



Paper Presentation - Artificial Intelligence and Machine Learning

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Area of Focus:

Quantum Computing in Human Digital Immortality: Review and Prospect

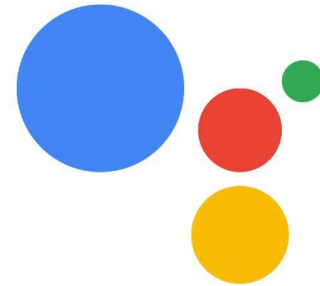
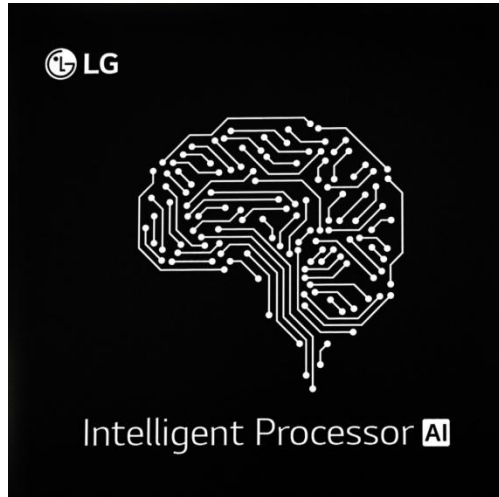
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- Machine Learning and Artificial Intelligence
 - Reinforcement Learning
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 - Neural Networks
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Artificial Intelligence:



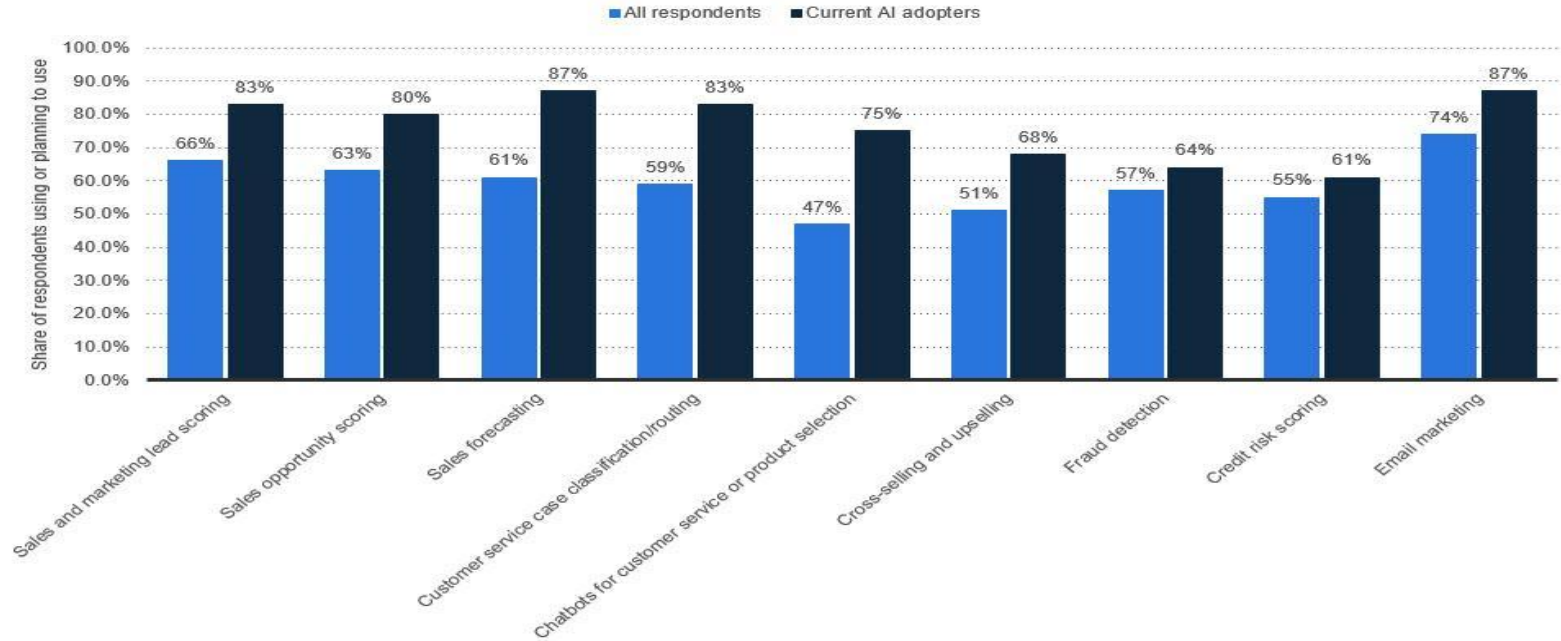
Hi, I'm Ada.
I can help if you're
feeling unwell.



