INFOLINE

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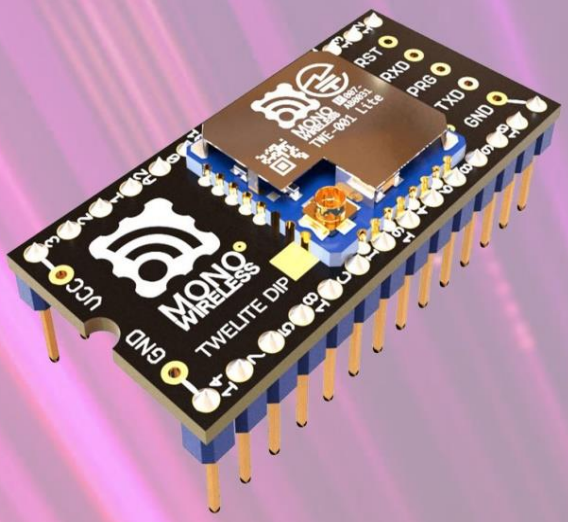

DEPARTMENT OF COMPUTER TECHNOLOGY AND INFORMATION TECHNOLOGY

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INFOLINE

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CONTENTS

TWEAKING AI SOFTWARE TO FUNCTION LIKE A HUMAN BRAIN

Computer-based artificial intelligence can function more like human intelligence when programmed to use a much faster technique for learning new objects, say two neuroscientists who designed such a model that was designed to mirror human visual learning. "Our model provides a biologically plausible way for artificial neural networks to learn new visual concepts from a small number of examples," says Riesenhuber. "We can get computers to learn much better from few examples by leveraging prior learning in a way that we think mirrors what the brain is doing."

Humans can quickly and accurately learn new visual concepts from sparse data sometimes just a single example. Even three to four-month-old babies can easily learn to recognize zebras and distinguish them from cats, horses and giraffes. But computers typically need to see many examples of the same object to know what it is?

"The big change needed was in designing software to identify relationships between entire visual categories, instead of trying the more standard approach of identifying an object using only low-level and intermediate information, such as shape and color," Riesenhuber says. The computational power of the brain's hierarchy lies in the potential to simplify learning by leveraging previously learned representations from a data bank, as it were full of concepts about objects. Riesenhuber and Rule found that artificial neural networks, which represent objects in terms of previously learned concepts, learned new visual concepts significantly faster.

The brain architecture underlying human visual concept learning builds on the neural networks involved in object recognition. The anterior temporal lobe of the brain is thought to contain abstract concept representations that go beyond shape. These complex neural hierarchies for visual recognition allow humans to learn new tasks

and, crucially, leverage prior learning. "By reusing these concepts, you can more easily learn new concepts, new meaning, such as the fact that a zebra is simply a horse of a different stripe," Riesenhuber says.

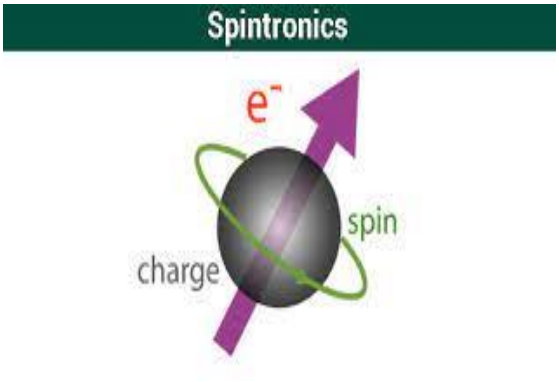
S.KANAGALAKSHMI

I B.Sc. (Information Technology)

SPINTRONICS TECHNOLOGY REVOLUTION

A decade ago, the discovery of quasiparticles called magnetic skyrmions provided important new clues into how microscopic spin textures will enable spintronics, a new class of electronics that use the orientation of an electron's spin rather than its charge to encode data.

The scientists have made big advances in this very young field, they still don't fully understand how to design spintronics materials that would allow for ultrasmall, ultrafast, low-power devices. Skyrmions may seem promising, but scientists have long treated skyrmions as merely 2D objects. Recent studies have suggested that 2D skyrmions could actually be the genesis of a 3D spin pattern called hopfions. But no one had been able to experimentally prove that magnetic hopfions exist on the nanoscale.



Now, a team of researchers co-led by Berkeley Lab has reported in Nature Communications the first demonstration and observation of 3D hopfions emerging from skyrmions at the nanoscale (billionths of a meter) in a magnetic system. The researchers say that “their discovery heralds a major step forward in realizing high-density, high-speed, low-power, yet ultrastable magnetic memory devices that exploit the intrinsic power of electron spin. We not only proved that complex spin textures like 3D hopfions exist and also demonstrated how to study and therefore harness them," said co-senior Peter Fischer, a senior scientist in Berkeley Lab's Materials Sciences Division who is also an adjunct professor in physics at UC Santa Cruz. "To understand how hopfions really work, we have to know how to make them and study them. This work was possible only because we have these amazing tools at Berkeley Lab and our collaborative partnerships with scientists around the world," he said.

According to previous studies, hopfions, unlike skyrmions, don't drift when they move along a device and are therefore

excellent candidates for data technologies. Furthermore, theory collaborators in the United Kingdom had predicted that hopfions could emerge from a multilayered 2D magnetic system.

Using nanofabrication tools at Berkeley Lab's Molecular Foundry, Noah Kent, a Ph.D. student in physics at UC Santa Cruz and in Fischer's group at Berkeley Lab, worked with Molecular Foundry staff to carve out magnetic nanopillars from layers of iridium, cobalt, and platinum.

The multilayered materials were prepared by UC Berkeley postdoctoral scholar Neal Reynolds under the supervision of co-senior author Frances Hellman, who holds titles of senior faculty scientist in Berkeley Lab's Materials Sciences Division, and professor of physics and materials science and engineering at UC Berkeley. She also leads the Department of Energy's Non-Equilibrium Magnetic Materials (NEMM) program, which supported this study.

Hopfions and skyrmions are known to co-exist in magnetic materials, but they have a characteristic spin pattern in three dimensions. So, to tell them apart, the researchers used a combination of two advanced magnetic X-ray microscopy techniques X-PEEM (X-ray photoemission electron microscopy) at Berkeley Lab's synchrotron user facility, the Advanced Light Source; and magnetic soft X-ray transmission microscopy (MTXM) at ALBA, a synchrotron light facility in Barcelona, Spain to image the distinct spin patterns of hopfions and skyrmions.

To confirm their observations, the researchers then carried out detailed simulations to mimic how 2D skyrmions inside a magnetic device evolve into 3D hopfions in carefully designed multilayer structures, and how these will appear when imaged by polarized X-ray light. Simulations are a hugely important part of this process, enabling us to understand the experimental images and to design structures that will support hopfions, skyrmions, or other designed 3D spin structures," Hellman said.

