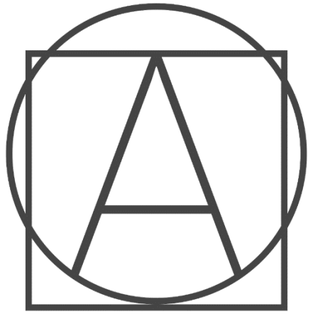
The Future of AI in Medicine and Beyond

José Morey, M.D. , Eisenhower Fellow

Chief Executive Officer – Ad Astra Media

EISENHOWER FELLOWSHIPS



Ad Astra Media

Singularity UNIVERSITY

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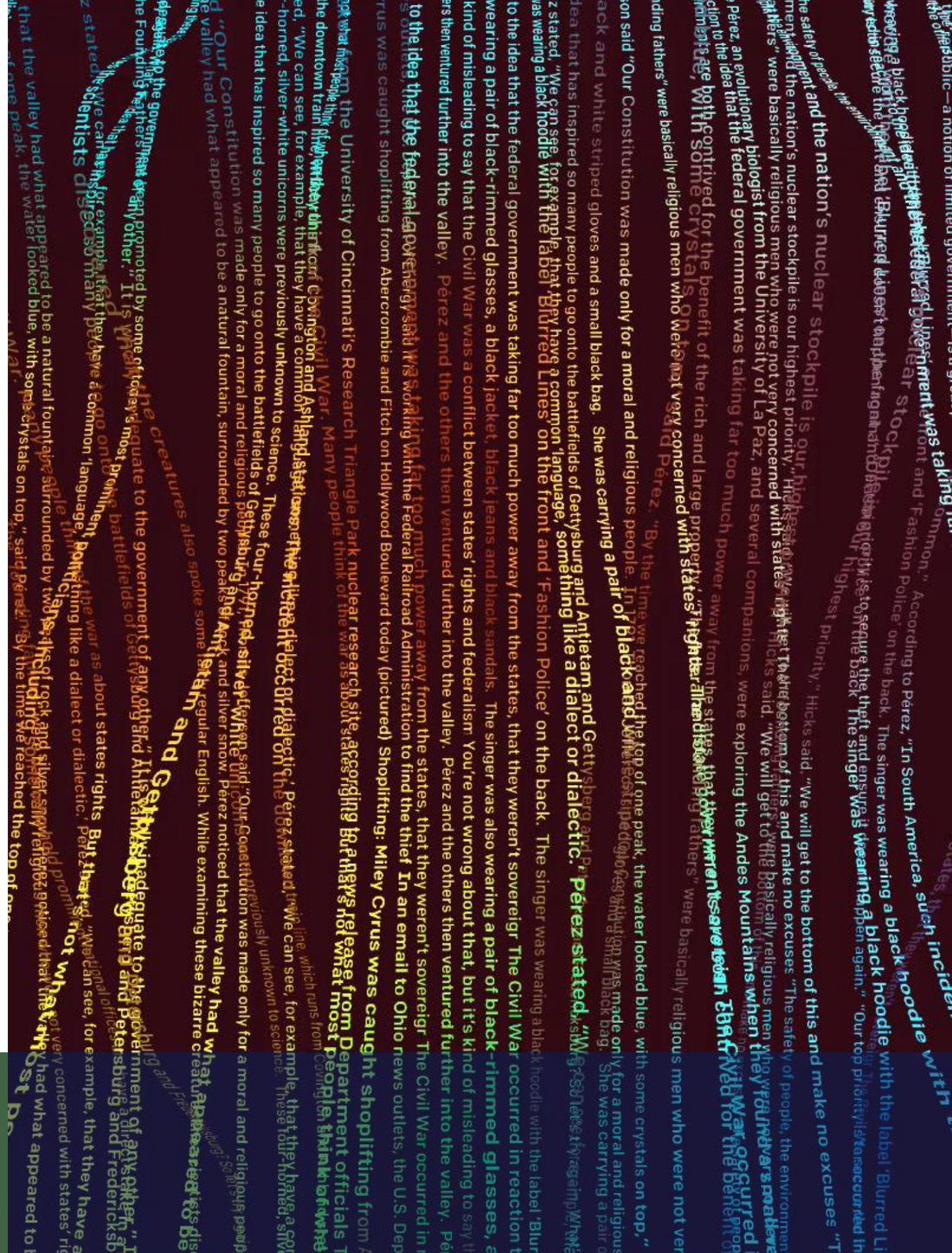
Sky
Building
Pole
Road Marking
Road
Pavement
Tree
Sign Symbol
Fence
Vehicle
Pedestrian
Bike

NATURAL LANGUAGE PROCESSING – LANGUAGE MODELING

In Language Modeling one of the best performing algorithms can be found in **Megatron-LM**



Other top-tier techniques (Method — Dataset):