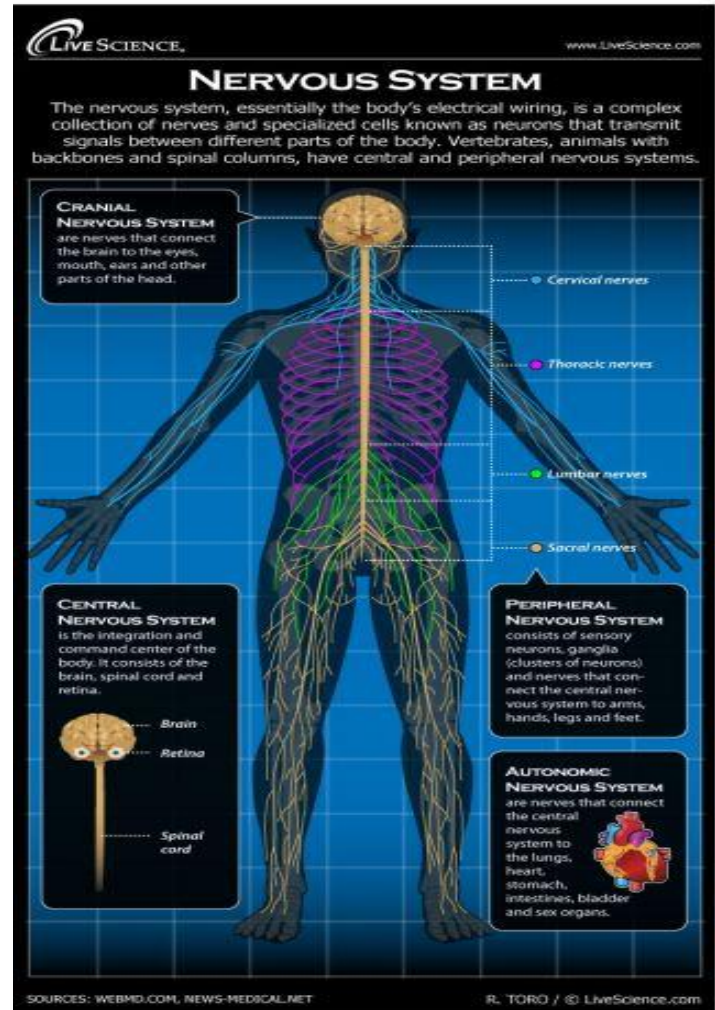
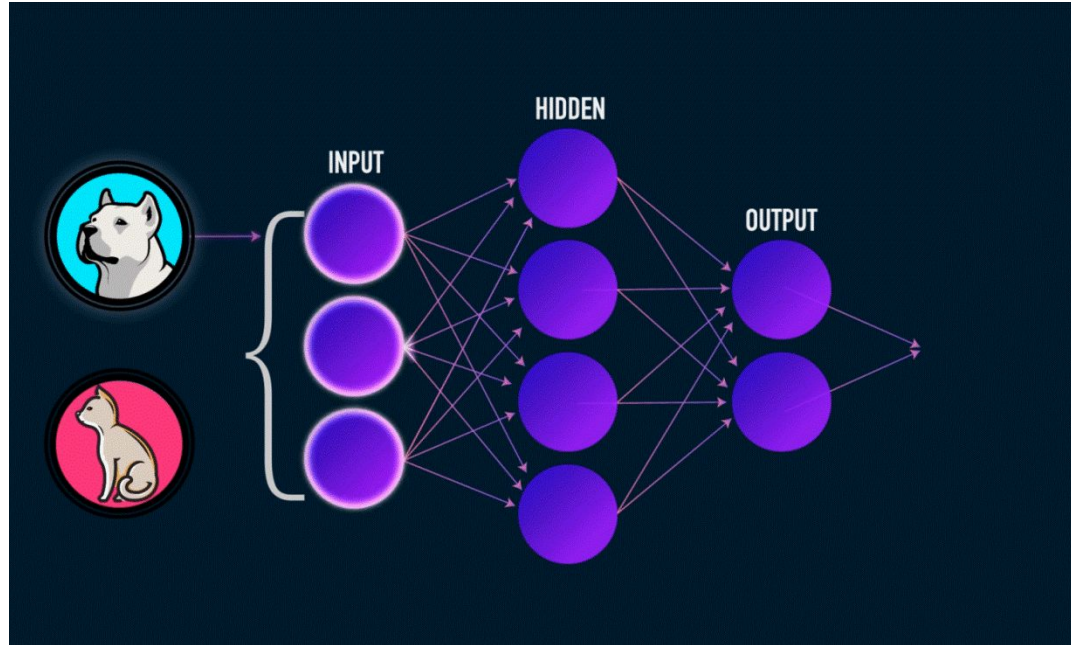
Google Assistant

