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X-ray Vision: The
NuSTAR Satellite

Eddie Zhang

Meta's NLLB-200 AI
Featured Article

Brian Wang

DNA Extraction from
Fruits

Brandon Wang

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Advancing Multilingual Translation: Meta's NLLB-200 Model and Its Impact on Low-Resource Languages

Featured Article

Brian Wang

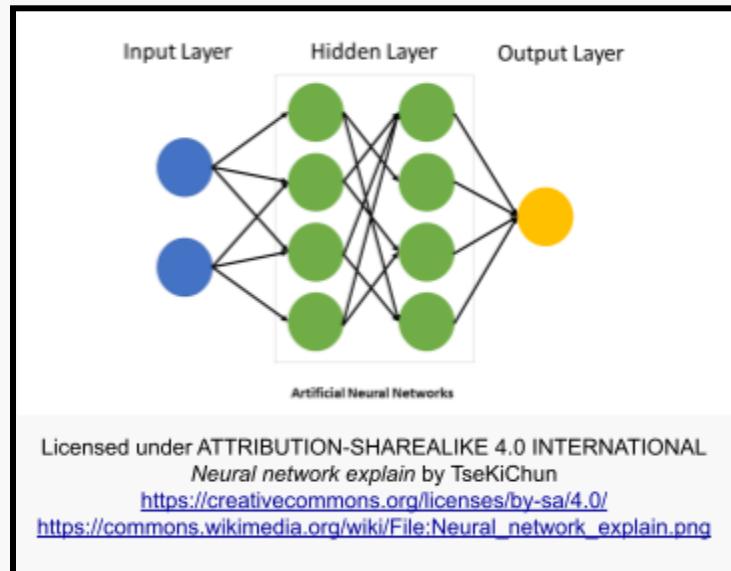
Google Translate has been a go-to app for many students, tourists, and ordinary people when they aim to translate something into another language. The translations are not entirely accurate and provide a slightly varied semantic to the text. Meta's team, formally known as No Language Left Behind (NLLB), has dedicated itself to improving this problem so that language translations are enhanced in quantity and quality.

Artificial intelligence learns through data samples. Many programmers, feed the AI up to ten thousand or a hundred thousand sample data sets. Since programs have no real brain, they power through trial and error, learning by being fed images or pieces of text under a class name. After this, these pieces of text are “remembered” under a class name, so any oncoming pieces of input can be predicted under said class name. Compiling these AI models takes up to days, and the accuracy will depend on the length and sample size it is trained on.

Data samples are not easy to find, especially large datasets with tens of thousands of information. Usually, programmers would use popular datasets on websites such as Kaggle, but for more professional companies, these datasets have already been fed into the AI. In turn, they need to find more low-resource datasets, which means datasets that are not high in quantity and are hard to find. These datasets are often found on internet archives, sold for a high price, or exist unknowingly within some websites.

That is mainly the flaw of Google Translate, the datasets fed into the program may not be adequate for it to fully translate text without error.

How does a program remember information? The answer to that question is artificial deep neural networks. These neural networks have three layers: the input layer, the hidden layer, and the output layer. The first and last layers consist of taking in the user's raw input and outputting some form of data afterward. The hidden layer is where the trial-and-error happens. It considers the raw input from the user in addition to any stored inputs it has received in the past, and will then predict with more accuracy in the future - assuming that both inputs are factual and help the AI learn correctly.



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NLLB has created a model called NLLB-200, which includes 200 languages, and has access to more than a thousand low-resource datasets about language, in addition to the already compiled high-resource datasets. In this way, the AI has stored more input or raw information within its neural networks compared to other models that may not have had access to the low-resource datasets. This AI performs much better than previous systems, but still perform errors.

What does this mean? First and foremost, that means Meta's applications and software will have a much more accurate AI model to translate text between different languages, and still preserve relatively the same semantics. On another note, this means that AIs in the world are now being competed against through the quantity and quality of training data. However, with the introduction of emulating human neurons in computers, it's marvelous what may happen in the future with AI.

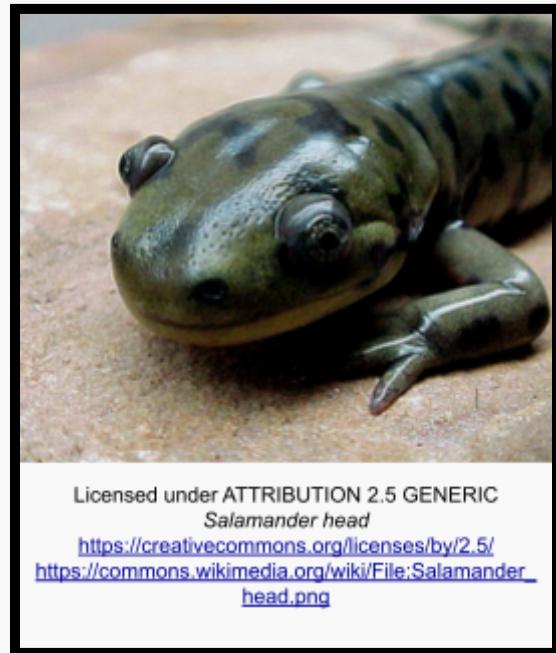
The Superpower of Limb Regeneration

Richard Wang

Limb loss affects around 2 million people in the United States and, unfortunately, prosthetic limbs remain the only option following amputation. The ability to regenerate limbs as seen in other animals but not humans, has interested scientists to discover how humans can obtain this ability. The idea of limb regeneration has remained an idea of fiction for many years and though we still have a long way to go, it is slowly starting to materialize as scientists make new insights and discoveries.

