

Research Technology Area in AI

Samson TAI
IBM Distinguished Engineer
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Artificial intelligence: The time to act is now

By [Gaurav Batra](#), [Andrea Queirolo](#), and [Nick Santhanam](#)



ARTIFICIAL INTELLIGENCE

13	69	2104	1177	\$29B
CATEGORIES	COUNTRIES	COMPANIES	FUNDED	TOTAL RAISED

Artificial Intelligence Market Report and Data

Venture Scanner is your analyst and technology powered research firm.

Tracking Artificial Intelligence Hype: Many More Companies Are Using '.ai' In Their URL

January 5, 2018



[Artificial Intelligence](#)

2017 set a record for first financings to ".ai" companies.

+ Add to myFT

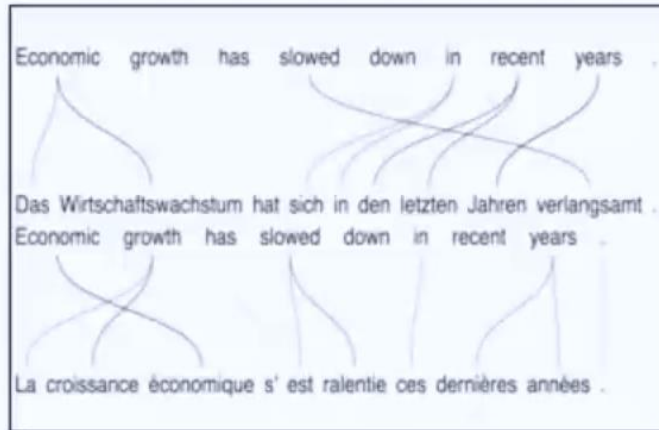
Artificial Intelligence and Robotics

China seeks dominance of global AI industry

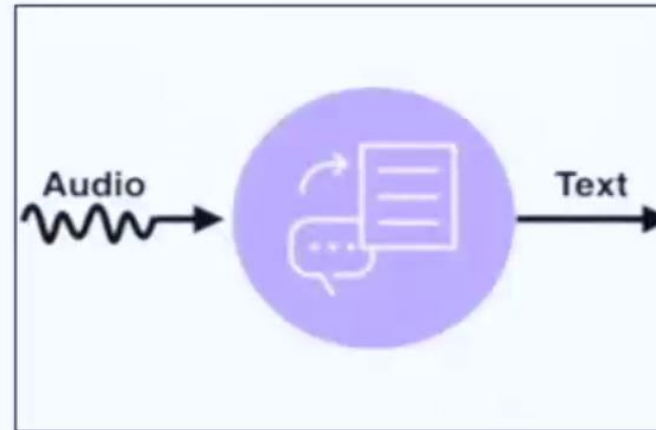
Beijing challenges US with plan to create \$150bn artificial intelligence sector



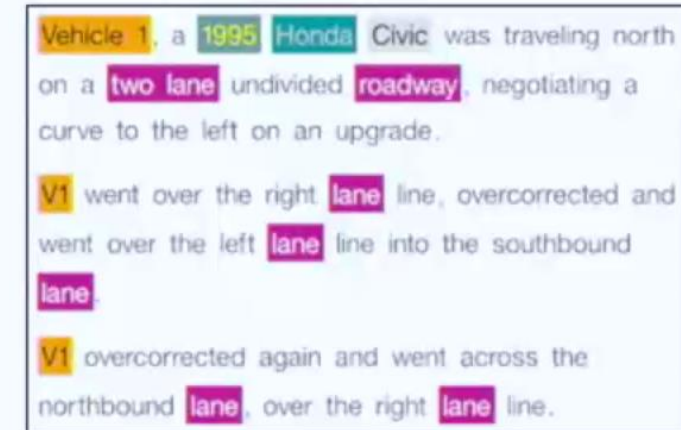
Specialized AI finally works



Language Translation



Speech Transcription



Language Understanding



Machine Reasoning



Object Detection



Face Recognition



Democratizing with the cloud the access to AI is contributing to generate new products, services and new kind of companies....

Source: <https://www.grushgamer.com/>

The Future of Man & Machine Relation



Soul Machines 'digital humans' have own unique personality and emotional intelligence.

- creating a realistic physiological model,
- the persona, and
- the self-learning from each human interaction.

Artificial Interactions – Soul Machine

Soul Machine Digital Humans:

https://www.youtube.com/watch?time_continue=2&v=AzPs7GfOkew

Baby 5.0 - <https://www.youtube.com/watch?v=yzFW4-dvFDA>

Soul Machine's Greg Cross Presentation

<https://www.facebook.com/bwnet.fans/videos/10154882117121837/>

The IBM Watson enables these digital humans to learn an organization's corpus of knowledge and Soul Machines' human computing engine allows them to embody the core values of the organization they will represent.

AI system & reasoning - debating



Marketplace

IBM Research - Haifa > Cognitive Analytics and Solutions >
Cognitive Information Analytics >

Connect with us:



Debating Technologies

“Argumentation and debating represent primary intellectual activities of the human mind. People in all societies argue and debate, not only to convince others of their own opinions but also in order to explore the differences between multiple perspectives and conceptualizations, and to learn from this exploration.” ACL Berlin 2016

IBM Research Debating Technologies Home Page: <http://www.research.ibm.com/haifa/dept/vst/debating.shtml>

AI systems & sighting



TOTAL CLIPS PROCESSED: 7

HOURS OF COVERAGE: 14



CURRENT TIME: 5:28 PM MOST RECENT: 8:20 PM

MATCH POINT: Williams Williams v Shvedova Babos Doubles Final Highlights



8:20 PM
MATCH POINT
0.76
EXCITEMENT LEVEL
SEE FULL HIGHLIGHT VIDEO



3:15 PM
SHAPOVALOV WITH THE BREAK
0.23
EXCITEMENT LEVEL
SEE FULL HIGHLIGHT VIDEO



1:41 PM
FIRST SET
BOLKVADZE/MCNALLY WITH THE BREAK
0.25
EXCITEMENT LEVEL
SEE FULL HIGHLIGHT VIDEO



2:40 PM
MATCH POINT
0.51
EXCITEMENT LEVEL
SEE FULL HIGHLIGHT VIDEO

Source: IBM Research automatic sport highlights generation <https://www.ibm.com/blogs/research/2017/06/scaling-wimbledons-video-production-highlight-reels-ai-technology/>



