INFOLINE

VOLUME IX ISSUE I JULY 2018

DEPARTMENT OF COMPUTER TECHNOLOGY AND INFORMATION TECHNOLOGY

KONGU ARTS AND SCIENCE COLLEGE
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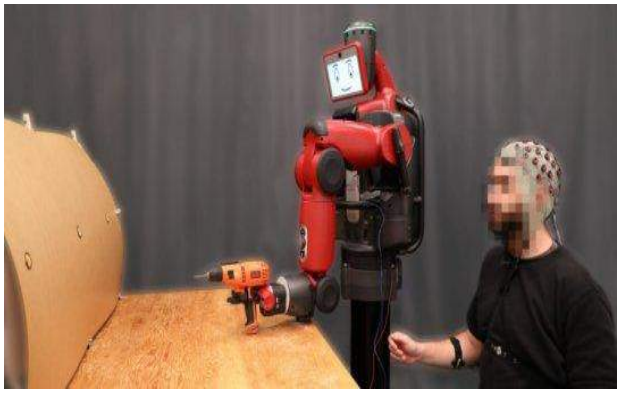
CONTROLLING ROBOTS WITH BRAINWAVES AND HAND GESTURES



Getting robots to do things isn't easy: usually scientists have to either explicitly program them or get them to understand how humans communicate via language. It is possible to control robots more intuitively, using just hand gestures and brainwaves. A new system spearheaded by researchers from MIT's Computer Science and Artificial Intelligence Laboratory (CSAIL) aims to do exactly that, allowing users to instantly correct robot mistakes with nothing more than brain signals and the flick of a finger.

Building off the team's past work focused on simple binary-choice activities, the new work expands the scope to multiple-choice tasks, opening up new possibilities for how human workers could manage teams of robots. By monitoring brain activity, the system can detect in real time if a person notices an error as a robot does a task. Using an interface that measures muscle activity, the person can then make hand gestures to scroll through and select the correct option for the robot to execute.

The team demonstrated the system on a task in which a robot moves a power drill to one of three possible targets on the body of a mock plane. Importantly, they showed that the system works on people it's never seen before, meaning that organizations could deploy it in real-world settings without needing to train it on users. "This work combining EEG and EMG feedback enables natural human-robot interactions for a broader set of applications than we've been able to do before using only EEG feedback," says CSAIL director Daniela Rus, who supervised the work.

Intuitive human-robot interaction

The systems could generally only recognize brain signals when people trained themselves to think in very specific but arbitrary ways and when the system was trained on such signals. For instance, a human operator might have to look at different light displays that correspond to different robot tasks during a training session. Not surprisingly, such approaches are difficult for people to handle reliably, especially if they work in fields like construction or navigation that already require intense concentration.

Meanwhile, Rus team harnessed the power of brain signals called error-related potentials (ErrPs), which researchers have found to naturally occur when people notice mistakes. If there's an ErrP, the system stops so the user can correct it; if not, it carries on. "The

great about this approach is that there's no need to train users to think in a prescribed way," says DelPreto. For the project the team used Baxter a humanoid robot from Rethink Robotics. With human supervision, the robot went from choosing the correct target 70 percent of the time to more than 97 percent of the time.

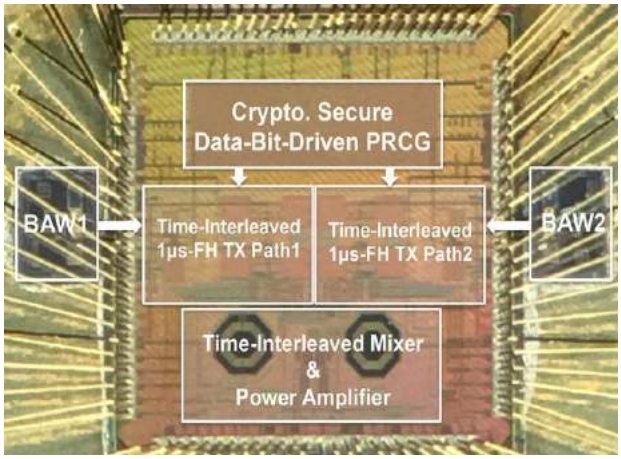
To create the system the team harnessed the power of electroencephalography (EEG) for brain activity and electromyography (EMG) for muscle activity, putting a series of electrodes on the users' scalp and forearm. Both metrics have some individual shortcomings: EEG signals are not always reliably detectable, while EMG signals can sometimes be difficult to map to motions that are any more specific than move left or right. Merging the two, however, allows for more robust bio-sensing and makes it possible for the system to work on new users without training. The team says that they could imagine the system one day being useful for the elderly, or workers with language disorders or limited mobility.

SRIDHARSHINI R K

III B.Sc. (Information Technology)

NOVEL TRANSMITTER PROTECTS WIRELESS DATA FROM HACKERS

Today, more than 8 billion devices are connected around the world, forming an "internet of things" that includes medical devices, wearables, vehicles, and smart household and city technologies. By 2020, experts estimate that number will rise to more than 20 billion devices, all uploading and sharing data online.



But those devices are vulnerable to hacker attacks that locate, intercept, and overwrite the data, jamming signals and generally wreaking havoc. One method to protect the data is called "frequency hopping," which sends each data packet, containing thousands of individual bits, on a random, unique radio frequency (RF) channel, so hackers can't pin down any given packet. Hopping large packets, however, is just slow enough that hackers can still pull off an attack.

The transmitter leverages frequency-agile devices called bulk acoustic wave (BAW)

resonators and rapidly switches between a wide range of RF channels, sending information for a data bit with each hop. In addition, the researchers incorporated a channel generator that, each microsecond, selects the random channel to send each bit. On top of that, the researchers developed a wireless protocol different from the protocol used today to support the ultrafast frequency hopping.

With the current existing [transmitter] architecture, you wouldn't be able to hop data bits at that speed with low power, says Rabia Tugce Yazicigil, a postdoc in the Department of Electrical Engineering and Computer Science and first author on a paper describing the transmitter, which is being presented at the IEEE Radio Frequency Integrated Circuits Symposium. By developing this protocol and radio frequency architecture together, physical layer security for connectivity of everything. Initially, this could mean securing smart meters that read home utilities, control heating, or monitor the grid.

More seriously, perhaps the transmitter could help secure medical devices, such as insulin pumps and pacemakers, that could be attacked if a hacker wants to harm someone," Yazicigil says. When people start corrupting the messages [of these devices] it starts affecting people's lives.

