



SCHOOL OF NURSING

The University of Alabama at Birmingham

Artificial Intelligence

Where are we?

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5/15/2021

My background...

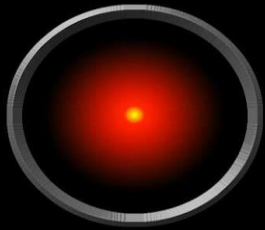
Educator
Administrator
Nurse
Informatician

Not a computer programmer....

Series 1A-1998 Class YM-3 Model B-9 General Utility
Non-Theorizing Environmental Control Robotic
Bion, Lost in Space

HAL, 2001: A Space Odyssey

I'm sorry Dave,
I'm afraid I can't do that.

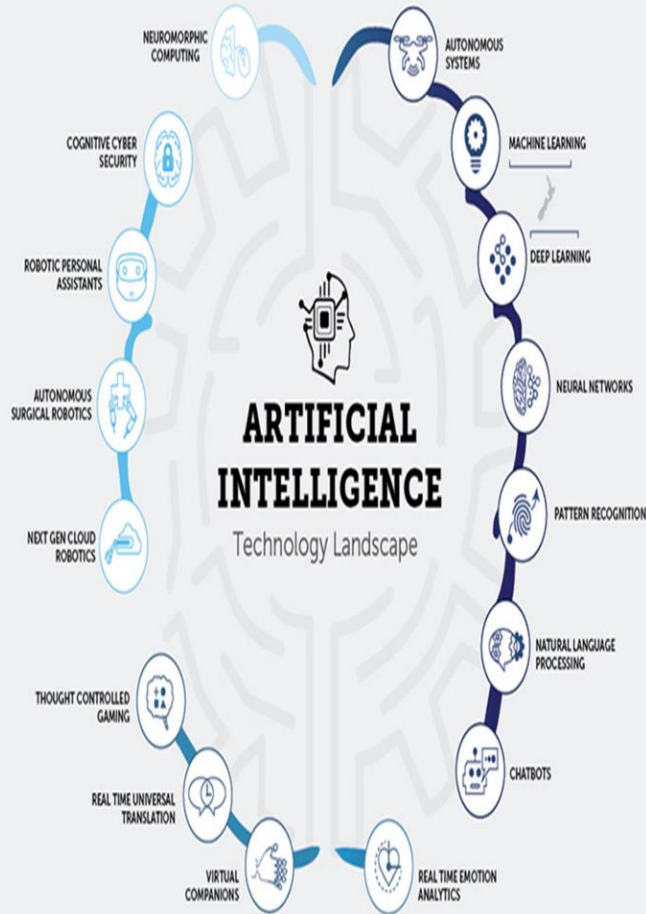


<https://youtu.be/ARJ8cAGm6JE>



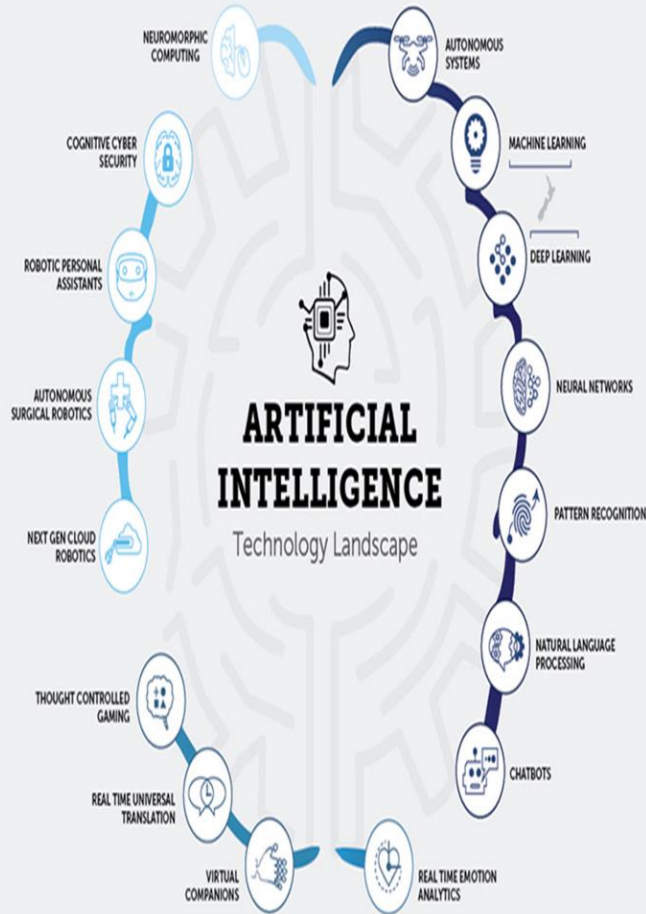
CPO3 and R2D2, Star Wars





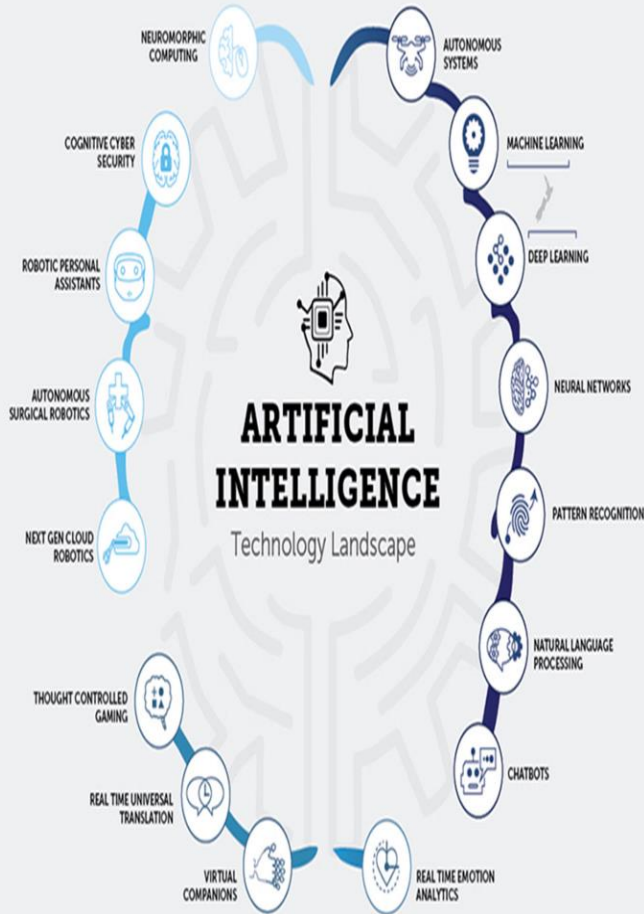
Definitions – Artificial Intelligence

- Branch of computer science dealing with the capability of computers to imitate intelligent human behavior.
- The developments of AI is fueled by advancements in machine learning and the growth in big data.
- **Machine learning** methods include decision trees, neural networks, support vector machines.
- **Neural networks** are a series of algorithms that endeavor to recognize relationships in sets of data by mimicking the way human brain works.