Food	Score
strawberry dipped in chocolate	1.00 <input checked="" type="checkbox"/> 0 <input type="checkbox"/> 1
fruit dipped in chocolate	1.00 <input checked="" type="checkbox"/> 0 <input type="checkbox"/> 1
fruit dish	1.00 <input checked="" type="checkbox"/> 0 <input type="checkbox"/> 1
sweet treat	1.00 <input checked="" type="checkbox"/> 0 <input type="checkbox"/> 1
chocolate egg	0.50 <input type="checkbox"/> 0 <input type="checkbox"/> 1
Easter egg	0.50 <input type="checkbox"/> 0 <input type="checkbox"/> 1
candy	0.50 <input type="checkbox"/> 0 <input type="checkbox"/> 1
sweet	0.50 <input type="checkbox"/> 0 <input type="checkbox"/> 1
delicacy	0.50 <input type="checkbox"/> 0 <input type="checkbox"/> 1

Did We Wow You? Yes No

Video Frames (10)



Video overview

🔍 Filter image frame

00:00



00:02



00:04



00:06



Video Overview

FRAMES
10

ENTITIES
None

KEYWORDS
13

CONCEPTS
5

couple craze quality 98% romance Lois 68% close mmhm 62%

Entities

No entity found

Concepts

Home 91% [🔗](#) Love 86% [🔗](#) Romance 81% [🔗](#) Romance 71% [🔗](#) Interpersonal relationship 65% [🔗](#)

Emotion Analysis

sadness 12% joy 81% fear 4% disgust 0% anger 3%

Video Transcript (15 minutes max)

00:00 A lot of my friends love having their homes designed in such a way that inspires romance Lois surely Jennifer especially for newlyweds what every couple craze quality time together at home is where they spend most of their time a place to be romantic and be close mmhm but it's hard to get over my.

AI systems & voice

SwitchBoard Corpus



Conversation among not known individuals

2,400 two-sided telephone conversations among 543 speakers (302 male, 241 female) from all areas of the United States.

Source: <https://catalog ldc.upenn.edu/ldc97s62>

Call Home Corpus



Most participants called family members or close friends.

120 unscripted 30-minute telephone conversations between native speakers of English.

Source: <https://catalog ldc.upenn.edu/ldc97s42>

Speech Recognition

“SWITCHBOARD” corpus

“CallHome” corpus

25 years

Error
Rate

1992: 70%-80%

2000: 19.3% (Cambridge University)

2014: 15% (IBM)

2015: 8% (IBM)

2016: 6.9% (IBM) - Apr

2016: 5.9% (Microsoft) - Oct

2017: 5.8% (Microsoft) – Feb

2017 5.5% IBM (Mar)

Human Parity 5.1% (to 5.9%)

25 years

Error
Rate

2000: 31.4% (Cambridge University)

2015: 14.1% (IBM)

2016: 12.2% (IBM) - Apr

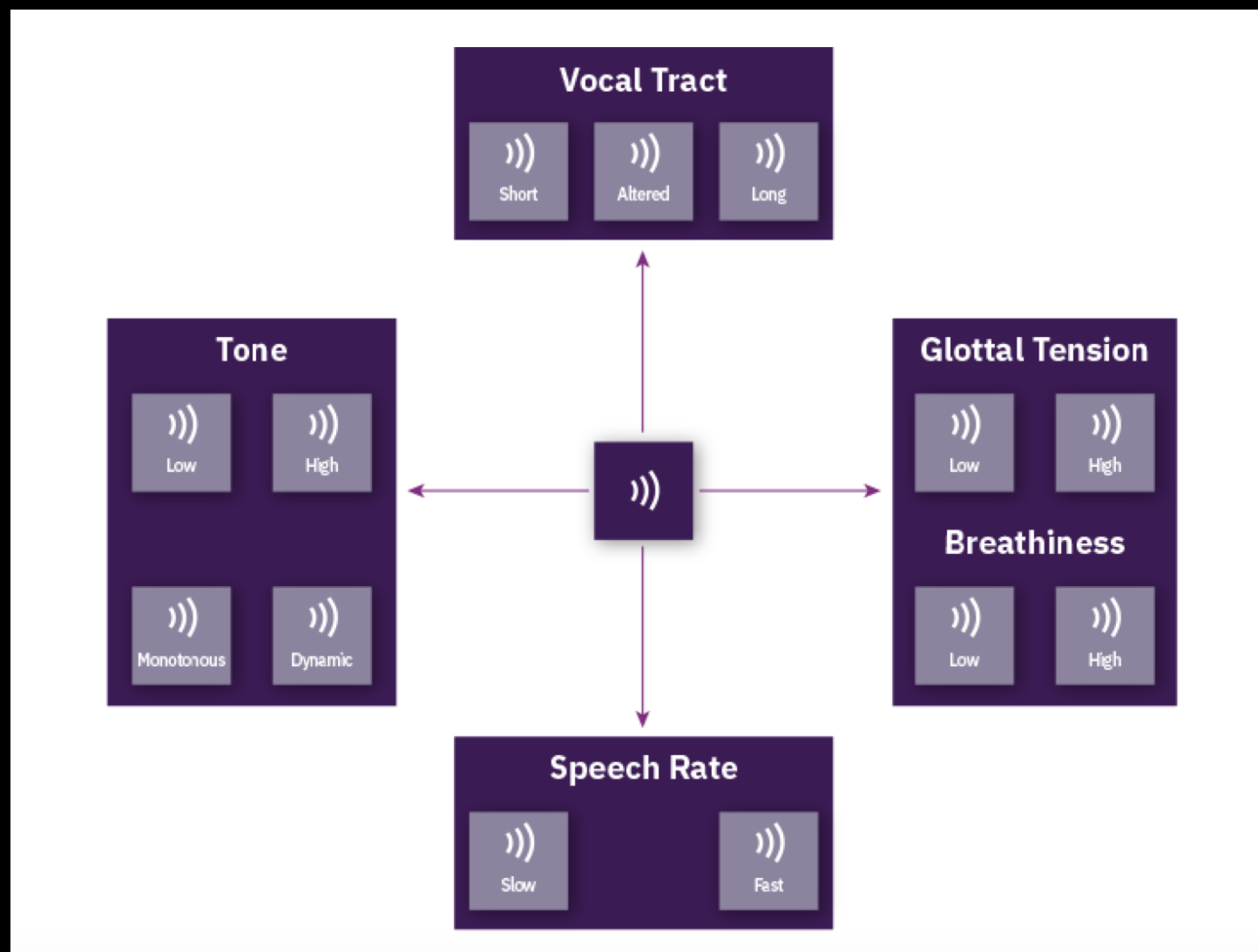
2016: 11.3% (Microsoft) – Oct

2017: 11% (Microsoft) – Feb

2017: 10.3% IBM (Mar)

Human Parity 6.8% (to 11.3%)

Synthetic speech



The IBM Virtual Voice Creator takes Text-To-Speech synthesis technology to the next level, letting enterprise customers and users create unique voice personas on-demand in a fast and easy way.