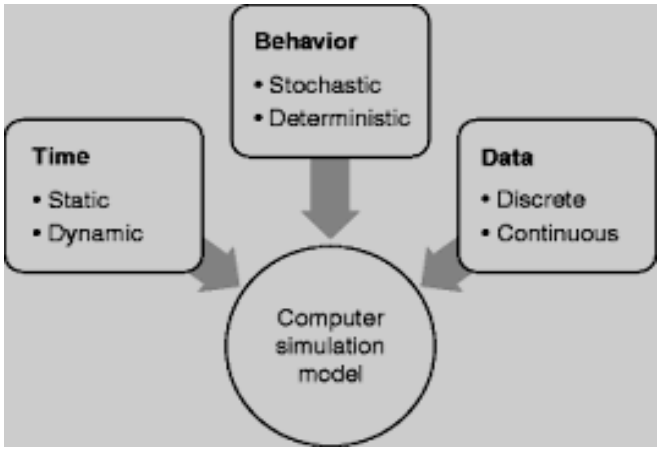
To understand how hopfions will ultimately function in a device, the researchers plan to employ Berkeley Lab's unique capabilities and world-class research facilities which Fischer describes as "essential for carrying out such interdisciplinary work" to further study the quixotic quasiparticles' dynamical behavior.

K.SURESHKUMAR

III B.Sc. (Computer Technology)

COMPUTER SIMULATION

A computer simulation or a computer model is a computer program that attempts to simulate an abstract model of a particular system. Computer simulations have become a useful part of mathematical modelling of many natural systems in physics, chemistry and biology, human systems in economics, psychology, and social science and in the process of engineering new technology, to gain insight into the operation of those systems. Traditionally, the formal modelling of systems has been via a mathematical model which attempts to find analytical solutions to problems which enable the prediction of the behaviour of the system from a set of parameters and initial conditions. Computer simulations build on, and are a useful adjunct to purely mathematical models in science, technology and entertainment. The reliability and the trust people put in computer simulations depends on the validity of the simulation model.



Simulation versus Model

A computer model is the algorithms and equations used to capture the behaviour of the system being modelled. By contrast, computer simulation is the actual running of the program that contains these equations or algorithms. Simulation therefore is the process of running a model. Thus one would not "build a simulation" instead, one would "build a model" and then either run the model or equivalently "run a simulation.

Data Preparation

The external data requirements of simulations and models vary widely. For some, the input might be just a few numbers (for example, simulation of a waveform of AC electricity on a wire), while others might require terabytes of information (such as weather and climate models).

Input sources also vary widely:

- Sensors and other physical devices connected to the model.
- Control surfaces used to direct the progress of the simulation in some way.
- Current or historical data entered by hand.
- Values extracted as a by-product from other processes.
- Values output for the purpose by other simulations, models or processes.

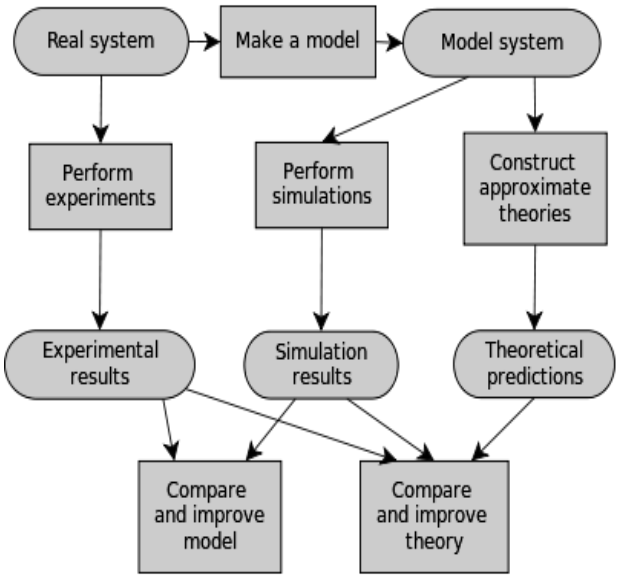
Systems that accept data from external sources must be very careful in knowing what

they are receiving. While it is easy for computers to read in values from text or binary files, what is much harder is knowing what the accuracy (compared to measurement of the values are. Often they are expressed as "error bars", a minimum and maximum deviation from the value range within which the true value (is expected to) lie. Because digital computer mathematics is not perfect, rounding and truncation errors multiply this error, so it is useful to perform an "error analysis" to confirm that values output by the simulation will still be usefully accurate.

Types

Computer models can be classified according to several independent pairs of attributes, including:

- Stochastic or deterministic (and as a special case of deterministic, chaotic
- Steady-state or dynamic
- Continuous or discrete (and as an important special case of discrete, discrete event or DE models)
- Dynamic system simulation, e.g. electric systems, hydraulic systems or multi-body mechanical systems (described primarily by DAE:s) or dynamics simulation of field problems, e.g. CFD of FEM simulations (described by PDE:s).
- Local or distributed.



M.BHAVAN

II B.Sc. (Computer Technology)

WIRELESS BRAIN-COMPUTER INTERFACE FOR HUMANS

Brain-computer interfaces (BCIs) are an emerging assistive technology, enabling people with paralysis to type on computer screens or manipulate robotic prostheses just by thinking about moving their own bodies. For years, investigational BCIs used in clinical trials have required cables to connect the sensing array in the brain to computers that decode the signals and use them to drive external devices.

For the first time, BrainGate clinical trial participants with tetraplegia have demonstrated use of an intracortical wireless BCI with an external wireless transmitter. The system is capable of transmitting brain signals at single-neuron resolution and in full broadband fidelity without physically tethering

the user to a decoding system. The traditional cables are replaced by a small transmitter about 2 inches in its largest dimension and weighing a little over 1.5 ounces. The unit sits on top of a user's head and connects to an electrode array within the brain's motor cortex using the same port used by wired systems.

For a study published in IEEE Transactions on Biomedical Engineering, two clinical trial participants with paralysis used the BrainGate system with a wireless transmitter to point, click and type on a standard tablet computer. The study showed that the wireless system transmitted signals with virtually the same fidelity as wired systems, and participants achieved similar point-and-click accuracy and typing speeds.

The researchers say the study represents an early but important step toward a major objective in BCI research: a fully implantable intracortical system that aids in restoring independence for people who have lost the ability to move. While wireless devices with lower bandwidth have been reported previously, this is the first device to transmit the full spectrum of signals recorded by an intracortical sensor. That high-broadband wireless signal enables clinical research and basic human neuroscience that is much more difficult to perform with wired BCIs.

The new study demonstrated some of those new possibilities. The trial participants a 35-year-old man and a 63-year-old man, both paralyzed by spinal cord injuries were able to use the system in their homes, as opposed to the lab setting where most BCI research takes place. Unencumbered by cables, the participants were able to use the BCI continuously for up to 24 hours, giving the researchers long-duration data including while participants slept.