Ultrafast frequency hopping

One sneaky attack on wireless devices is called selective jamming, where a hacker intercepts and corrupts data packets transmitting from a single device but leaves all other nearby devices unscathed. Such targeted attacks are difficult to identify, as they're often mistaken for poor a wireless link and are difficult to combat with current packet-level frequency-hopping transmitters.

With frequency hopping, a transmitter sends data on various channels, based on a predetermined sequence shared with the receiver. Packet-level frequency hopping sends one data packet at a time, on a single 1-megahertz channel, across a range of 80 channels. A packet takes around 612 microseconds for BLE-type transmitters to send on that channel. But attackers can locate the channel during the first 1 microsecond and then jam the packet.

"Because the packet stays in the channel for long time, and the attacker only needs a microsecond to identify the frequency, the attacker has enough time to overwrite the data in the remainder of packet," Yazicigil says.

To build their ultrafast frequency-hopping method, the researchers first replaced a crystal oscillator which vibrates to create an electrical signal with an oscillator based on a BAW resonator. However, the BAW resonators

only cover about 4 to 5 megahertz of frequency channels, falling far short of the 80-megahertz range available in the 2.4-gigahertz band designated for wireless communication. An additional mixer component combines the divided frequencies with the BAW's radio frequencies to create a host of new radio frequencies that can span about 80 channels.

Randomizing everything

The next step was randomizing how the data is sent. In traditional modulation schemes, when a transmitter sends data on a channel, that channel will display an offset a slight deviation in frequency. With BLE modulations, that offset is always a fixed 250 kilohertz for a 1 bit and a fixed -250 kilohertz for a 0 bit. A receiver simply notes the channel's 250-kilohertz or -250-kilohertz offset as each bit is sent and decodes the corresponding bits.

But that means, if hackers can pinpoint the carrier frequency, they too have access to that information. If hackers can see a 250-kilohertz offset on, say, channel 14, they'll know that's an incoming 1 and begin messing with the rest of the data packet.

To combat that, the researchers employed a system that each microsecond generates a pair of separate channels across the 80-channel spectrum. Based on a preshared secret key with the transmitter, the receiver does some calculations to designate one channel to carry a 1 bit and the other to carry a 0 bit. But the channel carrying the desired bit will always display more energy. The receiver then compares the energy in those two channels, notes which one has a higher energy, and decodes for the bit sent on that channel.

For example, by using the preshared key, the receiver will calculate that 1 will be sent on channel 14 and a 0 will be sent on channel 31 for one hop. But the transmitter only wants the receiver to decode a 1. The transmitter will send a 1 on channel 14, and send nothing on channel 31. The receiver sees channel 14 has a higher energy and, knowing that's a 1-bit channel, decodes a 1. In the next microsecond, the transmitter selects two more random channels for the next bit and repeats the process.

Because the channel selection is quick and random, and there is no fixed frequency offset, a hacker can never tell which bit is going to which channel. "For an attacker, that means they can't do any better than random guessing, making selective jamming infeasible," Yazicigil says.

As a final innovation, the researchers integrated two transmitter paths into a time-interleaved architecture. This allows the inactive transmitter to receive the selected next channel, while the active transmitter sends data on the current channel. Then, the workload alternates. Doing so ensures a 1-microsecond frequency-hop rate and, in turn, preserves the

1-megabyte-per-second data rate similar to BLE-type transmitters.

"Most of the current vulnerability [to signal jamming] stems from the fact that transmitters hop slowly and dwell on a channel for several consecutive bits. Bit-level frequency hopping makes it very hard to detect and selectively jam the wireless link," says Peter Kinget, a professor of electrical engineering and chair of the department at Columbia University. This innovation was only possible by working across the various layers in the communication stack requiring new circuits, architectures, and protocols. It has the potential to address key security challenges in IoT devices across industries.

S.AISWARYA

II B.Sc. (Computer Technology)

RAIN Technology

The name of the original research project was RAIN, which stands for Reliable Array of Independent Nodes. The goal of the RAIN project was to identify key software building blocks for creating reliable distributed applications using off-the-shelf hardware.

The focus of the research was on high-performance, fault-tolerant and portable clustering technology for space-borne computing. Two important assumptions were made, and these two assumptions reflect the differentiations between RAIN and a number of existing solutions both in the industry and in academia:

1. The most general share-nothing model is assumed. There is no shared storage accessible from all computing nodes. The only way for the computing nodes to share state is to communicate via a network. This differentiates RAIN technology from existing back-end server clustering solutions such as SUNcluster, HP MC Serviceguard or Microsoft Cluster Server.

2. The distributed application is not an isolated system. The distributed protocols interact closely with existing networking protocols so that a RAIN cluster is able to interact with the environment. Specifically, technological modules were created to handle high-volume network-based transactions. This differentiates it from traditional distributed computing projects such as Beowulf.

In short, the RAIN project is intended to marry distributed computing with networking protocols. It became obvious that RAIN technology was well-suited for Internet applications. During the RAIN project, key components were built to fulfill this vision. A patent was filed and granted for the RAIN technology. Rainfinity was spun off from Caltech in 1998, and the company has exclusive intellectual property rights to the RAIN technology. After the formation of the

company, the RAIN technology has been further augmented, and additional patents have been filed.

The guiding concepts that shaped the architecture are as follows:

1. Network Applications

The architecture goals for clustering data network applications that are different from clustering data storage applications. Similar goals apply in the telecom environment that provides the Internet backbone infrastructure, due to the nature of applications and services being clustered.

2. Shared-Nothing

The shared-storage cluster is the most widely used for database and application servers that store persistent data on disks. This type of cluster typically focuses on the availability of the database or application service, rather than performance. Recovery from failover is generally slow, because restoring application access to disk-based data takes minutes or longer, not seconds. Telecom servers deployed at the edge of the network are often diskless, keeping data in memory for performance reasons, and tolerate low failover time. Therefore, a new type of share-nothing cluster with rapid failure detection and recovery is required. The only way for the shared-nothing cluster to share is to communicate via the network.

3. Scalability

While the high-availability cluster focuses on recovery from unplanned and planned downtimes, this new type of cluster must also be able to maximize I/O performance by load balancing across multiple computing nodes. Linear scalability with network throughput is important. In order to maximize the total throughput, load load-balancing decisions must be made dynamically by measuring the current capacity of each computing node in real-time. Static hashing does not guarantee an even distribution of traffic.