Specific AI use case adoption worldwide 2017

Adoption of specific artificial intelligence (AI) use cases in 2017, by category



- Machine Learning:



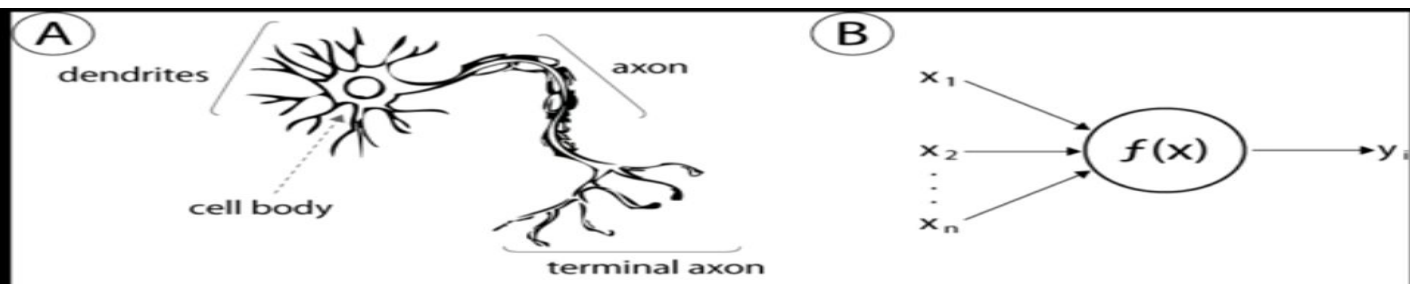


A Venn diagram consisting of three concentric ellipses. The outermost ellipse is labeled 'ARTIFICIAL INTELLIGENCE'. Inside it is a smaller ellipse labeled 'MACHINE LEARNING'. Inside that is the smallest ellipse labeled 'DEEP LEARNING and NEURAL NETWORKS'. The ellipses are shaded with a light gray, vertically-hatched pattern.

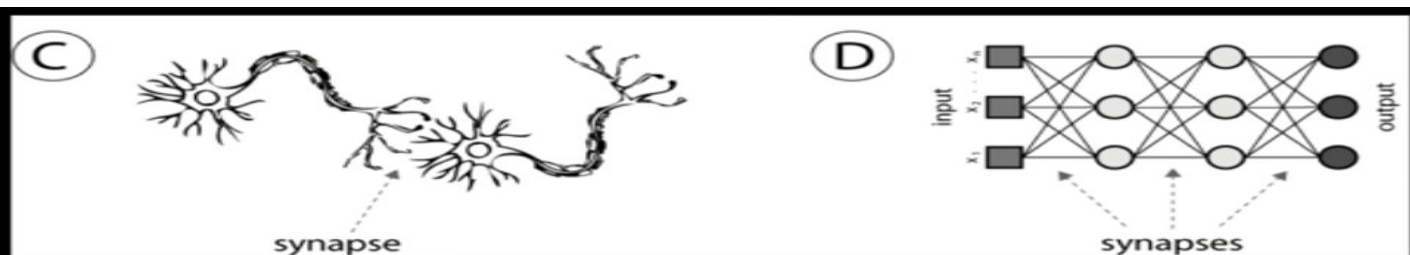
ARTIFICIAL
INTELLIGENCE

MACHINE
LEARNING

DEEP
LEARNING
and NEURAL
NETWORKS



(A) Human neuron; (B) artificial neuron or hidden unity;



(C) biological synapse; (D) Artificial Neuron Network synapses.

So let's address the elephant in the room:

QUANTUM COMPUTING





Quantum Simulation

The design of new materials and elucidation of complex physics through accurate simulations of chemistry and condensed matter models are among the most promising applications of quantum computing.