The IBM Virtual Voice Creator lets automatically create a voiceover for a multi-character game, animation or educational video, without the hassle of hiring voice actors and audio recording studios.

IBM Research Voice: <http://www.research.ibm.com/haifa/dept/imt/ivvc.shtml>

IBM Research Virtual Voice Creator Demo: <https://ivva-tts.sl.haifa.il.ibm.com/>

The beta-service is available until Aug 10, 2018. Generate speech files for your free use ([Terms](#))

Original Voices



Export-Voice

Delete

Save

Save As

▶ Michael
en-US - male

this is my voice, do you like it or not?



00:00



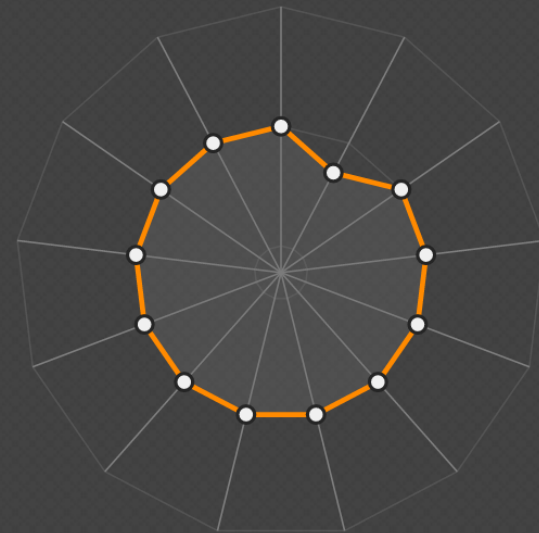
00:02

▶ Allison
en-US - female

▶ Lisa
en-US - female

Michael

Language: en-US
Gender: male



Description

Vocal Tract ⓘ * unsaved changes

Low Register

Shrink Stretch

Mid Register