4. Peer-to-Peer

A dispatcher-based, master-slave cluster architecture suffers from scalability by introducing a potential bottleneck. A peer-to-peer cluster architecture is more suitable for latency-sensitive data network applications processing short lived sessions. A hybrid architecture should be considered to offset the need for more control over resource management. For example, a cluster can assign multiple authoritative computing nodes that process traffic in the round-robin order for each network interface that is clustered to reduce the overhead of traffic forwarding.

VARSHA R

II B.Sc. (Information Technology)

iTwin

USB flash drive is a data storage device that consists of flash memory with an integrated Universal Serial Bus (USB) interface. A Cloud Storage is also a similar case where in the data is stored remotely and is accessed whenever needed.

The drawback of this USB flash drives is small size cause of which it can easily be misplaced or lost. This is a particular problem if the data it contains is sensitive and confidential. In Cloud Storages the data can be stolen or misused if the username and password of an account to access the storage is hacked by someone. There are many more drawbacks like limited storage, no security, back up, temp files, no remote disable etc.

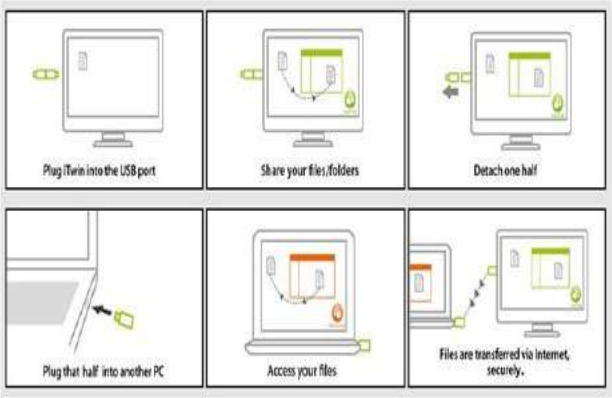
iTwin is a 'limitless' secure USB device that enables users to access, edit & share all their files & media between any two online computers anywhere in the world. The only limit is the size of your computer's hard drive. iTwin is an innovative solution that allows remote file access without the security and privacy risks of the cloud and USB flash drives. It's very easy to access as a USB device and no special installation is required. iTwin uses thoroughly analyzed crypto protocols and algorithms(AES 256 bit encryption). It has features like bi-directional file access, no temp files, remote disable, smart key generation, password support and twintrust authentication

What is an iTwin?

iTwin is a revolutionary new file sharing and remote access device brought to you by a company called iTwin. It's like two ends of a cable, without the cable. It's as simple to use as a flash drive. It's literally plug and play. iTwin can connect any two online computers anywhere in the world. iTwin enables you to have access to any or all of your home computer's files and folders while you're on-the-go. Similarly, you can also use iTwin to access to any or all of your office computer's files and folders while on-the-go. There's no in-built limit to the amount of storage you can access with iTwin while you're on-the-go. The only limit is the size of your hard drives. The only other limit is the speed of your Internet connection. The faster it is, the better your experience. You can select files for accessing later on-the-go, or you can edit them remotely, without the files leaving your computer. You can also back-up files to your home or office computer while you're out on-the-go. It's so easy, it's unbelievable.

Who invented iTwin?

Engineering from IIT in Chennai and a Masters degree from IISc in Bangalore, Lux worked first as an IT security researcher at the Institute of Systems Science, Singapore and then as senior researcher at Kent Ridge Digital Labs and the Institute for Infocomm Research. Lux specializes in PKI implementations, efficient digital certificate revocations and usable security. Lux was pursuing a part-time MBA at NUS Business School, Singapore, but put studies on hold because of potential of iTwin



How to use iTwin?

When you connect iTwin, to see a regular window pop-up, just as you would if you plugged in a regular USB flash drive. Drag and drop files and folders into this window to share them - as many as you want. Leave your computer with one half of iTwin connected to it. Detach the other half of iTwin and take it with you. Wherever you go, you can remotely access the shared files, simply by plugging the half you are carrying into any online Windows computer, anywhere. iTwin allows you to transfer files to or from your home computer. Or your office computer. Or your friend's, or your colleague's iTwin also allows to edit the shared files on a remote computer, while keeping them on that remote computer.

Unique Features

1. Smart key generation

Two iTwins together generate a random 256-bit AES key, everytime they are physically paired and plugged into a computer. Smart Key generation is assisted by the computer to add randomness. Smart crypto key resides only on the two halves of the paired iTwin. Smart Crypto key is used for encrypting all data traffic between two iTwins.

2. No “Temp Files”

Unplug iTwin and all temp files are purged automatically. This is especially useful when using a computer that does not belong to you.

3. Password support

iTwin even provides password support. Passwords of any length can be set. Unlike other web services, iTwin's password is stored on itself, not on any server. If you forget your password, simply pair both halves of your iTwin, plug them into a computer and set a new password. No need for tech support.

4. Bi-Directional File Access

When using iTwin, the connection between the 2 computers is completely symmetrical. Access, copy, backup & remotely edit files on computer A from computer B, and on B from A. You will have access to files on both A and B.

technology).

G.LOKESHWAR
III B.Sc. (Information Technology)

BIOLOGICAL COMPUTERS

Biological computers have emerged as an interdisciplinary field that draws together molecular biology, chemistry, computer science and mathematics. The highly predictable hybridization chemistry of DNA, the ability to completely control the length and content of oligonucleotides, and the wealth of enzymes available for the modification of the DNA, make use of nucleic acids an attractive candidate for all of these nanoscale applications.

A DNA computer has been used for the first time to find the only correct answer from over a million possible solutions to a computational problem. Leonard Adleman of the University of Southern California in the US and colleagues used different strands of DNA to represent the 20 variables in their problem, which could be the most complex task ever solved without a conventional computer. The researchers believe that the complexity of the structure of biological molecules could allow DNA computers to outperform their electronic counterparts in future.

Scientists have previously used DNA computers to crack computational problems with up to nine variables, which involves selecting the correct answer from 512 possible solutions. But now Adleman's team has shown that a similar technique can solve a problem with 20 variables, which has 220 or 1 048 576 possible solutions. Adleman and colleagues chose an exponential time problem, in which each extra variable doubles the amount of computation needed. This is known as an NP-complete problem, and is notoriously difficult to solve for a large number of variables. Other NP-complete problems include the 'travelling salesman' problem - in which a salesman has to find the shortest route between a number of cities - and the calculation of interactions between many atoms or molecules.