- GPT-3 — Penn Treebank
- GPT-2 — WikiText2, Text8, enwik8

The Future Of Health Care AI Includes Panomics

P6-MEDICINE

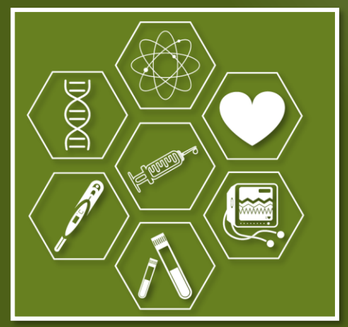
Participatory

Panomic

Preventive

Public

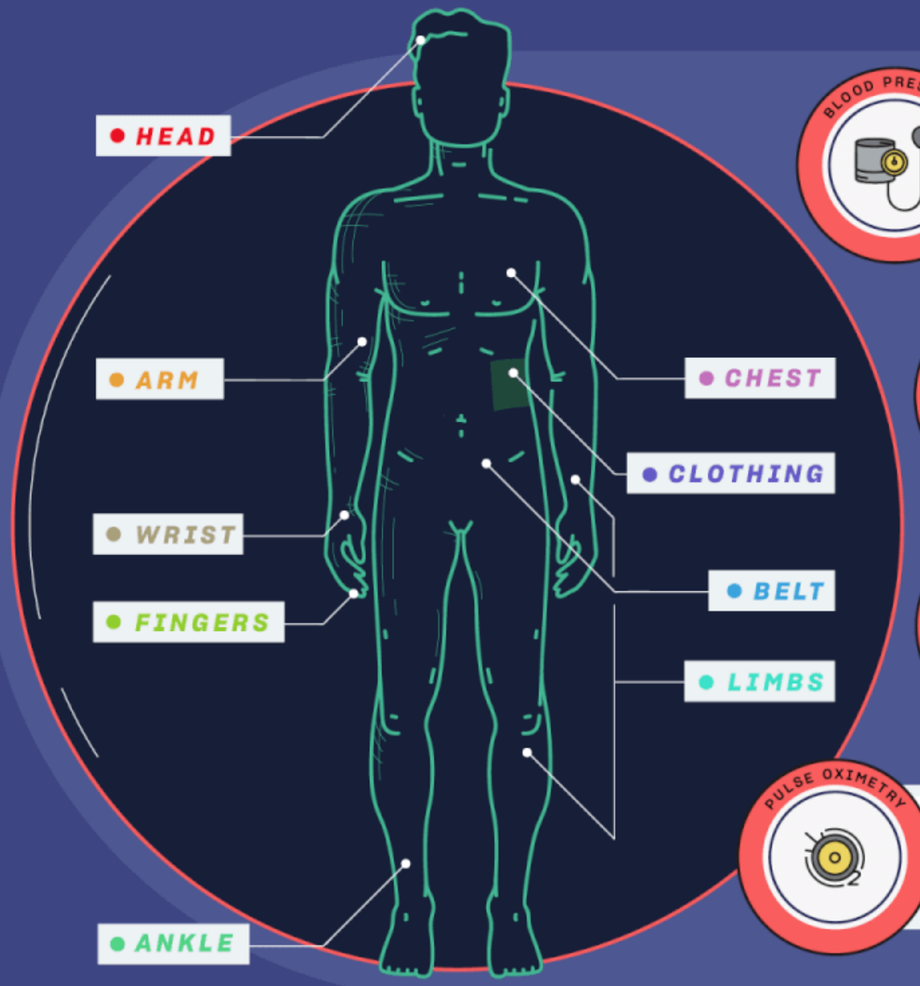
Predictive



Personalized

THE BODY MAP
OF DIGITAL HEALTH SENSORS

THE MEDICAL FUTURIST



BLOOD PRESSURE
- Withings
- iHealth
- MocaCare

EEG
- Muse
- Neurosky

MOTION
- Fitbit
- Garmin
- Polar
- Misfit
- Lumo Run
- Apple Watch
- Wahoo

ECG
- Kardia
- WIWE
- ECG Dongle
- Viatom

BREATHING
- Spire

HEART AND LUNG SOUNDS
- EKO
- Clinicloud

HEART RATE
- Viatom
- Fitbit
- Wahoo
- Garmin
- Polar

SLEEP
- Fitbit
- Misfit
- Apple Watch

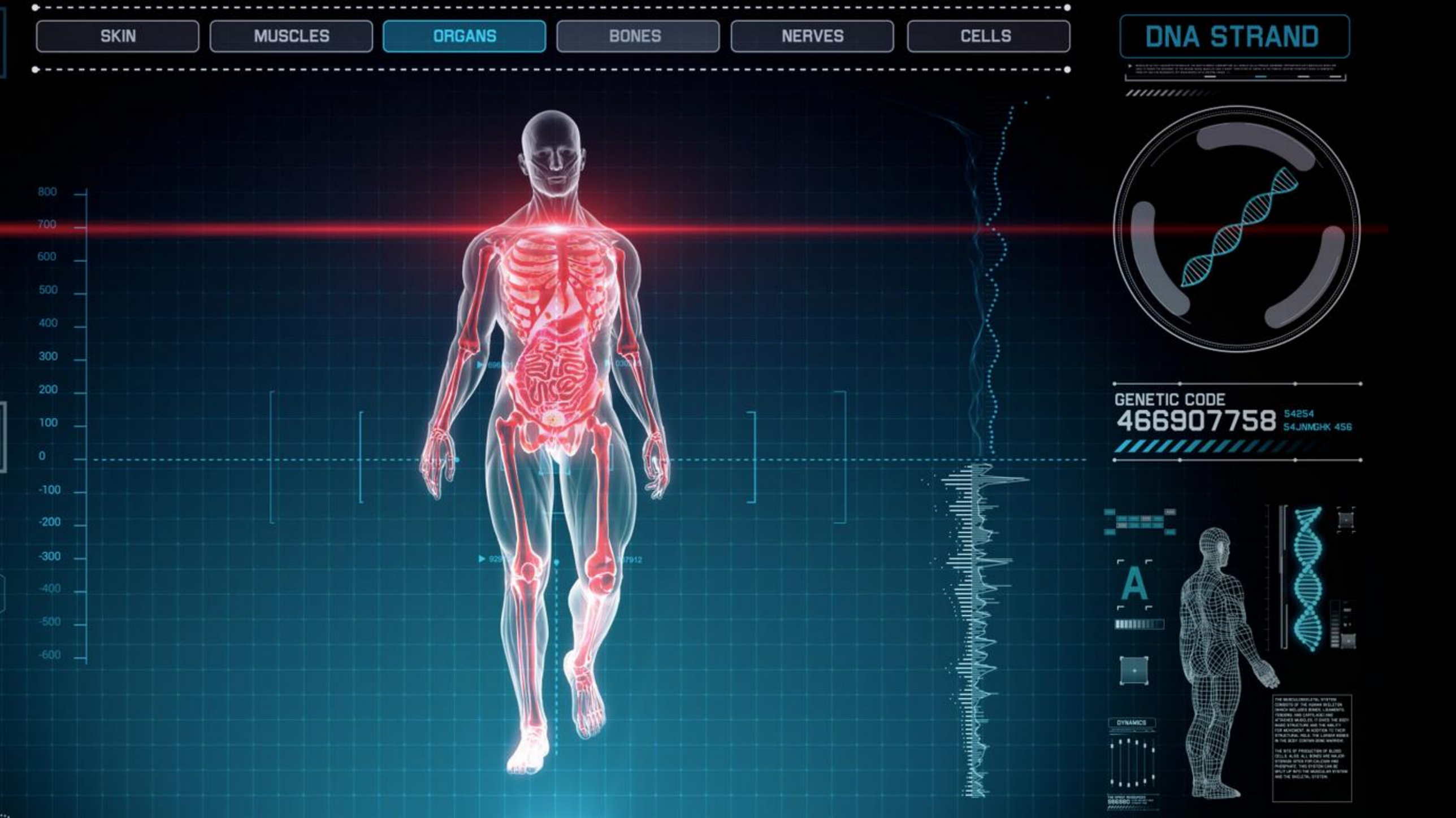
ELECTRODERMAL ACTIVITY
- PIP
- Empatica

PULSE OXIMETRY
- Viatom

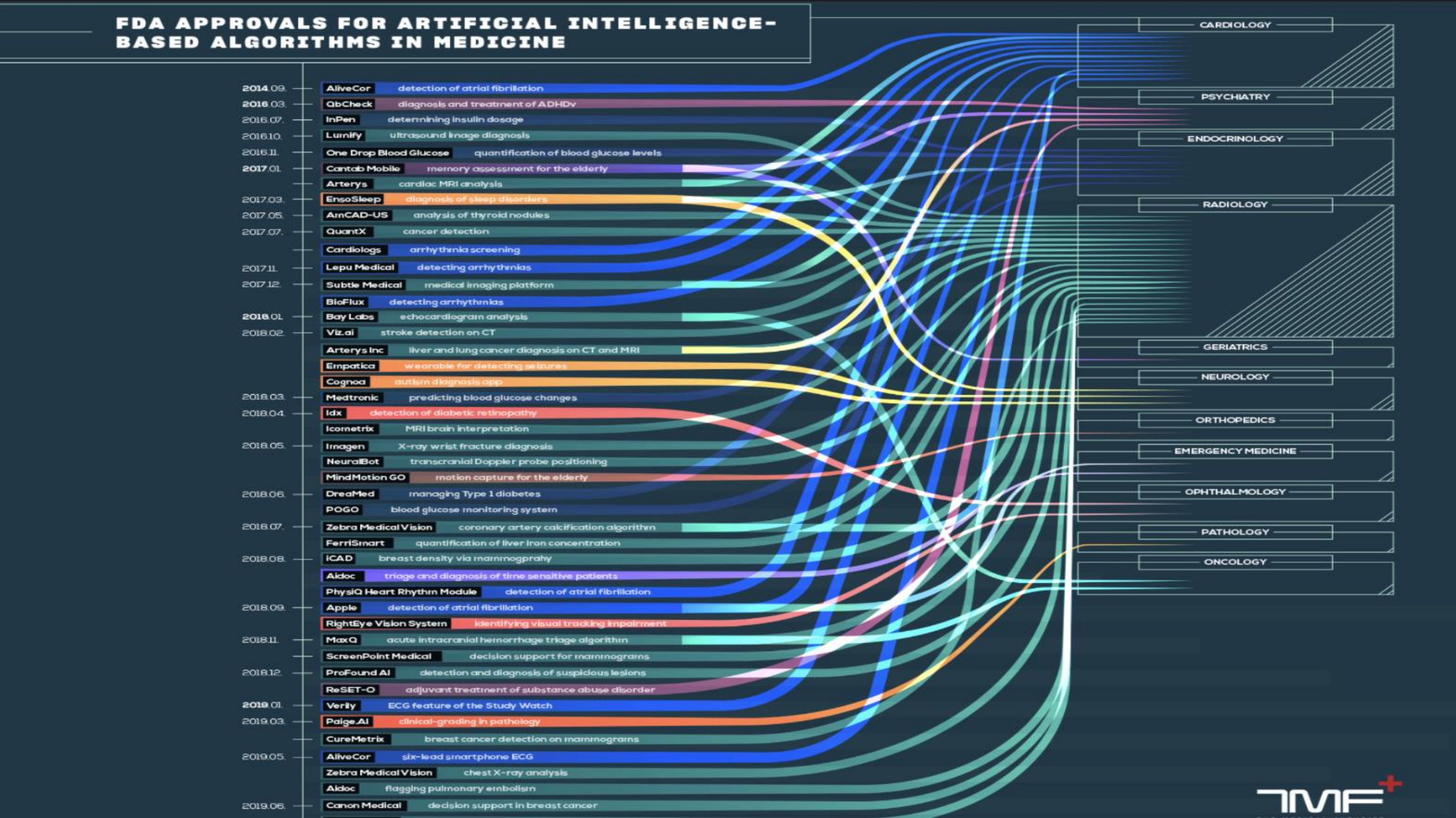
BODY TEMPERATURE
- Empatica

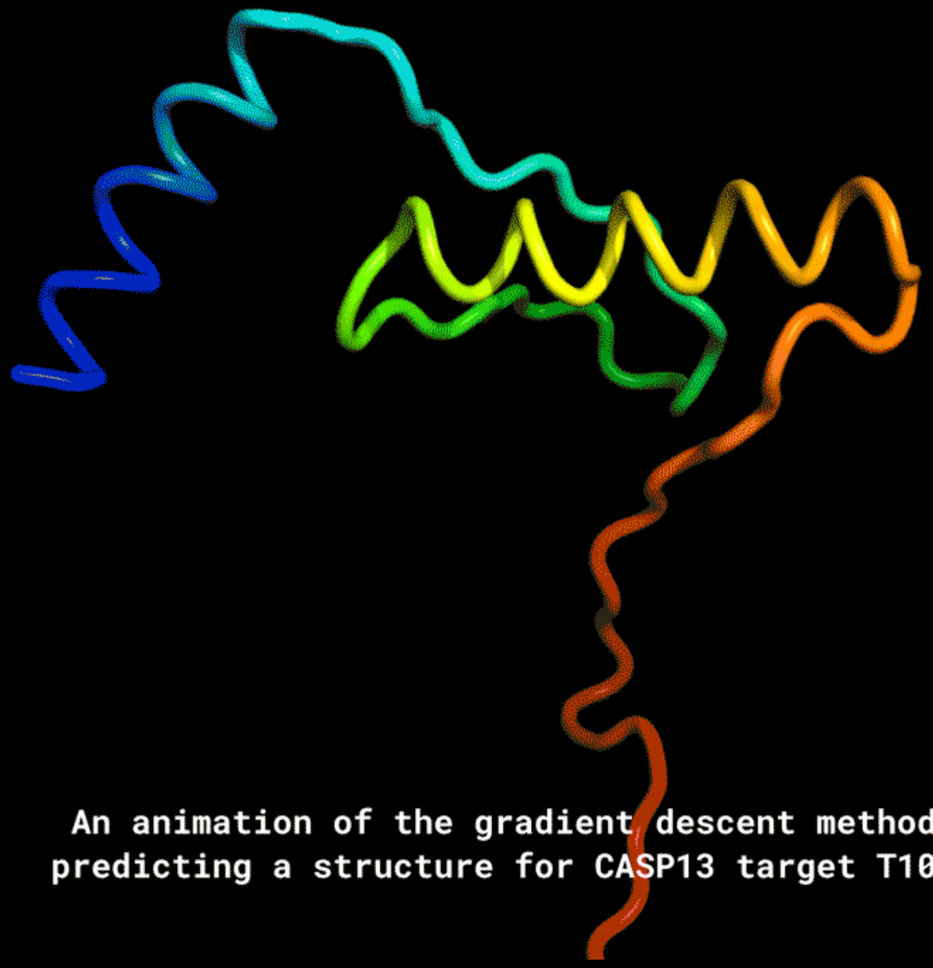
POSTURE
- Lumo

MUSCLE ACTIVITY
- Athos
- Gymwatch


SKIN
MUSCLES
ORGANS
BONES
NERVES
CELLS
DNA STRAND
800
700
600
500
400
300
200
100
0
-100
-200
-300
-400
-500
-600
GENETIC CODE
466907758
54254
54JNMGHK 456
A
DYNAMICS

FDA APPROVALS FOR ARTIFICIAL INTELLIGENCE-BASED ALGORITHMS IN MEDICINE





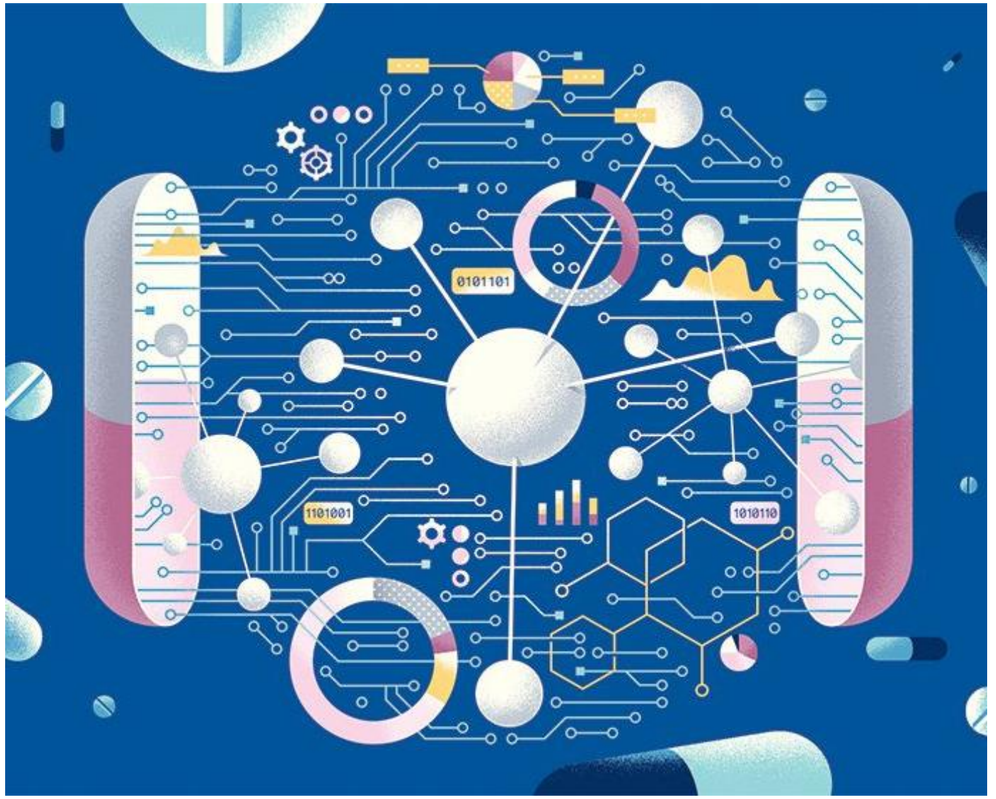
An animation of the gradient descent method
predicting a structure for CASP13 target T1008

MENU
nature
International journal of science

SPOTLIGHT · 30 MAY 2018

How artificial intelligence is changing drug discovery

Machine learning and other technologies are expected to make the hunt for new pharmaceuticals quicker, cheaper and more effective.



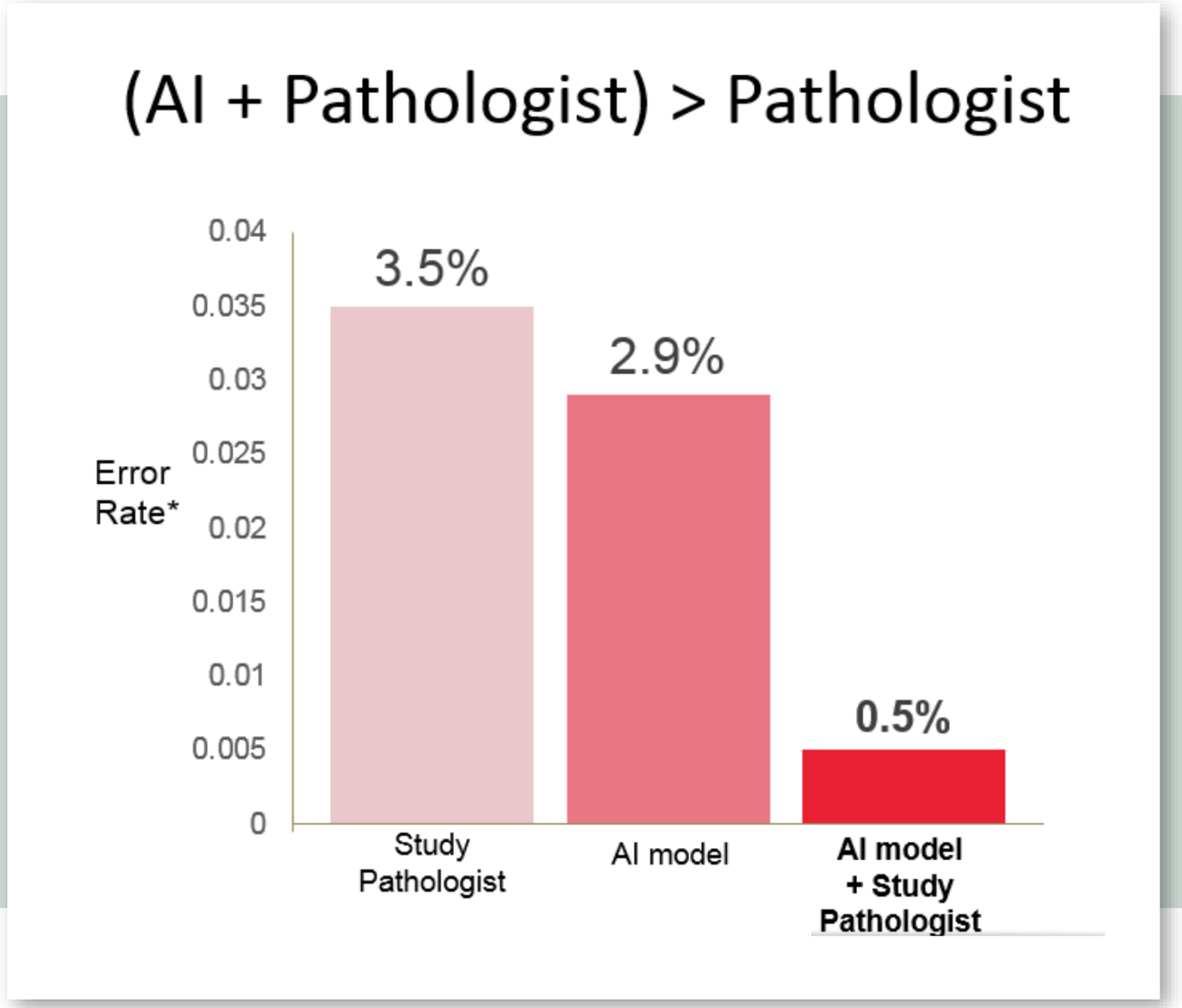
AI Drug Hunters Could Give Big Pharma a Run for Its Money

Alphabet's DeepMind cracked a problem that long vexed biologists, heating up a technological arms race in health care

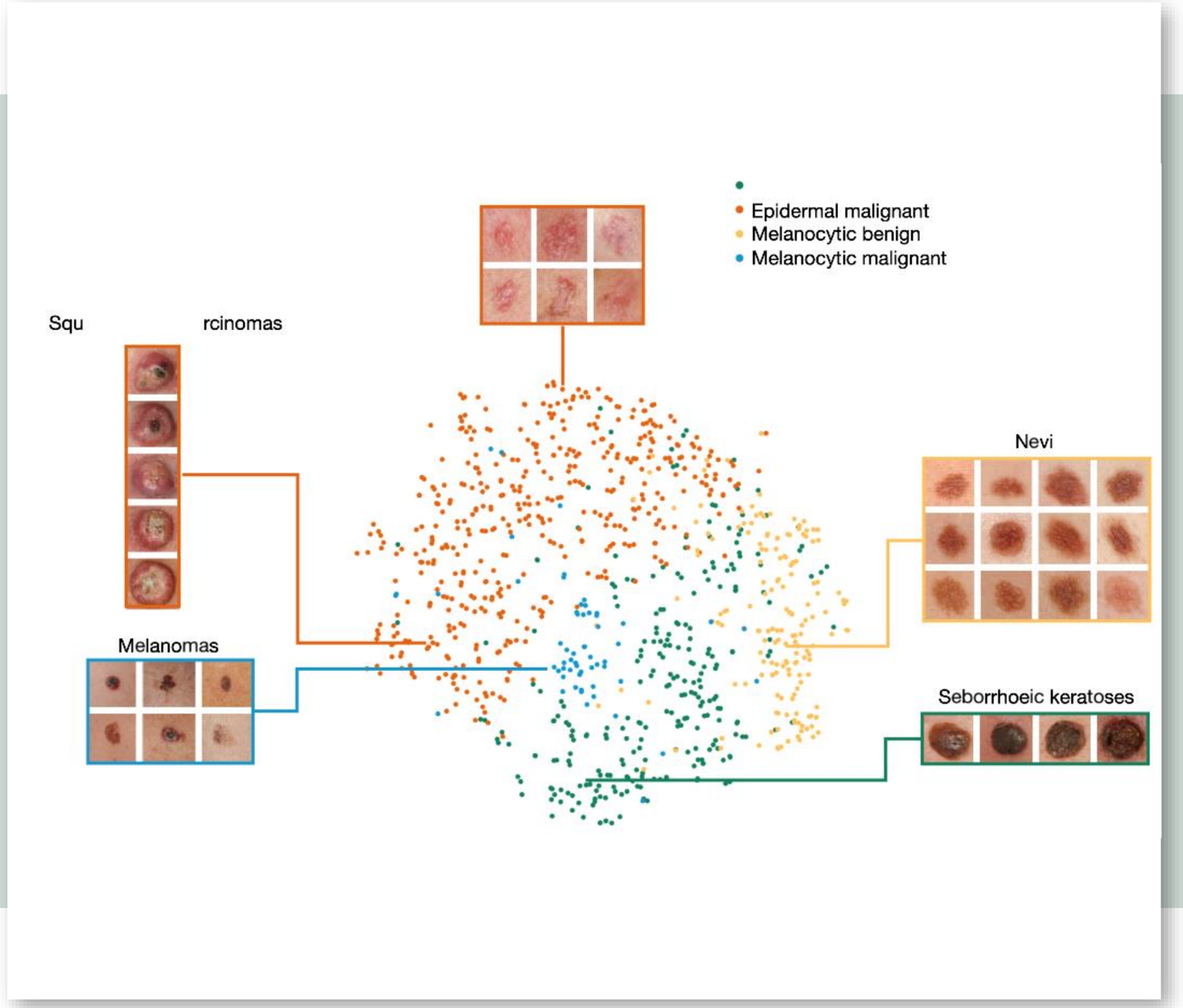

CLINICAL TRIAL
65%
completes in 2 seconds

Biological structure and function emerge from scaling unsupervised learning to 250 million protein sequences