- **Algorithms** are a finite sequence of well defined, computer implementable instructions.



Machine Learning Processes Supporting AI

- Machine Learning processes start with analyzing a data set containing multiple factors using a series of if/then statements.
- The decision tree would look at all possible combinations of if/then statements.
- The computer would look for the best combination of factors that predict the outcome.
- The resulting decision tree or algorithm can be further refined.
- The final algorithm is then integrated into prediction models.



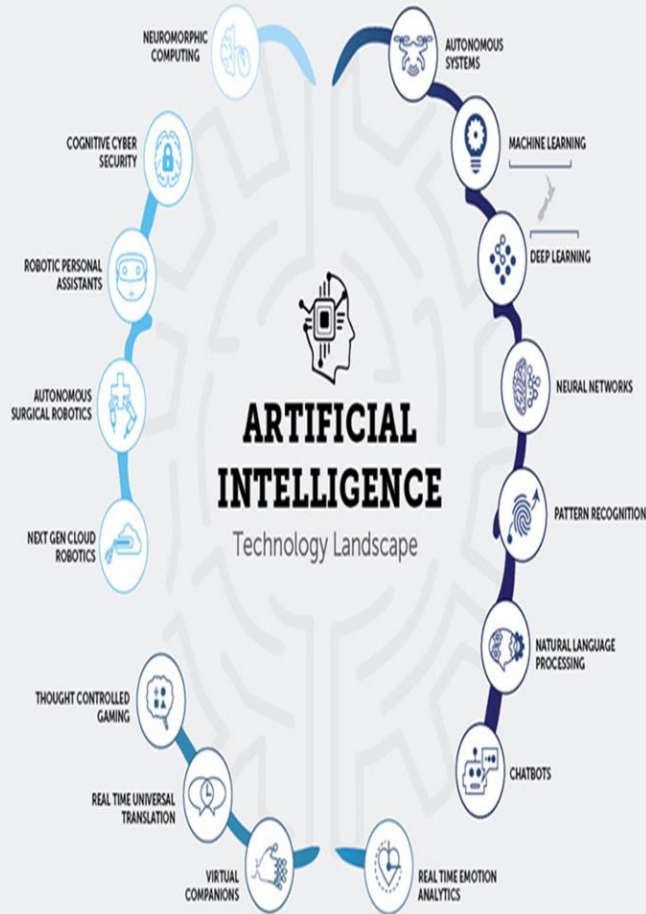
AI – A Long History

- The first industrial robotic arm used by GM in 1961. It followed step by step commands.
- 1964, Eliza was introduced. Eliza used natural language processing to communicate patterns. Eliza was an early chatbot.
- 1966, the first robot created at Stanford Research Institute. Could follow 1 step commands.
- 1970s, MYCIN developed. Based in patient data , a knowledge base of 600 rules provided a list of potential bacterial pathogens and recommended antibiotic. treatment