Adleman and co-workers expressed their problem as a string of 24 'clauses', each of which specified a certain combination of 'true' and 'false' for three of the 20 variables. The team then assigned two short strands of specially encoded DNA to all 20 variables, representing 'true' and 'false' for each one. In the experiment, each of the 24 clauses is represented by a gel-filled glass cell. The strands of DNA corresponding to the variables

and their 'true' or 'false' state in each clause were then placed in the cells.

Each of the possible 1,048,576 solutions were then represented by much longer strands of specially encoded DNA, which Adleman's team added to the first cell. If a long strand had a 'subsequence' that complemented all three short strands, it bound to them. But otherwise it passed through the cell. To move on to the second clause of the formula, a fresh set of long strands was sent into the second cell, which trapped any long strand with a 'subsequence' complementary to all three of its short strands. This process was repeated until a complete set of long strands had been added to all 24 cells, corresponding to the 24 clauses. The long strands captured in the cells were collected at the end of the experiment, and these represented the solution to the problem.

SELVA BHARATHI A
II B.Sc. (Computer Technology)

FINGER TRACKING IN REAL TIME HUMAN COMPUTER INTERACTION

Finger-tracking is the usage of bare hand to operate a computer in order to make human-computer interaction much more faster and easier. Fingertip finding deals with extraction of information from hand features and positions. In this method we use the position and direction of the fingers in order to get the required segmented region of interest.

Finger pointing systems aim to replace pointing and clicking devices like the mouse with the bare hand. These applications require a robust localization of the fingertip plus the recognition of a limited number of hand postures for “clicking-commands”. Finger-tracking systems are considered as specialized type of hand posture/gesture recognition system.

The typical Specializations are:

- Only the most simple hand postures and recognized
- The hand usually covers a part of the on screen
- The finger positions are being found in real-time
- Ideally, the system works with all kinds of backgrounds
- The system does not restrict the speed of hand movements

Methods

- Color Tracking Systems
- Correlation Tracking Systems
- Contour -Based Tracking Systems
- Finger Finding
- Finger Mouse

The FingerMouse system makes it possible to control a standard11 mouse pointer with the

bare hand. If the user moves an outstretched forefinger in front of the camera, the mouse pointer follows the finger in real-time. Keeping the finger in the same position for one second generates a single mouse click. An outstretched thumb invokes the double-click command; the mouse-wheel is activated by stretching out all five fingers.

Applications:

Three applications based on Finger-tracking systems are

- FingerMouse
- FreeHandPresent
- BrainStorm
- FingerMouse

Finger Mouse

The FingerMouse system makes it possible to control a standard11 mouse pointer with the bare hand. If the user moves an outstretched forefinger in front of the camera, the mouse pointer follows the finger in real-time. Keeping the finger in the same position for one second generates a single mouse click. An outstretched thumb invokes the double-click command; the mouse-wheel is activated by stretching out all five fingers. The application mainly demonstrates the capabilities of the tracking mechanism. The mouse pointer is a simple and well-known feedback system that permits us to show the robustness and responsiveness of the finger tracker. Also, it is interesting to compare the finger-based mouse-pointer control with the standard mouse as a reference. This way the usability of the system can easily be tested

c

Figure:The FingerMouse on a projected screen (a) Moving the mouse pointer (b) Double-clicking with an outstretched thumb (c) Scrolling up and down with all five fingers outstretched

There are two scenarios where tasks might be better solved with the Finger Mouse than with a standard mouse:

Projected Screens

Similar to the popular touch-screens, projected screens could become “touchable” with the FingerMouse. Several persons could work simultaneously on one surface and logical objects, such as buttons and sliders, could be manipulated directly without the need for a physical object as intermediary.

Navigation

For standard workplaces it is hard to beat the point-andclick feature of the mouse.

But for other mouse functions, such as navigating a document, the FingerMouse could offer additional usability. It is easy to switch between the different modes by (stretching out fingers), and the hand movement is similar to the one used to move around papers on a table (larger possible magnitude than with a standard mouse).For projected surfaces the FingerMouse is easier to use because the fingertip and mouse-pointer are always in the same place. Figure 6.5 shows such a setup. A user can "paint" directly onto the wall with his/her finger by controlling the Windows Paint application with the FingerMouse

FreeHandPresent

The second system is built to demonstrate how simple hand gestures can be used to control an application. A typical scenario where the user needs to control the computer from a certain distance is during a presentation. Several projector manufacturers have recognized this need and built remote controls for projectors that can also be used to control applications such as Microsoft PowerPoint. Our goal is to build a system that can do without remote controls.

The user's hand will become the only necessary controlling device. The interaction between human and computer during a presentation is focused on navigating between a set of slides. The most common command is "Next Slide". From time to time it is necessary to go back one slide or to jump to a certain slide within the presentation. The Free Hand Present system uses simple hand gestures for the three described cases. Two fingers shown to the camera invoke the "Next Slide" command; three fingers mean "Previous Slide"; and a hand with all five fingers stretched out opens a window that makes it possible to directly choose an arbitrary slide with the fingers.

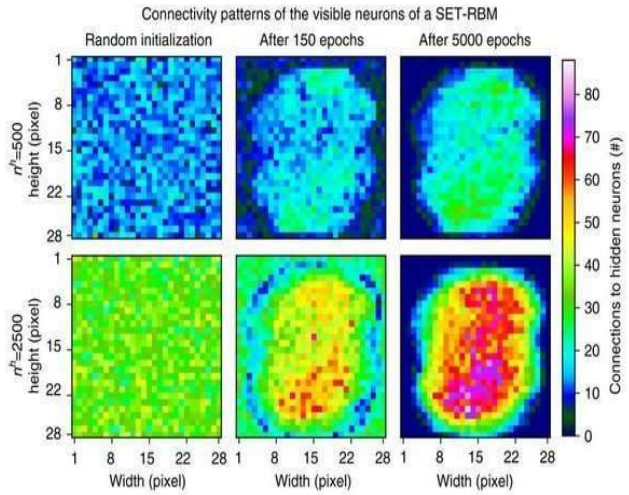
Brainstorm

The BrainStorm system is built for the described scenario. During the idea generation phase, users can type their thoughts into a wireless keyboard and attach colors to their input. The computer automatically distributes the user input on the screen, which is projected onto the wall. The resulting picture on the wall resembles the old paper-pinning technique but has the big advantage that it can be saved at any time. For the second phase of the process, the finger-tracking system comes into action.