The device used in the study was first developed at Brown in the lab of Arto Nurmikko, a professor in Brown's School of Engineering. Dubbed the Brown Wireless Device (BWD), it was designed to transmit high-fidelity signals while drawing minimal power. In the current study, two devices used together recorded neural signals at 48 megabits per second from 200 electrodes with a battery life of over 36 hours.

While the BWD has been used successfully for several years in basic neuroscience research, additional testing and regulatory permission were required prior to using the system in the BrainGate trial. Nurmikko says the step to human use marks a key moment in the development of BCI technology.

The new study marks another significant advance by researchers with the BrainGate consortium, an interdisciplinary group of researchers from Brown, Stanford and Case Western Reserve universities, as well as the Providence Veterans Affairs Medical Center and Massachusetts General Hospital. In 2012, the team published landmark research in which clinical trial participants were able, for the first time, to operate multidimensional robotic prosthetics using a BCI. That work has been followed by a steady stream of refinements to the system, as well as new clinical breakthroughs that have enabled people to type on computers, use tablet apps and even move their own paralyzed limbs.

The evolution of intracortical BCIs from requiring a wire cable to instead using a miniature wireless transmitter is a major step toward functional use of fully implanted, high-performance neural interfaces, said study c o-author Sharlene Flesher, who was a postdoctoral fellow at Stanford and is now a hardware engineer at Apple. As the field heads toward reducing transmitted bandwidth while preserving the accuracy of assistive device control, this study may be one of few that captures the full breadth of cortical signals for extended periods of time, including during practical BCI use.

The new wireless technology is already paying dividends in unexpected ways, the researchers say. Because participants are able to use the wireless device in their homes without a technician on hand to maintain the wired connection, the BrainGate team has been able to continue their work during the COVID-19 pandemic.

In March 2020, it became clear that we would not be able to visit our research participants' homes, said Hochberg, who is also a critical care neurologist at Massachusetts General Hospital and director of the V.A. Rehabilitation Research and Development Center for Neurorestoration and Neurotechnology. But by training caregivers how to establish the wireless connection, a trial participant was able to use the BCI without members of our team physically being there. So not only were we able to continue our research, this technology allowed us to continue with the full bandwidth and fidelity that we had before.

Simeral noted that, Multiple companies have wonderfully entered the BCI field, and some have already demonstrated human use of low-bandwidth wireless systems, including

some that are fully implanted. In this report, we're excited to have used a high-bandwidth wireless system that advances the scientific and clinical capabilities for future systems.

D.UDHYAKUMAR
I B.Sc. (Computer Technology)

SKIN IN THE GAME: TRANSFORMATIVE APPROACH USES THE HUMAN BODY TO RECHARGE SMARTWATCHES

As smart watches are increasingly able to monitor the vital signs of health including what's going on when we sleep, a problem has emerged: those wearable wireless devices are often disconnected from our body overnight, being charged at the bedside.

Quality of sleep and its patterns contain a lot of important information about patients' health conditions, says Sunghoon Ivan Lee, Assistant Professor in the University of Massachusetts, Amherst College of Information and Computer Sciences and Director of the Advanced Human Health Analytics Laboratory.

But that information can't be tracked on smart watches if the wearable devices are being charged as users sleep, which prior research has shown is frequently the case. Lee adds, the main reason users discontinue the long-term use of wearable devices is because they have to frequently charge the on-device battery.

Pondering this problem, Lee brainstormed with UMass Amherst wearable computing engineer Jeremy Gummeson to find a solution to continuously recharge these devices on the body so they can monitor the user's health 24/7. The scientists' aha moment came when they realized "human skin is a conductible material," Lee recalls. Why can't we instrument daily objects such as the office desk, chair and car steering wheel, so they can seamlessly transfer power through human skin to charge up a watch or any wearable sensor while the users interact with them? Like, using human skin as a wire.

The conventional black wire is established between two metal plates that are embedded on the wearable device and an

instrumented everyday object which becomes coupled (or virtually connected) via the surrounding environment when the frequency of the energy carrier signal is sufficiently high in the hundreds of megahertz (MHz) range.

The researchers tested a prototype of their technology with 10 people in three scenarios during which the individuals' arm or hand made contact with the power transmitter either as they worked on a desktop keyboard or a laptop, or as they were holding the steering wheel of a car.

Their research showed that approximately 0.5 - 1 milliwatt (mW) of direct current (DC) power was transferred to the wrist-worn device using the skin as the transfer medium. This small amount of electricity conforms to safety regulations established by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and Federal Communications Commission (FCC).

N.R. SHARMILA

II B.Sc. (Information Technology)

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ALGORITHMS IMPROVE HOW TO PROTECT OUR DATA

Daegu Gyeongbuk Institute of Science and Technology (DGIST) scientists in Korea have developed algorithms that more efficiently measure how difficult it would be for an attacker to guess secret keys for cryptographic systems. The approach they used was described in the journal IEEE Transactions on Information Forensics and Security and could reduce the computational complexity needed to validate encryption security.

Cryptography is used in cybersecurity for protecting information. Scientists often use a metric called min-entropy to estimate and validate how good a source is at generating the random numbers used to encrypt data. Data with low entropy is easier to decipher, whereas data with high entropy is much more difficult to decode. But it is difficult to accurately estimate the min-entropy for some types of sources, leading to underestimations.

Kim and his colleagues developed an offline algorithm that estimates min-entropy based on a whole data set and an online estimator that only needs limited data samples. The accuracy of the online estimator improves as the amount of data samples increases. Also, the online estimator does not need to store entire datasets, so it can be used in applications with stringent memory, storage and hardware constraints, like Internet-of-things devices.

"The evaluations showed that the algorithms can estimate min-entropy 500 times faster than the current standard algorithm while maintaining estimation accuracy," says Kim. Kim and his colleagues are working on improving the accuracy of this and other algorithms for estimating entropy in cryptography. They are also investigating how to improve privacy in machine learning applications.

R.SHOBIKA

II B.Sc. (Computer Technology)

THINKING IN 3D IMPROVES MATHEMATICAL SKILLS

Spatial reasoning ability in small children reflects how well they will perform in mathematics later. Researchers from the University of Basel recently came to this conclusion, making the case for better cultivation of spatial reasoning.

Good math skills open career doors in the natural sciences as well as technical and engineering fields. However, a nationwide study on basic skills conducted in Switzerland in 2019 found that schoolchildren achieved only modest results in mathematics. But it seems possible to begin promoting math skills from a young age, as Dr. Wenke Möhring's team of researchers from the University of Basel reported after studying nearly 600 children.

The team found a correlation between children's spatial sense at the age of three and their mathematical abilities in primary school. "We know from past studies that adults think spatially when working with numbers for example, represent small numbers to the left and large ones to the right," explains Möhring. "But little research has been done on how spatial reasoning at an early age affects children's learning and comprehension of mathematics later."