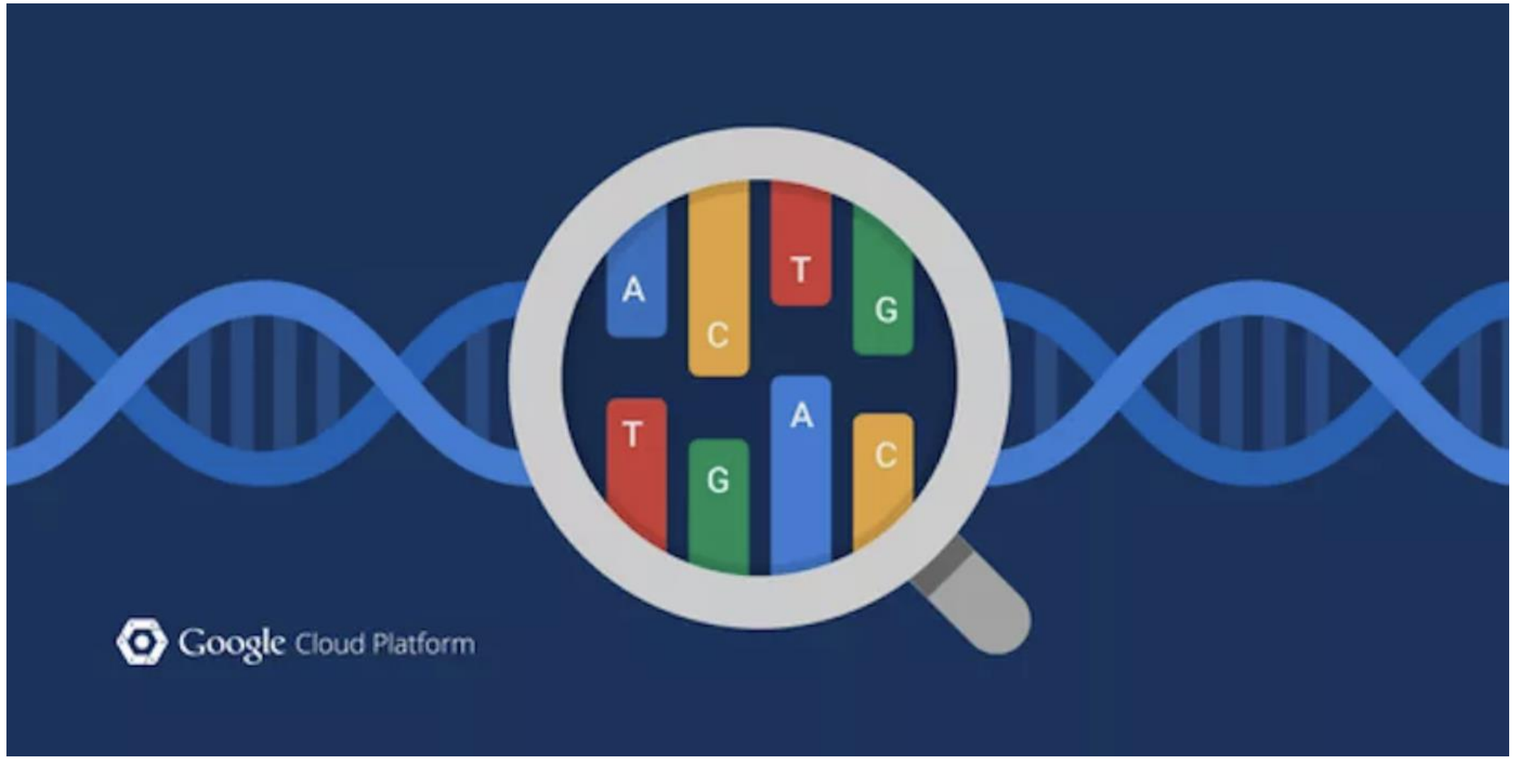

facebook

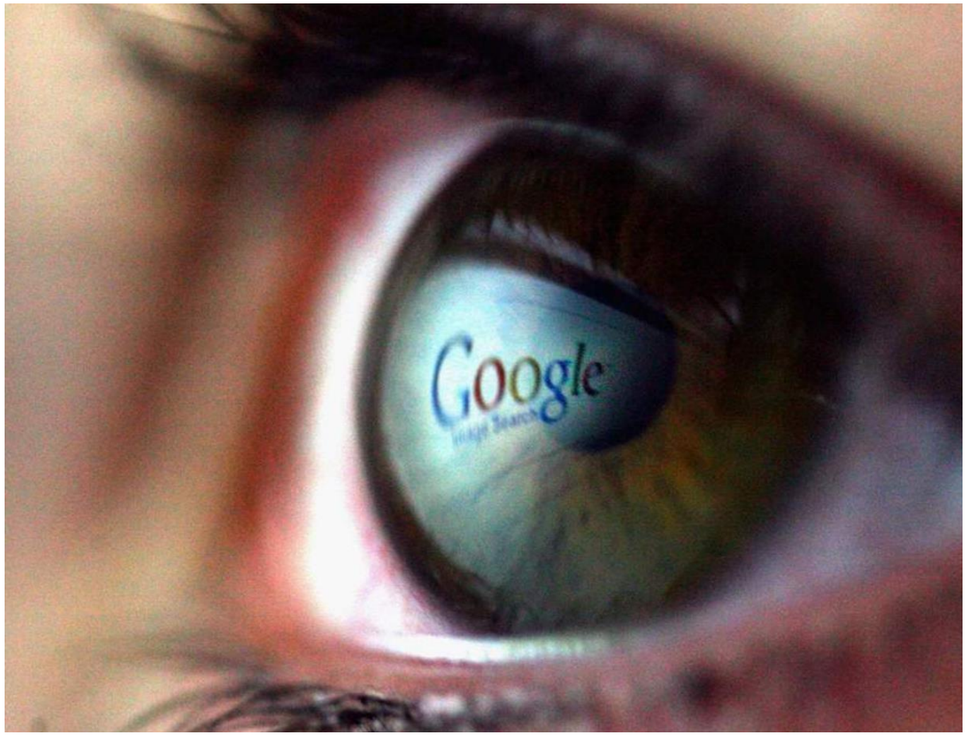


A study by NVIDIA reported that Deep Learning Drops Error Rate for Breast Cancer Diagnoses by 85%. The study observed that "human analysis combined with Deep Learning results achieved a 99.5 percent success rate. This shows pathologist performance can be improved when paired with AI systems, signaling an important advance in identifying and treating cancer."



Research from Stanford University published in Nature in 2017 by Esteva et al. showed that a "Convolutional Neural Network (CNN) achieves performance on par with all tested experts...demonstrating an artificial intelligence capable of classifying skin cancer with a level of competence comparable to dermatologists."





Man against machine: diagnostic performance of a deep learning convolutional neural network for dermoscopic melanoma recognition in comparison to 58 dermatologists

H. A. Haenssle[1*,†], C. Fink[1†], R. Schneiderbauer[1], F. Toberer[1], T. Buhl[2], A. Blum[3], A. Kalloo[4], A. Ben Hadj Hassen[5], L. Thomas[6], A. Enk[1] & L. Uhlmann[7]

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Google predicts spikes in flu before CDC

By Stephanie Grimes | Posted - Jan 11th, 2013 @ 10:16am

Amazon-JPMorgan-Berkshire healthcare venture gets named

By **Bloomberg News**

Published **March 06 2019, 5:38pm EST**

More in **Primary care physicians, Patient engagement, Insurance**

Print

The new healthcare venture started by Amazon.com, Berkshire Hathaway and JPMorgan Chase will be called Haven.

Haven also unveiled a website and a letter from Chief Executive Officer Atul Gawande, the surgeon, Harvard professor and writer chosen to lead the venture last June.

Amazon has a secret health tech team called 1492 working on medical records, virtual doc visits

- Amazon has a secret skunkworks lab called 1492, dedicated to health care tech.
- Areas of exploration include a platform for electronic medical record data, telemedicine and health apps for existing devices like the Amazon Echo.

Eugene Kim | Christina Farr

Published 5:30 PM ET Wed, 26 July 2017 | Updated 2:30 PM ET Thu, 27 July 2017

CNBC


zon go + theo
JUST WALK OUT
JUST WALK OUT
JUST WALK OUT

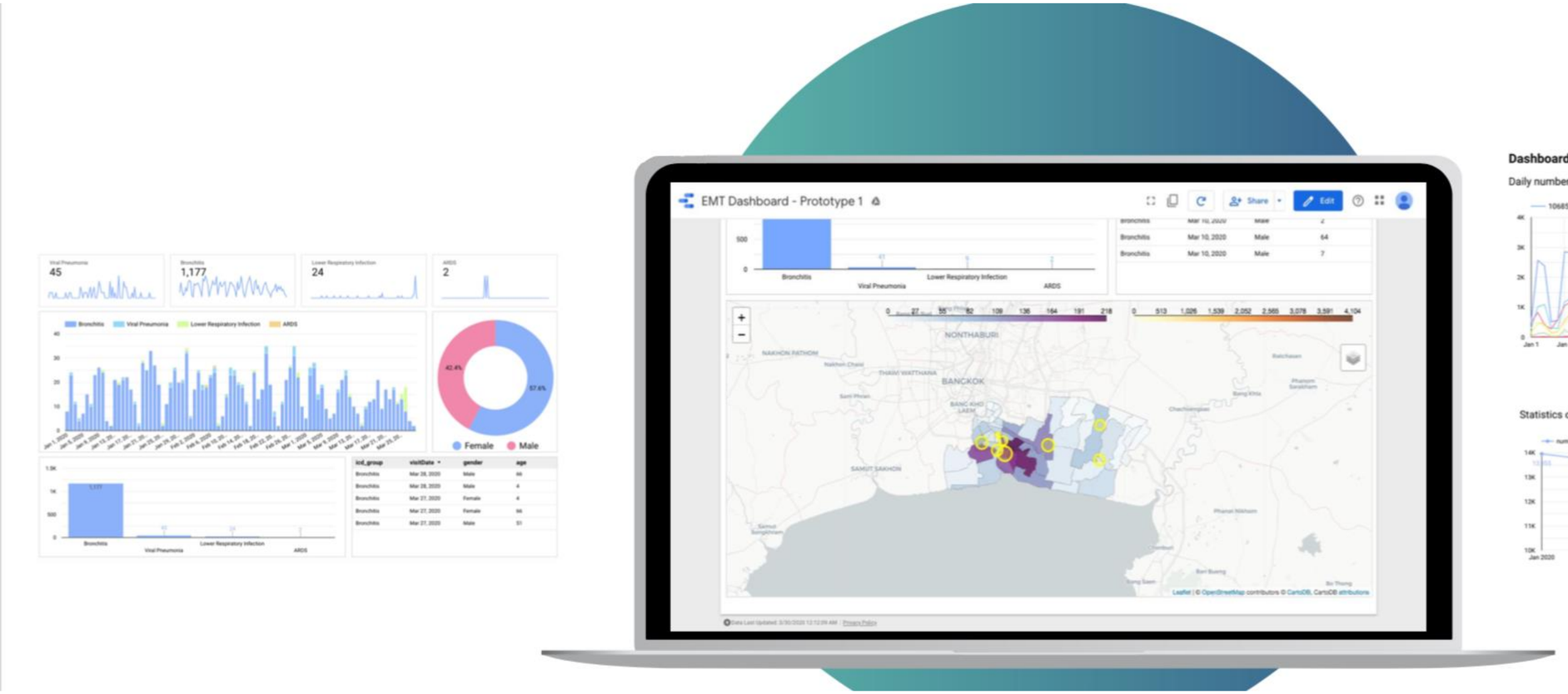

GOOD FOOD FAST
SALADS & BOWLS
GOOD FOOD FAST
WRAPS
HOLE GRAINS
PERSONALIZE YOUR MEAL WITH A PROTEIN PACK
STEAK, CHICKEN, OR TOFU
NEW KALE CAESAR SALAD
WITH HOUSE MADE DRESSING
TWO NEW WRAPS
[CURRIED CHICKEN] [ARTICHOKE]