SINDUJA T

II B.Sc. (Computer Technology)

NEW AI METHOD INCREASES THE POWER OF ARTIFICIAL NEURAL NETWORKS



An international team of scientists from Eindhoven University of Technology, University of Texas at Austin, and University of Derby, has developed a revolutionary method that quadratically accelerates artificial intelligence (AI) training algorithms. This gives full AI capability to inexpensive computers, and would make it possible in one to two years for supercomputers to utilize Artificial Neural Networks that quadratically exceed the possibilities of today's artificial neural networks. The scientists presented their method on June 19 in the journal Nature Communications.

Artificial Neural Networks (or ANN) are at the very heart of the AI revolution that is shaping every aspect of society and technology. But the ANNs that we are able to handle so far are nowhere near solving very complex problems. The very latest supercomputers would struggle with a 16 million-neuron network (just about the size of a frog brain), while it would take over a dozen days for a powerful desktop computer to train a mere 100,000-neuron network.

Personalized medicine

The proposed method, dubbed Sparse Evolutionary Training (SET), takes inspiration from biological networks and in particular neural networks that owe their efficiency to three simple features: networks have relatively few connections (sparsity), few hubs (scale-freeness) and short paths (small-worldness). The work reported in Nature Communications demonstrates the benefits of moving away from fully-connected ANNs (as done in common AI), by introducing a new training procedure that starts from a random, sparse network and iteratively evolves into a scale-free system. At each step, the weaker connections are eliminated and new links are added at random, similarly to a biological process known as synaptic shrinking.

The striking acceleration effect of this method has enormous significance, as it will allow the application of AI to problems that are not currently tractable due to the vast number of parameters. Examples include affordable personalized medicine and complex systems. In complex, rapidly changing environments such as smart grids and social systems, where frequent on-the-fly retraining of an ANN is

required, improvements in learning speed (without compromising accuracy) are essential. In addition, because such training can be achieved with limited computation resources, the proposed SET method will be preferred for the embedded intelligences of the many distributed devices connected to a larger system.

Frog brain

Thus, concretely, with SET any user can build on its own laptop an artificial neural network of up to 1 million neurons, while with state-of-the-art methods this was reserved only for expensive computing clouds. This does not mean that the clouds are not useful anymore. They are. Imagine what you can build on them with SET. Currently the largest artificial neural networks, built on supercomputers, have the size of a frog brain (about 16 million neurons). After some technical challenges are overpassed, with SET, we may build on the same supercomputers artificial neural networks close to the human brain size (about 80 billion neurons).

Lead author Dr. Decebal Mocanu: "And, yes, we do need such extremely large networks. It was shown, for example, that artificial neural networks are good in detecting cancer from human genes. However, complete chromosomes are too large to fit in state-of-the-art artificial neural networks, but they could fit in an 80 billion neuron network. This fact can hypothetically lead to better healthcare and affordable personalized medicine for all of us."

KARTHIKEYAN S
III B.Sc. (Computer Technology)

INSTAGRAM UNVEILS NEW VIDEO SERVICE IN CHALLENGE TO YOUTUBE

Facebook's Instagram service is loosening its restraints on video in an attempt to lure younger viewers away from YouTube when they're looking for something to watch on their smartphones. The expansion announced Wednesday, dubbed IGTV, will increase Instagram's video time limit from one minute to 10 minutes for most users. Accounts with large audiences will be able to go as long as an hour.

Video will be available through Instagram or a new app called IGTV. The video will eventually give Facebook more opportunities to sell advertising. It's the latest instance in which Instagram has ripped a page from a rival's playbook in an effort to preserve its status as a cool place for young people to share and view content. In this case, Instagram is mimicking Google's YouTube. Before, Facebook and Instagram have copied Snapchat another magnet for teens and young adults.

Instagram, now nearly 8 years old, is moving further from its roots as a photo-sharing service as it dives headlong into longer-form video. The initiative comes as parent

company Facebook struggles to attract teens, while also dealing with a scandal that exposed its leaky controls for protecting users' personal information.

Instagram CEO Kevin Systrom told The Associated Press that he hopes IGTV will emerge as a hub of creativity for relative unknowns who turn into internet sensations with fervent followings among teens and young adults.

That is what's already happening on YouTube, which has become the world's most popular video outlet since Google bought it for $1.76 billion nearly 12 years ago. YouTube now boasts 1.8 billion users. Instagram, which Facebook bought for $1 billion six years ago, now has 1 billion users, up from 800 million nine months ago.

More importantly, 72 percent of U.S. kids ranging from 13 to 17 years old use Instagram, second to YouTube at 85 percent, according to the Pew Research Center. Only 51 percent of people in that group now use Facebook, down from 71 percent from a similar Pew survey . That trend appears to be one of the reasons that Facebook is "hedging its bets" by opening Instagram to the longer-form videos typically found on YouTube, said analyst Paul Verna of the research firm eMarketer.

Besides giving Instagram another potential drawing card, longer clips are more conducive for video ads lasting from 30 seconds to one minute. Instagram doesn't currently allow video ads, but Systrom said it eventually will. When the ads come, Instagram intends to share revenue with the videos' creators just as YouTube already does.

S.GOKUL

III B.Sc. (Computer Technology)

TECHNOLOGY TRENDS FOR 2018

1. **Deep learning (DL)** Machine learning (ML) and more specifically DL are already on the cusp of revolution. They are widely adopted in datacenters (Amazon making graphical processing units [GPUs] available for DL, Google running DL on tensor processing units [TPUs], Microsoft using field programmable gate arrays [FPGAs], etc.), and DL is being explored at the edge of the network to reduce the amount of data propagated back to datacenters. Applications such as

image, video, and audio recognition are already being deployed for a variety of verticals. DL heavily depends on accelerators (see #9 below) and is used for a variety of assistive functions.

2. **Digital currencies** Bitcoin, Ethereum, and newcomers Litecoin, Dash, and Ripple have become commonly traded currencies. They will continue to become a more widely adopted means of trading. This will trigger improved cybersecurity because the stakes will be ever higher as their values rise. In addition, digital currencies will continue to enable and be enabled by other technologies, such as storage , cloud computing the Internet of Things (IoT), edge computing, and more.

3. **Blockchain** The use of Bitcoin and the revitalization of peer-to-peer computing have been essential for the adoption of blockchain technology in a broader sense. We predict increased expansion of companies delivering blockchain products and even IT heavyweights entering the market and consolidating the products.

4. **Industrial IoT** Empowered by DL at the edge, industrial IoT continues to be the most widely adopted use case for edge computing. It is driven by real needs and requirements. We anticipate that it will continue to be adopted with a broader set of technical offerings enabled by DL, as well as other uses of IoT .