The researchers also closely examined whether the pace of development, i.e. particularly rapid development of spatial abilities can predict future mathematical ability. Past studies with a small sample size had found a correlation, but Möhring and her colleagues were unable to confirm this in their own study. Three-year-old children who started out with low spatial abilities improved them faster in the subsequent years, but still performed at a lower level in mathematics when they were seven years old. Despite faster development, by the time they began school

these children had still not fully caught up with the children possessing higher initial spatial reasoning skills.

Parents often push their children in the area of language skills, says Möhring. "Our results suggest how important it is to cultivate spatial reasoning at an early age as well." There are simple ways to do this such as using "spatial language" (larger, smaller, same, above, below) and toys e.g. building blocks that help improve spatial reasoning ability.

Spatial reasoning and gender

The researchers found that boys and girls are practically indistinguishable in terms of their spatial reasoning ability at the age of three but in subsequent years this develops more slowly in girls. Möhring and her colleagues suspect that boys may hear more "spatial language" and that toys typically designed for boys often promote spatial reasoning whereas toys for girls focus mainly on social skills. Children may also internalize their parents' and teacher's expectations and then, as they grow up, live up to stereotypes for example, that women do not perform as well in the areas of spatial reasoning and mathematics as men.

HOW CHILDREN INTEGRATE INFORMATION

Children learn a huge number of words in the early preschool years. A two-year-old might be able to say just a handful of words, while a five-year-old is quite likely to know many thousands. How do children achieve this marvelous feat? The question has occupied psychologists for over a century: In countless carefully designed experiments, researchers titrate the information children use to learn new words. How children integrate different types of information, has remained unclear.

D.KRISHNAKUMAR
III B.Sc. (Information Technology)

GREAT WEBSITES FOR INTERNET DEVELOPERS

Internet Development has proven over the past few years to be a very steady career. Anyone who has chosen this as a career path or is interested in Internet development as a hobby knows that programming and information is constantly evolving. Therefore, it is important for anyone working in Internet development to stay on top of the latest trends and information. The staff at Best Computer Science Degrees is aware of this constant need for information and decided to compile a list of some great websites for Internet developers.

Associations

American Institute of Graphic Arts: The AIGA is an association for graphic artists, including those in the digital arts, such as Internet Developers and page designers.

Association for Women in Computing: The AWC is one of the first professional organizations for women in computing and is dedicated to promoting the advancement of women in computing.

Association of Information Technology Professionals: An association which seeks to advance the IT profession through professional development, support of IT education, and national policies on IT.

Association of Web Design Professionals: An association of Web design professionals to allow non-Web professionals to look for developers for work.

IEEE Computer Society: This society is a source for computer technology information, inspiration, and collaboration.

International Association of Computer - Science and Information Technology: The website for this professional organization with up-t0-date information about Internet developers.

International Webmaster's Association: This organization is the industry's recognized leader in providing educational and certification standards for Web professionals.

HTML Writer's Guild: A leading training organization for the Web design community.

Network Professional Association: The website of the leading organization for network computing professionals.

Society for Technical Communication: The website for the world's largest and oldest professional association dedicated to the advancement of the field of technical communication.

Web Professionals: An organization dedicated to the support of individuals who create, manage or market web sites.

Women in Technology: An organization promoting women in the technology field.

Websites-Magazines

Net Magazine: A magazine devoted to Web design.

PC Magazine: The website of the popular technology magazine.

Smashing Magazine: An online magazine for designers and developers, with a focus on useful techniques and best practices in web design.

Speckyboy: A magazine for Web design news and resources.

Web Designer: A magazine about Web design and development news with free tutorials and guides.

Wired: The website of the magazine with technology news, trends and stories for computer scientists and programmers.

Blogs

Adaptive Path: A blog offering news about interface design.

Boxes and Arrows: A blog about design principals.

Cats Who Code: A blog about Web development.

Codea Tutorials: A blog about Codea and developing apps for the iPhone and iPad.

Coding Horror : A blog about Web development.

Creative Blog : The latest on Web design and related information.

CSS Globe: A blog about Web design news.

Digital Inspiration: A blog from top computer scientist Amit Agarwal, with how-to guides for computer software, consumer gadgets, and web apps.

Line 25: A blog about Web design.

Noupe: A blog about news and resources for Web development and design.

PHP Developer: News from sites and blogs about PHP, including tutorials.

John Resig : A blog from the JavaScript developer with thoughts about development of JavaScripts and Web applications.

Reefwing : A blog about coding and iPhone and iPad apps.

Signal vs. Noise: A blog by the company 37 Signals that discusses design and usability.

Snook: A blog about tips, tricks and bookmarks about Web development.

Spoongraphics : A blog focusing on graphics and Web design, which includes tutorials and free, downloadable resources.

Vandelay Design: A blog about Web design and development.

Wake Up Later: A website general web development related things, such as coding mistakes and improving productivity.

Web Designer Wall : A blog that features design ideas and elaborate, stunning tutorials, such as creating a CSS gradient Text Effect.

Webitect : A resource blog for Webmasters.

Web Monkey : A blog about HTML coding and the latest in website development news.

Women in Computing : A blog that supporting women in computing.

S.HARITHA

III B.Sc. (Information Technology)

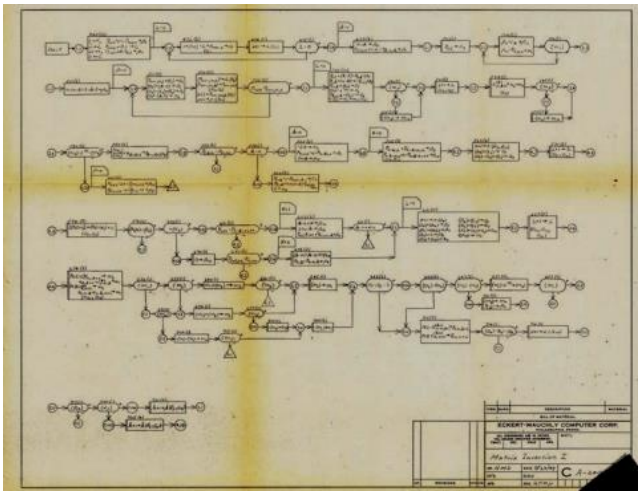
FLOWCHARTING TEMPLATES

The smithsonian has begun to post online descriptions of objects in its collections. Figures and accounts are now available for roughly 2500 objects from the math and computer collections perhaps a quarter of the total. Recently cataloged the two dozen flowcharting templates in the collections. This brief account is intended to encourage readers to add their own reminiscences to the online records, creating a much richer resource.