Shrink Stretch

High Register

Shrink Stretch

Pitch ⓘ

Low High

Flat Jumpy

Phonation ⓘ

Soft Tense

Crisp Breathy

Speed ⓘ

Slow Fast

Effects ⓘ

Normal Hoarse

Normal Growling

Normal Trembling

Mood ⓘ

Neutral Excited

Neutral Sad

IVVA-Gallery Voices



▶ Dwarf (en-US Michael)
owner: ivva

▶ Giant (en-US Michael)
owner: ivva

▶ Mr Allison (en-US Allison)
owner: ivva

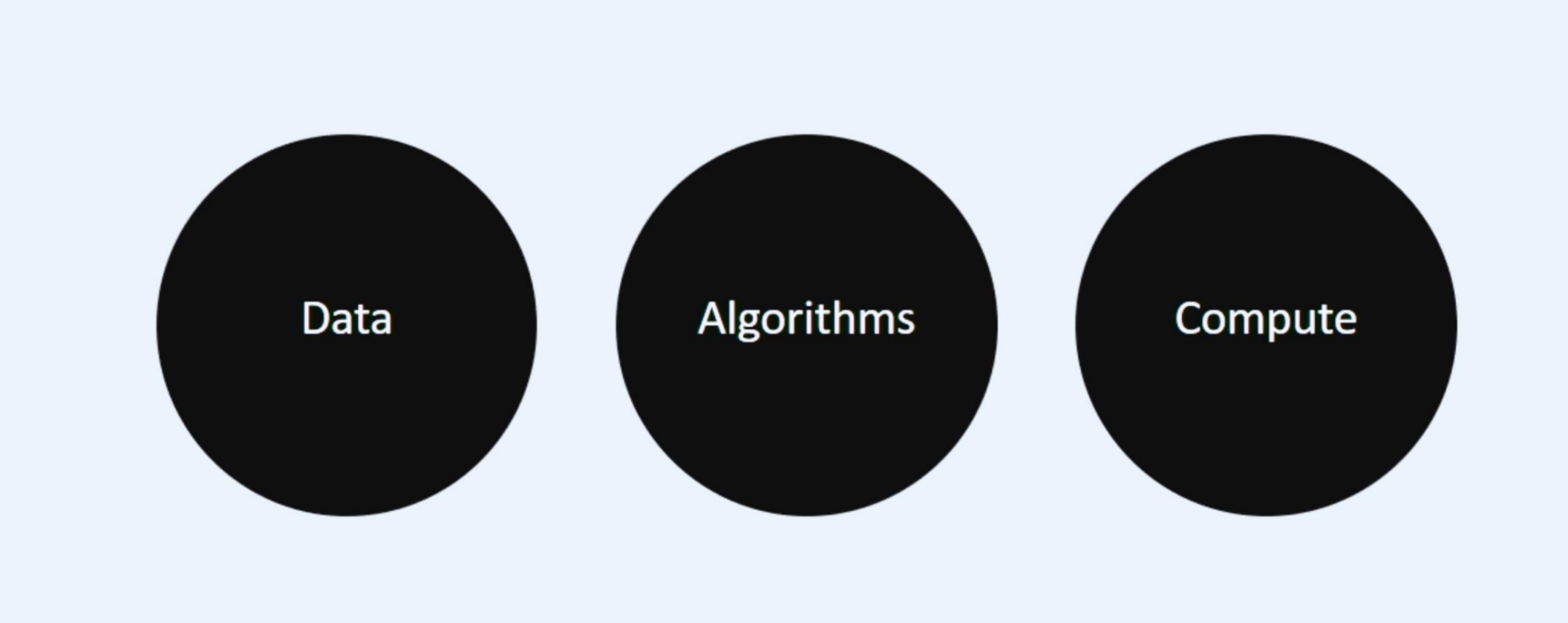
▶ Ms Sadness (en-US Lisa)
owner: ivva

Draft Voices

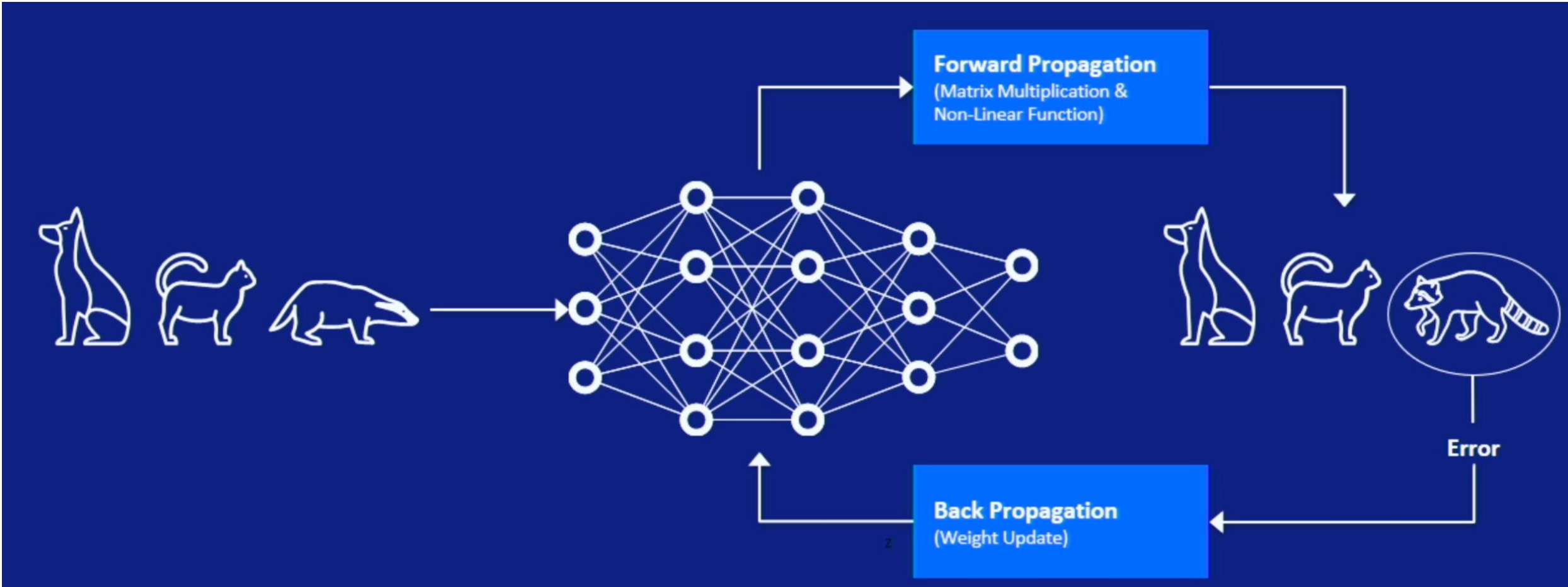


The Future of Machine Intelligence

Foundation of AI



Deep Learning



Basic Mathematical Operations in Neural Net

Multiply / accumulate

$$y_i = \sum_j w_{i,j} x_j$$

Multiply + add
Multiply + add
...

Activation

$$y_j \rightarrow f(y_j)$$

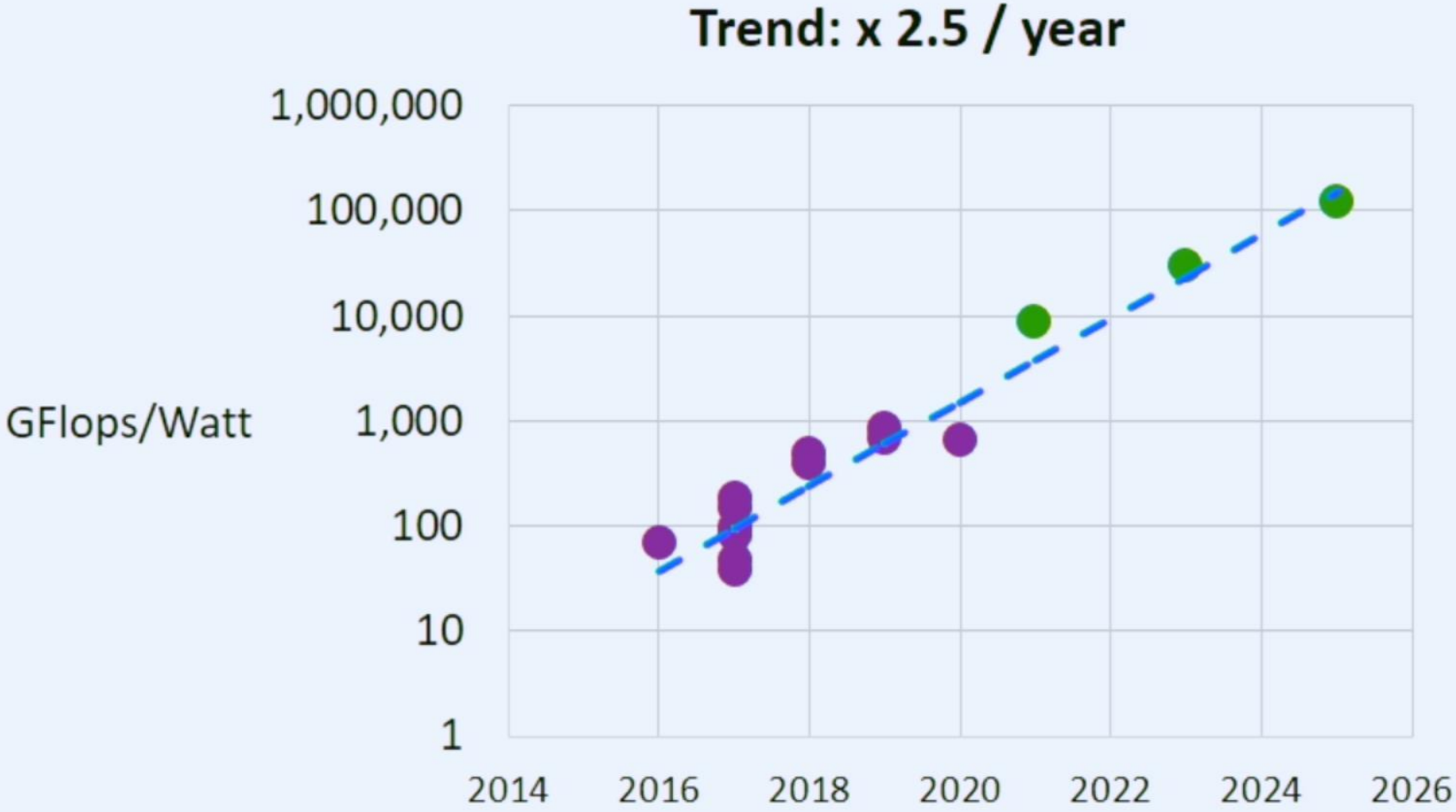
Sigmoid
Softmax
ReLU
...