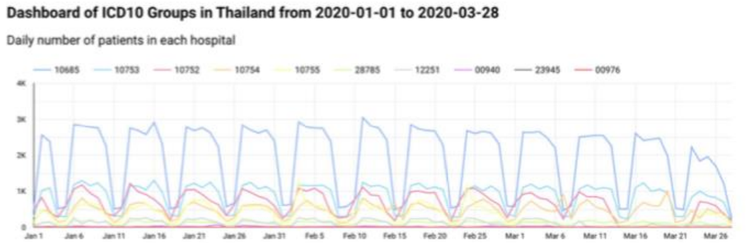
Dr. Alexa Will See You Now

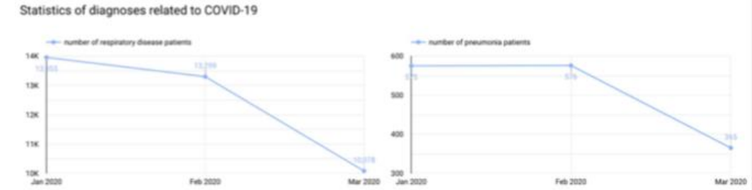
CHUCK NORRIS HAS BEEN EXPOSED TO THE CORONAVIRUS

THE VIRUS IS NOW IN QUARANTINE FOR THE NEXT TWO WEEKS

CORONAVIRUS SURVEILLANCE SYSTEM







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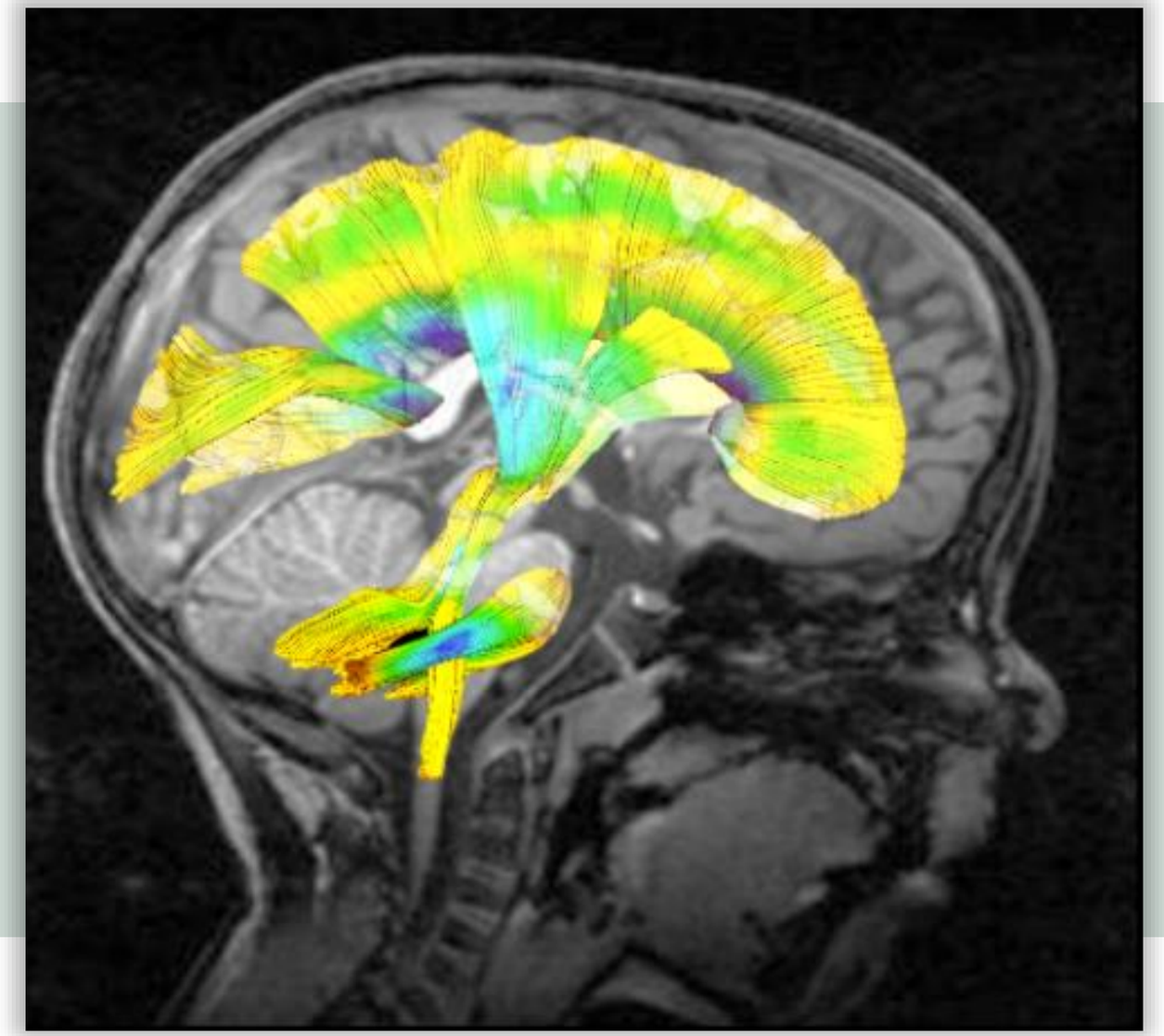
nature
International journal of science

Evaluation and accurate diagnoses of pediatric diseases using artificial intelligence



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01 May 2017 | 17:00 GMT

AI Predicts Heart Attacks and Strokes More Accurately Than Standard Doctor's Method

An artificial intelligence program correctly identifies 355 more patients who developed cardiovascular disease

Artificial Intelligence Diagnoses Heart Murmurs Better Than Expert Cardiologists

U.S. ARTIFICIAL INTELLIGENCE SAFETY INSTITUTE

Strategic Vision
Guidance
Artificial Intelligence Safety Institute Consortium +
NIST AI Engagement
AI @ NIST

AI is one of the defining technologies of our era. Its emergence, together with its multiplying contexts of use and increasing capabilities, presents enormous opportunities as well as significant present and future harms. To enable a future in which we realize AI's full potential to benefit humanity and the planet, it is crucial that we encourage innovation in this transformative technology while mitigating its risks. One of the key challenges in achieving and sustaining safe AI innovation is a lack of scientific study of AI safety. A reliable, reproducible science of AI safety is urgently needed to accurately evaluate the capabilities and risks of models and systems and assess the effectiveness of mitigations and safeguards.

The U.S. AI Safety Institute, housed within the National Institute of Standards and Technology (NIST), is advancing the science, practice, and adoption of AI safety across the spectrum of risks, including those to national security, public safety, and individual rights. Our efforts will initially focus on the priorities assigned to NIST under President Biden's Executive Order on Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence. The Safety Institute will pursue a range of projects, each dedicated to a specific challenge that is key to our mission; these will initially include advancing research and measurement science for AI safety, conducting safety evaluations of models and systems, and developing guidelines for evaluations and risk mitigations, including content authentication and the detection of synthetic content. As the technology and world changes, additional projects will likely be necessary.

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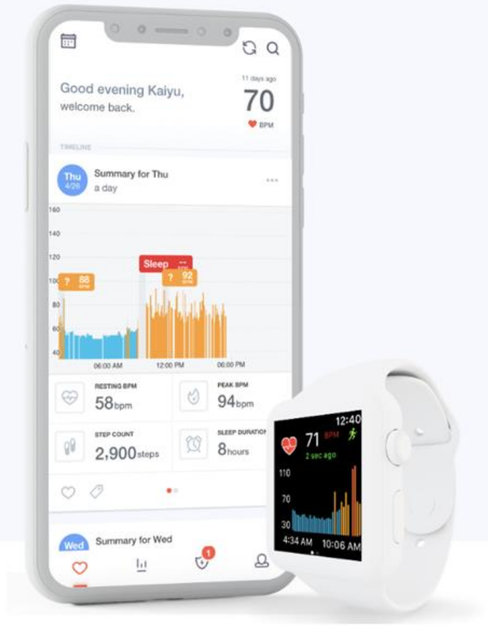
RECOVERY

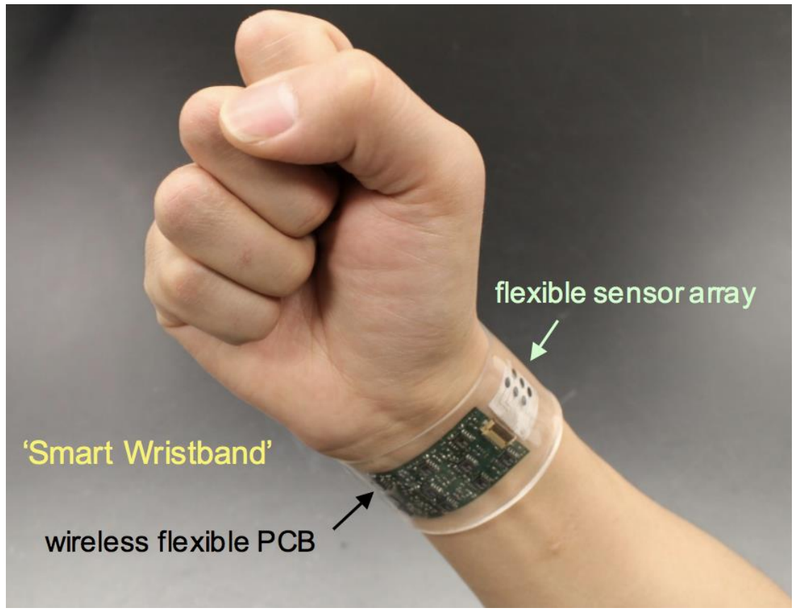
Dexcom. Retrieved from https://www.dexcom.com/

About Cardiogram

Cardiogram is building your personal healthcare assistant. We want to turn your wearable device into a continuous health monitor that can be used to not only track sleep and fitness, but may one day also prevent a stroke and save your life.



Cardiogram. Retrieved from https://cardiogr.am/about/



Gao, et.al Nature, 2016,529, 509

Theragen®

“Theragen creates non-invasive technologies that deliver therapeutic energy to the body to treat pain and disease and heal tissue.

We leverage digital technology, software, algorithms and apps to drive patient engagement to regain an active lifestyle. We are committed to promoting compliance to improve surgical and non-surgical outcomes.”

ActaStim®·S

ActaStim-S™ Spine Fusion Stimulator is the newest way to deliver FDA-approved lumbar spine fusion therapy. The ActaStim-S™ device uses capacitive coupling technology – a safe and effective therapeutic signal that has been prescribed clinically for over two decades and is backed by Level I clinical data. The ActaStim-S™ device is enhanced by the ActaStim Sync mobile app – a digital companion that tracks treatment compliance, activity levels and allows for journaling of life circumstances during recovery.

Digital engagement encourages greater compliance and the information gathered facilitates more meaningful conversations between prescribers and patients.

As assessed 12 months after surgery, patients who use the same proven therapy delivered by ActaStim-S were **2.3 times more likely to achieve overall success with 9 months of treatment.**

CONTEXT AI

www.context.ai

File Edit View History Bookmarks Tools Help

Bittrex.com - The Next Generat

Loomia — Applications

https://loomia.com/applications/

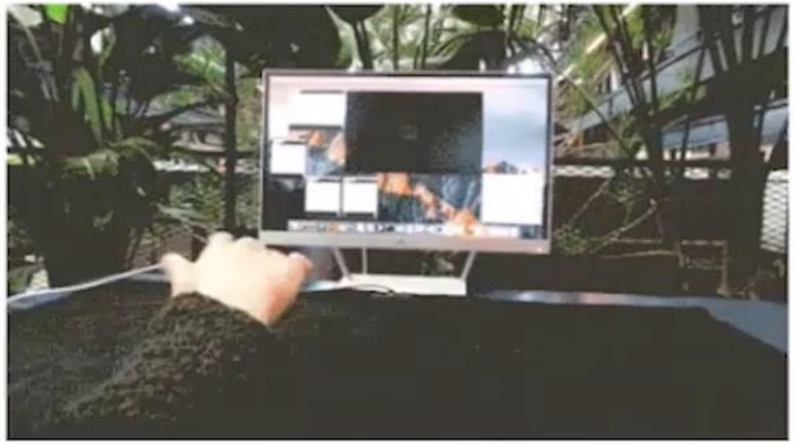
Search

LOOMIA provides heating, lighting, and sensing functionalities for visionary brands.

HEATING

Flexible, soft heating that can integrate into shoes, garments, seats and more. Heating gets up to 200 degrees depending on power

TOUCH SENSING



Touch sensitive fabrics that can be used as interfaces, sensors and more. Useful for automotive, interiors, industrial as well as garment applications

LIGHTING

Flexible, soft lighting that can be used for high-visibility safety applications, as well as more commercial uses.


EXIT

Artificial Intelligence and the Future of Surgical Robotics

Sandip Panesar, MD, MSc, Yvonne Cagle, MD,†§ Divya Chander, MD, PhD,‡§ Jose Morey, MD,§||¶#**†† Juan Fernandez-Miranda, MD,* and Michel Kliot, MD**

Keywords: artificial intelligence, autonomous robotic surgery, future of surgery, machine learning, surgical robotics

(*Ann Surg* 2019;xx:xxx–xxx)

In 2016, Shademan et al reported complete in vivo, autonomous robotic anastomosis of porcine intestine using the Smart Tissue Autonomous Robot (STAR).[1,2] Although conducted in a highly controlled experimental setting, STAR quantitatively outperformed human surgeons in a series of ex vivo and in vivo surgical tasks. These trials demonstrated nascent clinical viability of an autonomous soft-tissue surgical robot for the first time. Unlike conventional surgical robots which are controlled in real-time by humans and which have become commonplace in particular subspecialties, STAR was controlled by artificial intelligence (AI) algorithms, and received input from an array of visual and haptic sensors.

Applications of AI to clinical data for diagnostic purposes have already begun to demonstrate capability approximating that of specialist physicians.[3,4] Consequentially, clinical AI has received much attention from within and outside the medical community.[5] The STAR trials give clinical AI a surgical context and provide a glimpse into the future, should autonomous surgical devices be further developed. Nevertheless, their development must be rationalized and, for widespread utilization, they must confer either technical or financial advantages over conventional surgical techniques. We henceforth expand upon how this may unfold.

DEFINITIONS OF AUTONOMY

The International Organization for Standardization (ISO 8373:2012) defines autonomy as "an ability to perform intended tasks based on current state and sensing without human intervention." However, "autonomy" is not a singular state, but rather a scale in which the degree of human intervention is traded against full independence (Fig. 1). Examples of robotic surgical devices of variable autonomy include the DaVinci (Intuitive Surgical, Sunnyvale, CA) a "master-slave" robot completely dependent upon human control; the TSolution-One (previously ROBODOC; THINK Surgical, Fremont, CA) orthopedic robot; and the Mazor X (Mazor Robotics, Caesarea, Israel) spinal robot. The latter 2 offer reduced levels of human input for a limited range of surgical tasks. Partially autonomous robotic devices such as the CyberKnife (Accuray, Sunnyvale, CA) are already in clinical use at present, however, as this uses external radiation beams, it cannot be truly considered a "surgical robot" in the context of this piece.