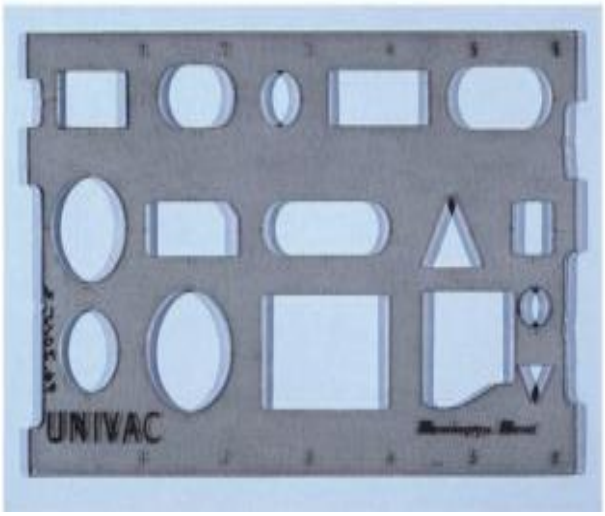
Early commercial computer manufacturers, most notably Remington Rand UNIVAC (previously Eckert Mauchly Computer Company, later Remington Rand UNIVAC, now UNISYS) and IBM, faced the challenge of teaching both potential customers

and budding programmers about the logical structure of computer programs. Toward that end, they used diagrams called flowcharts, which had separate symbols to represent forms of input and output, operations, decisions, connectors and directions of logical flow.

The earliest flowcharting template in the Smithsonian collections dates from about 1955 and was distributed, appropriately enough, by Remington Rand Univac, the corporate descendent of EMCC. The symbols on it are not labeled but are an expanded version of those used in earlier Eckert-Mauchly diagrams. The template is shown in a short, undated, movie entitled Remington Rand Presents UNIVAC. It also appeared on the cover of a company publication known as the Programmer in March–April, 1956. Other computer manufacturers also soon issued flowcharting. Examples in the Smithsonian collections come from the Electro data Division of Burroughs, Burroughs itself, IBM, RCA, Honeywell, the Massachusetts firm of Sprague Electric, RCA, Bunker-Ramo Corporation, the Bell System and Control Data Corporation.



Once templates had become a standard tool of computer programming, they also were sold by makers of drawing instruments. Two examples in the Smithsonian collections were made in the U.S., distributed by the German firm of Mars Staedler, and used in Canada. By the 1980s, such templates also might be distributed as giveaways by prospective employers. This profusion of flow charts led to attempts at standardization. In the early 1960s, the American Standards Association established sectional committee X3 to develop standards for computers and information processing.



The first standard developed by the subcommittee on problem description and analysis concerned flowcharting symbols. A proposal circulated in 1963 was approved as ASA Standard X3.5-1965 (the 1965 version of the fifth standard developed by committee X3), and was soon revised as X3.5-1966 and then as X3.5-1970. Templates sometimes refer to the standard used in creating them, offering a clue as to the date on which they were designed. Surviving flowcharting templates well represent the emergence of commercial computer manufacturers, early attempts to provide training for programmers, and efforts to develop standards within information processing.

B. A.AKSHAYA SHREE

III B.Sc. (Computer Technology)

MAKING COMPUTER SERVERS WORLDWIDE MORE CLIMATE FRIENDLY

An elegant new algorithm developed by Danish researchers can significantly reduce the resource consumption of the world's computer servers. Computer servers are as taxing on the climate as global air traffic combined, thereby making the green transition in IT an urgent matter. The researchers, from the University of Copenhagen, expect major IT companies to deploy the algorithm immediately.

One of the flipsides of our runaway internet usage is its impact on climate due to the massive amount of electricity consumed by computer servers. Current CO2 emissions from data centres are as high as from global air traffic combined with emissions expected to double within just a few years.

Only a handful of years have passed since Professor Mikkel Thorup was among a group of researchers behind an algorithm that addressed part of this problem by producing a groundbreaking recipe to streamline computer server workflows. Their work saved energy and resources. Tech giants including Vimeo and Google enthusiastically implemented the algorithm in their systems, with online video platform Vimeo reporting that the algorithm had reduced their bandwidth usage by a factor of eight.

Now, Thorup and two fellow UCPH researchers have perfected the already clever algorithm, making it possible to address a fundamental problem in computer systems the fact that some servers become overloaded while other servers have capacity left many times faster than today.

Soaring internet traffic

The algorithm addresses the problem of servers becoming overloaded as they receive more requests from clients than they have the capacity to handle. This happens as users pile in to watch a certain Vimeo video or Netflix film. As a result, systems often need to shift

clients around many times to achieve a balanced distribution among servers.

The mathematical calculation required to achieve this balancing act is extraordinarily difficult as up to a billion servers can be involved in the system. And, it is ever-volatile as new clients and servers join and leave. This leads to congestion and server breakdowns, as well as resource consumption that influences the overall climate impact.

As internet traffic soars explosively, the problem will continue to grow. Therefore, we need a scalable solution that doesn't depend on the number of servers involved. Our algorithm provides exactly such a solution, explains Thorup. According to the American IT firm Cisco, internet traffic is projected to triple between 2017 and 2022.

From 100 steps to 10

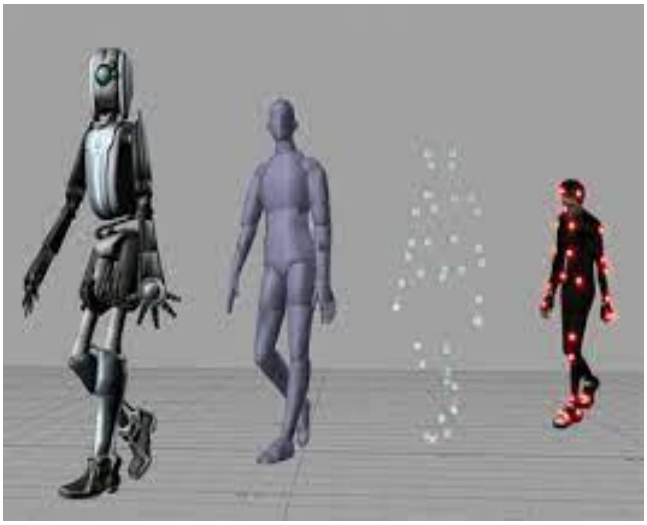
The new algorithm ensures that clients are distributed as evenly as possible among servers, by moving them around as little as possible, and by retrieving content as locally as possible. For example, to ensure that client distribution among servers balances so that no server is more than 10% more burdened than others, the old algorithm could deal with an update by moving a client one hundred times. The new algorithm reduces this to 10 moves, even when there are billions of clients and servers in the system. Mathematically stated: if the balance is to be kept within a factor of 1+1/X, the improvement in the number of moves from X2 to X is generally impossible to improve upon. As many large IT firms have already implemented Professor Thorup's original algorithm, he believes that industry will adopt the new one immediately and that it may already be in use.

V.LEEPIKA

II B.Sc. (Information Technology)

COMPUTER-GENERATED IMAGERY

Computer-generated imagery (CGI) is the application of the field of computer graphics (or more specifically, 3D computer graphics) to special effects.



CGI is used in films, television programs and commercials, and in printed media. Video games most often use real-time computer graphics (rarely referred to as CGI), but may also include pre-rendered "cut scenes"

and intro movies that would be typical CGI applications.

