2001, Estonia developed a distributed data exchange layer for registers and information systems. There were limited resources to create a national integration platform, which represented a challenge, as well as ballooning data exchange costs and public data leaks from existing unsecure databases. With hard work and perseverance, the X-Road has become the backbone of e-Estonia, allowing the nation's public and private sector information systems to link up and operate in full harmony. Today, 99 percent of all public services in Estonia are accessible online 24/7.

e-ID and digital signature

In 2002, the logical next step was to create a digital identification system based on the mandatory ID card. This would allow citizens to securely identify residence using public and private e-services. Estonian residents using smart-ID have increased from 140,276 in 2017 to 463,559 in 2019, representing 99 percent of the population, from which 67 percent use their ID card regularly. The electronic ID is used to access 99 percent of state services that are online and 2,773 services that can be used via X-Road. Digital signatures save 2 percent of GDP annually.

i-Voting

In 2005, Estonia became the first country in the world to adopt online voting in order to maximize accessibility to local and general elections. The challenge was to overcome politically turbulent times, establishing IT as essential to solving the challenges society was facing. Today, one-third of the votes in parliamentary elections are cast online; votes are cast from over 110 countries where Estonian nationals reside or are visiting at the time of elections.

Cyber security

In 2007, Estonia concerted all its efforts to enhance IT security. The challenge came after Estonia was hit by the largest organized cyber attack against a single country in April 2007. International cooperation was needed in order to contain this new thread. As a result, of the nation's cyber security efforts, Estonia has become one of the leading nations in cyber security. Both the NATO Cooperative Cyber

Defence Center of Excellence and the EU IT Agency are located in Tallinn.

Blockchain technology

In 2008, Estonian cryptographers developed the scalable block chain technology KSI aimed at mitigating threats of insider data manipulation in Estonia's registries. This development was created following the cyber attacks in 2007. As a result of this initiative, Estonia has become a pioneer of block chain technology. Several government registries are backed by the KSI block chain.

e-Health

In 2008, Estonia created a nationwide system integrating data from the country's healthcare providers. This would improve the quality and efficiency of healthcare provided under public health insurance. The electronic health record (EHR) has created a comprehensive profile of each patient, reducing bureaucracy and giving access to time-critical information in emergency situations; therefore, saving countless lives.

e-Prescription

In 2010, to complement the e-Health system, Estonia created a centralized paperless system for issuing and handling medical prescriptions. The e-prescription system aimed at minimizing paperwork for prescribing and dispensing medical drugs. Today, 99 percent of medical prescriptions in Estonia are handled online; routine refills can be issued without appointments.

Public services green paper

2013 was the year for mapping challenges and solutions for developing state e-services. The challenge was to address the e-state's shortcomings at the time in order to assure its sustainability and future development. The result was a better understanding of the public's needs and the clear definition of goals and principles for the development of e-services.

Road administration's e-Portal

2014 was the time to create a one-stop online service for drivers and owners of vehicles. The service was created for simplifying and reducing the costs of the Road Administration's service provision. Today, the e-portal provides services six times faster, 20 percent cheaper, and increases transparency.

e-Residency

2014 was the year Estonia created the world's first borderless digital society for any global citizen to join. This was a true innovation showing full understanding of the benefits a digital society can bring not only to Estonia but to every citizen in the world who understands what it means to live in the 21st century. The e-Residency was a way of finding new and innovative paths for attracting international business and talent to Estonia. The e-Residency is the first digital nation for global citizens. The number of e-residents and their businesses is steadily increasing.

World's first data embassy

In 2015, Estonia created the world's first data embassy outside its borders. The challenge was to assure the digital continuity of Estonia and its statehood in worse-case scenarios such as critical system failures or external threats. Estonia is the first country in the cloud. The country's critical databases and services are backed up in a high-security data center in Luxembourg.

NIIS X-Road consortium

2017 marked the year of the creation of the Nordic Institute for Interoperability Solutions (NIIS), which ensures the development and strategic management of X-Road and other e-government solutions. The challenge was to ensure the interoperability of e-governance solutions and platforms both nationally and internationally. Founded by Estonia and Finland, the NIIS is a pioneer of cross-border e-governance solutions with the intent of providing better content and services for the public.

Seamless Services roadmap

In 2018, the first Seamless Service went live. The challenge for Estonia was to reduce bureaucracy and human resources to manage essential routine state services. Seamless Services are proactive government services that react to life events requiring minimal bureaucracy. Seamless Services provide a more natural relationship with the state.