Humans can heal their tissue but limb regeneration which can be commonly seen in animals like salamanders is much more complicated. For limb regeneration, there needs to be bone, muscle, and blood vessels. Adult stem cells which are undifferentiated can turn into special cells to regenerate an amputated limb but they don't seem to activate. To solve the wandering question, scientists decided to study regeneration in axolotls.

Scientists have discovered an approach that involves making molecular tweaks that cause the axolotl to lose its ability to regenerate. A major player discovered in regenerative ability in the axolotls was the immune system. Another suggestion is that macrophages may be essential in regeneration. Scientists have also tried tweaking the nervous system which affected regeneration. They are even looking at the genetic level.



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For example, researchers tried to answer the question of how many times an axolotl can successfully regenerate a limb. It was discovered on the fifth trial, the limb wasn't able to regrow to the same potential. What the researchers discovered was extensive scar tissue build up which is also seen in human injuries. They then looked at which genes were activated or switched off to hinder the axolotl's regrowth. What scientists hope to accomplish is finding something that can express these genes in humans to help a limb to regrow.

It is important to be hopeful for the future as we are fortunate to have the resources to study this superpower of limb regeneration. Scientists are working ardently to study this and transfer these insights to other mammals like mice to help the millions of humans with lost limbs.



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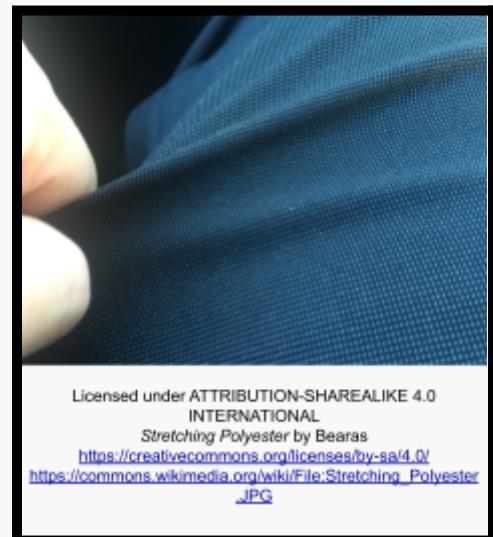
Pollution From Microplastics

Wilson Zhu

In the digital age, deleting files is as familiar as it is misleading. To begin, microplastics are small pieces of plastic that are usually less than 5 mm in length. Microplastics can cause pollution in the ecosystems due to a variety of sources that utilize plastic such as clothing, food packaging, and industrial processes. These plastics degrade slowly which can often take over hundreds or thousands of years.

The presence of microplastics in marine ecosystems is troubling as many sea animals mistake them for food. This ingestion can lead to physical harm, such as blockages in the digestive system, and chemical harm due to the release of toxic substances from the plastics. Additionally, on land, microplastics are found in agricultural soils, where they can affect soil health and crop growth dramatically. Most of the microplastic pollution comes from textiles, tires, and dust from the cities and accounts for around 80% of all microplastic in the environment. The usage of tires from continuous wear and tear, synthetic fibers from clothing that include nylon, polyester, etc., and microbeads that could be found in cosmetics, get released into the environment. The potential risks have been associated with health conditions such as respiratory disease and inflammation.

In conclusion, microplastic pollution is a growing environmental problem that can have significant implications for marine and land ecosystems. The addressing of microplastics requires efforts in waste management and public awareness to protect ecosystems and health.



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Exploring the Universe's X-ray Vision: The NuSTAR Satellite

Eddie Zhang

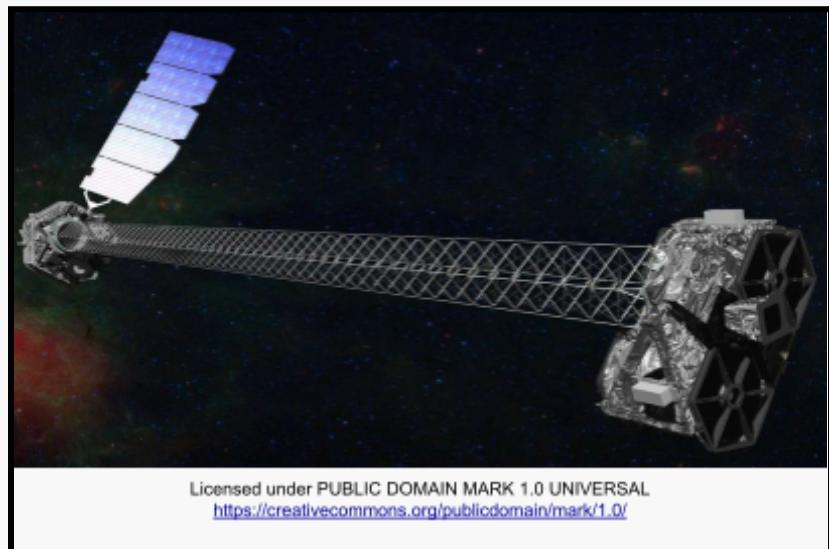
In the vast expanse of the cosmos, where mysteries abound and phenomena defy conventional understanding, humanity has always sought ways to peer deeper into the fabric of space. Among the many instruments designed for this purpose, the Nuclear Spectroscopic Telescope Array (NuSTAR) stands as a beacon of innovation and discovery in the realm of X-ray astronomy.