CGI is used for visual effects because the quality is often higher and effects are more controllable than other more physically based processes such as constructing miniatures for effects shots or hiring extras for crowd scenes and because it allows the creation of images that would not be feasible using any other technology.

R.JANANI

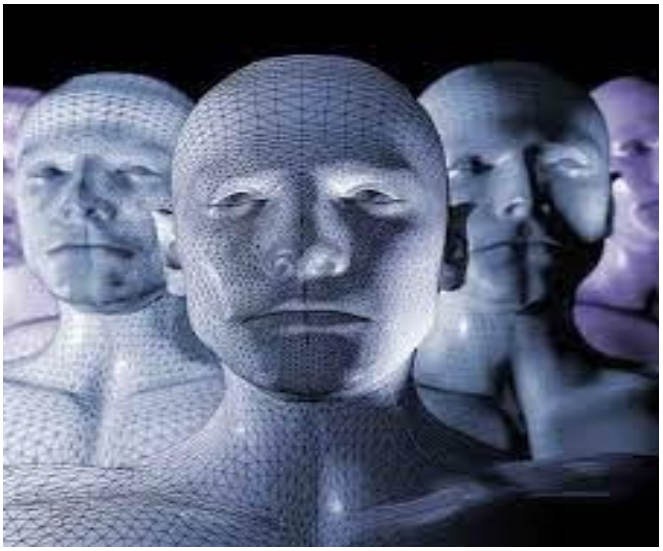
I B.Sc. (Computer Technology)

COMPUTER-ASSISTED BIOLOGY: DECODING NOISY DATA TO PREDICT CELL GROWTH

Scientists from The University of Tokyo Institute of Industrial Science have designed a machine learning algorithm to predict the size of an individual cell as it grows and divides. By using an artificial neural network that does not impose the assumptions commonly employed in biology, the computer was able to make more complex and accurate forecasts than previously possible. This work may help advance the field of quantitative biology as well as improve the industrial production of medications or fermented products.

As in all of the natural sciences, biology has developed mathematical models to help fit data and make predictions about the future. However, because of the inherent complexities of living systems, many of these equations rely on simplifying assumptions that do not always reflect the actual underlying biological processes. Now, researchers at The University of Tokyo Institute of Industrial Science have implemented a machine learning algorithm that can use the measured size of single cells over time to predict their future size. Because the computer automatically recognizes patterns in the data, it is not constrained like conventional methods.

"In biology, simple models are often used based on their capacity to reproduce the measured data," first author Atsushi Kamimura says. "However, the models may fail to capture what is really going on because of human preconceptions,."



The data for this latest study were collected from either an Escherichia coli bacterium or a Schizosaccharomyces pombe yeast cell held in a microfluidic channel at various temperatures. The plot of size over time looked like a sawtooth as exponential

growth was interrupted by division events. Human biologists usually use a sizer model, based on the absolute size of the cell, or "adder" model, based on the increase in size since birth, to predict when divisions will occur. The computer algorithm found support for the adder principle, but as part of a complex web of biochemical reactions and signaling.

This method can be extended to many other aspects of biology besides predicting cell size. In the future, life science may be driven more by objective artificial intelligence than human models. This may lead to more efficient control of microorganisms we use to ferment products and produce drugs.

D.KRISHNAKUMAR

III B.Sc. (Information Technology)

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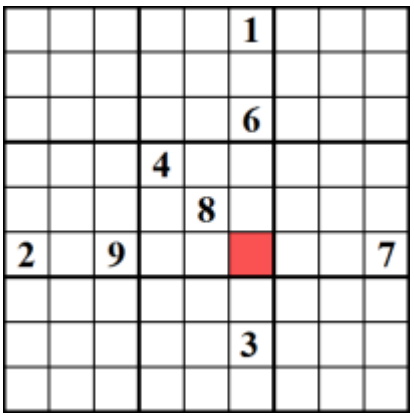
SUDOKU SOLVING TECHNIQUES

One of the greatest aspects of Sudoku is that the game offers engaging challenges to both the novice, as well as the seasoned puzzle player. Whenever they play a puzzle tailored for their level of competence, both the beginner and the experienced Sudoku solver will have to put a good amount of thought and technique into completing the task. Their approach, though, may not be the same. Solving a hard Sudoku puzzle will require quite a different set of techniques compared to an easy one. This article presents nine such techniques in increasing difficulty. When utilizing these techniques, the way to prefer to do it is to start with the basic ones. Use the first few techniques to insert as many numbers as you can. Then, when you can add no more numbers to the board using the basic techniques, try the more advanced ones. Do one at a time until you can plot one more number into a cell. Then, start with the basic techniques again and repeat the process. You should be able to solve almost any Sudoku puzzle using these techniques.

Techniques for removing numbers:

Sole Candidate

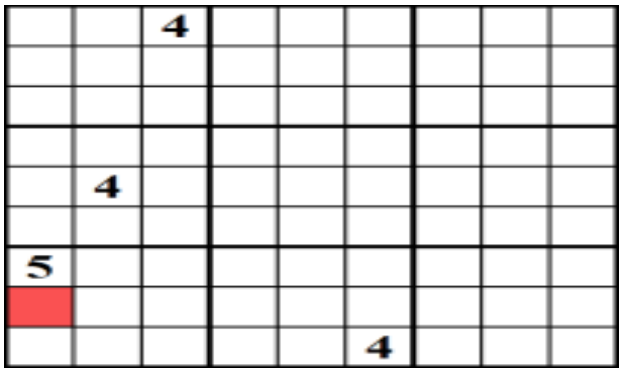
When a specific cell can only contain a single number, that number is a "sole candidate". This happens whenever all other numbers but the candidate number exists in the current block, column or row. In this example, the red cell can only contain the number 5, as the other eight numbers have all been used in the related block, column and row.



Unique Candidate

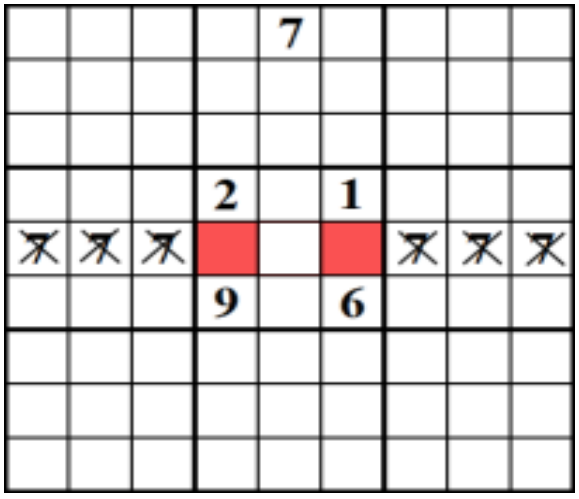
You know that each block, row and column on a Sudoku board must contain every number between 1 and 9. Therefore, if a number, say 4, can only be put in a single cell

within a block/column/row, then that number is guaranteed to fit there. This example illustrates the number 4 as the unique candidate for the cell marked in red.