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=====
EEEEEEEE L      IIIIII ZZZZZZ      AAA
EEEEEE  L      I      Z      A A A
EEEE    L      I      Z      A A A
EEEEEE  L      I      Z      A A A
EEEEEEEE LLLLLL IIIIII ZZZZZZ      A A A
=====
ELIZA > (PLEASE TYPE IN ALL CAPS) WHAT'S YOUR NAME DEAR ?
AMIT
ELIZA > HI. I'M ELIZA. WHAT DO YOU WANT TO TALK ABOUT ?
AMIT > CAN I TALK ABOUT MY PROBLEM ?
ELIZA > SURE...
AMIT > DUE TO ON GOING EXAMS IN COLLEGE, I HAVE A LOT OF STRESS.
ELIZA > PLEASE RELAX A LITTLE. SLEEP WELL.
AMIT > THANKS FOR YOUR ADVICE.
ELIZA > NO MENTION.
AMIT > BYE
ELIZA > BYE AND KEEP IN TOUCH...
=====

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AI – A Long History

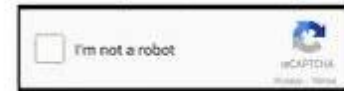
- The concept of using computers to simulate intelligent behavior and critical thinking was first described by Alan Turing in 1950.
- The term first named by John McCarthy in 1955.
- Advances in AI due to:
 - Advances in digital storage
 - Improved computer chip processing speeds
 - New developments in machine learning.

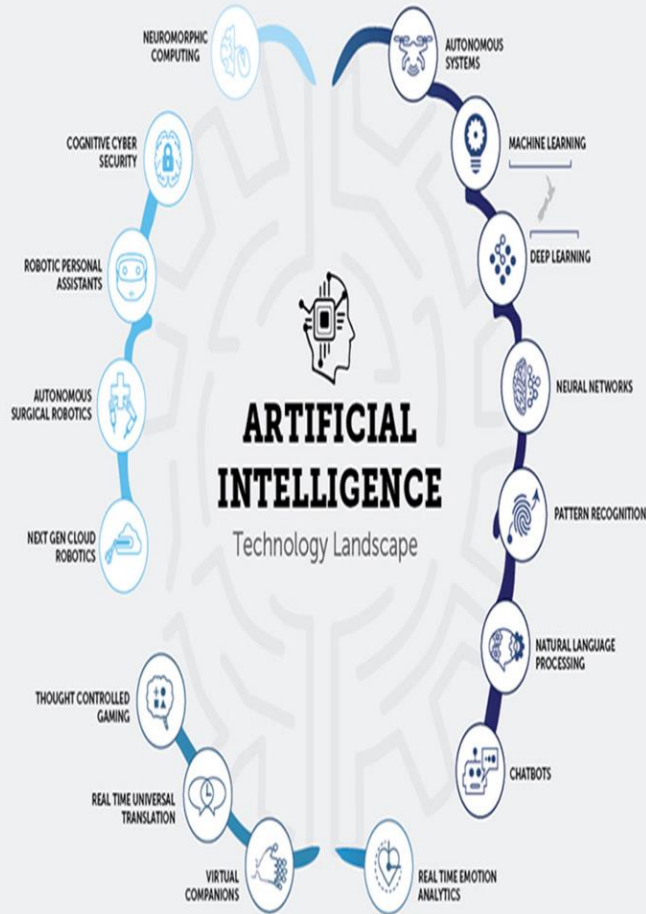


Alan Turing

1950: Can a computer convince a human that it is not a computer but a real person.