5. **Robotics** Even though robotics research has been performed for many decades, robotics adoption has not flourished. However, the past few years have seen the increased market availability of consumer robots, as well as more sophisticated military and industrial robots. We predict that this will trigger wider adoption of robotics in the medical space for caregiving and other healthcare uses. Combined with DL and AI, robotics will further advance in 2018. Robotics will also motivate further evolution of ethics.

6. **Assisted transportation** While the promise of fully autonomous vehicles has slowed down due to numerous obstacles, a limited use of automated assistance has continued to grow, such as parking assistance, video recognition, and alerts for leaving the lane or identifying sudden obstacles. We anticipate that vehicle assistance will develop further as automation and ML/DL are deployed in the automotive industry.

7. **Assisted reality and virtual reality (AR/VR)** Gaming and AR/VR gadgets have grown in adoption in the past year. We anticipate that this trend will grow

with modern user interfaces such as 3D projections and movement detection. This will allow for associating individuals with metadata that can be viewed subject to privacy configurations, which will continue to drive international policies for cybersecurity and privacy.

8. **Ethics, laws, and policies for privacy, security, and liability** With the increasing advancement of DL, robotics and technological assistance and applications of AI, technology has moved beyond society's ability to control it easily. Mandatory guidance has already been deeply analyzed and rolled out in various aspects of design to autonomous and intelligent systems and in cybersecurity. But adoption of ethical considerations will speed up in many vertical industries and horizontal technologies.

9. **Accelerators and 3D** With the end of power scaling and Moore's law and the shift to 3D, accelerators are emerging as a way to continue improving hardware performance and energy efficiency and to reduce costs. There are a number of existing technologies (FPGAs and ASICs) and new ones (such as memristor-based DPE) that hold a lot of promise for accelerating application domains (such as matrix multiplication for the use of DL algorithms). We predict wider diversity and broader applicability of accelerators, leading to more widespread use in 2018.

10. **Cybersecurity and AI** Cybersecurity is becoming essential to everyday life and business, yet it is increasingly hard to manage. Exploits have become extremely sophisticated and it is hard for IT to keep up. Pure automation no longer suffices and AI is required to enhance data analytics and automated scripts. It is expected that humans will still be in the loop of taking actions; hence, the relationship to ethics. But AI itself is not immune to cyber attacks. We will need to make AI/DL techniques more robust in the presence of adversarial traffic in any application area.

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EDGE COMPUTING

Edge computing is a method of optimizing cloud computing systems "by taking the control of computing applications, data, and services away from some central nodes (the "core") to the other logical extreme (the "edge") of the Internet" which makes contact with the physical world. In this architecture, data comes in from the physical world via various sensors, and actions are taken

to change physical state via various forms of output and actuators; by performing analytics and knowledge generation at the edge, communications bandwidth between systems under control and the central data centre is reduced. Edge Computing takes advantage of proximity to the physical items of interest also exploiting relationships those items may have to each other.

This approach requires leveraging resources that may not be continuously connected to a network such as autonomous vehicles, implanted medical devices, fields of highly distributed sensors, and mobile devices. Edge computing covers a wide range of technologies including wireless sensor networks, mobile data acquisition, mobile signature analysis, cooperative distributed peer-to-peer ad hoc networking and processing also classifiable as local cloud/fog computing and grid/mesh computing, dew computing, mobile edge computing, cloudlet, distributed data storage and retrieval, autonomic self-healing networks, remote cloud services, augmented reality, the Internet of Things (IoT) and more. Edge Computing can involve Edge nodes directly attached to physical inputs and output or Edge Clouds that may have such contact but at least exist outside of centralized Clouds closer to the Edge.

Edge computing pushes applications, data and computing power (services) away from centralized points to the logical extremes of a network. Edge computing replicates fragments of information across distributed networks of servers and data stores, which may spread over a vast area. As a technological paradigm, edge computing may be architecturally organized as peer-to-peer computing, autonomic (self-healing) computing, grid computing, and by other names implying non-centralized availability.

To ensure acceptable performance of widely dispersed distributed services, large organizations typically implement edge computing by deploying server farms with clustering and large scale storage networks. Previously available only to very large corporate and government organizations, edge computing has utilized technology advances and cost reductions for large-scale implementations have made the technology available to small and medium-sized businesses while small low cost cluster hardware and freely available cluster management software have made Edge Computing affordable to individual professionals, students, and hobbyists.

The target of Edge Computing is any application or general functionality needing to be closer to the source of the action where distributed systems technology interacts with the physical world. Edge Computing does not need contact with any centralized Cloud. Edge Computing does uses the same distributed

systems architecture as centralized Clouds but closer to or directly at the Edge.

Edge computing imposes certain limitations on the choices of technology platforms, applications or services, all of which need to be specifically developed or configured for edge computing.

Possible advantages of edge computing are:

1. Edge application services significantly decrease the volumes of data that must be moved, the consequent traffic, and the distance the data must travel, thereby reducing transmission costs, shrinking latency, and improving quality of service (QoS).
2. Edge computing eliminates, or at least de-emphasizes, the core computing environment, limiting or removing a major bottleneck and a potential single point of failure.
3. Ability to ride the same cost curves and improvements by exploitation of the same architecture and fundamental underlying computing technologies as other Clouds whether centralized fee-for-service Clouds or closed private clouds which are also centralized. Cost accounting models based upon how shared resources are billed in fee-for-service clouds (timesharing) often expressed by the phrase "as a Service" should not be confused with the common architectural basis of centralized Clouds, Edge Clouds, and increasingly Edge nodes as well. Ultimately all IT systems, distributed or not, must provide viable services regardless of how or where they are implemented. Clouds, however, do share common distributed system architecture and technology forming three modes defined by distance from the edge: Centralized Clouds, Edge Clouds, and Edge nodes taken collectively also known as fog computing.

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INTRODUCTION TO SCREENLESS DISPLAYS WITH THEIR TYPES

Nowadays, advanced technologies are growing faster wherein each technology is renewed with implementation of new one. The current trending display technology most commonly used in gadgets such as tablets, smart phones, etc., is the touch-screen display, which will become outdated in the near future. Screenless display is the advanced display technology, which replaces the touch screen technology to resolve the problems and to make lives more comfortable. Therefore, this article is intended to give an idea of the screenless display, which transmits or displays the information without using a projector or the

screen. By using this screenless display technology, we can display the images directly on the open space, human retina and also to the human brain.