Government AI strategy

In 2019, the Estonian government outlined the current and future usage of Artificial Intelligence (AI) in government and private services. The main challenge was to create the legal and strategic framework for accelerating AI development and making Estonia a trailblazer in this emerging field. The creation of the AI strategy resulted in a detailed strategic plan for promoting the implementation of AI solutions in the public and private sectors.

P. VIJAYA SHREE
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SPOT THE ROBOT DOG TO MEASURE COVID-19 PATIENTS' VITALS

Health care workers are coming face to face with the COVID-19 virus regularly by being in close contact with patients, or people potentially contagious. The plan is to minimize any potential contagious contact between patients and health care workers.

Health care workers are coming face to face with the COVID-19 virus regularly by being in close contact with patients, or people potentially contagious. The plan is to minimize any potential contagious contact between patients and health care workers.

A team of MIT and Brigham and Women's Hospital researchers is looking to reduce that contact by using robots that can take patients' vitals and send the results directly to a remote doctor. The robots are also able to carry a tablet that can assist a virtual doctor to ask direct questions to the patient in another room.

Spot the dog

The team's robot is none other than the infamous Spot the robot dog, originally built by Boston Dynamics. This COVID-19-assisting version of Spot was first introduced in April this year, and has since gone through some updates and tweaks. Now, he's almost ready to rumble. "In robotics, one of our goals is to use automation and robotic technology to remove people from dangerous jobs," explained Henwei Huang, an MIT postdoc. "We thought it should be possible for us to use a robot to remove the health care worker from the risk of directly exposing themselves to the patient."

The robot can measure skin temperature, breathing rate, pulse rate, and blood oxygen saturation from two meters away something rather useful right now. So far, the robot health care assistant has only been tested measuring healthy people, and the plan is to now test patients with COVID-19 symptoms.

The robot is easy to use and keeps health care workers safe. Spot can be maneuvered to move towards patients thanks to a handheld controller. An infrared camera and three monochrome ones function thanks to an algorithm developed by the researchers. The algorithm enables the infrared camera to measure elevated skin temperature and breathing rate.

The plan at the moment is to use Boston Dynamics' updated Spot robot dog to work in triage centers, where patients are tested to see whether they do, in fact, have COVID-19. Moving down the line, the researchers explained that they hope the robot can be used in hospital bedrooms, in order to help doctors and nurses monitor patients from a safe distance.

A.TAMILHARIHARAN
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SMART GAMING GLOVE CAN MERGE HUMANS WITH MACHINES

Gamers have long dreamed of a truly immersive way of controlling their games with just hand gestures. And although gaming gloves have been around for a while, they haven't been very practical. a new team from the National University of Singapore (NUS) has created a smart glove called 'InfinityGlove' that overcomes current problems with weight and flexibility by weaving ultra-thin, highly sensitive micro fibre sensors into the material of the gloves.

This then allows users of the device to recreate a multitude of in-game controls with simple hand gestures. "We were very much inspired by the need to remotely control tasks with just hand gestures," said Professor Lim Chwee Teck, Director of the NUS Institute for Health Innovation & Technology. "Current commercially available technology is not very responsive and causes a strain on the user's hands after prolonged use due to their bulky setup. We envision that gesture-based control using our lightweight smart gloves can bring us one step closer to a truly immersive interface between humans and machines."

Each InfinityGlove is equipped with five thread-like sensors, one for each finger. These sensors interact with game software to generate three-dimensional (3D) positions of a moving hand. These positions are then mapped to specific controller inputs. With just a total of 11 inputs mapped, the team has successfully played games such as Battlefield V.

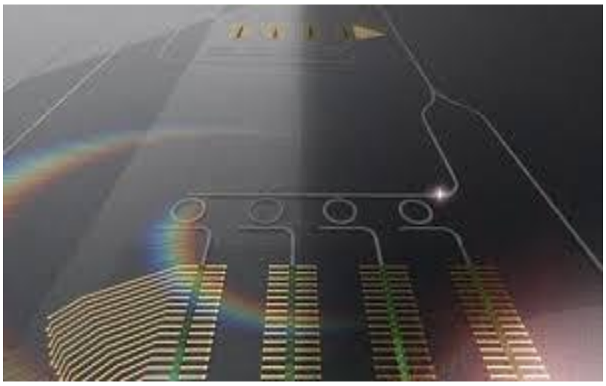
But the InfinityGlove is not limited to gaming. The device can be used in hand rehabilitation. The glove can be used in gaming for rehabilitation which motivates patients to stick to their hand exercise regimes through an immersive gaming experience. In addition, healthcare professionals can use the glove to track their patients' hand gesturing progress. And the NUS team has ambitious goals for its device. The team wants to integrate its glove into the realms of virtual reality, complex gaming, and robotic control.