From the *Department of Neurosurgery, Stanford University, Stanford, CA; †NASA Ames Research Center, Mountain View, CA; ‡Department of Medi-

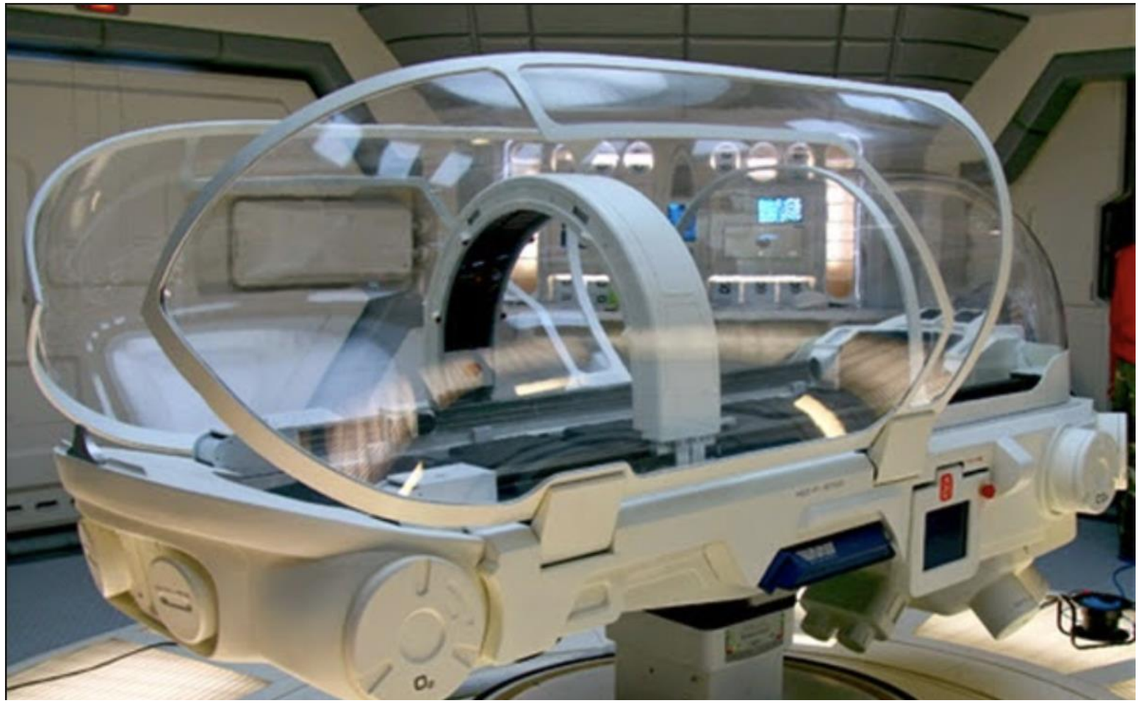
RATIONALE FOR AUTONOMOUS SURGICAL DEVICES

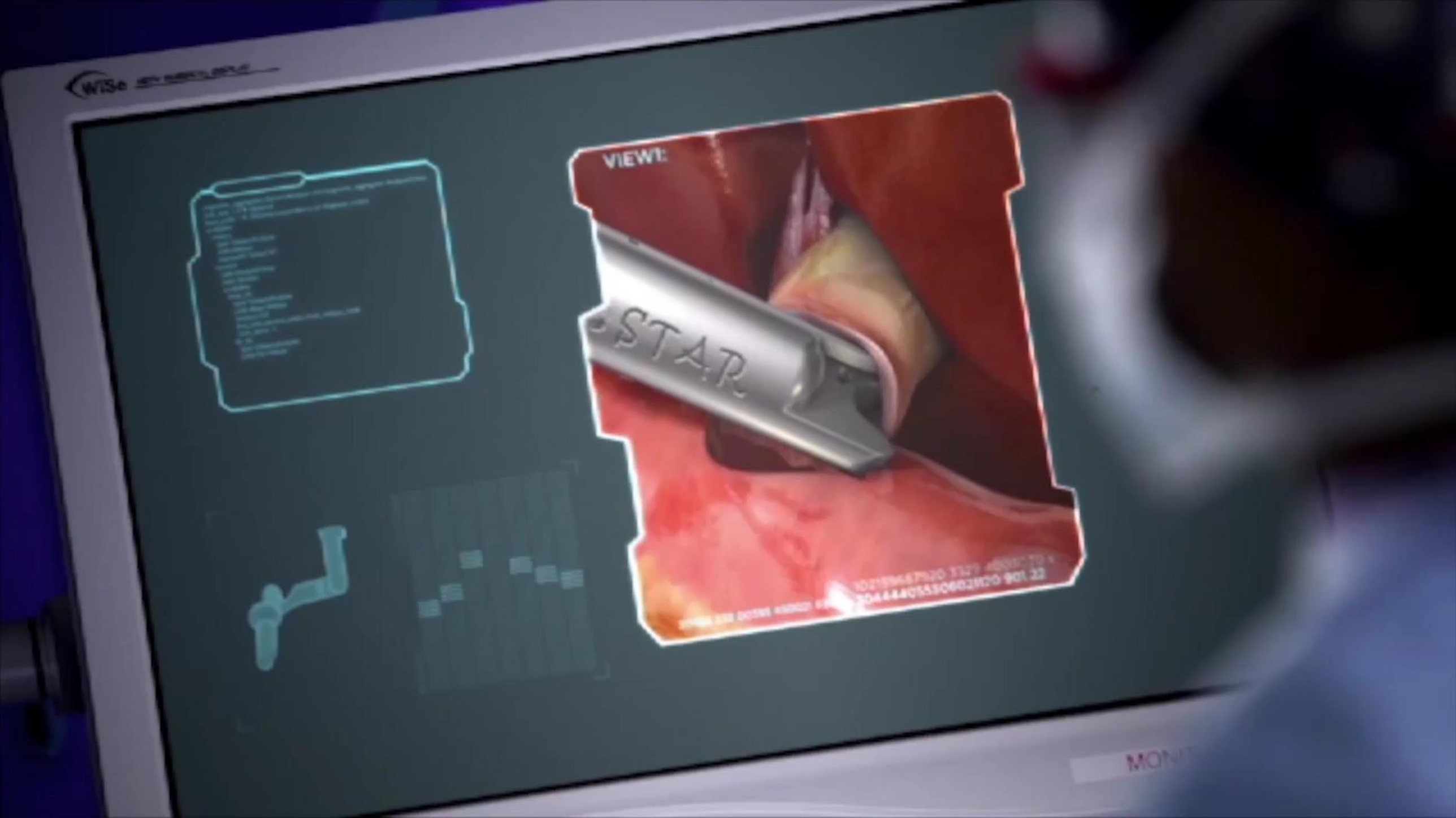
Human surgical performance is dictated by numerous physical, mental, and technical variables, meaning that surgical consistency is difficult to both quantify and achieve. These factors may contribute to the high variability in terms of functional outcomes, complication rates, and survival observed across institutions and geographies. Conventional surgical robots possess certain advantages over humans (insusceptibility to fatigue, tremor resistance, scalable motion, greater range of axial movement[6]), which have been shown to produce enhanced margins and lower morbidity rates[7] for certain procedures. Combination of AI control algorithms with the inherent advantages of surgical robots may therefore benefit surgical practice by reducing technical errors and operative times, enhancing access to hard-to-reach body areas, and improving outcomes by removing (or reducing) the potential for human error.[2]

Sociopolitical issues may provide a catalyst for further development and refinement of autonomous surgical robots. A device controlled by AI-based algorithms may permit rapid dissemination of surgical skills via the Internet or mobile platforms, potentially democratizing surgical care and standardizing surgical outcomes independent of geographic or economic constraints. A clinically capable robot may also be able to provide surgical care in environments where care provision is lacking, for example, aboard a spacecraft in deep space,[8] where access to surgical care will be severely restricted, and following environmental disasters or in war zones, where healthcare infrastructure has sustained damage or is unavailable.

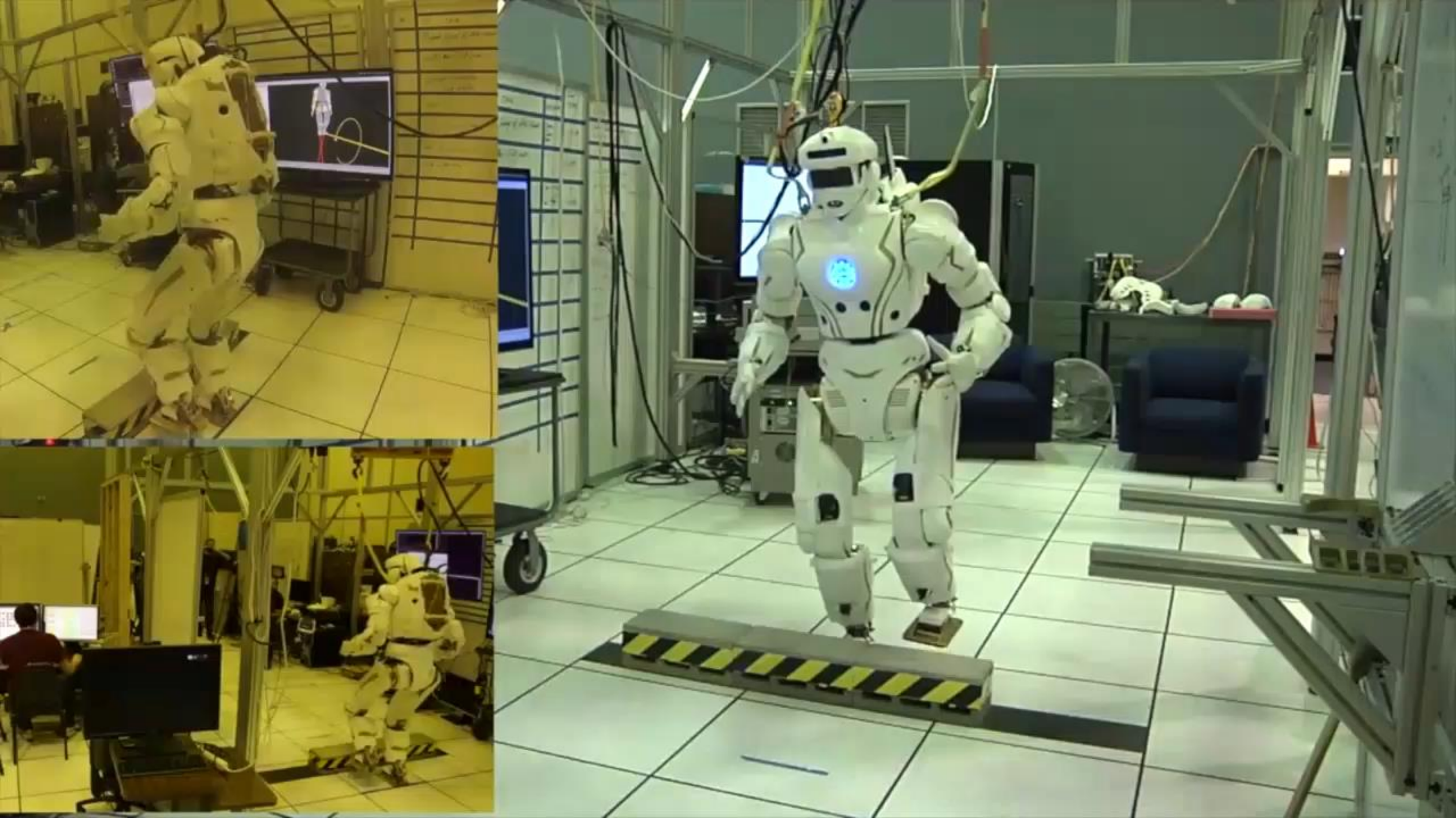
PROPOSED FRAMEWORK FOR AUTONOMOUS SURGICAL ROBOTS

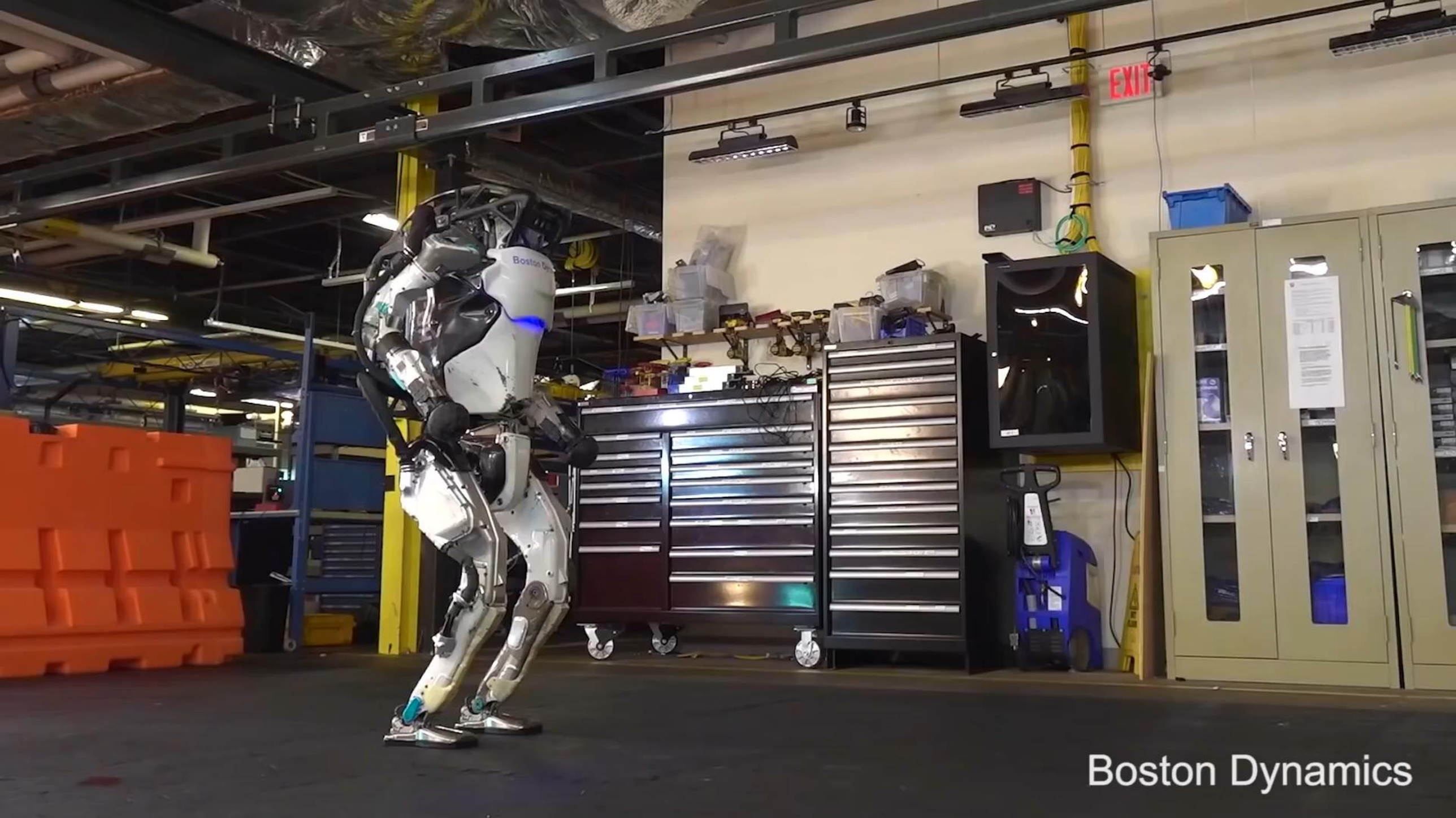
Future autonomous surgical robots will have ability to "see," "think," and "act" without active human intervention to achieve a predetermined surgical goal safely and effectively. Three parameters define the task of an autonomous surgical robot: mission complexity, environmental difficulty, and human independence[9] (Fig. 2A). To enable this, the autonomous robot possesses visual and physical sensors that perceive the environment, a central processor that receives sensory input and calculates outputs, and mechanical actuators that permit physical task completion. Due to the highly deformable nature of soft tissue environments, the presence of hollow organs