Now: Can a human convince a computer that he is a real person, not a computer

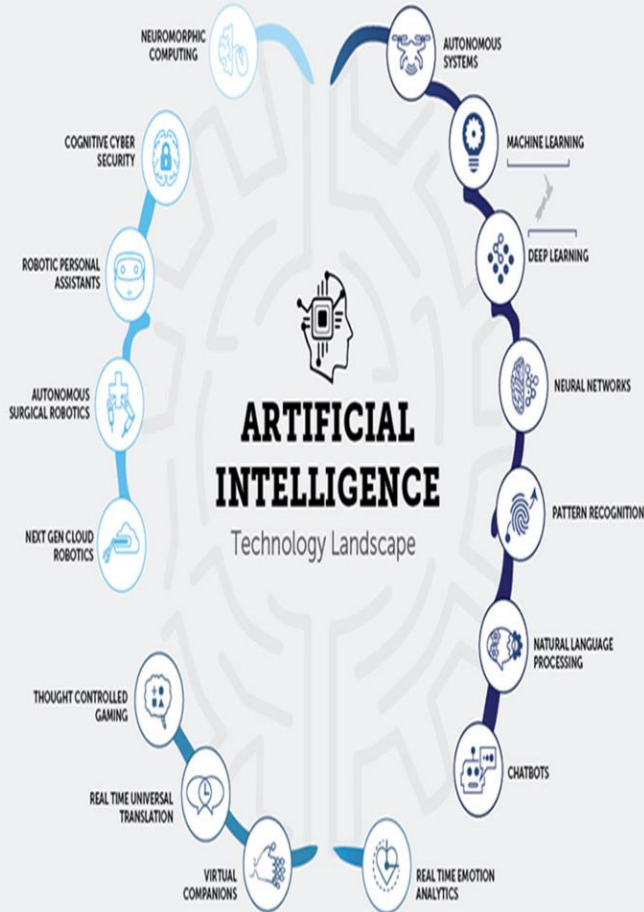




Artificial Intelligence (AI) A view from the American Nurses Foundation

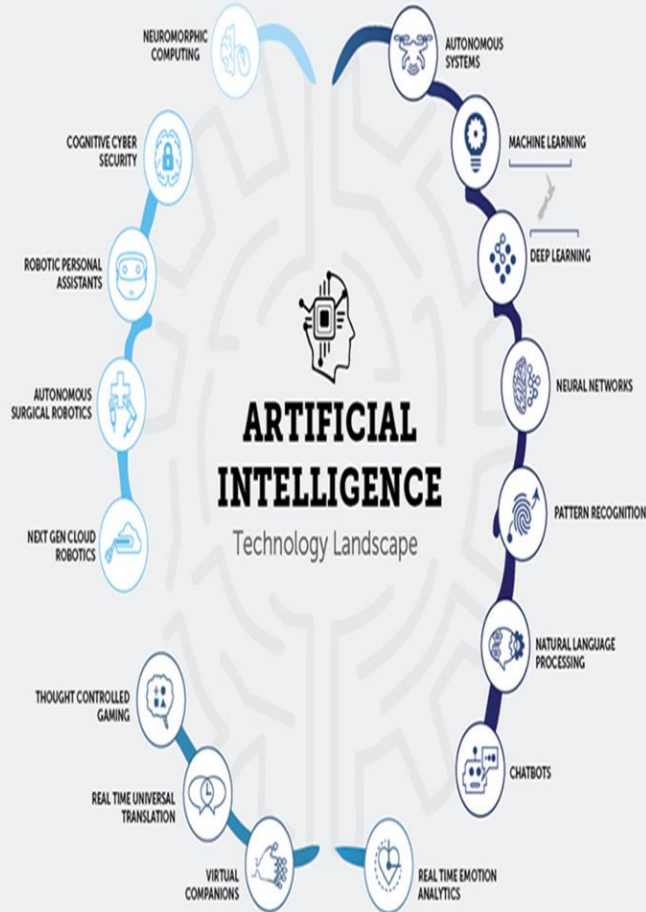
- AI is powered by math and you are already using or experiencing it.
- AI will not replace nurses. Nurses will learn to incorporate AI into their practice.
- AI can disrupt care resulting in saved time, effort, and resources.
- Beware of the AI hype. We are still in the early phases.
- Nurses must drive development of AI.

Artificial Intelligence (AI) in Everyday Use



- ▶ • Netflix knows what films and TV series you may want to watch
- Amazon knows which items you may want to buy
- Google know which symptoms and conditions people are searching for
- Facebook serves up advertisements

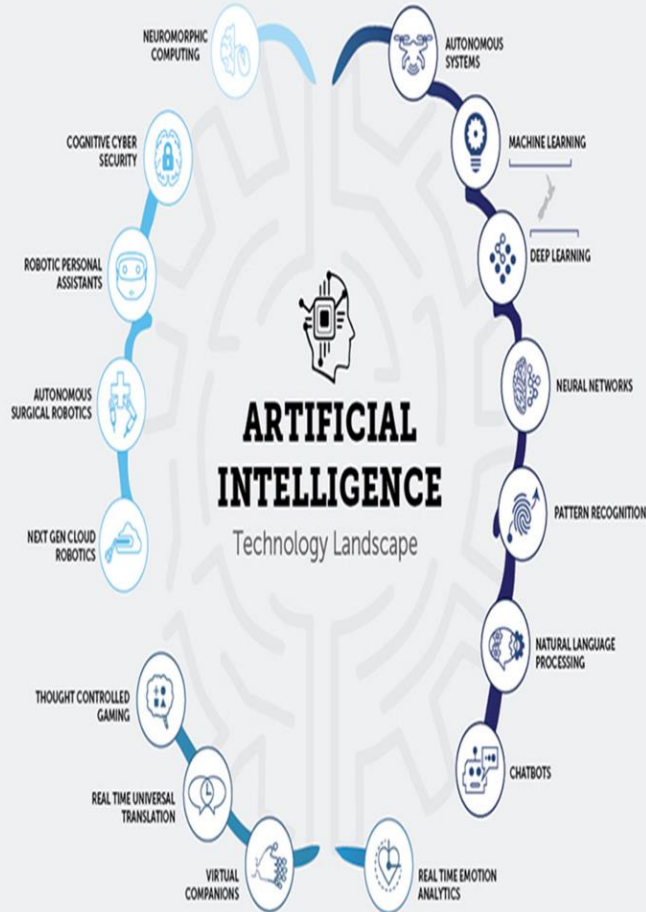
Artificial Intelligence (AI) is Already in Use



- ▶ AI is often described as a stand-alone product that a healthcare provider can choose to use or not.
- ▶ AI is already employed in healthcare and is embedded in routinely used medical and health devices.
- ▶ AI may not be readily apparent to the provider.