NuSTAR, launched by NASA in June 2012, represents a significant leap forward in our ability to observe the

universe in high-energy X-ray wavelengths. Unlike optical telescopes that detect visible light, NuSTAR is specifically engineered to capture the extremely energetic X-rays emitted by celestial objects such as black holes, neutron stars, and supernova remnants.

This capability allows astronomers to study phenomena that are otherwise invisible or obscured in other wavelengths.

One of NuSTAR's primary objectives is to investigate the enigmatic nature of black holes. By focusing on the high-energy X-rays produced as matter falls into these cosmic giants, NuSTAR provides crucial insights into the processes of accretion and the powerful



gravitational fields surrounding black holes. These observations have helped refine our understanding of how black holes grow and influence their surroundings, shedding light on some of the most energetic events in the universe.

Moreover, NuSTAR has been instrumental in studying neutron stars, the remnants of massive stars that have undergone supernova explosions. These compact, dense objects emit X-rays due to their intense magnetic fields and rapid rotation, allowing NuSTAR to probe their exotic physical properties with unprecedented detail. Such observations have contributed significantly to our knowledge of neutron star structure, dynamics, and evolution, offering clues about the fundamental forces at play within these cosmic laboratories.

In addition to these primary missions, NuSTAR has broadened our understanding of supernovae, the explosive deaths of stars that forge many of the elements essential for life. By detecting the X-rays emitted from supernova remnants, NuSTAR helps astronomers trace the formation of heavy elements and study the shockwaves that propagate through interstellar space, influencing the birth of new stars and planets.

Technologically, NuSTAR represents a marvel of engineering. Its focusing optics, based on a nested shell design, are the most precise ever developed for X-ray astronomy, enabling it to achieve unparalleled resolution and sensitivity in the high-energy X-ray regime. This capability allows NuSTAR to pinpoint X-ray sources with remarkable accuracy and distinguish between different types of emissions, providing a clearer picture of the energetic processes occurring across the universe.

Beyond its scientific achievements, NuSTAR serves as a testament to international collaboration and perseverance in the pursuit of knowledge. Developed in partnership between NASA, international space agencies, and academic institutions, NuSTAR embodies the collective effort of scientists and engineers worldwide to push the boundaries of our understanding of the cosmos.

Looking ahead, NuSTAR continues to operate as a trailblazer in X-ray astronomy, with ongoing missions to explore black holes, neutron stars, and supernovae in greater

detail. Its discoveries not only deepen our understanding of the universe but also inspire new questions and avenues of research that promise to unravel the remaining mysteries of the cosmos.

In conclusion, the Nuclear Spectroscopic Telescope Array (NuSTAR) stands as a testament to human ingenuity and curiosity, expanding the frontiers of X-ray astronomy and uncovering the secrets of some of the most extreme phenomena in the universe. With its advanced technology and international collaboration, NuSTAR continues to illuminate the cosmos and pave the way for future discoveries that will shape our understanding of the universe for generations to come.



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The Fascinating Process of DNA Extraction from Fruits

Brandon Wang

DNA extraction is a foundational technique in molecular biology that allows scientists to isolate the genetic material from cells. This procedure is necessary for various applications, such as genetic testing, research, and biotechnology. Extracting DNA from fruits is an important experiment that demonstrates the universality of DNA across all living organisms and provides comprehension of the molecular workings of life.



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The primary objective of extracting DNA from fruits is to isolate and observe the genetic material. For example, fruits such as strawberries, bananas, and kiwis are outstanding due to their soft tissue and abundant DNA content. The materials required for this experiment include many common household items such as dish soap, salt, water, rubbing alcohol, ziplock bags, coffee filters, small containers, pipettes, and test tubes.

Prepare an extraction solution composed of dish soap, salt, and water. The dish soap assists by breaking down cell membranes and nuclear envelopes, allowing the DNA to be released into the solution. The salt supports the DNA molecule's stabilization and aids in removing proteins bound to the DNA. The selected fruit is then mashed in a ziplock bag to break apart the cell walls and increase the surface area for the extraction solution to work on.

After that, the extraction solution is added to the mashed fruit and thoroughly mixed. Filter the mixture through a coffee filter into a container to remove the solid

debris. The filtered liquid contains the not-yet-visible DNA which is then precipitated by the carefully added cold rubbing alcohol without mixing. The DNA is not soluble in alcohol, causing it to precipitate out of the solution, forming a visible white string substance.

This experiment allows comparative analysis by measuring the DNA yield from different fruits. There are many elements of DNA fruit extraction such as the type of fruit, its ripeness, and the efficiency of the extraction process can influence the amount of DNA acquired. By comparing the results, it provides a deeper understanding of the cellular structure and DNA content of various fruits.