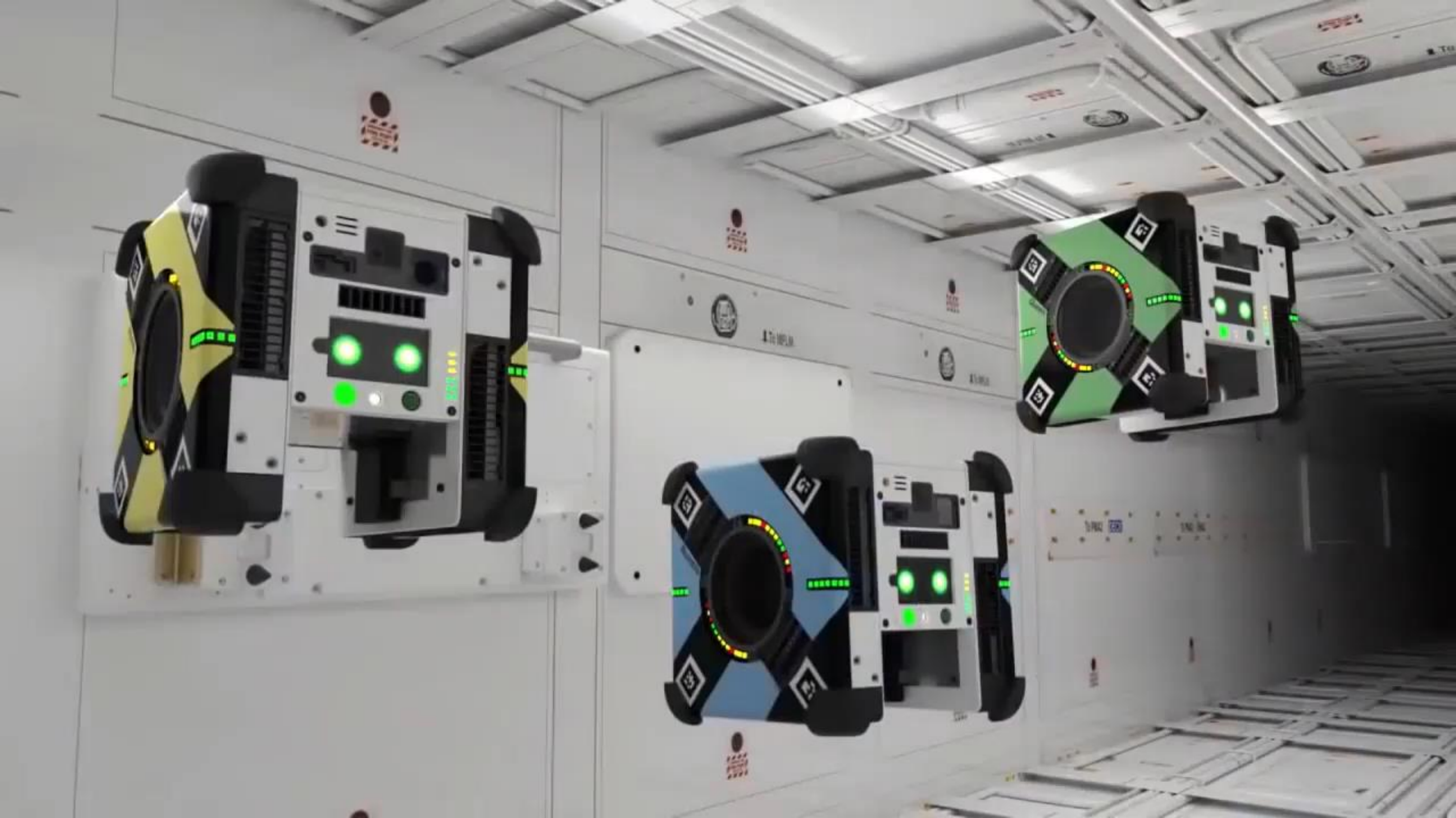


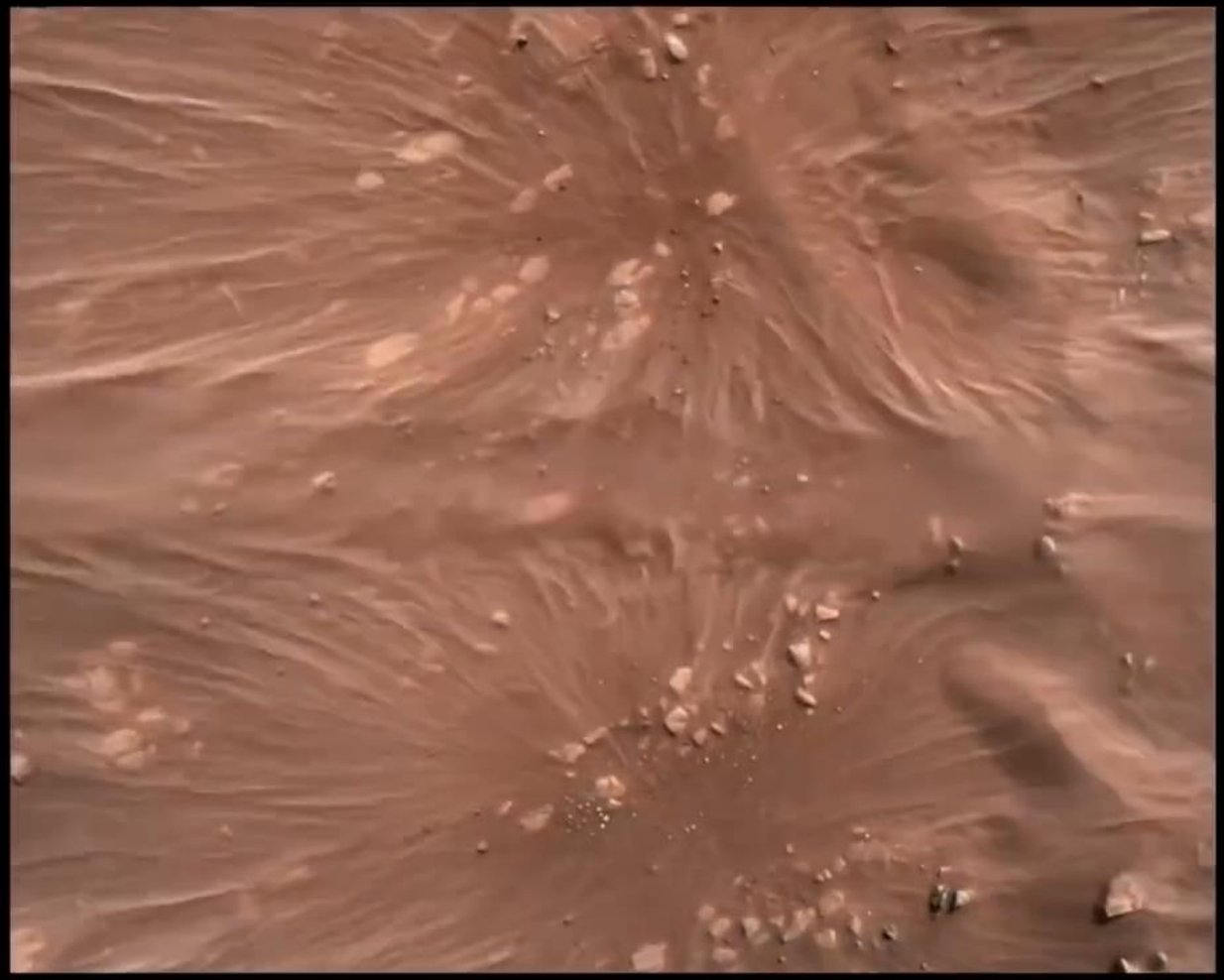

VIEW1:
STAR

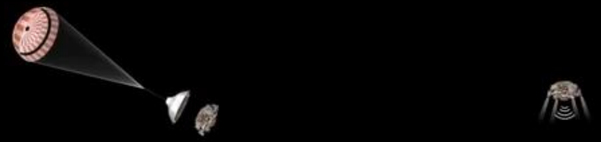

abacus
Courtesy Meituan
美团外卖
So Meituan is sending out




EXIT
Boston Dynamics

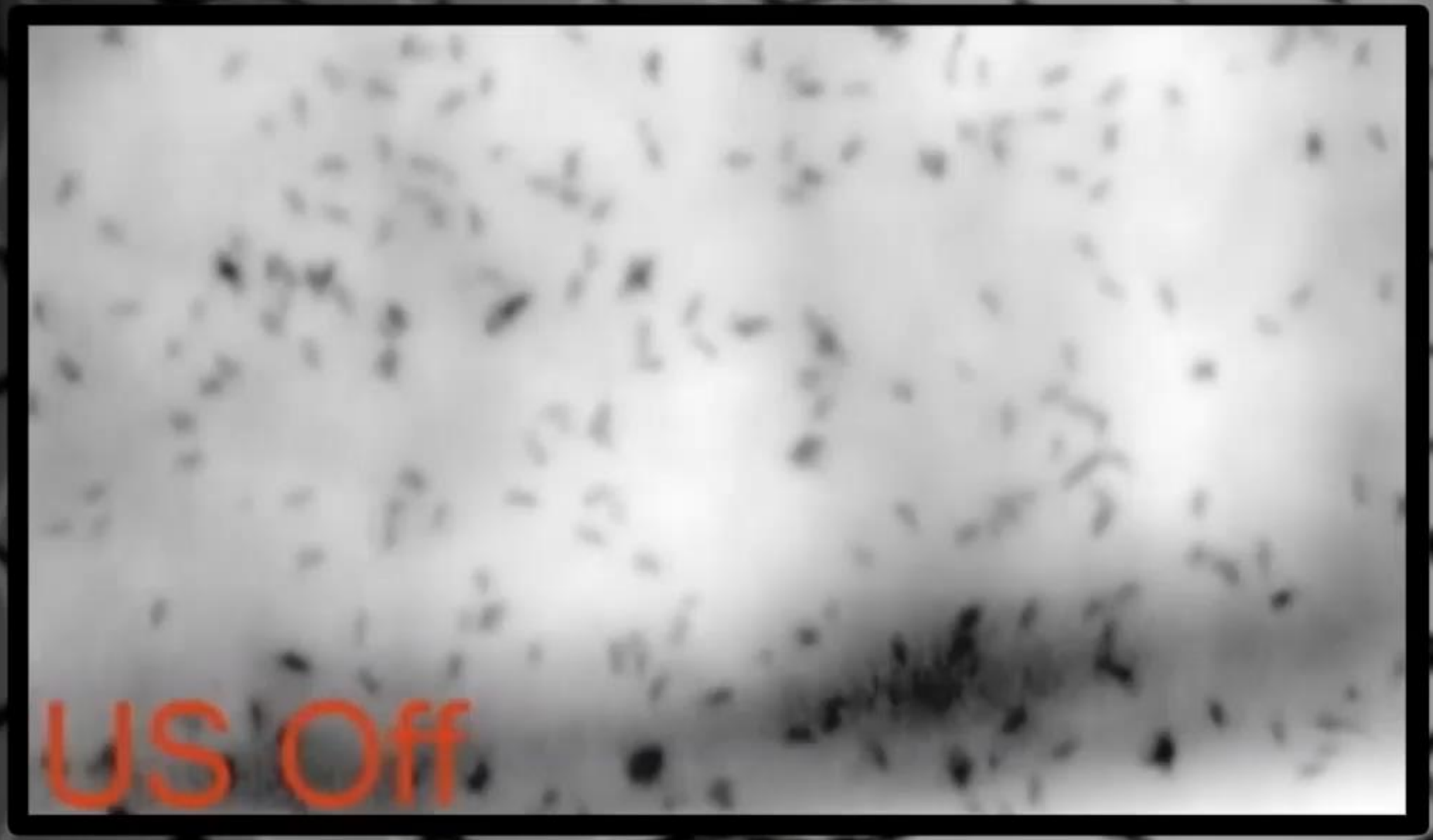


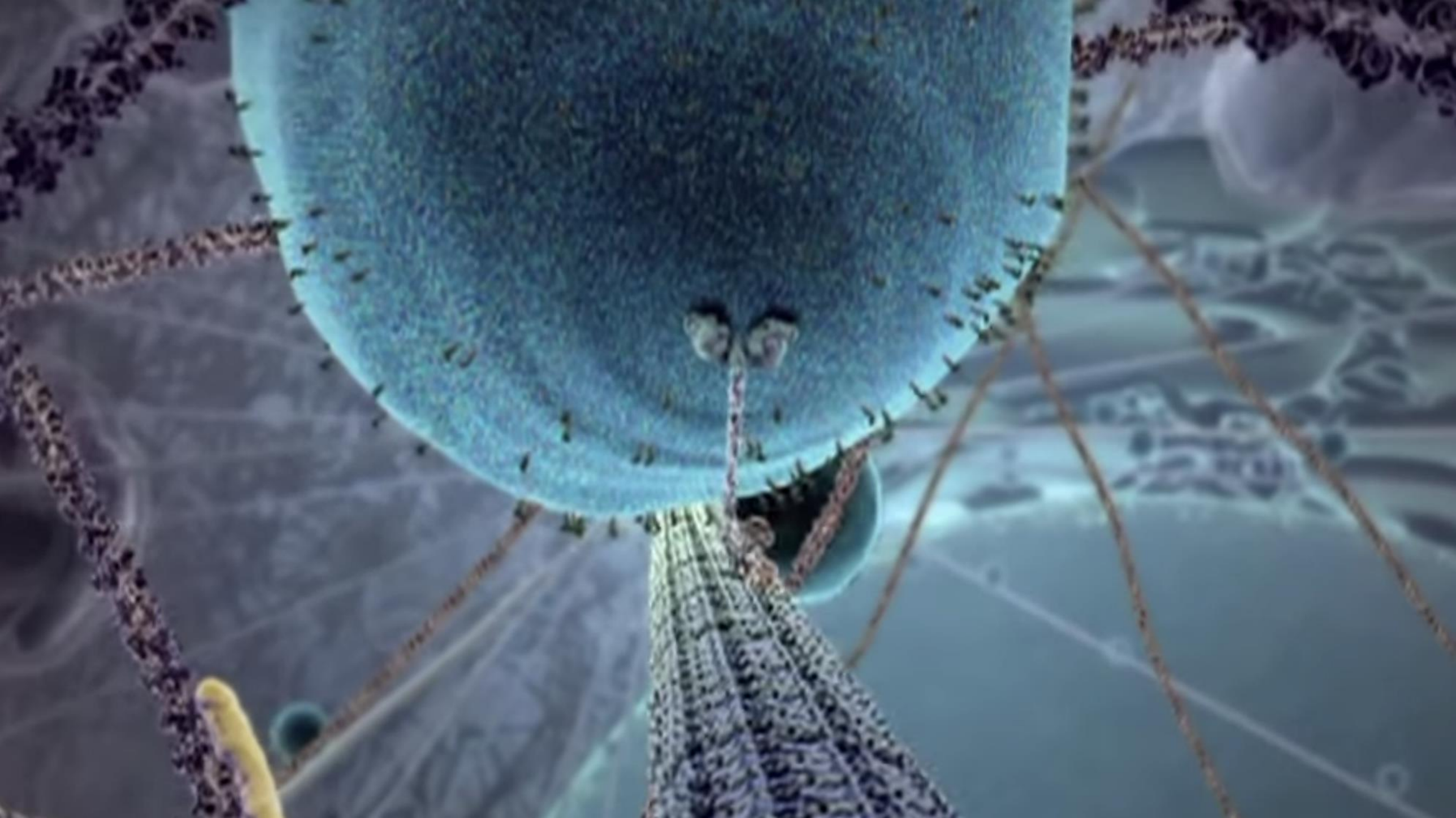


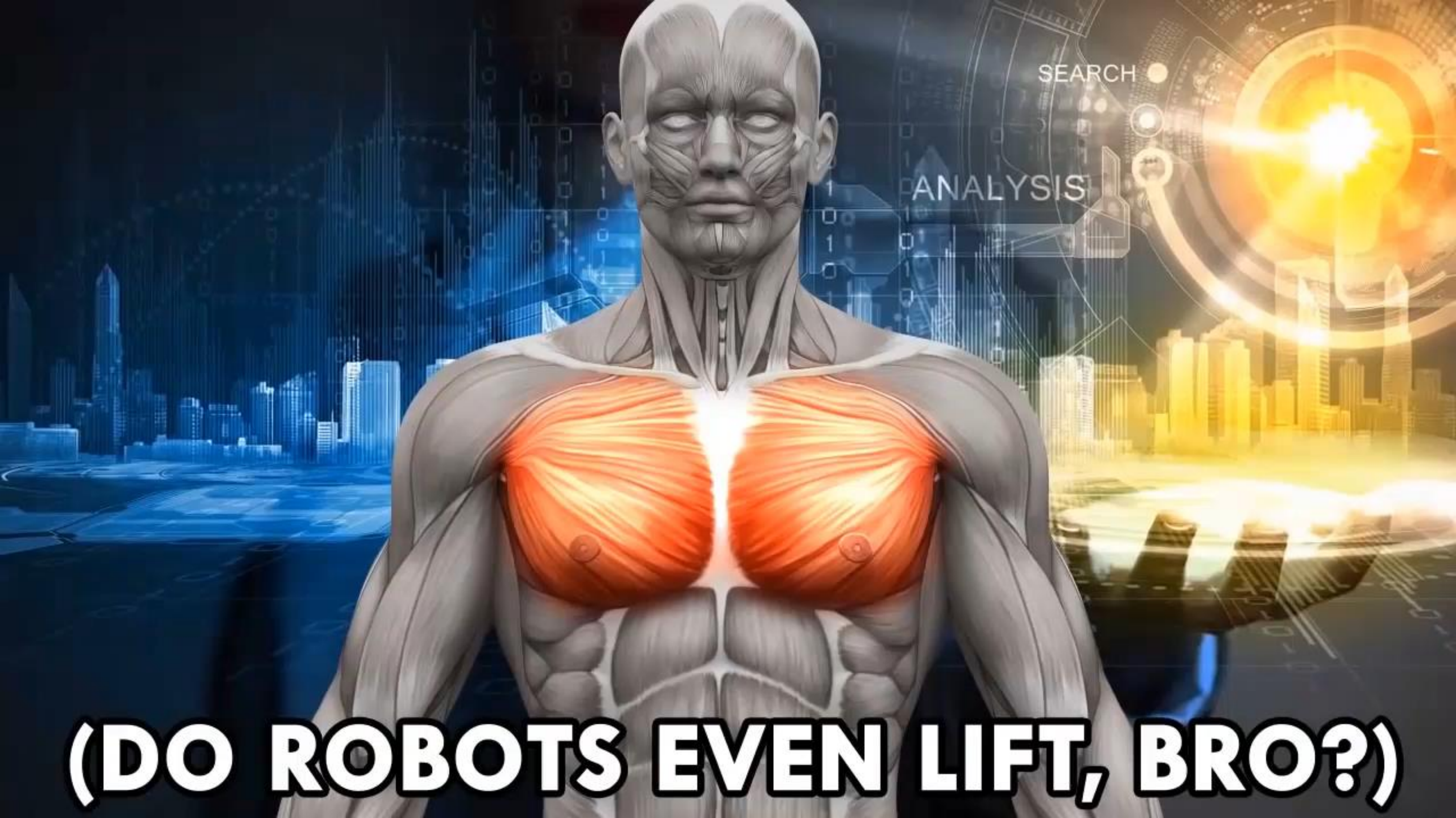


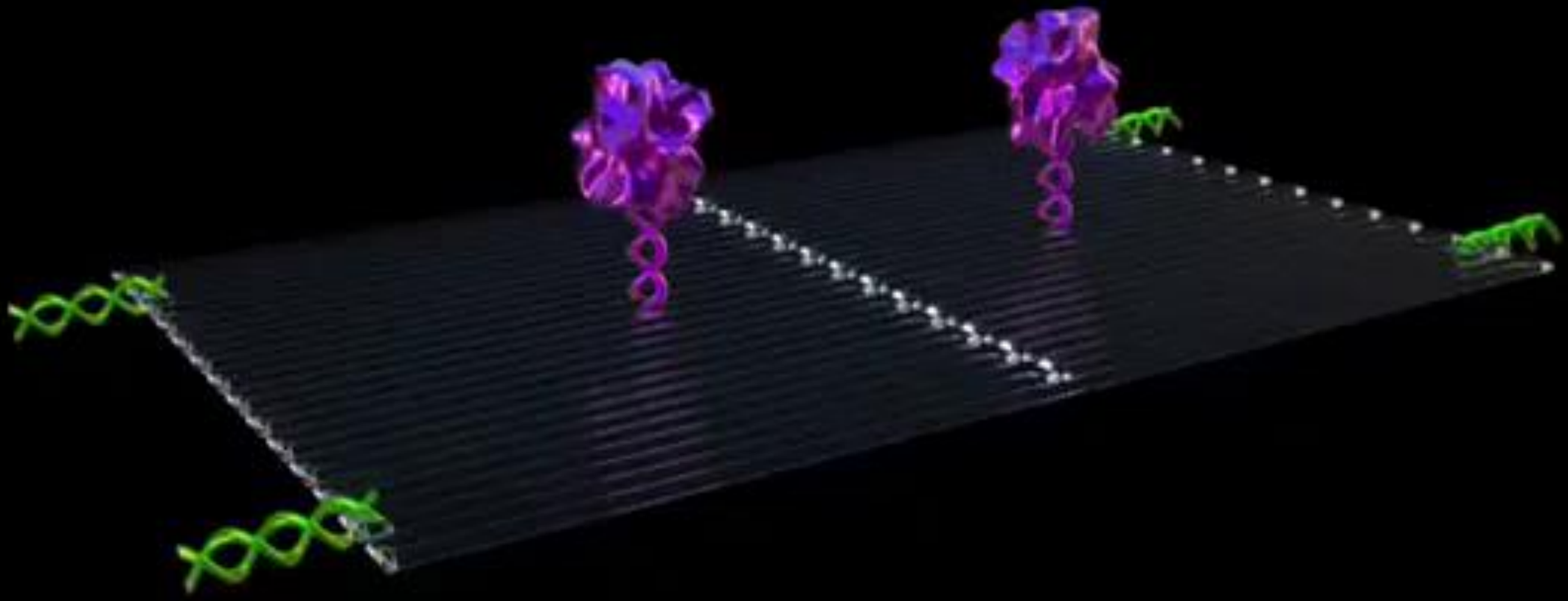

JPL Caltech MIT KAIST LULEÅ UNIVERSITY OF TECHNOLOGY
Team CoSTAR Subterranean Challenge Practice Run
COSTAR

NANOMOTORS






SEARCH
ANALYSIS