(Schonberger, D, 2019)

Artificial Intelligence (AI) is Already in Use



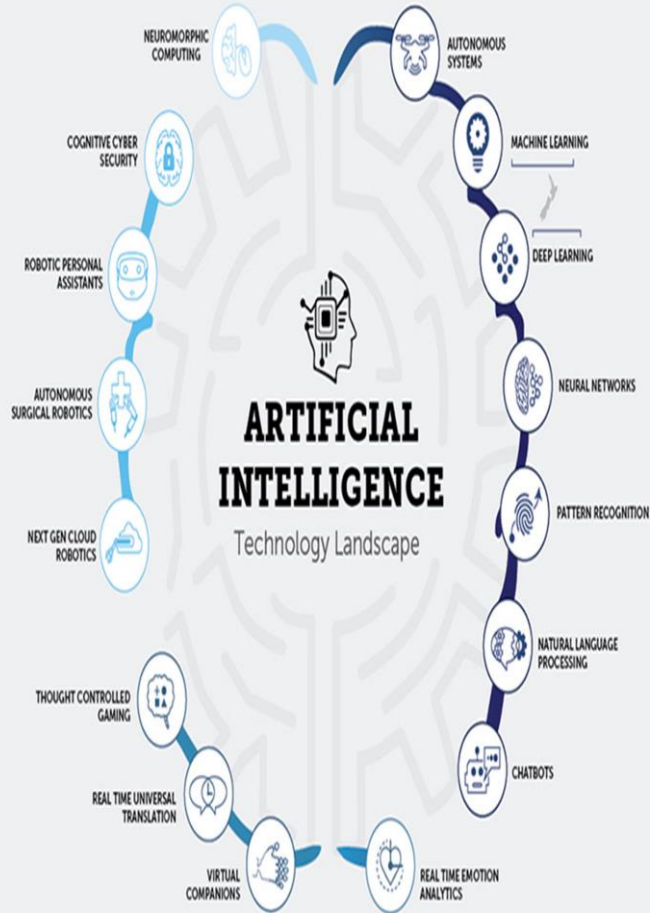
AI uses computational algorithms with the electronic health record (EHR) as the data source.

Work is being done to develop “robotic clinicians” to automate human activities, this AI application isn’t common, nor is it the primary focus of research and development. I

The National Academy of Sciences urges researchers and industry leaders not to prioritize developing task-automation AI; instead, AI should be developed to support tasks and reduce clinician burden.

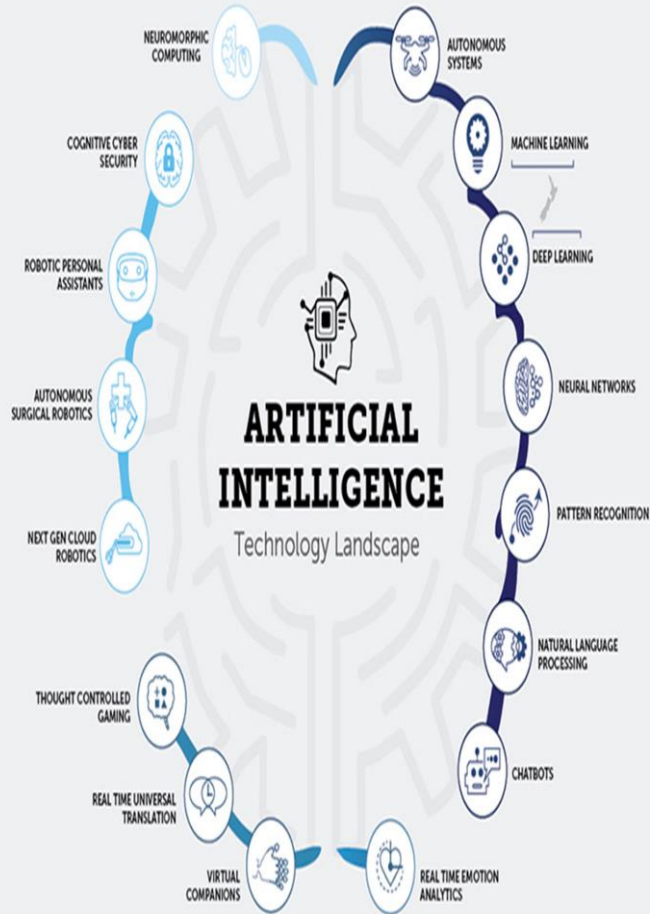
DOUTHIT, HU. RICHESSON, KIM & CAREY (2020)