To conclude, DNA extraction from fruits efficiently demonstrates what molecular biology is and is very informative. It exemplifies the universality of genetic material, the basic principles of cell structure, and the chemical processes involved in DNA isolation. This forms a bridge between our theoretical knowledge and practical knowledge, producing the perplexing concept of DNA to become comprehensible. This activity permits students and enthusiasts to develop a deeper appreciation for the complexities of life at the molecular level.



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The Effects of Different Types of Fertilizers on Plant Growth

Natalie Dai

Organic and inorganic fertilizers each affect soil quality and plant health differently, enhancing plant growth through their unique properties. Obtained from natural sources like compost, manure, and bone meal, organic fertilizers improve soil structure, and water retention, and encourage microbial activity. For instance, compost adds organic matter to the soil. Manure delivers a balanced nutrient mix. Whereas bone meal, rich in phosphorus aids strong root growth. Due to their slow-release nature, organic fertilizers provide a constant nutrient supply making sure of steady plant growth.

Inorganic fertilizers, also called synthetic or chemical fertilizers, contain specific NPK ratios releasing nutrients rapidly. This results in a quick increase in plant growth. Urea, a nitrogen compound found in fertilizers, promotes fast leaf and stem growth. Superphosphate, a type of fertilizer, enhances root growth, and potassium chloride improves disease resistance.

To relieve their drawbacks balancing both, organic, and inorganic fertilizers can be effective. Combining both supports optimal plant growth and sustainable agriculture. Organic fertilizers improve soil quality over time. Inorganic fertilizers give nutrients at once. Using both types helps in achieving healthy plants, and sustainable, farming practices.



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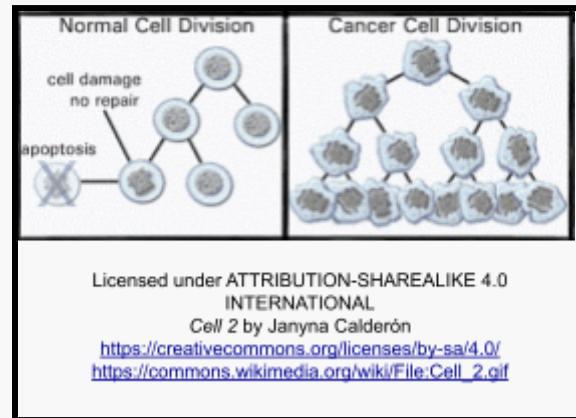
How Cancer is Formed

Arick Hong

Many famous people in the past have died of cancer. US President Grover Cleveland, Steve Jobs, and Babe Ruth were all victims of this disease. However, what causes cancer to form? Do they just pop up from nowhere, or are they acquired from an infected patient?

Before we start, we need to know about cell division. This is a process in which

human cells split into 2 cells, hence the name. It first grows, then replicates its chromosome before breaking apart. Occasionally, the cell could split into a bad copy. This bad copy is also known as a cancer cell. Using our knowledge of cell division, we understand that these cancer cells can also split, making more cancerous cells in your body.



Some people may wonder why cancerous cells don't split back into normal cells. The reason is simple, the cancerous cells are different from the regular cells, so they can't split back into normal cells. These cancerous cells grow until they become a clump called a tumor. Tumors are what become deadly, not the cell itself. Now we can explain how cancer kills you. Every organ in your body is made of tissues, which are made of cells. If there are enough cancerous cells to the point where most of your tissues are cancerous, the organ itself could fail, which kills you.

You must understand how cancer is formed since it could help you if you one day suddenly contract it. Steve Jobs died from cancer because he didn't want to treat it right

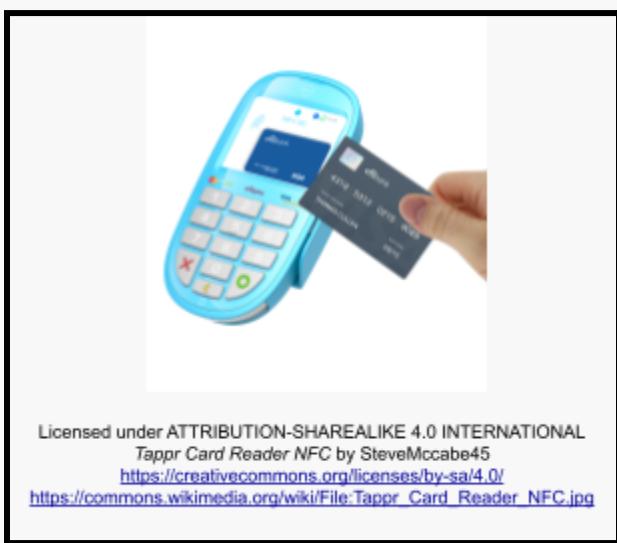
away, and he pursued alternative medicine. If you are educated about the risks of cancer, you can choose to treat it right away.

NFC Technology

Aidan Hong

There are many kinds of connections in technology. From WiFi to Bluetooth, different types offer different services. One such type of this technology is NFC Technology. NFC Technology offers a secure method to send data over a short distance quickly and reliably.