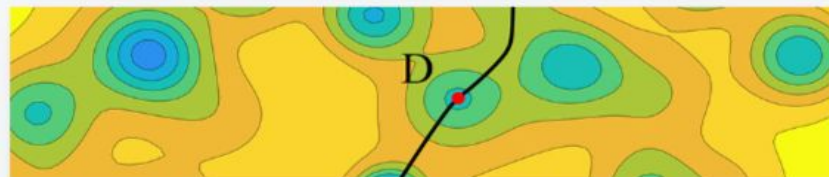
Error mitigation techniques

We work to develop methods on the road to full quantum error correction that have the capability of dramatically reducing noise in current devices. While full-scale fault tolerant quantum computing may require considerable developments, we have developed the [quantum subspace expansion](#) technique to help utilize techniques from quantum error correction to improve performance of applications on near-term devices. Moreover, these techniques facilitate testing of complex quantum codes on near-term devices. We are actively pushing these techniques into new areas and leveraging them as a basis for design of near term experiments.



Quantum Machine Learning

We are developing hybrid quantum-classical machine learning techniques on near-term quantum devices. We are studying universal quantum circuit learning for classification and clustering of quantum and classical data. We are also interested in generative and discriminative quantum neural networks, that could be used as quantum repeaters and state purification units within quantum communication networks, or for verification of other quantum circuits.



Quantum Optimization

Discrete optimizations in aerospace, automotive, and other industries may benefit from hybrid quantum-classical optimization, for example simulated annealing, quantum assisted optimization algorithm (QAOA) and quantum enhanced population transfer may have utility with today's processors.

SOURCE: GoogleAI

Look inside a quantum computer

In order to work with qubits for extended periods of time, they must be kept very cold. Any heat in the system can introduce error, which is why quantum computers are designed to create and operate at temperatures near absolute zero.

Here's a look at how a quantum computer's dilution refrigerator, made from more than 2,000 components, exploits the rising properties of low helium isotopes to create such an environment for the qubits inside.

1 Qubit Signal Amplifier
One of two amplifying stages is cooled to a temperature of 4 Kelvin.

2 Input Microwave Lines
Amplification is applied at each stage in the refrigerator in order to protect qubits from thermal noise during the process of sending control and readout signals to the processor.

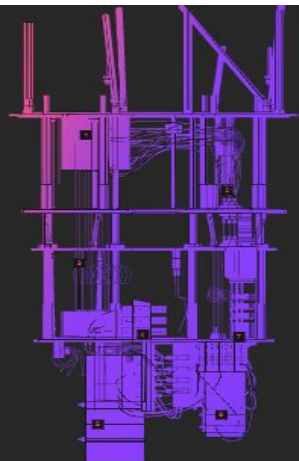
Superconducting Coaxial Lines
In order to minimize energy loss, the coaxial lines that direct signals between the first and second amplifying stages are made out of superconductors.

3 Cryogenic Isolators
Cryogenic isolators insulate qubits signals to go forward while preventing noise from compromising qubit quality.

4 Quantum Amplifiers
Quantum amplifiers inside of a magnetic shield capture and amplify processor readout signals while minimizing noise.

5 Cryoperm Shield
The quantum processor sits inside a shield that protects it from electromagnetic radiation in order to preserve its quality.

6 Mixing Chamber
The mixing chamber at the lowest part of the refrigerator provides the necessary cooling power to bring the processor and associated components down to a temperature of 1.5 mK — colder than outer space.



8 bits
01011001
0 1

8 Bits

V.S.

Quantum Properties

Three quantum mechanical properties — superposition, entanglement, and interference — are used in quantum computing to manipulate the state of a qubit.

Superposition

Superposition refers to a combination of states we should intuitively describe independently. To make a classical analogy, if you play two musical notes at once, what you will hear is a superposition of the two notes.

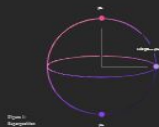


Figure 1 Superposition

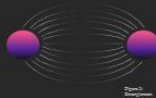


Figure 2 Entanglement

Entanglement

Entanglement is a famously counter-intuitive quantum phenomenon describing behavior and states seen in the classical world. Entangled particles behave together as a system in ways that cannot be explained using classical logic.

Interference

Finally, quantum states can undergo interference due to a phenomenon known as phase. Quantum interference can be collected similarly to wave interference, when two waves are in phase, their amplitudes add, and when they are out of phase, their amplitudes cancel.

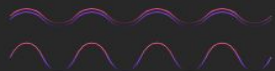
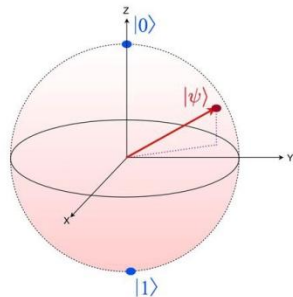


Figure 3 Interference



1 Qubit

Quantum Computation

There are a few different ways quantum systems use quantum properties to compute. Let's investigate one type of algorithm designed for current quantum hardware, which uses quantum computing to find the "best" solution among many possible solutions.