D.KRISHNAKUMAR
II B.Sc. INFORMATION TECHNOLOGY

PHOTON-BASED PROCESSING UNITS ENABLE MORE COMPLEX MACHINE LEARNING

Machine learning performed by neural networks is a popular approach to developing artificial intelligence, as researchers aim to replicate brain functionalities for a variety of applications. A paper proposes a new approach to perform computations required by a neural network, using light instead of electricity. In this approach, a photonic tensor core performs multiplications of matrices in parallel, improving speed and efficiency of current deep learning paradigms.

In machine learning, neural networks are trained to learn to perform unsupervised decision and classification on unseen data. Once a neural network is trained on data, it can produce an inference to recognize and classify objects and patterns and find a signature within the data. The photonic TPU stores and processes data in parallel, featuring an electro-optical interconnect, which allows the optical memory to be efficiently read and written and the photonic TPU to interface with other architectures.



Most neural networks unravel multiple layers of interconnected neurons aiming to mimic the human brain. An efficient way to represent these networks is a composite function that multiplies matrices and vectors together. This representation allows the performance of parallel operations through architectures specialized in vectorized operations such as matrix multiplication. However, the more intelligent the task and the higher accuracy of the prediction desired, the more complex the network becomes. Such networks demand larger amounts of data for computation and more power to process that data.

Current digital processors suitable for deep learning, such as graphics processing units or tensor processing units, are limited in performing more complex operations with greater accuracy by the power required to do so and by the slow transmission of electronic data between the processor and the memory. The researchers showed that the performance of their TPU could be 2-3 orders higher than an electrical TPU. Photons may also be an ideal match for computing node-distributed networks and engines performing intelligent tasks with high throughput at the edge of a networks, such as 5G. At network edges, data signals may already exist in the form of photons from surveillance cameras, optical sensors and other sources.

GANs or Generative Adversarial Networks

GANs, or Generative Adversarial Networks is one of the latest developments in neural networks could be the future. Invented by Ian Goodfellow, this class of machine learning basically sets two neural networks against each other to solve a problem. Given a set starting condition, the two networks battle it out in a usually non-zero sum game to find a solution to something. These have been described by some as the coolest idea in machine learning in the last twenty years. Applications for this technology include generating artificial images, modelling things, improving computer games and many more.

S.AISWARYA
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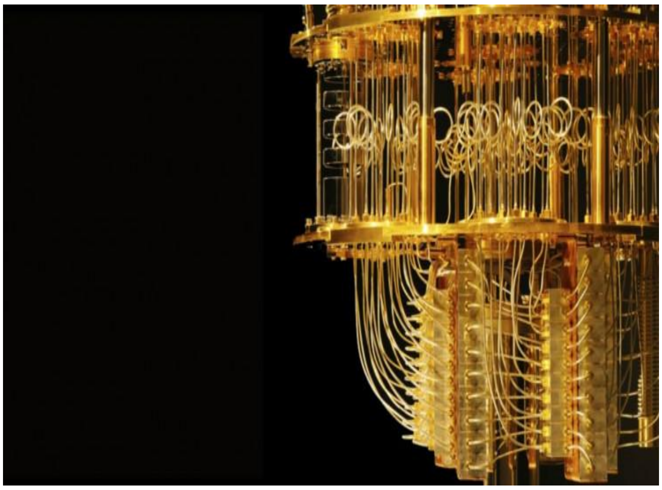
THE WORLD'S FIRST QUANTUM PHASE BATTERY

The battery, which represents a big step in quantum computing, consists of an indium arsenide nanowire in contact with aluminum superconducting leads.

Quantum versus classical batteries

Batteries are ubiquitous in our everyday lives, with lithium-ion batteries being the most commonly used type though interesting alternatives are, in fact, in development. The quantum phase battery is a different beast altogether. While classical batteries convert chemical energy into voltage, which powers electronic circuits, quantum technologies use circuits or devices based on superconducting materials.