NFC Technology, short for Near Field Communication, is a communication protocol increasingly used by many devices. Unlike most protocols, its security makes it popular when sending sensitive data over very short distances. One such use case of NFC Technology is in finance and payment. Apple Pay, Google Pay, and others utilize



NFC Technology when interacting with point-of-sale devices at a store. Its reliability and security, along with no need to send data over long distances, make NFC the perfect protocol to use, transferring the client's credit card information securely and reliably. NFC also has other uses beyond smartphones. Credit cards also have NFC embedded in them, allowing them to conveniently tap

the credit card on the point-of-sale device to pay. NFC can also be used beyond point-of-sale devices. Public transport systems can use NFC to collect fares as well.

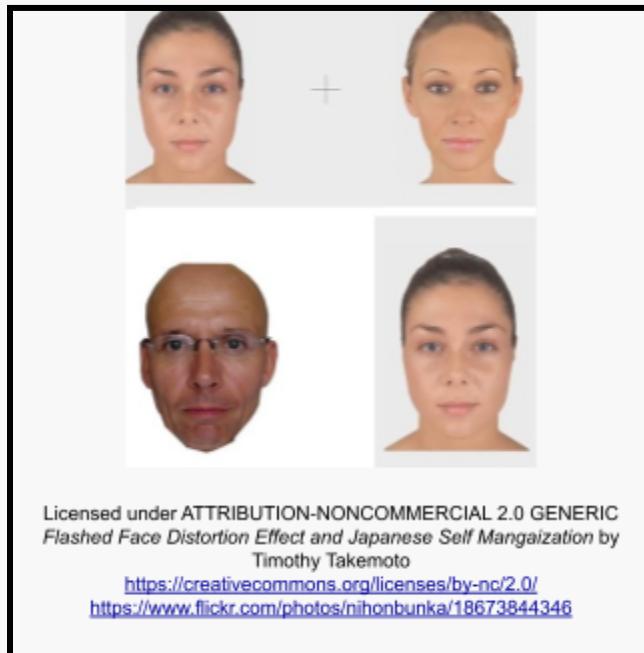
Beyond money, NFC can be used to transfer data. By simply tapping a phone on an NFC tag, data can be easily transferred from the tag to the phone. This can easily allow the user to open a link, and prompt the user to download an app or more. Business owners can easily use this technology to increase engagement with a user.

Distortion of Faces

Denise Lee

“It’s like staring at demons,” 59-year-old, Victor Sharrah states, “Imagine waking up one morning and suddenly everybody in the world looks like a creature in a horror movie.” Prosopometamorphopsia (PMO) and prosopagnosia are two intriguing and challenging neurological disorders that distort facial perception. PMO distorts the appearance of faces, making them evil and sinister, while prosopagnosia impairs the ability to recognize familiar and new faces. These disorders, though rare, highlight the complex of facial recognition in the human brain and can lead to significant social and psychological challenges for those affected.

Prosopometamorphopsia (PMO), also known as Demon-Face Syndrome, is a rare visual neurological disorder that causes individuals to perceive faces as distorted. The distortions can significantly alter the shape, size, texture, and color of a person's face, making it appear evil, twisted, and demented. Those affected by PMO may see features such as ears, noses, and mouths stretched back, deep grooves in the forehead, cheeks, and chin, as well as drooping, swelling, discoloration, and shifts in position. This condition can manifest suddenly and may last for days, months, or even years. The exact cause of PMO is not well understood, but it is believed to be related to abnormalities in the brain regions responsible for facial recognition and perception.



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Prosopagnosia, commonly known as face blindness, is a neurological disorder that impairs the ability to recognize faces. This condition can be either hereditary, present from birth, or acquired through brain damage or strokes. Prosopagnosia is not associated with memory dysfunction, memory loss, impaired vision, or learning disabilities. Individuals with prosopagnosia can see faces but have difficulty distinguishing between them and interpreting facial expressions and social cues. This can lead to significant social challenges, such as difficulty recognizing friends and family members, and can affect personal and professional relationships.

Currently, there are no specific treatments available for prosopagnosia or prosopometamorphopsia. Both prosopometamorphopsia and prosopagnosia can have an impact on a person's daily life. PMO can cause distress and anxiety due to the disturbing nature of the visual distortions. On the other hand, prosopagnosia can lead to social isolation and difficulty in social interactions due to the inability to recognize and remember faces.



Atom-thick gold sheet to be used in technology

Yifan Yang

The chemist Mendeleev is remembered for his contribution to the scientific world by laying out the framework that led to the modern periodic table. The periodic table is separated into several categories: metals, metalloids, and nonmetals. Metals have a specific characteristic that allows them to be of incredible use in modern technology, being a good conductor of heat and electricity. One example is gold, as it is seen in many devices such as computers, smartphones, and more.

Recently, researchers have created goldene, the economically viable sheet of gold that is just one atom thick. It offers the same function as a normal slab of gold and is



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the next introduction of a group of elements formed into a two-dimensional sheet. Gold possesses a problem not found in the two earlier elements, carbon, and sulfur, as the sheet would clump in on itself. Once fully prepared, the research team discovered another issue, in which the gold would curl in on itself, forcing the team to make a special solution that suspends the sheet of gold. The

success of this has given the team the new goal of making other two-dimensional sheets of metallic elements, such as platinum.

