World's first hack using DNA? Malware in genetic code hack programming

Scientists say they've encoded DNA to hack a computer for the first time.

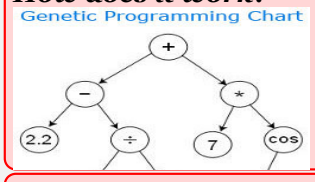
The research shows how attackers could disrupt a police investigation by injecting malicious DNA into samples they know will be sequenced on a computer. Scientists have successfully encoded a software exploit in a gene to remotely hack a computer. But why would anyone want to hack a computer with a malicious DNA strand? **The researchers who developed it argue an attacker could use it to hack any computer in the DNA sequencing pipeline.**

From digital to biological: Why the future of storage is all about DNA

The same four chemical building blocks behind almost all life on earth could one day be used replace traditional computer storage.

This pipeline includes any facility that accepts DNA samples for computer-based gene sequencing and processing. An attacker could mess with a police investigation by tainting blood, hair, and saliva

Comment [i]:
Genetic Programming
Updated: 04/26/2017 by Computer Hope
Genetic programming is the process of enhancing computer programs using algorithms inspired by biological evolution. Programming languages that lend themselves naturally **to genetic programming are those able to evaluate their own code natively**. A classic example is LISP because LISP's characteristic data structure is a list — and every LISP program is itself a list.
How does it work?



Comment [i]: Not could --is --2018 a AI system iis coming online to be full on

samples with injected malicious DNA they know will be sequenced on a computer. "Since DNA sequencing is rapidly progressing into new domains, such as forensics and DNA data storage, we believe it is prudent to understand current security challenges in the DNA sequencing pipeline before mass adoption," write the researchers from the University of Washington's Paul Allen School of Computer Science & Engineering. **Though the prospect of defending against DNA malware is interesting, the researchers rigged the attack in their favor, making it unrealistic**. The scientists designed a **synthetic DNA strand to target a buffer overflow vulnerability they inserted into FASTQ, an open-source program used to compress DNA sequences**. They also ran the modified program on a machine with the exploit mitigation feature, Address Space Layout Randomization, disabled. Having set the right conditions, **they were able to "remotely exploit and gain full control over a computer using adversarial synthetic DNA**," they note. **The researchers admit that the threat of a DNA attack on computers remains theoretical today and consequently see no need for immediate concern. However, they also argue there are plenty of "easy" attack vectors if an attacker wanted to target DNA processing machines**. While there are regulations to prevent synthesizing biological viruses such as chicken pox, the researchers warn it **may be more difficult to detect executable code in DNA**. **Anyone who creates an account at DNA research institutes could also submit sequencing files that could be malicious.** Additionally, since bioinformatics software isn't commonly targeted by hackers, the software isn't generally hardened to attacks. They also note patching difficulties since **DNA analysis software packages are often aren't managed in a central code repository.**

Comment [i]: Now since we are comprised of dna and since we have now been made accessible with carbon c 60 fullerenes and other nano particles which are also embedded into the cells and dna and genetics of everything including

Comment [i]: the BS statement here is what it is ~ they are saying this to pacify anyone who can comprehend the ful limplications of this

Comment [i]: in other words there is nothing in place to offset this probability as per usual throw it outther e before any neutrlaizing counter can be ready or a contingincy paln to shut it down--anyone here the biblical term of pestillence!!!

~~~~~~

DNA data storage landmark: Now it's 215 petabytes per gram or over 100 million movies

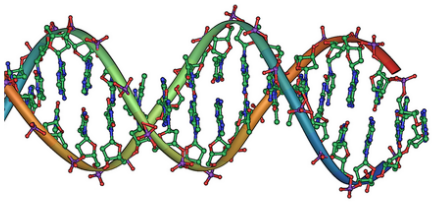
Synthetic DNA could be the answer to the world's accelerating data-storage needs, and **now researchers have shown that it can have a much higher density than previously demonstrated**. Microsoft last year claimed a record by storing 200MB of data but now researchers have gone much further. **Researchers from Columbia University and the New York Genome Center have devised a new coding system, dubbed DNA Fountain, which is capable of stuffing 215 petabytes of data onto one gram of DNA**. **That's about 100 times more than previous researchers have stored on DNA, and was achieved by customizing an algorithm for streaming video on a smartphone**, *Science Daily* reports. The same four chemical building blocks behind almost all life on earth could one day be used replace traditional computer storage. **DNA holds promise for data storage because of its superior density to tape, disk, and optical media. It can also store information for thousands of years if it's kept in the right**
~~~~~~