In superconducting materials, currents flow without the need for an applied voltage. Therefore, when it comes to quantum computers, there is no need for a classical battery. Supercurrents get their name from the fact that they do not exhibit any energy losses. They are induced from a phase difference of the wave function of the quantum circuit, rather than from a voltage. This means that a quantum device able to provide a persistent phase difference can be seen as a quantum phase battery, which induces supercurrents in a quantum circuit.



Building a functioning quantum phase battery

Francesco Giazotto and Elia Strambini from the NEST-CNR Institute, Pisa have built. They built on the work of Sebastian Bergeret and Ilya Tokatly, both Donostia international Physics Center (DIPC) associate researchers, who devised the idea of a quantum phase battery in 2015.Bergeret and Tokatly's idea consisted in a combination of superconducting, and magnetic materials with an intrinsic relativistic effect, called spin-orbit coupling. Giazotto and Strambini's contribution was to identify a suitable material combination that allowed them to fabricate the first quantum phase battery. Their results are now published in the journal Nature Nanotechnology.

Their quantum phase battery consists of an n-doped In as nanowire forming the core of the battery (the pile) and Al superconducting leads as poles. It is charged by applying an external magnetic field, which then can be switched off. Cristina Sanz-Fernández and Claudio Guarcello, also from CFM, adapted the theory to simulate the experimental findings.

The battery is being further developed and improved at CFM premises in collaboration between the Nanophysics Lab and the Mesoscopic Physics Group. These advances could contribute to enormous advances that many say will come from the field of quantum computing.

R.SHOBIKA
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HOW TO MAKE AI TRUSTWORTHY

One of the biggest impediments to adoption of new technologies is trust in artificial intelligence (AI). Now, a new tool generates automatic indicators if data and predictions generated by AI algorithms are trustworthy. Now, a new tool developed by USC Viterbi Engineering researchers generates automatic indicators if data and predictions generated by AI algorithms are trustworthy. Their research paper, "There is hope after all: Quantifying Opinion and Trustworthiness in Neural Networks" by Mingxi Cheng, ShahinNazarian and Paul Bogdan of the USC

Cyber Physical Systems Group, was featured in Frontiers in Artificial Intelligence.

Neural networks are a type of artificial intelligence that are modeled after the brain and generate predictions. But can the predictions these neural networks generate be trusted? One of the key barriers to adoption of self-driving cars is that the vehicles need to act as independent decision-makers on auto-pilot and quickly decipher and recognize objects on the road whether an object is a speed bump, an inanimate object, a pet or a child and make decisions on how to act if another vehicle is swerving towards it. Should the car hit the oncoming vehicle or swerve and hit what the vehicle perceives to be an inanimate object or a child? Can we trust the computer software within the vehicles to make sound decisions within fractions of a second especially when conflicting information is coming from different sensing modalities such as computer vision from cameras or data from lidar? Knowing which systems to trust and which sensing system is most accurate would be helpful to determine what decisions the autopilot should make.

Lead author Mingxi Cheng was driven to work on this project by this thought: "Even humans can be indecisive in certain decision-making scenarios. In cases involving conflicting information, why can't machines tell us when they don't know?". A tool the authors created named DeepTrust can quantify the amount of uncertainty," says Paul Bogdan, an associate professor in the Ming Hsieh Department of Electrical and Computer Engineering and corresponding author, and thus, if human intervention is necessary. Developing this tool took the USC research team almost two years employing what is known as subjective logic to assess the architecture of the neural networks. On one of their test cases, the polls from the 2016 Presidential election, DeepTrust found that the prediction pointing towards Clinton winning had a greater margin for error.

The other significance of this study is that it provides insights on how to test reliability of AI algorithms that are normally trained on thousands to millions of data points. It would be incredibly time-consuming to check if each one of these data points that inform AI predictions were labelled accurately. Rather, more critical, say the researchers, is that the architecture of these neural network systems has greater accuracy. Bogdan notes that if computer scientists want to maximize accuracy and trust simultaneously, this work could also serve as guidepost as to how much "noise" can be in testing samples.

The researchers believe this model is the first of its kind. Says Bogdan, "To our knowledge, there is no trust quantification model or tool for deep learning, artificial intelligence and machine learning. This is the first approach and opens new research directions." He adds that this tool has the potential to make "artificial intelligence aware and adaptive."