This algorithm can be used to simulate a molecule by determining the lowest energy state among various molecular bond lengths. For each possible bond length, parts of the energy state are represented on a quantum processor. Then, aspects of the quantum state are measured and related back to an energy in the molecule, for the given electronic configuration.

Repeating this process for different inter-atomic spacings eventually leads to the bond length with the lowest energy state, which represents the equilibrium molecular configuration.

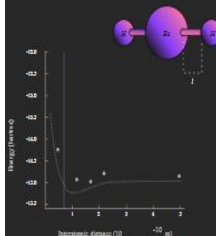
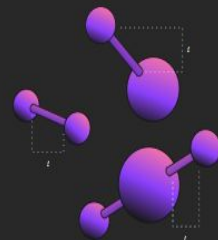


Figure 4: Experimental results (circles) and the exact energy values (dotted line) for several interatomic distances of BeH2

[View paper on quantum chemistry](#)

In addition to algorithms for near-term quantum computing systems, researchers have designed algorithms for future quantum systems, often referred to as fault-tolerant quantum computers. These systems will need to perform many sequential quantum operations and run for long periods of time.

Learn more about what it takes to build the robust quantum systems needed to solve more complex problems in the next section.

Why Quantum Computing??

$$2^{53} = 9007199254740992$$

A New 53 Qubit Quantum Computer Announced By IBM

By Editor — Last updated Oct 1, 2019

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ibm quantum computer

quantum mechanics

computer algorithm

computer mechanics

Quantum computing is still one of the most potential techs that have a long way to go before it can be discovered properly. We do understand that it has huge possibilities and in the future, we will see it more and more work for humans. Maybe the future is now as we are getting closer to a bigger part of Quantum computing. IBM has been working with quantum computers for some while now and it has just announced that another step has been taken. After the 13th it's their 14th of quantum computers while it also is the first of 53 qubits by them.



sciencealert

Trending

(ankarb/iStock)

HUMANS

Are We All Quantum Computers? Scientists Are Conducting Tests to Find Out

DAVID NIELD 29 MAR 2018



“Quantum Artificial Intelligence will enhance the most consequential of human activities, explaining observations of the world around us.”

Hartmut Neven
Engineering Director

Google
AI

DIGITAL IMMORTALITY, MIND UPLOADING, AVATAR CREATION, INFINITE

New Blockchain Platform to Provide Digital Immortality

By Tim Copeland - July 18, 2018



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\$10 million XPRIZE Aims for Robot Avatars That Let You See, Hear, and Feel by 2021

Ever wished you could be in two places at the same time? The XPRIZE Foundation wants to make that a reality with a \$10 million competition to build robot avatars that can be controlled from at least 100 kilometers away.

20.03.2018
Artificial intelligence is going to completely change your life
Just as electricity transformed the way industries functioned in the past century, artificial intelligence — the creation of intelligent machines

Dmitry Itskov: www.Immortal.me - Want to be immortal? Act!

Global Future 2045

New York, June 15-16, 2013

The second international Global Future 2045 congress focused on discussion of a new evolutionary strategy for humanity aimed at overcoming the 21st century's civilization challenges.

2045 AVATAR PROJECT MILESTONES

Avatar D 2040 - 2045
A hologram-like avatar

Avatar C 2030 - 2035
An Avatar with an artificial brain in which a human personality is transferred at the end of one's life

Avatar B 2020 - 2025
An Avatar in which a human brain is transplanted at the end of one's life

Avatar A 2015 - 2020
A robotic copy of a human body remotely controlled via BCI

“ As a hopefully minimalistic definition then, digital immortality can be roughly considered as involving a person-centric repository containing a copy of everything that a person sees, hears, says, or engenders over his or her lifespan, including photographs, videos, audio recordings, movies, television shows, music albums/CDs, newspapers, documents, diaries and journals, interviews, meetings, love letters, notes, papers, art pieces, and so on, and so on; and if not everything, then at least as much as the person has and takes the time and trouble to include. The person's personality, emotion profiles, thoughts, beliefs, and appearance are also captured and integrated into an artificially intelligent, interactive, conversational agent/avatar.

This avatar is placed in charge of (and perhaps "equated" with) the collected material in the repository so that the agent can present the illusion of having the factual memories, thoughts, and beliefs of the person him/herself. ”

—Susanne Asche, Kulturelles Gedächtnis im 21. Jahrhundert: Tagungsband des internationalen Symposiums, Digital Immortality & Runaway Technology

The future is fundamentally uncertain, and to me that
is certainly exciting.

Thank You!