Artificial Intelligence (AI) in Healthcare



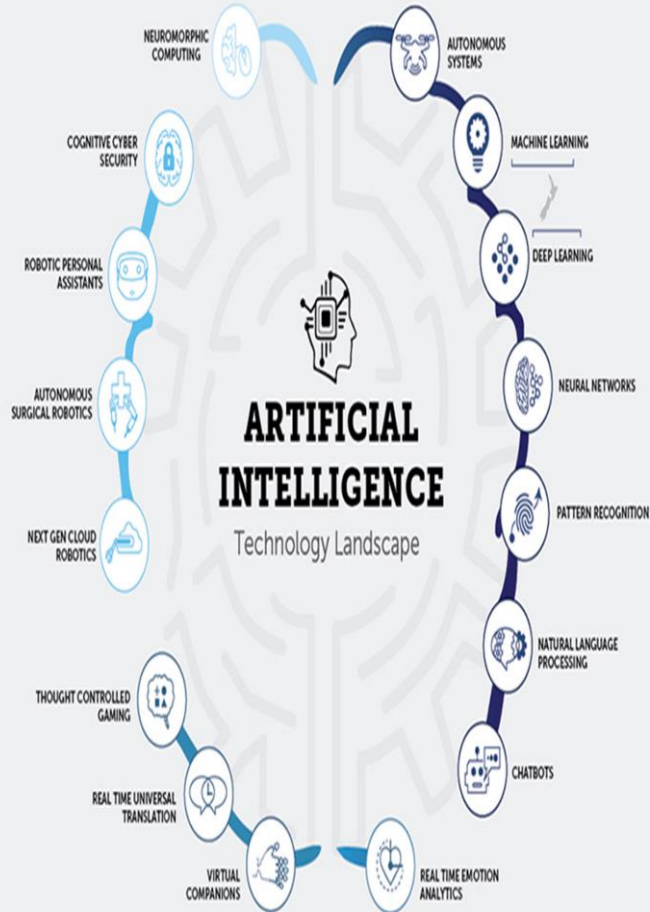
- ▶ Demand for health care services is ever increasing
- Countries are experiencing shortages of providers
- Technological developments and high expectations of patients for service and outcomes coming from consumer experiences is pushing AI into the forefront.

Artificial Intelligence (AI) in Healthcare

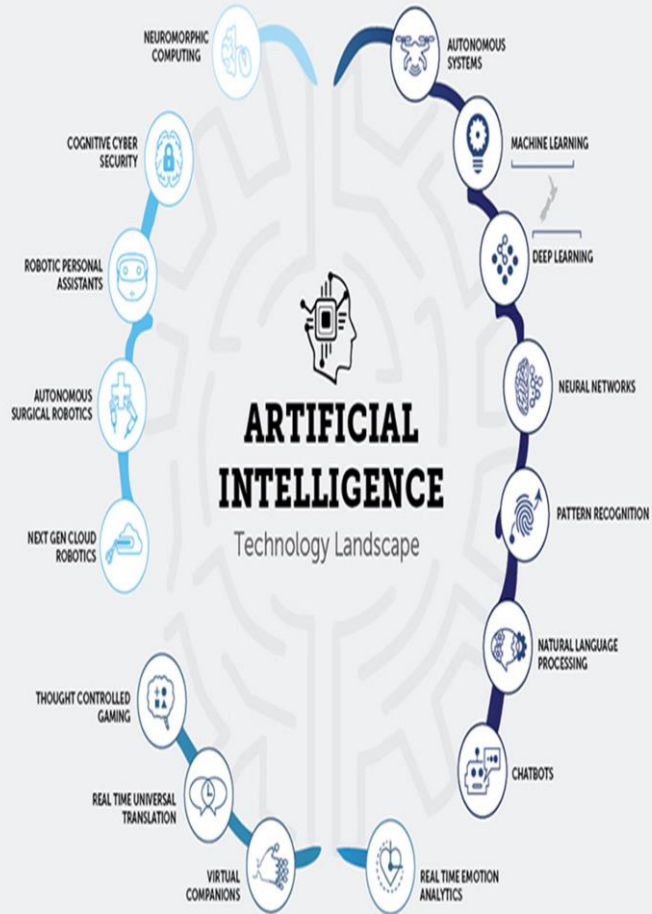


- ▶ • AI in current use
 - Predictive Analytics (using mathematical computations to analyze historic data from multiple sources)
 - A machine approach to refine data, extract value, recognize patterns, and dynamically inform
 - Used in decision support, radiology recognition, and disease progression
 - Natural Language Processing and Automated Speech Recognition