S.P VISHVA
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VERBAL REASONING

1. **Syllogism**

i) Statements: All the harmoniums are instruments. All the instruments are flutes.

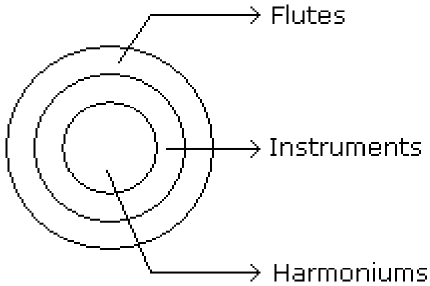
Conclusions:

1. All the flutes are instruments.
2. All the harmoniums are flutes.

A. Only (1) conclusion follows
B. Only (2) conclusion follows
C. Either (1) or (2) follows
D. Neither (1) nor (2) follows
E. Both (1) and (2) follow

Answer: Option B

Explanation



Only (2) follows.

ii) Statements: Some mangoes are yellow. Some tixo are mangoes.

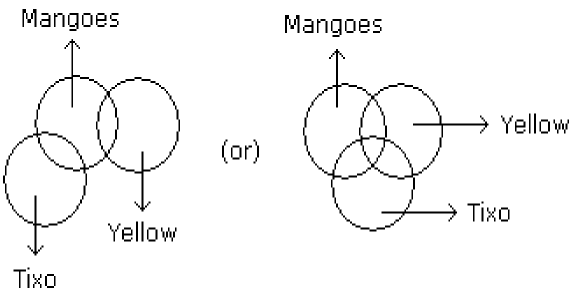
Conclusions:

1. Some mangoes are green.
2. Tixo is a yellow.

A. Only (1) conclusion follows
B. Only (2) conclusion follows
C. Either (1) or (2) follows
D. Neither (1) nor (2) follows
E. Both (1) and (2) follow

Answer: Option D

Explanation



None of the two follows.

2. Arithmetic Reasoning

i) The total of the ages of Amar, Akbar and Anthony is 80 years. What was the total of their ages three years ago?

A. 71 years

B. 72 years

C. 74 years

D. 77 years

Answer: Option A

Explanation

Required sum = (80 - 3 x 3) years = (80 - 9) years = 71 years.

ii) Two bus tickets from city A to B and three tickets from city A to C cost Rs. 77 but three tickets from city A to B and two tickets from city A to C cost Rs. 73. What are the fares for cities B and C from A?

A. Rs. 4, Rs. 23

B. Rs. 13, Rs. 17

C. Rs. 15, Rs. 14

D. Rs. 17, Rs. 13

Answer: Option B

Explanation

Let Rs. x be the fare of city B from city A and Rs. y be the fare of city C from city A.

Then, $2x + 3y = 77$ ...(i) and

$3x + 2y = 73$ ...(ii)

Multiplying (i) by 3 and (ii) by 2 and subtracting, we get: $5y = 85$ or $y = 17$.
Putting $y = 17$ in (i), we get: $x = 13$.

iii) A girl counted in the following way on the fingers of her left hand : She started by calling the thumb 1, the index finger 2, middle finger 3, ring finger 4, little finger 5 and then reversed direction calling the ring finger 6, middle finger 7 and so on. She counted upto 1994. She ended counting on which finger?

A. Thumb

B. Index finger

C. Middle finger

D. Ring finger

Answer: Option B

Explanation

Clearly, while counting, the numbers associated to the thumb will be : 1, 9,17, 25,.....
i.e. numbers of the form $(8n + 1)$.
Since 1994 = 249 x 8 + 2, so 1993 shall correspond to the thumb and 1994 to the index finger.
iv) A man has Rs. 480 in the denominations of one-rupee notes, five-rupee notes and ten-rupee notes. The number of notes of each denomination is equal. What is the total number of notes that he has?

A. 45

B. 60

C. 75

D. 90

Answer: Option D

Explanation

Let number of notes of each denomination be x.

Then, x + 5x + 10x = 480 ⇔16x = 480 ⇔x = 30.

Hence, total number of notes = 3x = 90.

V) A is 3 years older to B and 3 years younger to C, while B and D are twins. How many years older is C to D?

A. 2

B. 3

C. 6

D. 12

Answer: Option C

Explanation:

Since B and D are twins, so B = D.

Now, A = B + 3 and A = C - 3.