Update

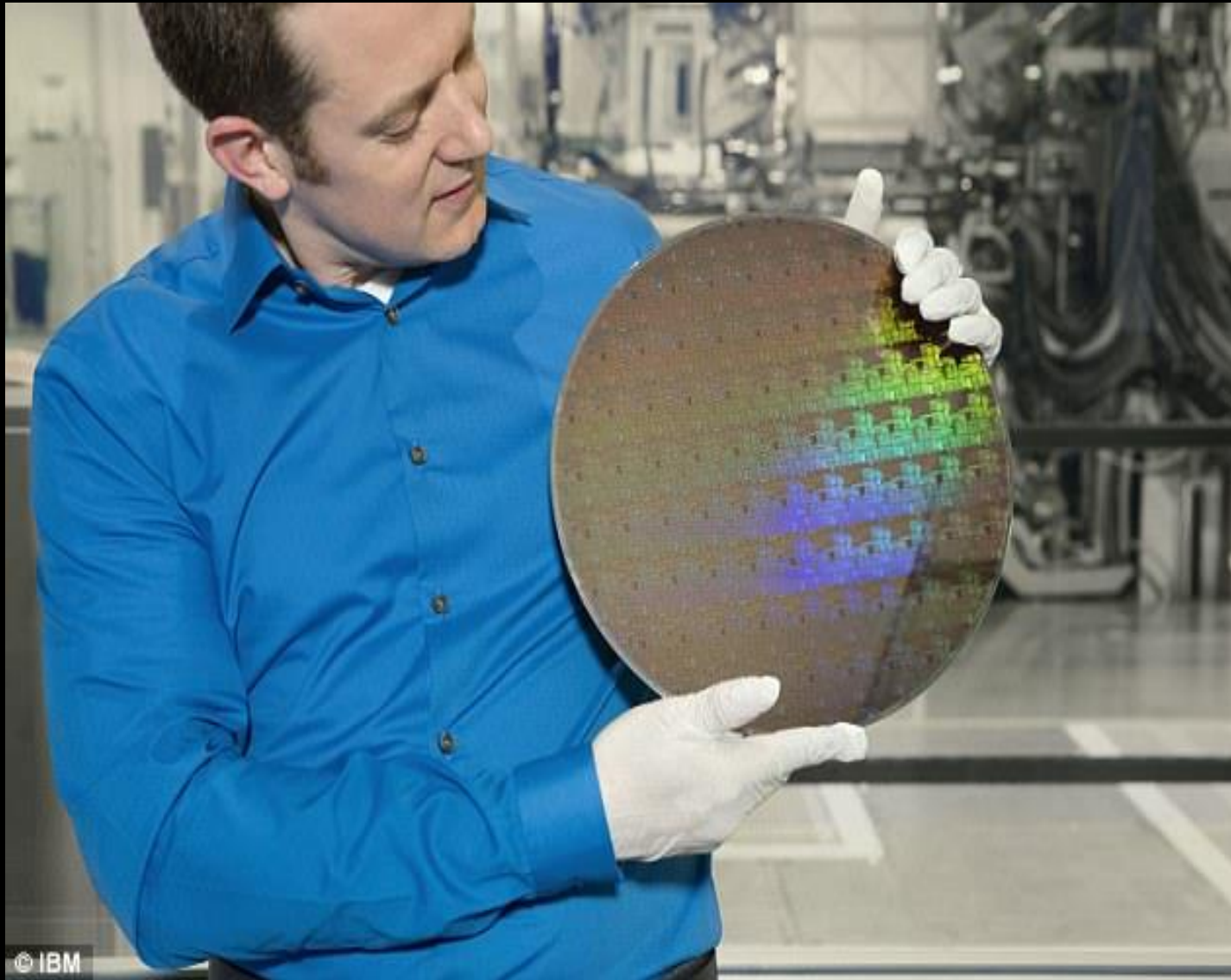
$$\begin{bmatrix} w_{11} & \cdots & w_{1m} \\ \vdots & \ddots & \vdots \\ w_{n1} & \cdots & w_{nm} \end{bmatrix}$$

Multiply + add

AI Accelerator Roadmap



The world's first five-nanometre silicon chip. A finger-nail sized chips with 30 billion transistors.



5 nanometre chips are possible, more powerful, and not too far off in the future.

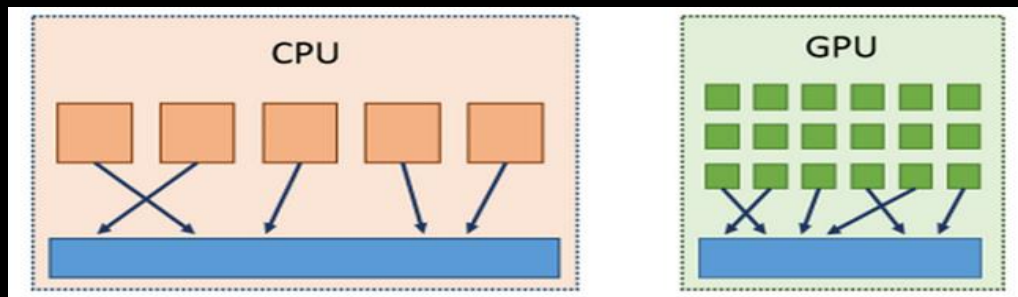
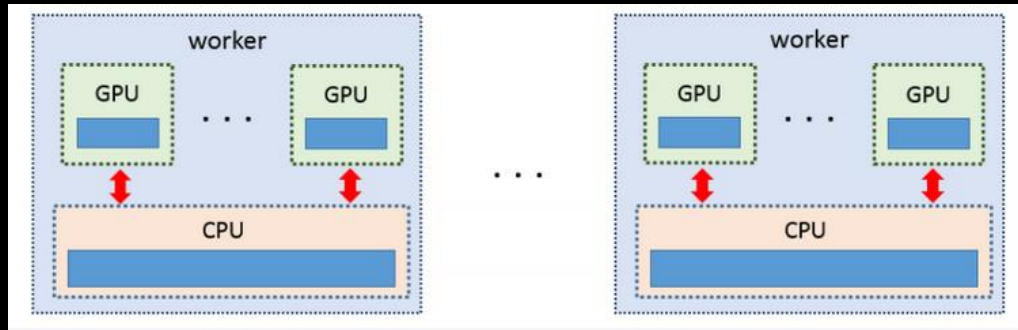
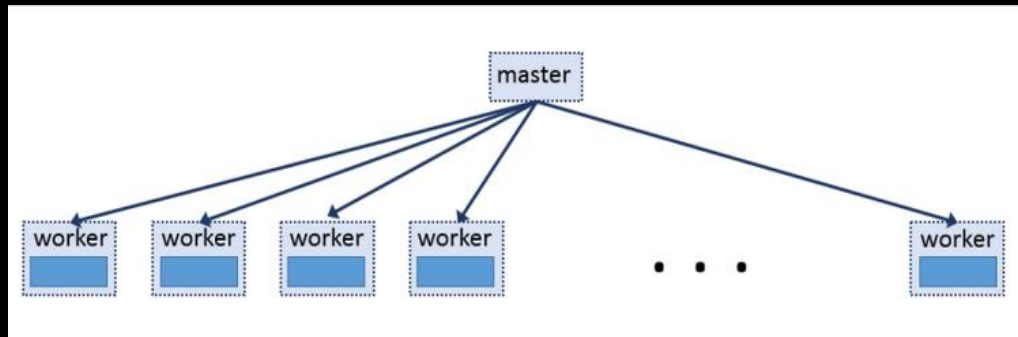
Compared with 10nm technology available in the market, a nanosheet-based five nm technology gives a **40% performance boost**.