Techniques for removing candidates:
Block and column / Row Interaction

This method won't help you pencil in any new numbers, but it will help you nail a number down within a specific row or column. The example shows that the number 7 can only be inserted in the red cells of the middle row. Thus you can remove 7 as a possible candidate from the rest of the row.

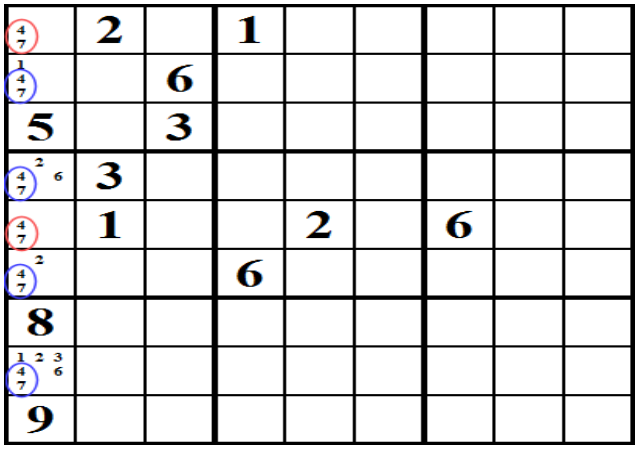


Block / Block Interaction

This technique is best understood by looking at the example. In the middle and the middle-left blocks, the number 8 must be placed in one of the red cells. This means, we can eliminate 8 from the upper and lower rows in the middle-right column.

Naked Subset

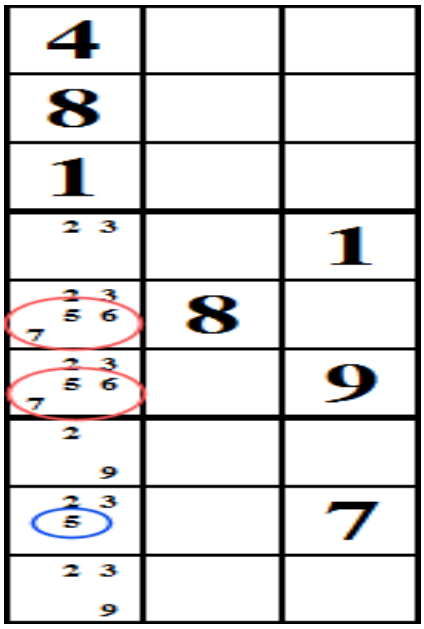
The example shows that row number 1 and row number 5 both have a cell in the same column containing only the candidate numbers 4 and 7. These two numbers appear as candidates in all of the other open cells in that column too, but since they are the only two candidates in rows 1 and 5, these two numbers cannot appear anywhere else in the row, thus you can remove them. In the example, the two candidate pairs circled in red, are the sole candidates. Since 4 and 7 must be placed in either of these two cells, all of the pairs circled in blue, can remove those numbers as candidates. In this puzzle, this means 1 becomes sole candidate in the second row; 2 becomes sole candidate in row 6; and thus, 6 is sole candidate for row number 4.



You can also use this technique if you have more than two candidates. For example, let us say the pairs circled in red were instead triple candidates of the numbers 1, 4, 7. This would mean those three numbers would have to be placed in either rows 1, 2 or 5. We could remove these three numbers as candidates in any of the remaining cells in the column. This technique even works with four candidate numbers, assuming you have 4 possible candidates in four different cells in a row/column.

Hidden subset

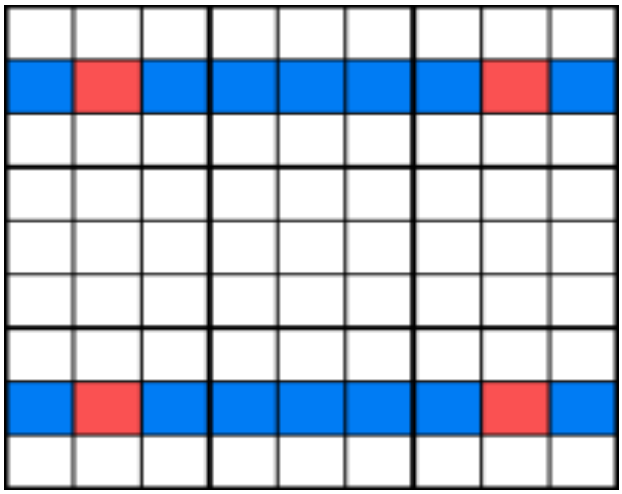
This is similar to Naked subset, but it affects the cells holding the candidates. In this example, we see that the numbers 5, 6, 7 can only be placed in cells 5 or 6 in the first column (marked in a red circle), and that the number 5 can only be inserted in cell number 8 (marked in a blue circle). Since 6 and 7 must be placed in one of the cells with a red circle, it follows that the number 5 has to be placed in cell number 8, and thus we can remove any other candidates from the 8th cell; in this case, 2 and 3.



X-Wing

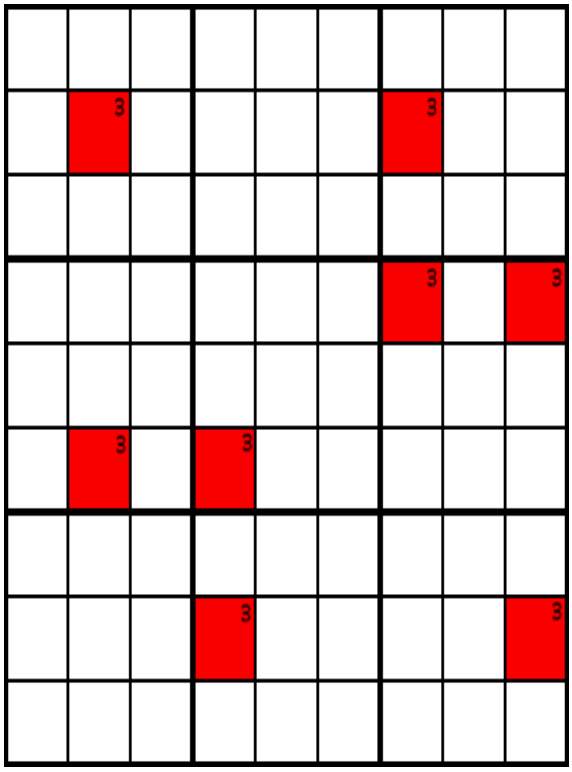
This method can work when you look at cells comprising a rectangle, such as the cells marked in red. In this example, let's say that the red and blue cells all have the number 5 as candidate numbers. Now, imagine if the red cells are the only cells in column 2 and 8 in which you can put 5.

In this case you obviously need to put a 5 in two of the red cells, and you also know they cannot both be in the same row. Well, now, this means you can eliminate 5 as the candidate for all the blue cells. This is because in the top row, either the first or the second red cell must have a 5, and the same can be said about the lower row.