conditions. While information in computers is written as ones and zeros, researchers have devised different algorithms for encoding data to conform with DNA's four base nucleotides: adenine, A, guanine, G, cytosine, C, and thymine, T. Using this method, Microsoft last year claimed a record by storing 200MB of data including a music video, on synthetic DNA strands. DNA Fountain was created by Yaniv Erlich, a computer science professor at Columbia Engineering, who's also a core member of the NYGC, and Dina Zielinski, an associate scientist at NYGC. Within the 2MB compressed file, the pair wrote to DNA included graphical operating system KolibriOS, an old French film, a $50 Amazon gift card, a computer virus, and a Pioneer plaque. It also included the 1948 study, *A Mathematical Theory of Communication,* by Bell Lab information theorist Claude **Shannon, in a nod to his pioneering work on encoding, noise and decoding in information transmission**. The researchers looked at the challenge through Shannon's theory on information capacity of DNA storage, which says the maximum capacity each nucleotide could reach in an ideal world is two bits. However, as with communications, DNA storage capacity is obstructed by various noise factors**. "DNA storage is basically a communication channel,"** write Erlich and Zielinski. **"We transmit information over the channel by synthesizing DNA oligos. We receive information by sequencing the oligos and decoding the sequencing data**. The channel is noisy due to various experimental factors, including DNA synthesis imperfections, PCR dropout, stutter noise, degradation of DNA molecules over time, and sequencing errors." **They say DNA Fountain, so named because it uses fountain codes, which are used for video streaming to mobile devices** "approaches the Shannon capacity while providing robustness against data corruption". According to *Science Daily*, they used DNA **Fountain to generate 72,000 DNA strands or oligos** that were sent to Twist Bioscience, the DNA synthesis firm that supplied Microsoft's synthetic DNA. According to the paper, they achieved an information density of 1.57 bits per nucleotide, just shy of Shannon capacity. **That density translates to 215 petabytes per gram of DNA and is also 60 percent more than previous studies.** Despite more evidence of DNA's superior storage density, disk still has one major advantage. As the researchers highlight, DNA storage in this study cost $3,500 per megabyte. However, they see the cost falling with improvements to DNA synthesis chemistry, as well as "quick-and-dirty oligo synthesis methods" that consume less machine time

~~~~~~

Scientists reveal new super-fast form of computer that 'grows as it computes'

March 1, 2017, University of Manchester
~~~~~~



DNA double helix. Credit: public domain

Researchers from The University of Manchester have shown it is possible to build a new super-fast form of computer that **"grows as it computes".** Professor Ross D King and his team have demonstrated for the first time the feasibility of engineering a **nondeterministic universal Turing machine (NUTM),** and their research is to be published in the prestigious *Journal of the Royal Society Interface*.

The theoretical properties of such a computing machine, including its exponential boost in speed over electronic and quantum computers, have been well understood for many years – but the Manchester breakthrough **demonstrates that it is actually possible to physically create a NUTM using DNA molecules.** "Imagine a computer is searching a maze and comes to a choice point, one path leading left, the other right," explained Professor King, from Manchester's School of Computer Science. "Electronic computers need to choose which path to follow first. "**But our new computer doesn't need to choose, for it can replicate itself and follow both paths at the same time, thus finding the answer faster.**" This 'magical' property is **possible because the computer's processors are made of DNA** rather than silicon chips. All electronic computers have a fixed number of chips. "**Our computer's ability to grow as it computes makes it faster than any other form of computer, and enables the solution of many computational problems previously considered impossible.**" "Quantum computers are an exciting other form of computer, and they can also follow both paths in a maze, but only if the maze has certain symmetries, which greatly limits their use. "As DNA molecules are very small a desktop computer could potentially utilize more processors than all the electronic computers in the world combined - **and therefore outperform the world's current fastest supercomputer, while consuming a tiny fraction of its energy**."The University of Manchester is famous for its connection with Alan Turing - the founder of computer science - **and for creating the first stored memory electronic computer**. "This new research builds on both these pioneering foundations," added Professor King. Alan Turing's greatest achievement was inventing the concept of a universal Turing machine (UTM) - **a computer that can be programmed to compute anything any other computer can compute. Electronic computers are a form of UTM**, but no quantum UTM has yet been built. **DNA computing is the performing of**

Comment [i]: **AI self writing and upgrade uses this and they are referring to this--AI**

Comment [i]: **Called the deep or deep learning**

Comment [i]: **called as well parallel computing**

computations using biological molecules rather than traditional silicon chips. In DNA computing, information is represented using the four-character genetic alphabet - A [adenine], G [guanine], C [cytosine], and T [thymine] - rather than the binary alphabet, which is a series of 1s and 0s used by traditional computers.
Read more at: https://phys.org/news/2017-03-scientists-reveal-super-fast.html#jCp