Significant boost to meeting the future demands of artificial intelligence systems, virtual reality and mobile devices.

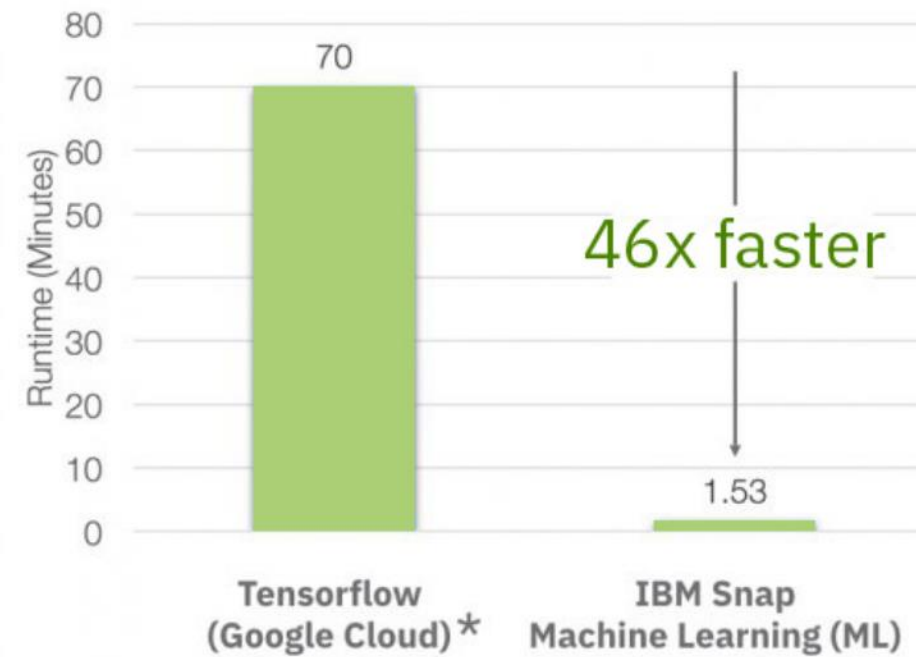
Reduced or mixed precision accelerator



Snap Machine Learning on Power

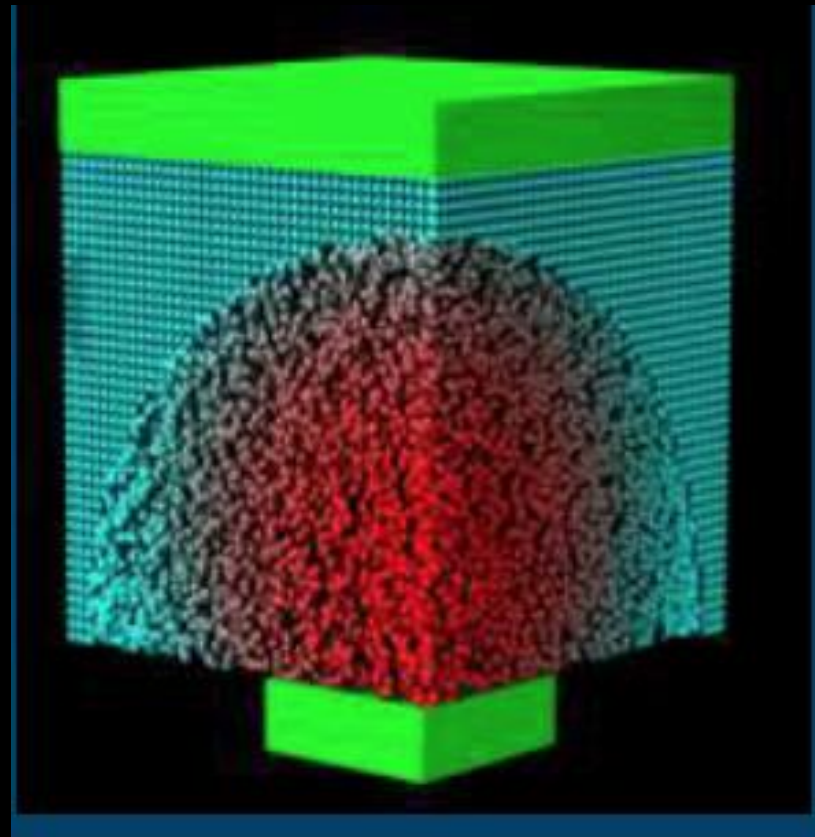


Criteo Terabyte Click Logs Benchmark

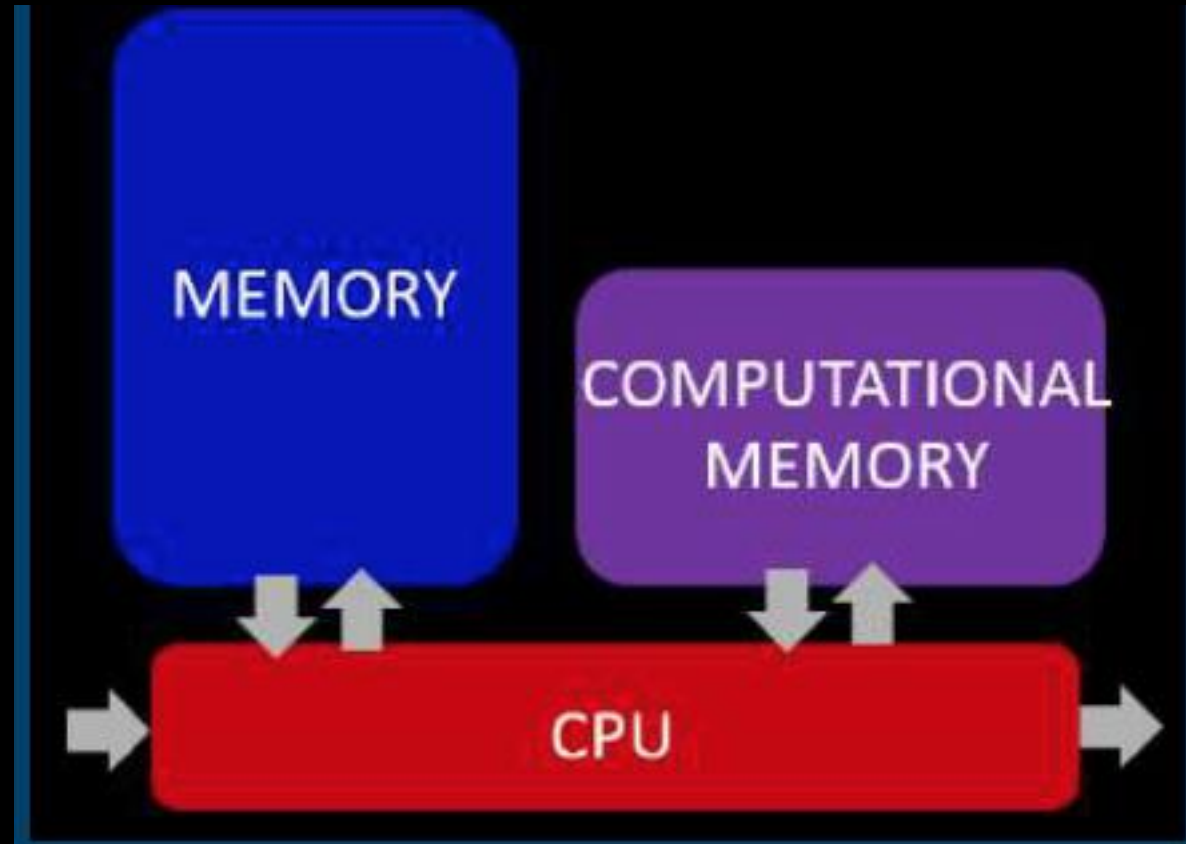


Comparison of Tensorflow on Google Cloud with Snap ML on POWER9 (AC922) cluster

In-memory Computing (内存计算) with 1 Million Devices for Applications in AI



PCM Device



Collocated Memory and computing

IBM Research demonstrated that an unsupervised machine-learning algorithm, running on one million phase change memory (PCM) devices, successfully found temporal correlations in unknown data streams.

When compared to state-of-the-art classical computers, this prototype technology is expected to yield 200x improvements in both speed and energy efficiency

Source IBM Research Phase Change Memory: <https://www.ibm.com/blogs/research/2017/10/ibm-scientists-demonstrate-memory-computing-1-million-devices-applications-ai/>