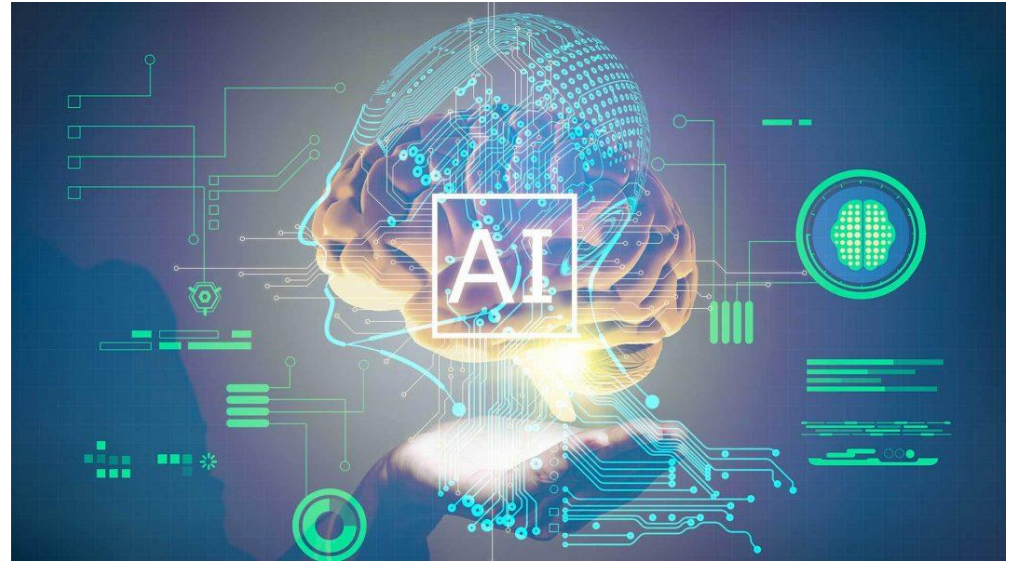
Artificial Intelligence (AI) in Healthcare - Drivers



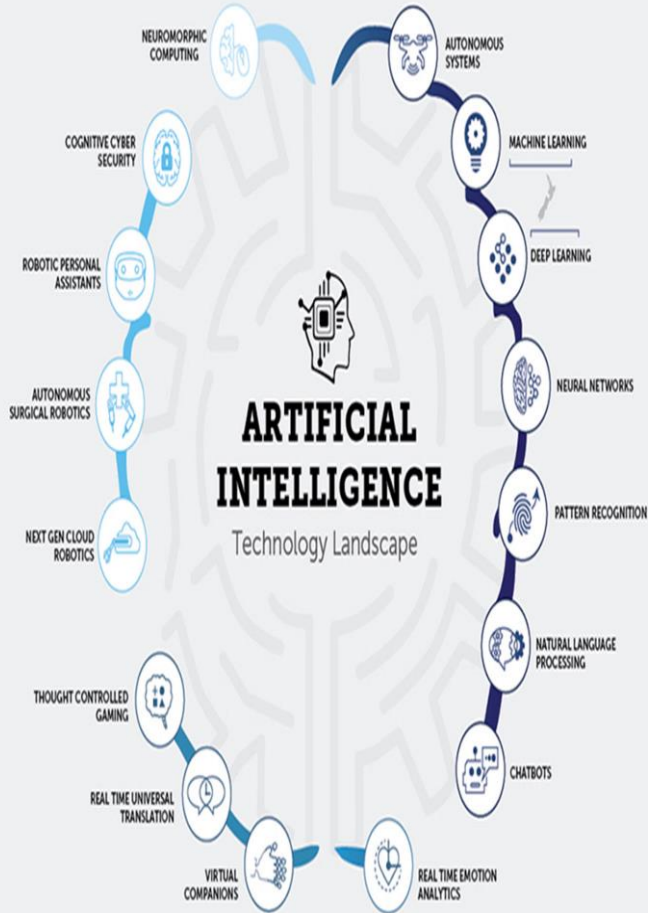
- ▶ • Technological advances within the field of AI and data science
- Increased computer processing speed
- Larger data collection data libraries
- Large pool of talented AI professionals
- Development of deep learning allowing finding of correlations that were too complex using previous machine learning algorithms



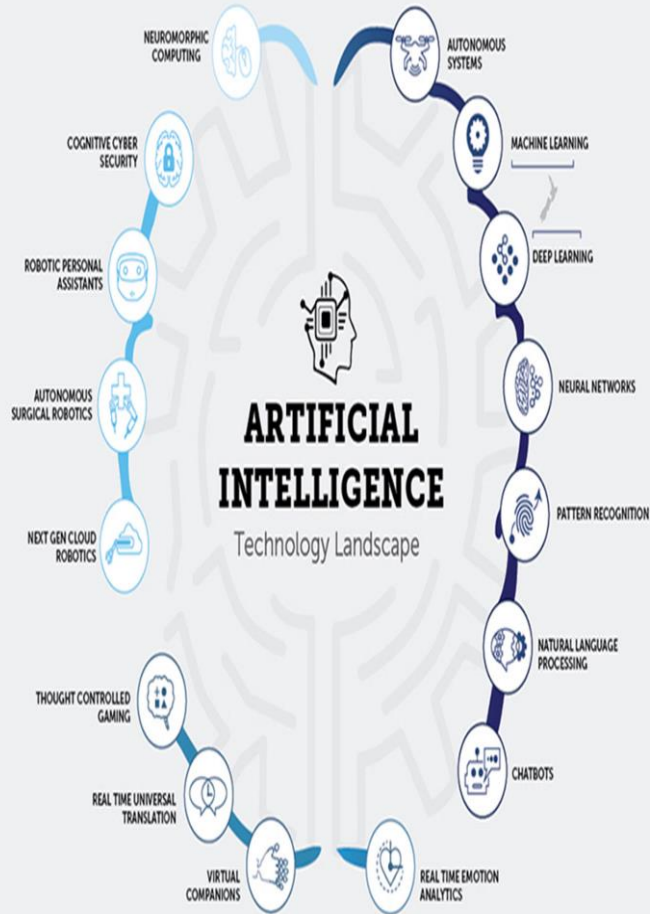
What is AI?