Screenless Display

Screenless display is an interactive projection technology developed to solve the problems related to the device miniaturization of the modern communication technologies. The lack of space on screen based displays provides an opportunity for the development of screenless displays. As the name indicates screenless display has no screen and it can be defined as a display used to transmit any data such as pictures or videos without the help of screens.

Types of Screenless Display

Screenless display technology is divided into three main categories:

- Visual Image Display
- Retinal Display
- Synaptic Interface

The first category, visual image is defined as the things that can be seen by the human eye such as holograms. The second category, retinal display – the name itself- indicates the display of image directly onto the retina. The third category , synaptic reference which means sending information directly to the human brain. Let us look on in detail about these three display types.

1. Visual Image Display

The visual image is a type of screenless display, which recognizes any type of image or thing with the help of the human eye.The following are few examples of the visual image display: holographic display, virtual reality goggles, heads up display, etc. The working principle of this display states that the light gets reflected by the intermediate object before reaching the retina or the eye. The intermediate object can be a hologram, Liquid Crystal Displays (LCD)s or even windows.

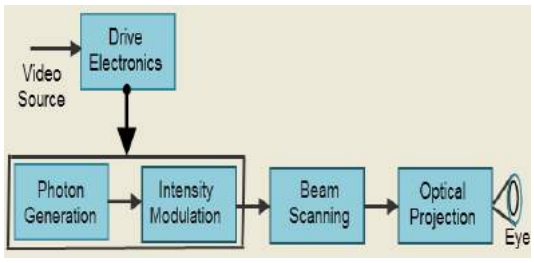
By using the components like Helium Neon Laser, an object, a Lens,a holographic

film and mirror, the **Holographic Displays** display the three dimensional (3D) images. A 3D image will be projected and appears to be floating in the air whenever the laser and object beams overlaps with each other. This display can supply accurate depth cues and high-quality images and videos that can be viewed by the human eyes without any need of special observation devices. Based on the colors of the laser projector, images are formed in three distinct planes. Holographic displays are commonly used as an alternative to screens.

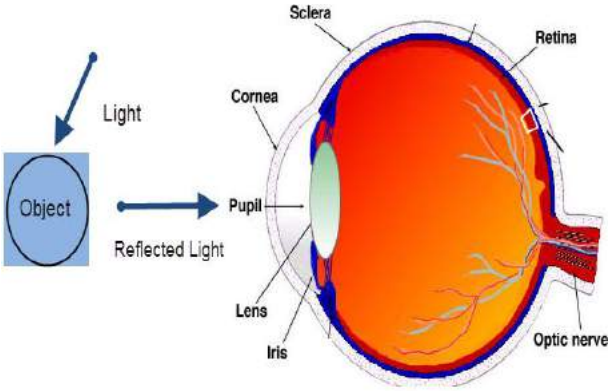
Heads up display are also named as transparent displays. These displays are applied in different applications such as aeroplanes, computer games and automobiles, etc. Many of the users do not need to look away from their field of view because the device displays the information on a windshield. An orginary heads up display comprises of following components: a projector unit, combiner and a computer. The projector unit projects the image, and the combiner redirects the displayed image by that projected image, and the field of view are seen simultaneously. The screenless computer acts as an interface between the projector and the combiner (data to be displayed).

2. Retinal Display

The second category of advancement in the display system, retinal display as the name itself indicates the display of image directly onto the retina. Instead of using some intermediate object for light reflection to project the images, this display directly projects the image onto the retina. The user will sense that the display is moving freely in the space. Retinal display is commonly known as retinal scan display and retinal projector. This display allows short light emission, coherent light and narrow band color. Let us know about this display with the help of the following block diagram.

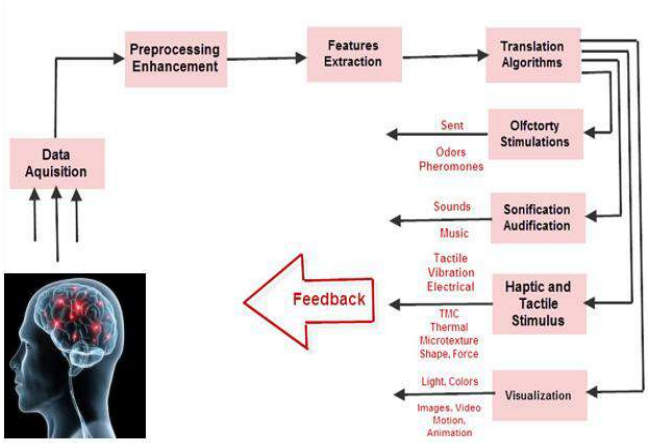


The block diagram of the virtual retinal display consists of following blocks: photon generation, intensity modulation, beam scanning, optical projection and drive electronics. Photon generation block generates the coherent beam of light; this photon source makes use of the laser diodes as coherent source with retina display to give diffraction onto the retina of the human eye. The light generated from photon source is intensity modulated. The intensity of the light beam gets modulated to match the intensity of the image.



3.Synaptic Interface:

The third category, synaptic interface means sending information directly to the human brain without using any light. This technology is already tested on humans and most of the companies started using this technology for effective communication, education, business and security system. This technology was successfully developed by sampling the video signals from horse crab eyes through their nerves, and the other video signals are sampled from the electronic cameras into the brains of creatures.



The brain computer interface allows direct interaction between the human brain and external devices such as computer. This category can also be known by different names such as human machine interface, synthetic telepathy interface, mind machine interface and direct neural interface.

These are the three types of latest Screenless displays which replace the current use of touch screen technology to fill the lack of space in the screen-based electronic displays. We hope that the future definitely looks promising for this technology.

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SERVERLESS ARCHITECTURES

Serverless architectures are application designs that incorporate third-party "Backend as a Service" (BaaS) services, and/or that include custom code run in managed, ephemeral

containers on a “Functions as a Service” (FaaS) platform. By using these ideas, and related ones like single-page applications, such architectures remove much of the need for a traditional always-on server component. Serverless architectures may benefit from significantly reduced operational cost, complexity, and engineering lead time, at a cost of increased reliance on vendor dependencies and comparatively immature supporting services.

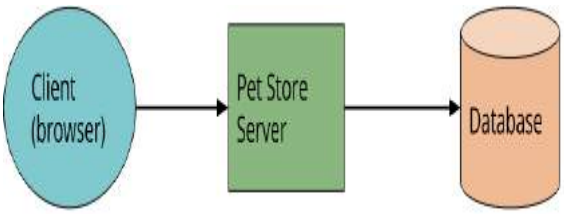
What is Serverless?