These atomic sheets of elements provide a gateway to reducing the waste and pollution caused by mining these precious metals. The need for conductor materials would drop as the function provided by the sheets would fulfill the requirements that would usually require more of the material, creating a more modern and cleaner future.

The Orion Nebula

Mary Liang

The Orion Nebula, also known as Messier 42, has an incredible distance of about 1,500 light years away. This makes it the closest large star formation to Earth, giving it a prominent star in the night sky. Orion can be seen in a clear cloudless sky from November to February, which can be found by locating Orion's belt. It is believed to be the celestial fire of outcome by the Maya of Mesoamerica and is known in many different civilizations throughout the human past. M42 is a diffuse nebula, also known as the birthplace of stars are clouds of gas, dust, hydrogen, and helium left over from the Big Bang. It lies south of Orion's Belt in the constellation of Orion and is also labeled as the idle "star" of Orion.



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This diffuse nebula has the size of 24 light-years across with an encompassing line of 2,000 times the mass of the Sun. It is also the home to extremely young open clusters called the Trapezium Cluster, which contains six stars within a 1.5 light-year diameter, organized in the pattern of a trapezoid. They are part of the larger Orion Nebula luster, spanning around 2,800 stars within a diameter of 20 light-years. From these stars, ultraviolet light is released to carve in the nebula and influence the growth of stars.

The Orion Nebula was an interest to many passionate astronomers and has been studied and photographed. Their research revealed insights into star and planetary system formation from collapsing dust clouds and gas.

Unveiling the Deep Sea

Kenny Wu

The Deep Sea is a mysterious location that has yet to be thoroughly explored, scientists have only scratched the surface of such a realm that makes up 71% of Earth. This vast segment of the sea begins at about 200 meters below the ocean surface, where sunlight can no longer reach, extending down to the ocean floor.

To begin, the Deep Sea possesses living creatures that are fascinating with their features from adapting to the extreme environment. To survive in the Deep Sea, these creatures must bear high pressure, low temperature, and complete darkness. Instances include the anglerfish and the vampire squid which developed a feature of producing light to attract prey and communicate, these naturally produced lights are known to be a few of the only light sources in the deep sea. The Deep Sea creatures provide further proof of the limitless potential of adoption and living beings.



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Furthermore, the Deep Sea is a largely unexplored area despite its importance. As technology improves, more underwater tools will be made that facilitate Deep Sea explorations. Examples are remotely operated vehicles and Deep Sea submersibles. The exploration of the Deep Sea calls for a revolution in understanding organisms and

adaptation, revealing new species and ecosystems. However, it is expected to take a long time before completely unraveling the mystery of the Deep Sea.

In addition, the Deep Sea plays a key role in global processes. The Deep Sea acts as a carbon sink, which manages the Earth's climate by absorbing excess carbon dioxide from the atmosphere. Additionally, the Deep Sea is where hydrothermal vents form, created when the seawater meets the magma. These vents are crucial for biodiversity and provide insights into the origins of life.

All in all, the Deep Sea is a remarkable location that requires more recognition and effort for exploration. By fully unraveling the Deep Sea, scientists would unlock important knowledge about living beings and further improve our daily lives. Continued exploration and study of the Deep Sea are essential for humanity to keep stepping forward.



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The Potential and Strength of Hydrogen Power

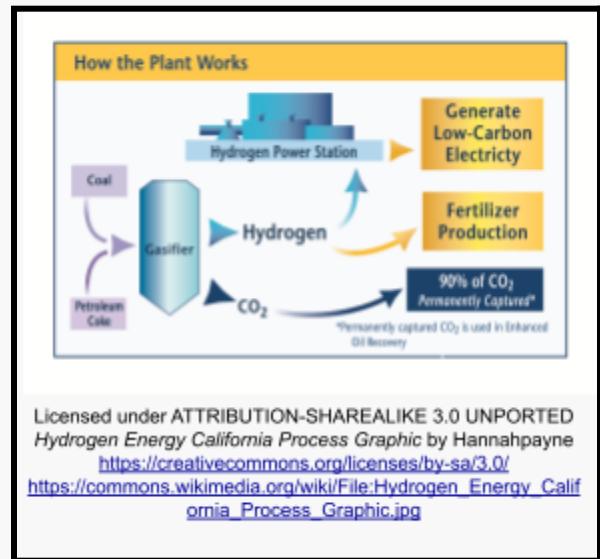
Riley Lee

Hydrogen power is becoming an energy known as clean energy. Hydrogen power is an environmentally friendly alternative to fossil fuels, which helps reduce greenhouse gas emissions and climate change. When hydrogen is used in fuel cells or combustion engines, hydrogen produces only water as a byproduct. The element hydrogen is abundant and can be produced from multiple different sources such as water, natural gas, and biomass, making it a strong and flexible energy option.