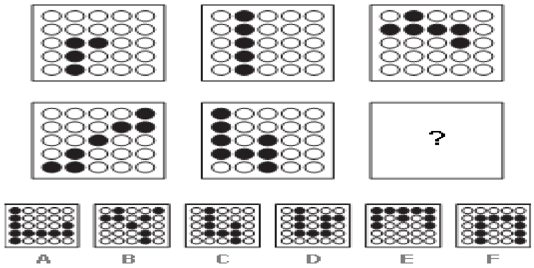
Thus, B + 3 = C - 3 ⇔D + 3 = C-3 ⇔C - D = 6.

K.SURESHKUMAR

II B.SC. COMPUTER TECHNOLOGY

LOGICAL PUZZLES

1. What is missing in the last grid?

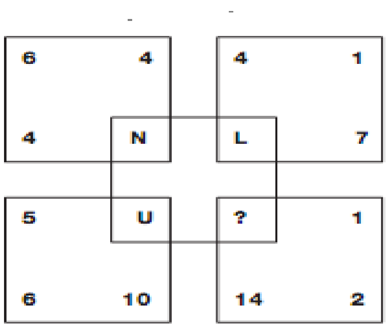


Answer: D

Explanation

The number of black dots in each grid increases by 1 each time, starting with the top left grid and working to the right, top row then bottom row.

2. Which letter replaces the question mark?



Answer:Q

Explanation:

Adding the three numbers in each square together gives the numerical value of the letter at the centre of each square.

S.PRAKASH

III B.SC. INFORMATION TECHNOLOGY

BRAIN TEASER

1. I have keys but no locks. I have a space but no room. You can enter, but can't go outside. What am I?

Answer: A keyboard.

2. When you do know me about me, them I am definitely something. You will always search for me. But when you know me, I am nothing. Who am I?

Answer: I'm a Riddle.

3. I am as big as you are, but I am weightless. Who am I?

Answer: Shadow.

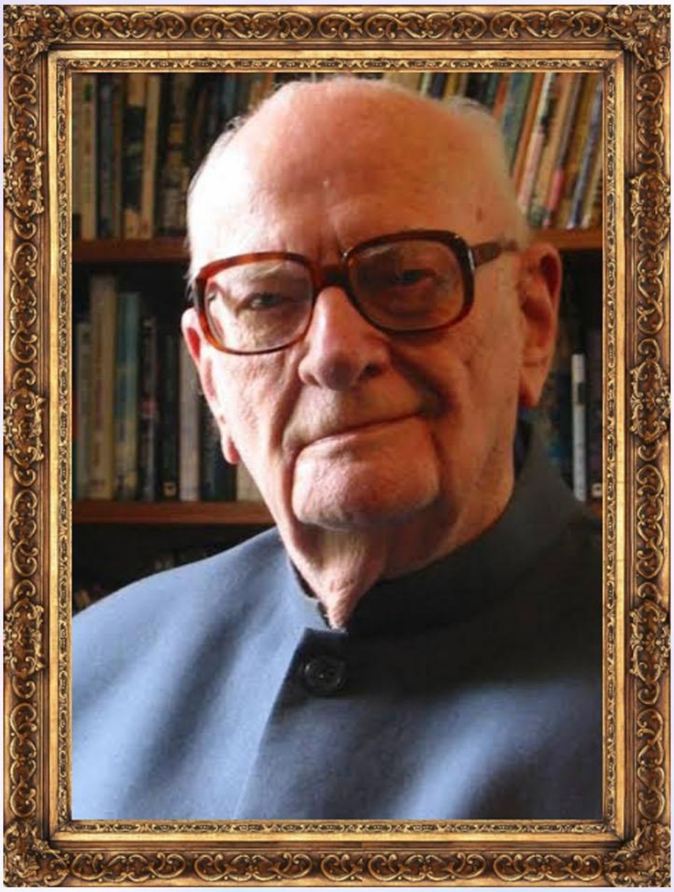
4. We are a family of 12 members. I am the second. I am also the youngest in our family. Who am I?

Answer: February. A year has 12 months and February is the second month.

5. Everyone in the world break me when they speak every time. Who am I?

Answer: Silence.

S.HARITHA
II B.Sc. INFORMATION TECHNOLOGY



ANY SUFFICIENTLY ADVANCED TECHNOLOGY IS INDISTINGUISHABLE FROM MAGIC

- ARTHUR C CLARKE