(DO ROBOTS EVEN LIFT, BRO?)




Video No. 2543
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Health Check
72

Berna Gomez, wearing glasses to test the prosthesis. (John A. Moran Eye Center at the University of Utah)

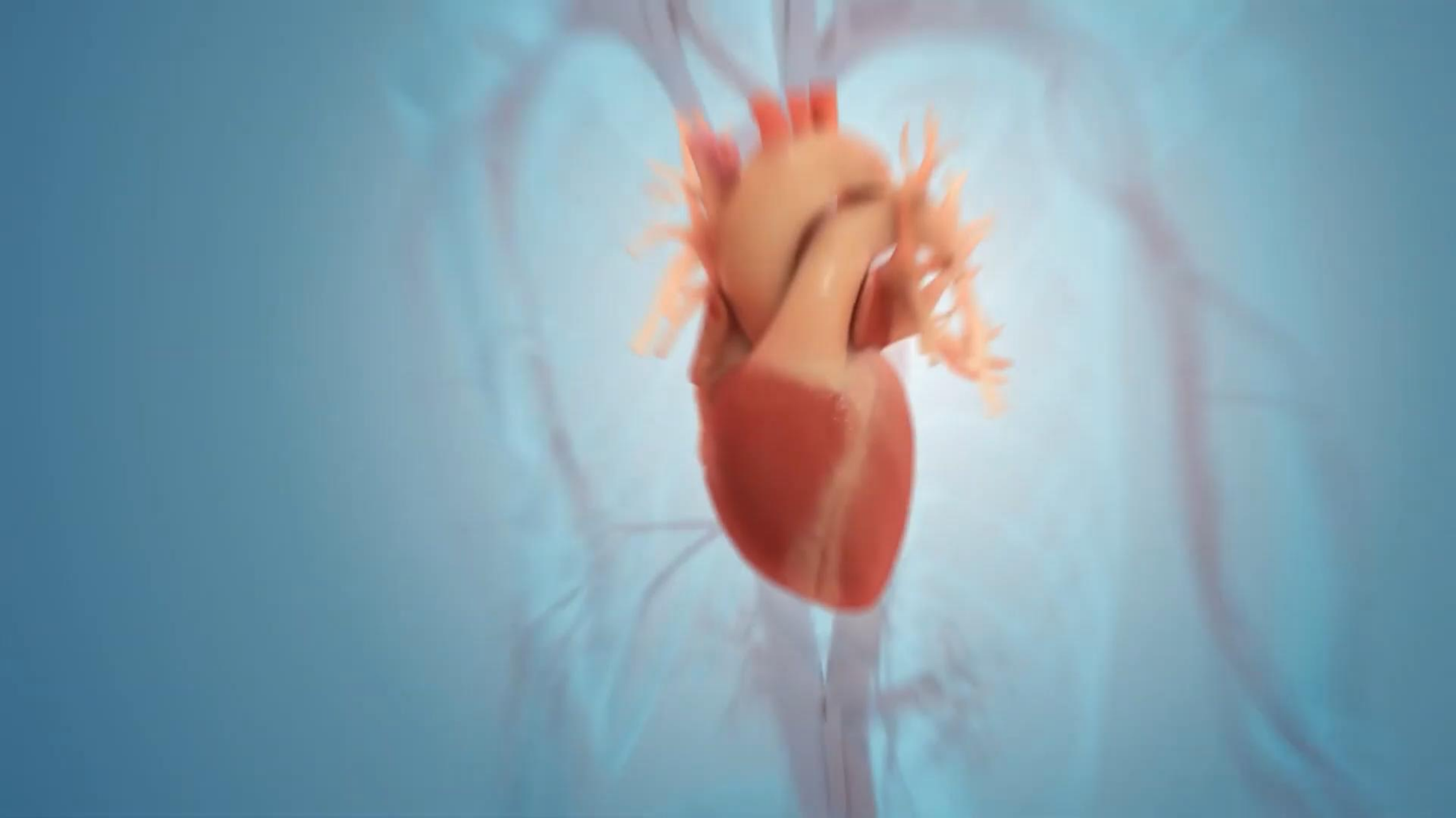
HEALTH

Brain Implant Gives Blind Woman Artificial Vision in Scientific First

CARLY CASSELLA 28 OCTOBER 2021

A 'visual prosthesis' implanted directly into the brain has allowed a blind woman to perceive two-dimensional shapes and letters for the first time in 16 years.