Source: <http://www.nature.com/articles/s41467-017-01481-9>

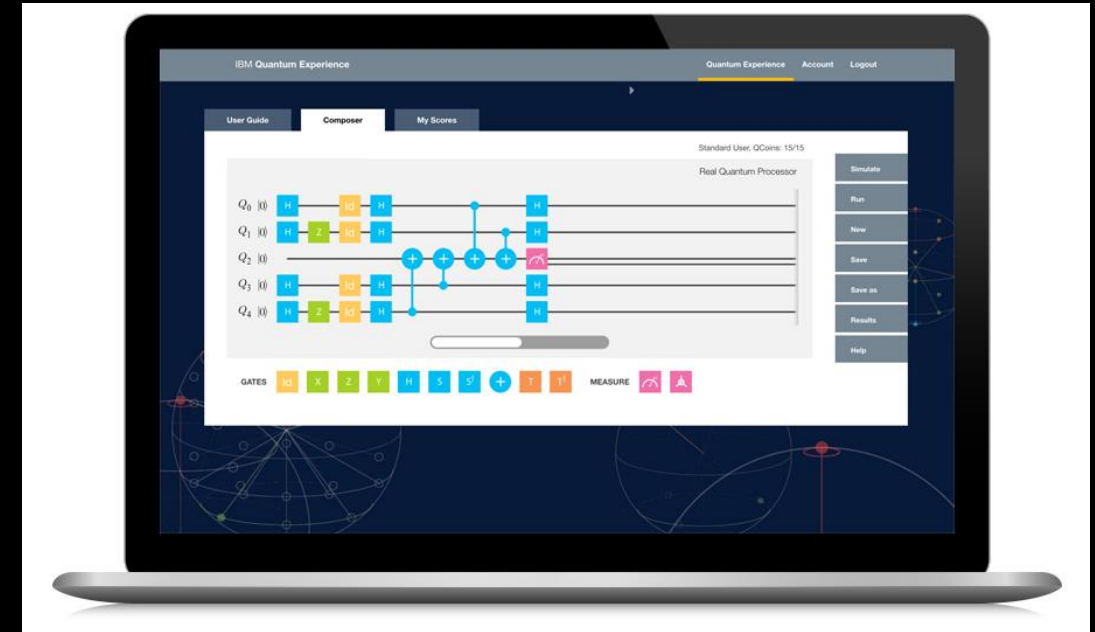
Artificial Intelligence

Quantum Computing

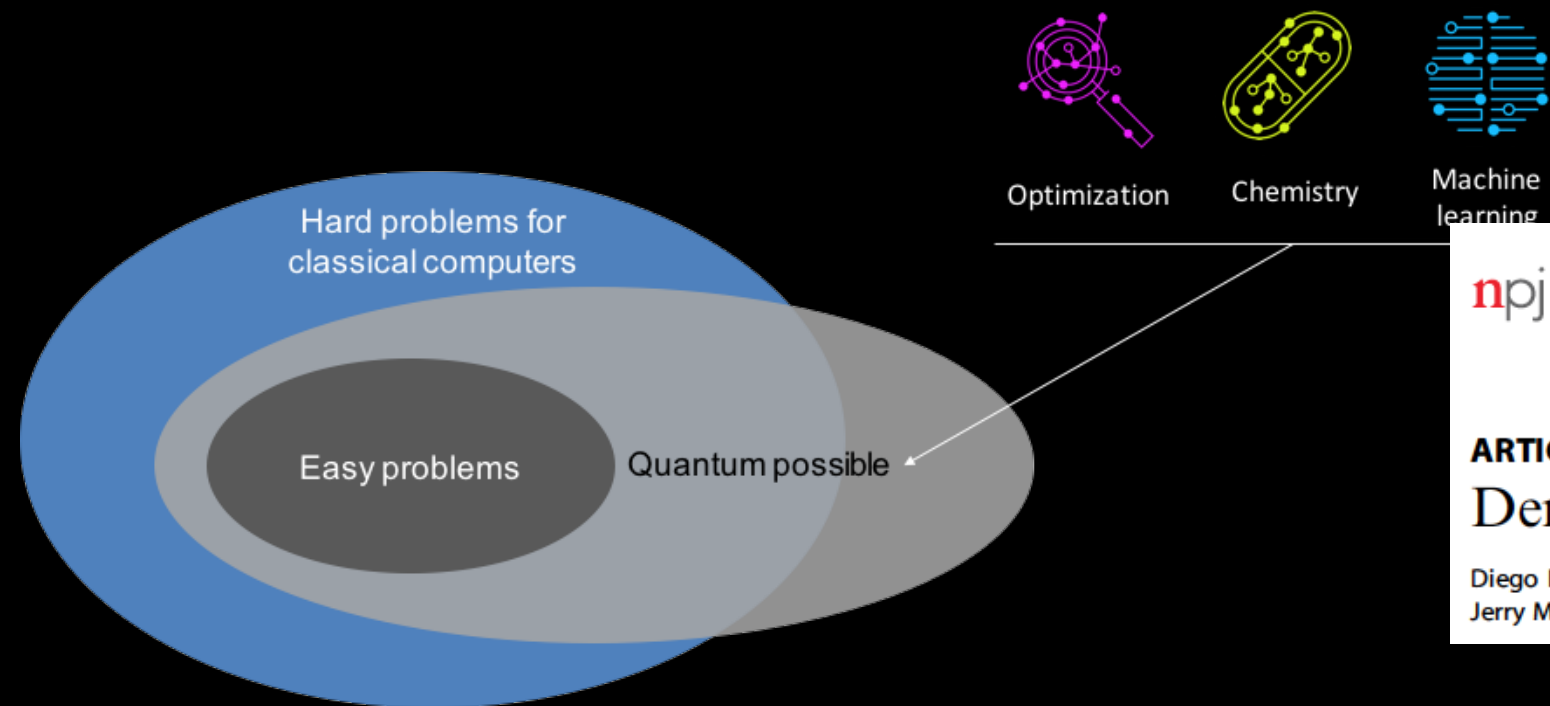
Intersection of AI & Quantum Computing

How can AI accelerate the development of quantum computers?

How will quantum computers speed up the training of AI models?



IBM Quantum Environment
www.research.ibm.com/ibm-qx



npj | Quantum Information

www.nature.com/npjqi

ARTICLE OPEN

Demonstration of quantum advantage in machine learning

Diego Ristè¹, Marcus P. da Silva¹, Colm A. Ryan¹, Andrew W. Cross², Antonio D. Córcoles², John A. Smolin², Jay M. Gambetta², Jerry M. Chow² and Blake R. Johnson¹

doi:10.1038/s41534-017-00