As hydrogen power has its pros it also has cons. One major issue of hydrogen power is the cost of production. Currently producing energy from hydrogen is more

expensive compared to fossil fuels, especially through electrolysis. For example, producing hydrogen through electrolysis while using renewable energy can cost up from 3\$ to 7\$ per kilogram, but when using natural gas it only costs 1\$ per kilogram. The expensive cost of hydrogen is due to the high energy requirements of the process and the cost of renewable electricity needed for production. Another con of hydrogen power is storing and transporting hydrogen

because hydrogen is flammable and has low energy density by volume. Since the production, storage, and distribution of hydrogen is limited, it requires a lot of investment to build and expand.



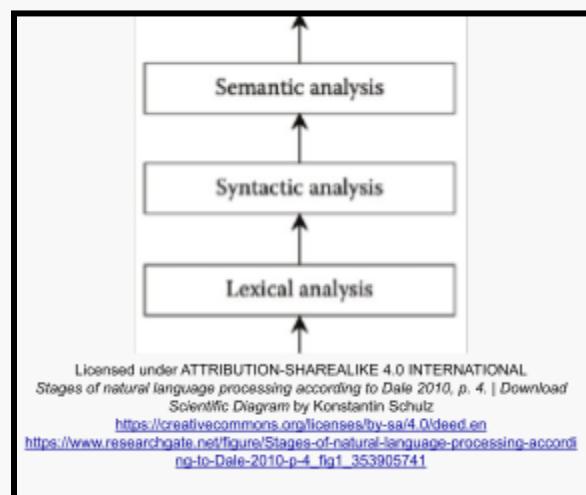
Understanding Human Language through Natural Language Processing

Owen Chen

Natural Language Processing (NLP) is a subfield of artificial intelligence (AI) focused on enabling computers to understand, interpret, and generate human language. The rapid advancements in this field have revolutionized how machines interact with humans, transforming various industries and enhancing our daily lives.

Human language is complex, comprising syntax, semantics, pragmatics, and phonetics. Syntax involves the rules that govern the structure of sentences. Semantics pertains to the meaning conveyed by words and sentences. Pragmatics considers the context in which language is used, including implied meanings, while phonetics and phonology deal with the sounds of speech and their organizational patterns. To comprehend human language, NLP systems must address these components effectively.

One of the initial steps in NLP is tokenization, which involves breaking down text into smaller units called tokens, such as words, phrases, or sentences. Text preprocessing follows, involving tasks such as removing punctuation, converting text to lowercase, and eliminating stop words like "and" or "the" to simplify analysis. These steps are foundational, ensuring that the text is in a format suitable for further processing.



Part-of-speech (POS) tagging is another crucial technique in NLP. It assigns parts of speech, such as nouns, verbs, and adjectives, to each word in a sentence, aiding in understanding sentence structure. Named Entity Recognition (NER) identifies and classifies entities, such as names of people, organizations, and locations, within text, which is crucial for extracting meaningful information.

Parsing and syntax analysis involve examining the grammatical structure of sentences. Syntax analysis helps in constructing parse trees, which represent the syntactic structure and relationships between words in a sentence. This is vital for understanding complex sentence structures and ensuring accurate interpretation. These trees are fundamental for deciphering the grammatical relationships within sentences, leading to a better understanding of the intended meaning.

Machine learning algorithms, particularly deep learning models, have significantly enhanced NLP capabilities. Traditional machine learning approaches involved feature extraction and classification using models like Support Vector Machines (SVM) and Naive Bayes. However, deep learning models, especially neural networks, have revolutionized NLP. Recurrent Neural Networks (RNNs) are adept at handling sequential data, making them suitable for tasks like language modeling and machine translation. A specific type of RNN, Long Short-Term Memory (LSTM) networks, addresses the vanishing gradient problem, effectively capturing long-term dependencies in text. Transformer models, introduced by Vaswani et al. in 2017, have transformed NLP. These models, such as BERT (Bidirectional Encoder Representations from Transformers) and GPT (Generative Pre-trained Transformer), leverage self-attention mechanisms, enabling them to process words in parallel and understand context more effectively.

Pre-trained language models have further revolutionized NLP by learning from vast amounts of text data. Models like BERT and GPT are pre-trained on large corpora and can be fine-tuned for specific tasks, achieving state-of-the-art performance in various NLP applications. This pre-training and fine-tuning paradigm has significantly enhanced the performance and versatility of NLP systems.

Acoustic Levitation: Floating Objects with Sound

Arthur Liang

Acoustic levitation is a phenomenon where sound waves are used to suspend objects in the air. Two principles of sound waves, namely wave interference and pressure nodes, help to make these interactions possible. The potential applications of this technology are promising and could help humanity enter a new phase as a species.

Fundamentally, sound waves are mechanical vibrations that travel through a medium such as air. Wave interference occurs when two sound waves of the same frequency and amplitude intersect, causing the waves to interfere with each other constructively and destructively. This forms waves with high-pressure regions, known as antinodes, and low-pressure regions, known as nodes. Acoustic levitation acts on these two principles by trapping objects at the pressure nodes of interfering waves. High-pressure regions exert upward forces which can counteract gravity.