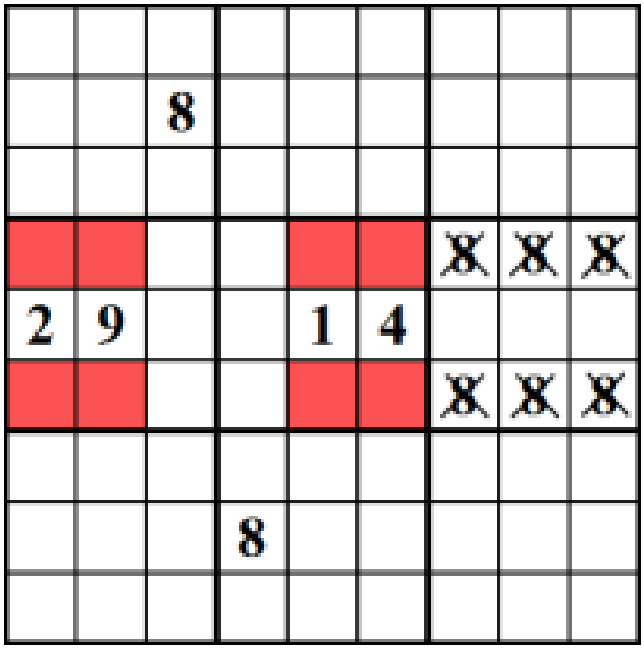
Swordfish

Swordfish is a more complicated version of X-Wing. In most cases, the technique might seem like much work for very little pay but some puzzles can only be solved.



Example A

In example A, we've plotted in some candidate cells for the number 3. Now, assume that in column 2, 4, 7 and 9, the only cells that can contain the number 3 are the ones marked in red. You know that each column must contain a 3.



B. A.AKSHAYA SHREE

III B.Sc. (Computer Technology)

HOW TO IMPROVE YOUR TELEPHONIC INTERVIEW SKILL?

Telephonic interviews are an important part of the selection process of the recruited candidates. In order to connect and make the most out of the interview, make sure you have blocked your timetable at the scheduled time of the interview. What should you ask? What shouldn't you?

Introduction

Start with an introduction. Talk about the company precisely and introduce the candidate to the entire selection process. Further, once you've spoken about the organisation and its management, confirm the candidate's acceptance on the overall approach of the company.

Strength and weakness

These are the two questions you should generally ask the candidate to analyse if he fits in with the position you are hiring him for or not. However, it is essential for you to apprehend if the candidate has delivered a pre-planned well-designed answer or honestly answered it on the spot. If you like his approach to the question, you may consider him for the next process.

- Further, you may also talk to the candidate about his previous job or education.
- Also, consider discussing the job roles of various open positions in the company.

What should you not ask?

- Avoid asking questions that are expected to give you programmed answers. For example, asking the candidate about his career plan will provide you with a pre-planned answer. Instead, ask him about his professional goals in 5 years, 10 years, 20 years and so on.
- Never ask the person's age. You may consider the same from his/her CV.
- Do not ask about his religion, region, caste or creed.
- Further, never ask them about their family, their kids or about their personal matters.
- Do not talk about their disabilities over the call.
- Do not ask them the reason why they left their prior job. You may though ask them about their prior experiences.

PERSONAL INTERVIEW SKILLS

Whom do the interviewers select?

The candidate they "like" – so your job is to be "liked" by the panel.

Attributes that normal panels like:

Honesty

- Be ruthlessly honest with your answers

- You should know your subject
- You should understand your immediate environment
- Your answering should demonstrate analysis
- Listen to the words and the body language
- Answer the question asked
- Panels dislike arrogance

Knowledge

Clarity of thought/ ability to think

Listening skills

Ability to handle stress

Humility

Questions address the following areas:

Personal

- Academic and family background
- Hobbies and interests
- Ideal person/ greatest achievement

Career-related

- Why MBA? Specialization?
- 5/ 10 years from now?
- Current job role/ reasons for leaving

Subject-related

- Major in undergraduate
- Emphasis on fundamentals

Attitude-related

- Opinions on reservation
- Stand on ethics

What can you do?

Prepare, prepare, prepare

1) Find out everything about the Business School

2) Prepare answers to typical questions like

- Tell us something about yourself
- Where do you see yourself 5/10 years from now?
- Why do you want to do an MBA?
- Why from our school?

3) Bring yourself up to date on events around the globe

4) Prepare questions that you can ask the interviewers

5) Learn to answer open-ended questions in a way that guides the interview to your area o strength

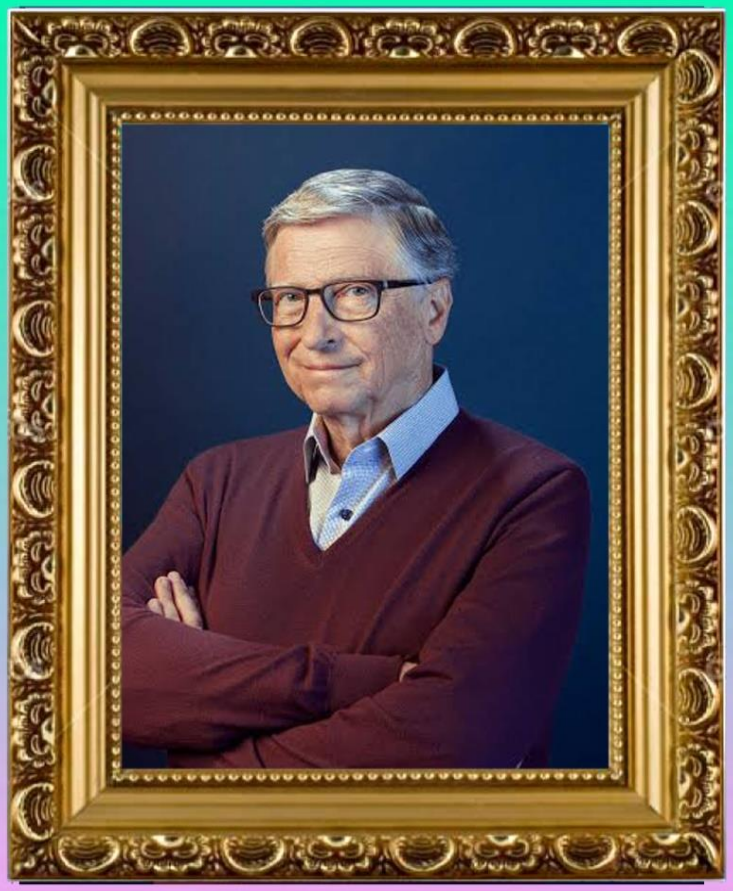
6) Remember, an interview is an interaction

You don't want to

- Answer without letting the interviewer finish his/her question
- Volunteer more information than asked for
- "Guess" this is not a multiple choice situation
- Get into an argument with the panel
- Come across as opinionated and judgmental
- Appear to be in a hurry

You want to

- Take your time: think before you answer
- Be pleasant and courteous



We are Changing the World with Technology

- Bill Gates