Like many trends in software, there’s no one clear view of what Serverless is?. For starters, it encompasses two different but overlapping areas:

1. Serverless was first used to describe applications that significantly or fully incorporate third-party, cloud-hosted applications and services, to manage server-side logic and state. These are typically “rich client” applications single-page web apps, or mobile apps that use the vast ecosystem of cloud-accessible databases (e.g., Parse, Firebase), authentication services (e.g., Auth0, AWS Cognito), and so on. These types of services have been previously described as “(Mobile) Backend as a Service", and I use "BaaS" as shorthand in the rest of this article.
2. Serverless can also mean applications where server-side logic is still written by the application developer, but, unlike traditional architectures, it’s run in stateless compute containers that are event-triggered, ephemeral (may only last for one invocation), and fully managed by a third party. One way to think of this is “Functions as a Service” or "FaaS". (Note: The original source for this name a tweet by @marak is no longer publicly available.) AWS Lambda is one of the most popular implementations of a Functions-as-a-Service platform at present, but there are many others, too.

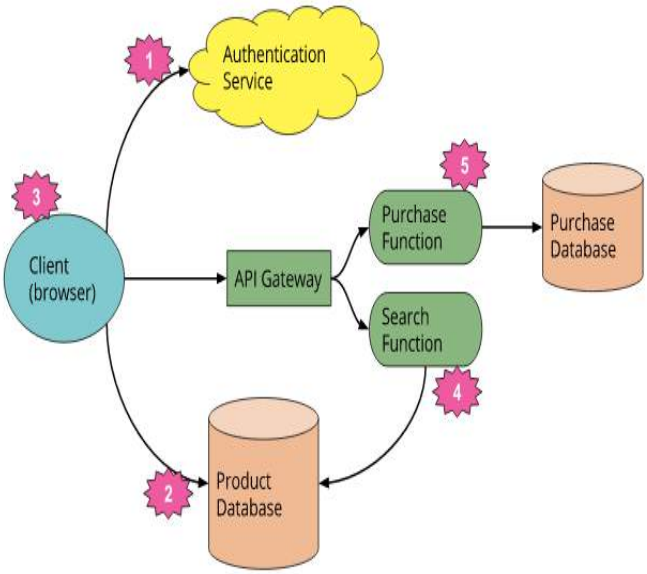
UI-driven applications

Traditionally, the architecture will look something like the diagram below. It’s implemented in Java or Javascript on the server side, with an HTML + Javascript component as the client:



With this architecture the client can be relatively unintelligent, with much of the logic in the system authentication, page navigation, searching, transactions implemented by the server application.

With a Serverless architecture this may end up looking more like this:



This is a massively simplified view, but even here we see a number of significant changes:

1. We've deleted the authentication logic in the original application and have replaced it with a third-party BaaS service (e.g., Auth0.)
2. Using another example of BaaS, we've allowed the client direct access to a subset of our database (for product listings), which itself is fully hosted by a third party (e.g., Google Firebase.) We likely have a different security profile for the client accessing the database in this way than for server resources that access the database.
3. These previous two points imply a very important third: some logic that was in the Pet Store server is now within the client e.g., keeping track of a user session, understanding the UX structure of the application, reading from a database and translating that into a usable view, etc. The client is well on its way to becoming a Single Page Application.
4. We may want to keep some UX-related functionality in the server, if, for example, it's compute intensive or requires access to significant amounts of data. In our pet store, an example is "search." Instead of having an always-running server, as existed in the original architecture, we can instead implement a FaaS function that responds to HTTP requests via an API gateway (described later). Both the client and the server "search" function read from the same database for product data.

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RIDDLES

- If you have me, you want to share me. If you share me, you haven't got me. What am I?

  Ans: Secret.
- I come in square package, but I am round. I contain a lots of information for your computer. Handle me carefully. Who am I?

  Ans: compact disc

- What can travel around the world while staying in a corner?
  Ans: A stamp.

- There was a green house. Inside the green house there was a white house. Inside the white house there was a red house. Inside the red house there were lots of babies. What is it?
  Ans : Watermelon.

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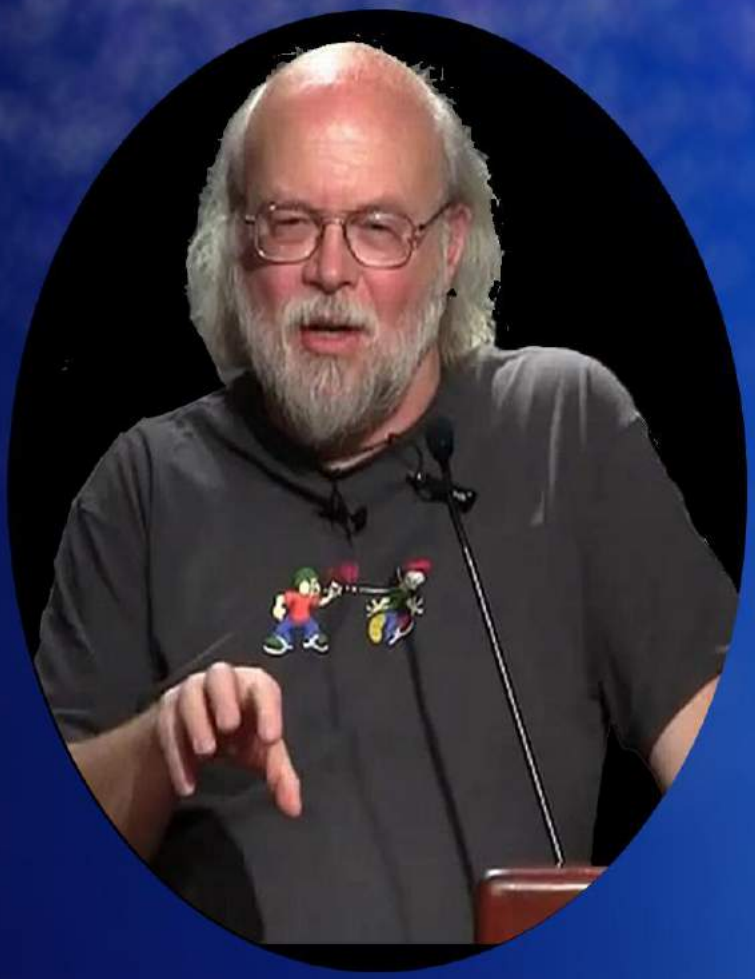

I think it would be a tragic statement of the universe if java was the last language that swept through".

-James Gosling.