The US researchers behind this phenomenal advance in optical prostheses have recently published the results of their experiments, presenting findings




Concert
Game
Studio
Samsung
Newsroom


Navigation


14 PM
90°
450 MPH


DATA
GED
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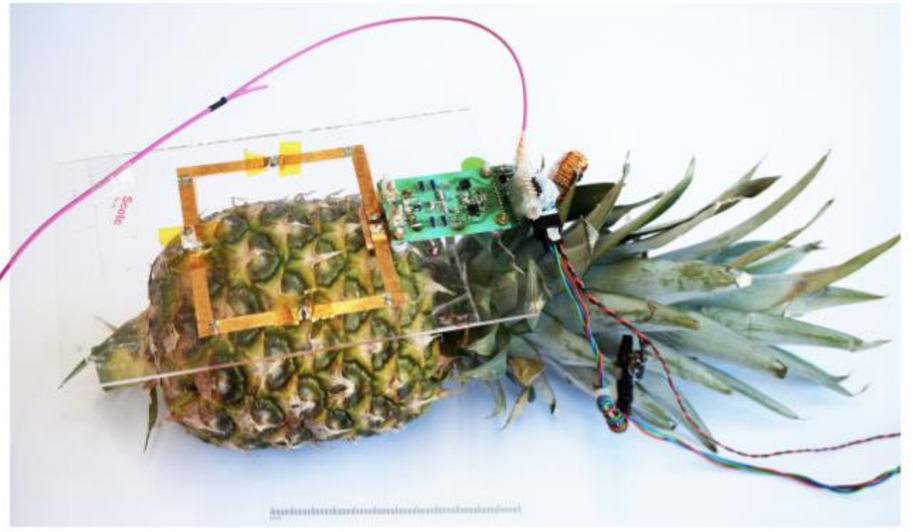
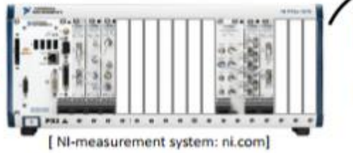
BIO
ACKT
POOL
INTRSHP
TRICRDR
FWD
INPUT
RVS
ERASE
TR-590 TRICORDER



End of static magnetic field
(MRI room)

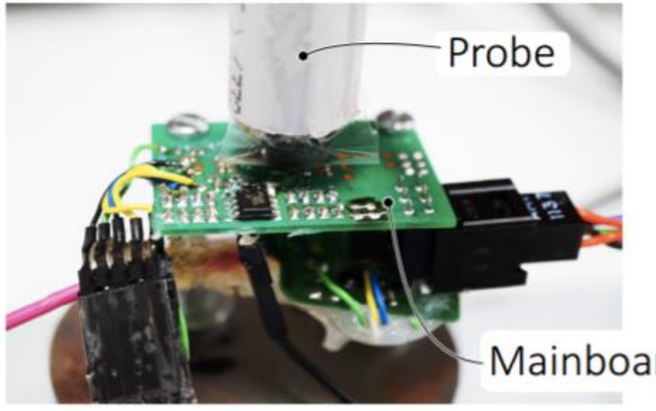


[NI-measurement system: ni.com]

Data recording and offline computing

- WearableMRI device operates during MRI scan sequence without fault due to optimized layout and geometry

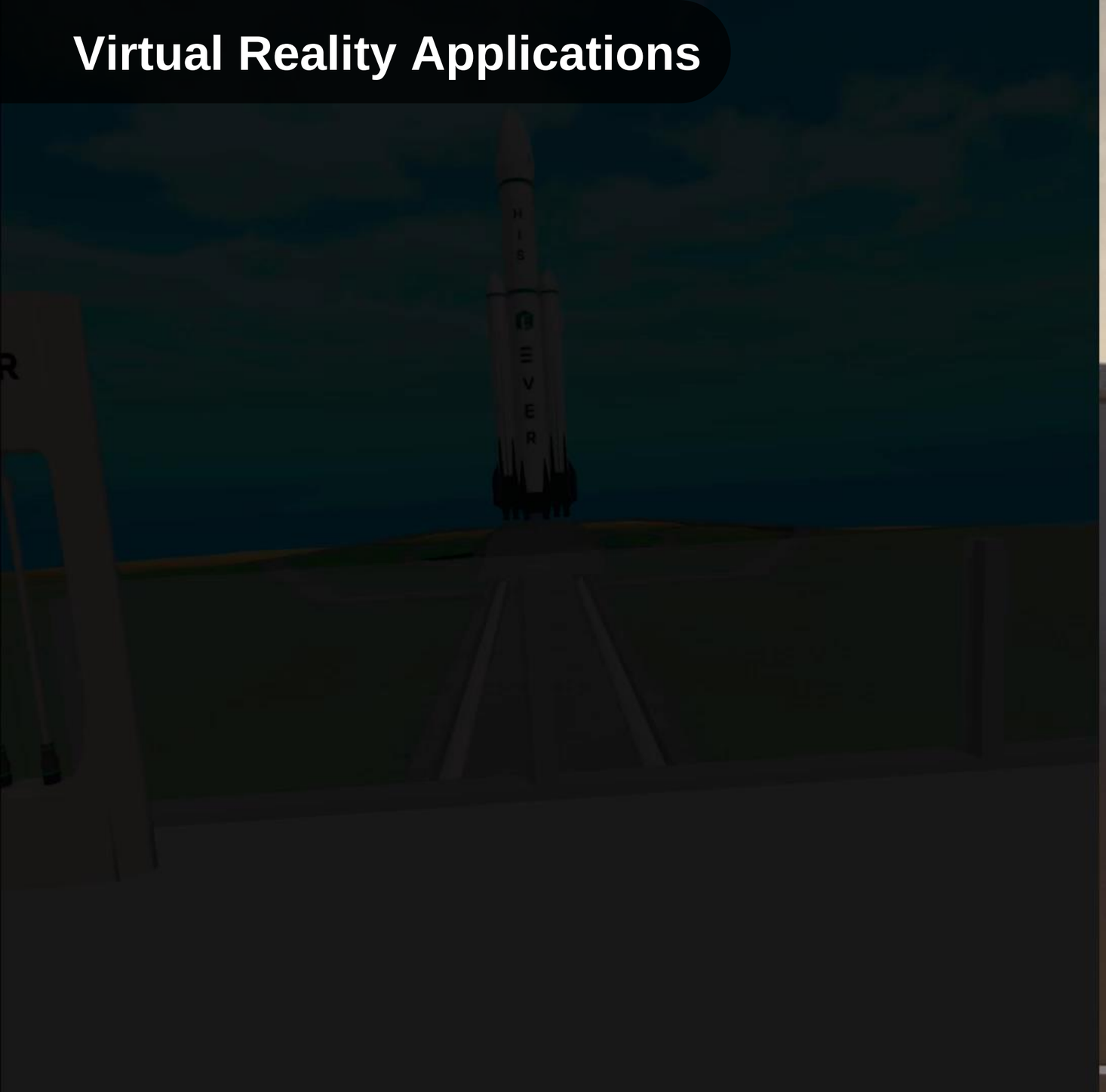
Test system to evaluate influence of MR operation on circuit



- Area around MR receiver chip influenced most by eddy current noise

Source: Ogilvy Brazil

Virtual Reality Applications



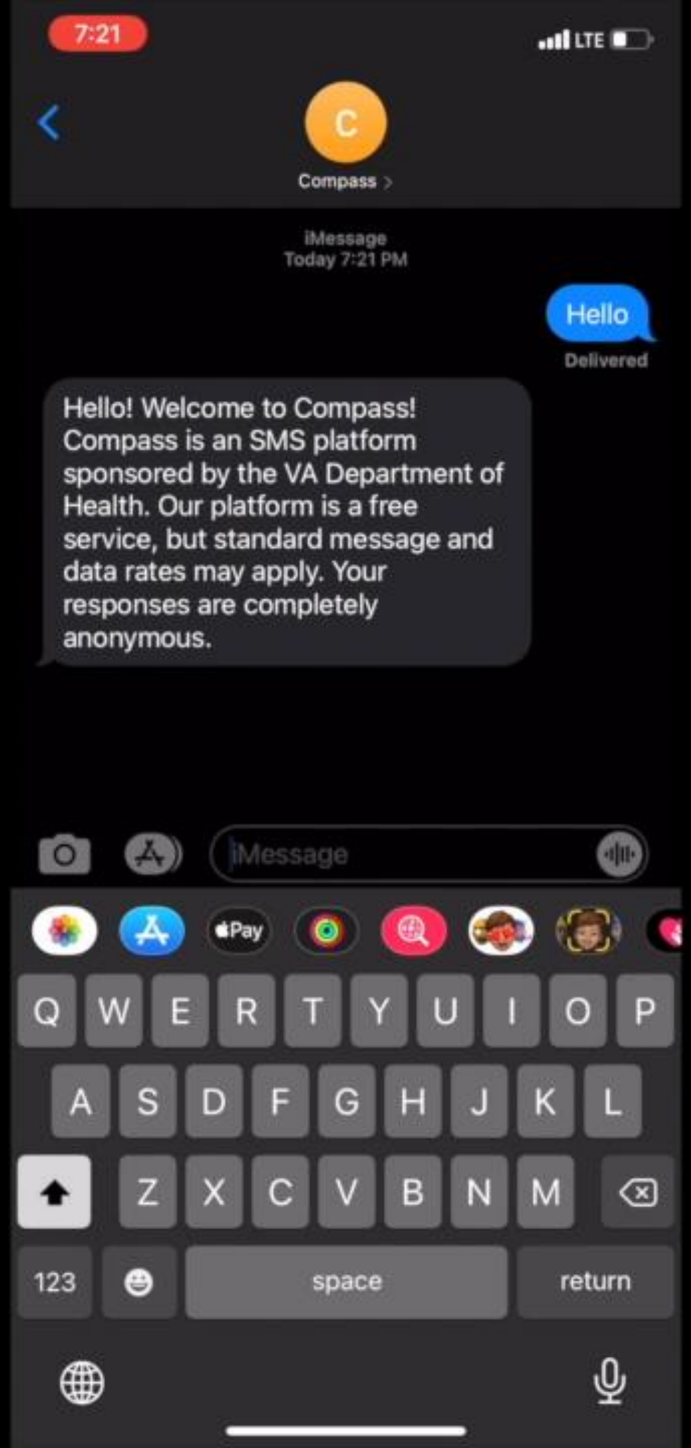
NASA flight surgeon Josef Schmid holoported onto the ISS.

NASA Beamed a Doctor to The ISS in a World-First 'Holoportation' Achievement

PETER DOCKRILL19 APRIL 2022

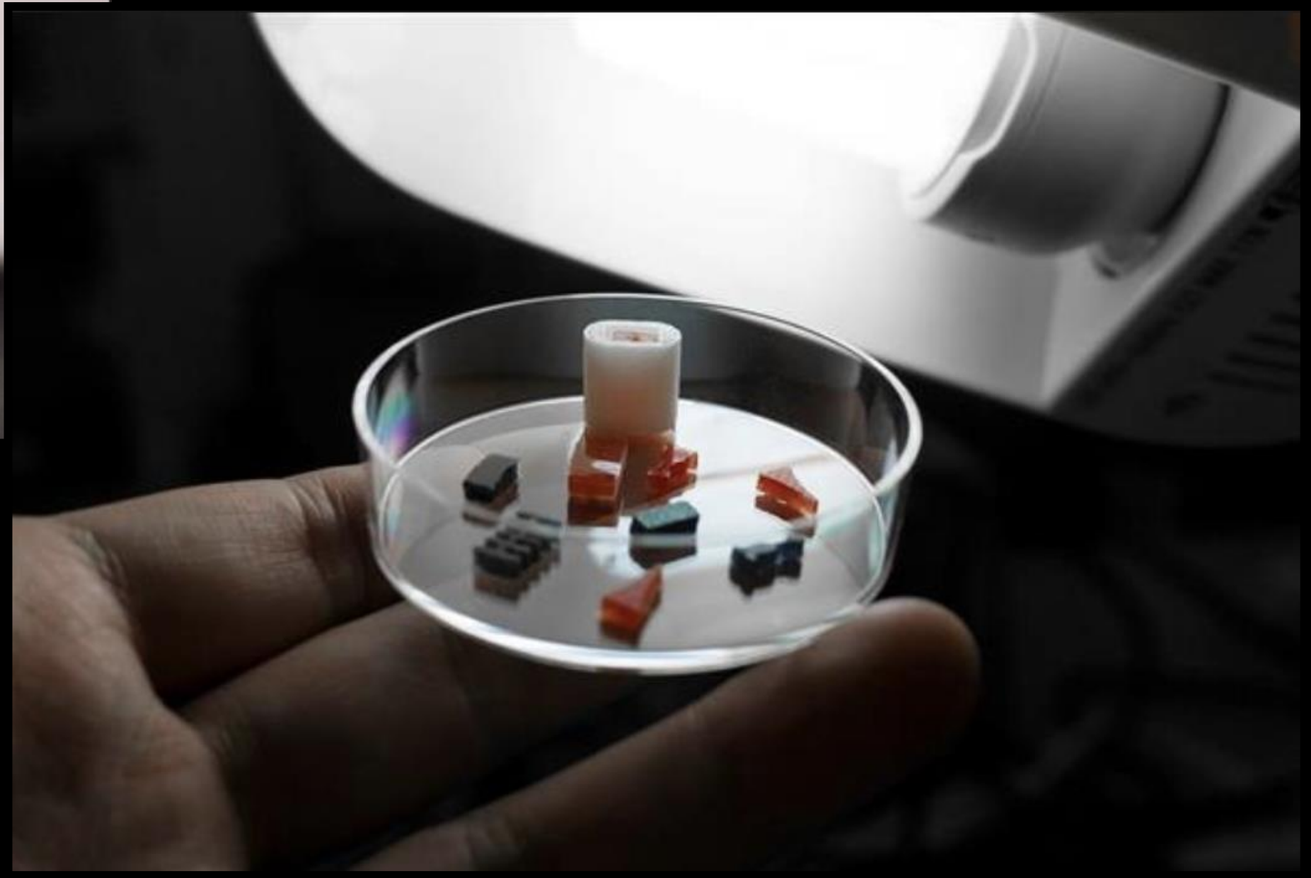
There's never been a house call quite like this. In a first for telepresence communication, a NASA flight surgeon was

Text Message Campaigns



THE WORLD'S FIRST 3D PRINTED PILL

- SPRITAM -

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