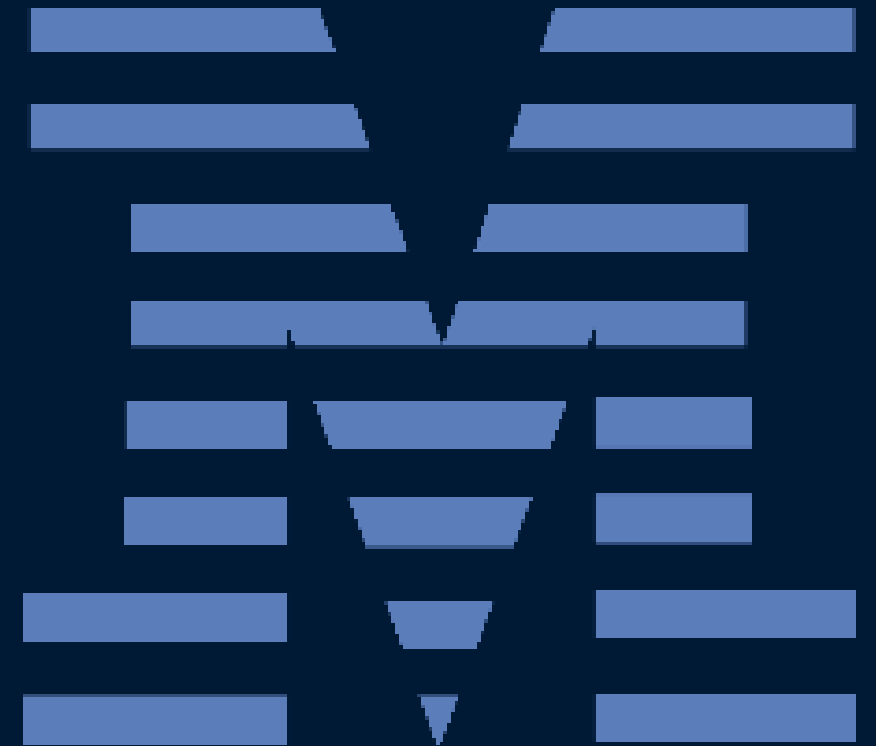
The future is quantum



- A 20 qubits available on cloud to our clients at the end of this year (already made available 5-16 and 17 qubits)
- A prototype with 50 qubits has been successful tested with a double of coherence time with respect previous systems.
- An open source Quantum Information software (Qikit)
- Quantum Computing: Breaking Through the 49 Qubit Simulation Barrier

[Source: https://www.ibm.com/blogs/research/2017/11/the-future-is-quantum](https://www.ibm.com/blogs/research/2017/11/the-future-is-quantum)

[Source: https://www.ibm.com/blogs/research/2017/10/quantum-computing-barrier/](https://www.ibm.com/blogs/research/2017/10/quantum-computing-barrier/)



Thank You