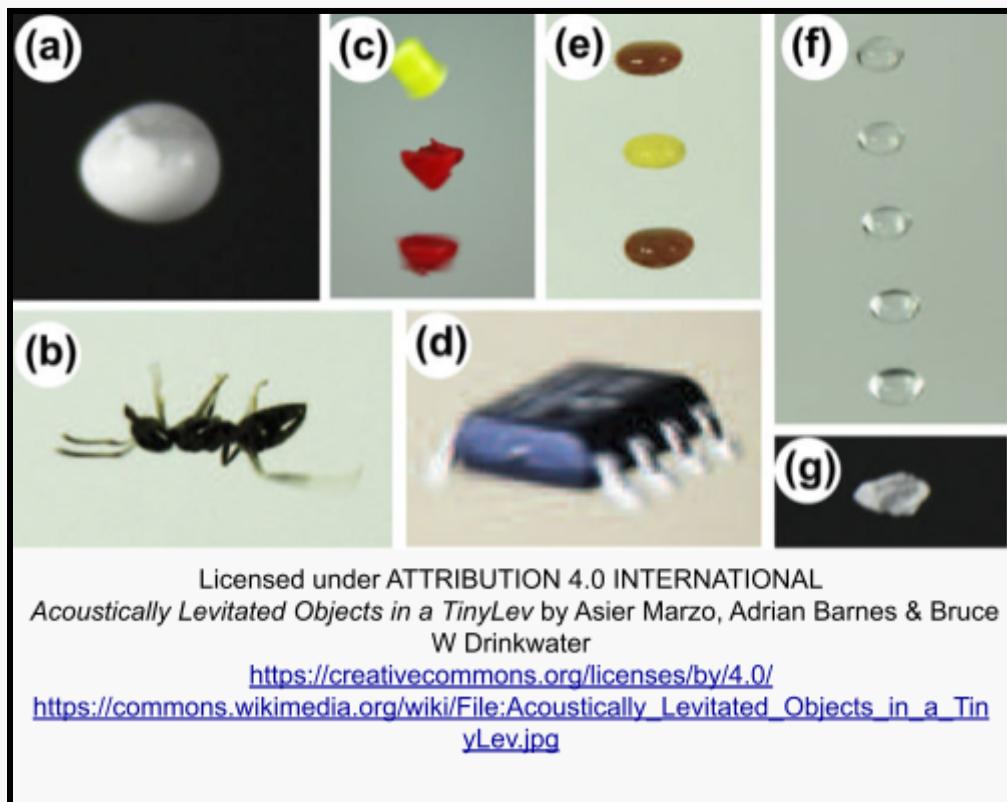
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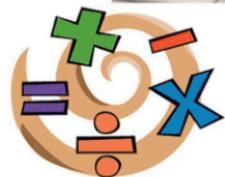
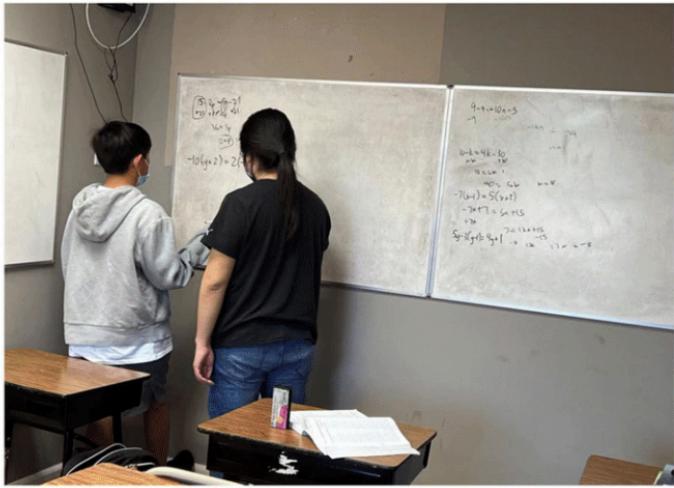
Acoustic Virtual Vortices Levitating Mie Particle by Tatsuki Fushimi

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Practically, this phenomenon can be achieved through devices known as ultrasonic transducers, which generate sound waves at certain frequencies, usually beyond what human ears can pick up. One interesting application for this technology is to use it to levitate and handle sensitive materials without contaminating or altering their properties. Levitation can also be used to study the properties of liquids or biological samples in a controlled environment. In the future, we may also see these devices used in space exploration where levitation can be used to manipulate materials in microgravity. As the technology and study around this phenomenon develops, the precision and control of these devices will be enhanced, paving the way for all sorts of potential luxuries and inventions for humanity.





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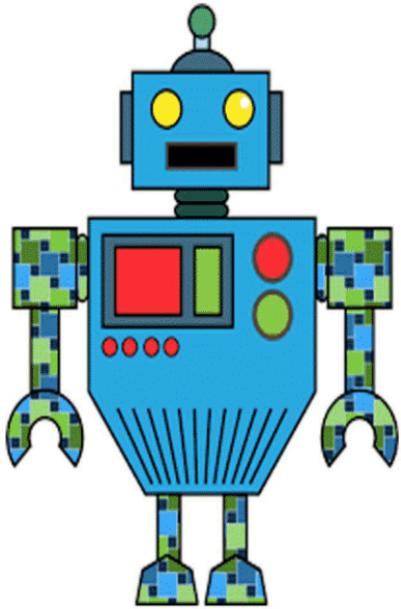
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