An Artificial Intelligence (AI) Primer



- ▶ • Science of making machines smart.
- Uses algorithms that allow computers to solve problems
- Branch of computer science dedicated to creating intelligent machines that work and react like humans



Types of AI

- Reactive Machines – no memories or past experiences to base decisions upon – designed to do specific jobs

▶ Deep Blue – IBM's Chess playing supercomputer

- Limited Memory – uses past experiences and present data to make decisions – not evolving new idea, requires programming

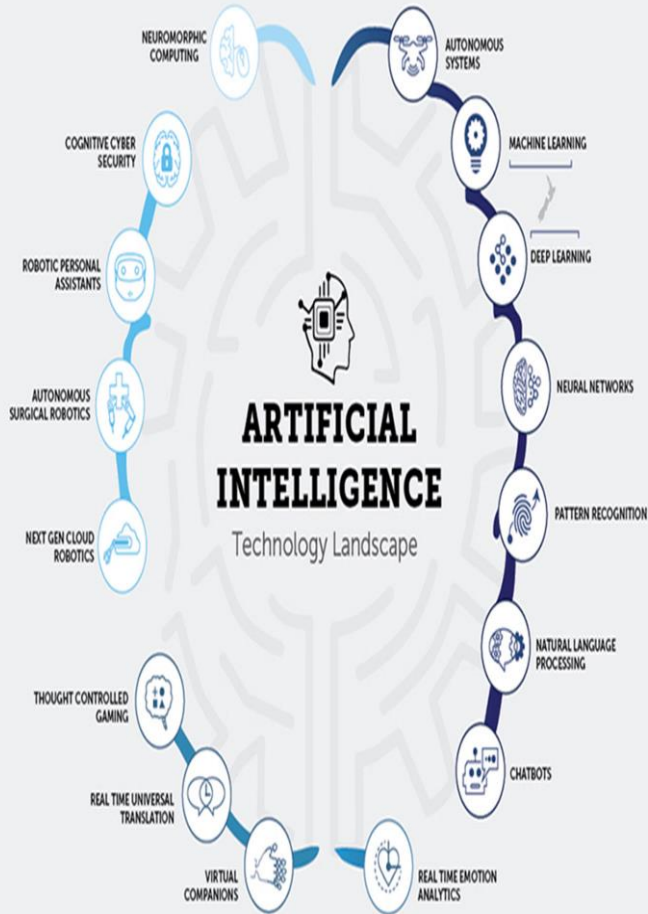
Self driving cars

- Theory of Mind – can socialize and understand human emotion – decision making ability equal to a human

Sophia - <https://www.hansonrobotics.com/sophia/>

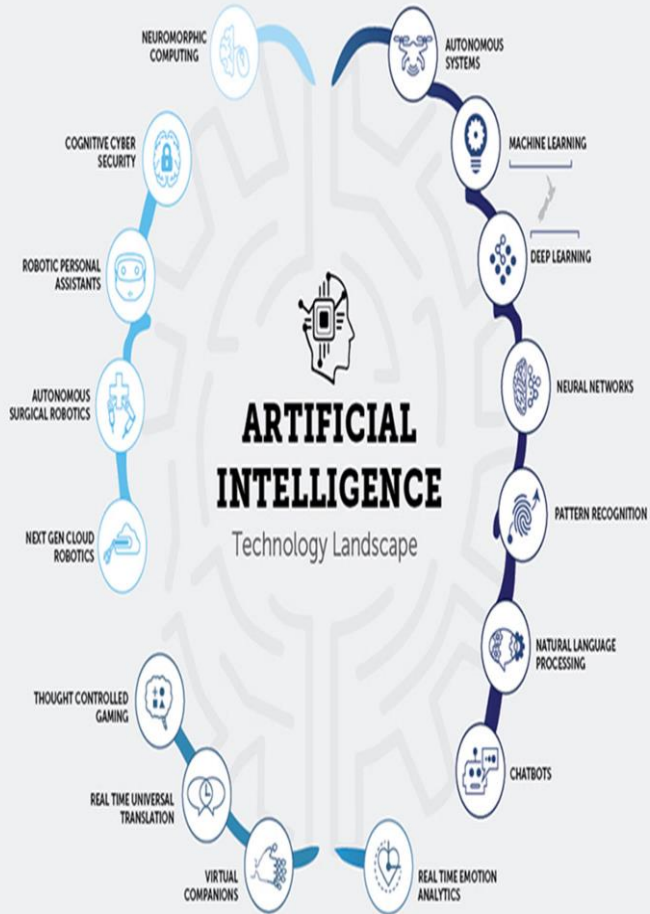
<https://youtu.be/R1Mwl6p1enA>

- Self Awareness – machines that are super intelligent, sentient, with human level consciousness

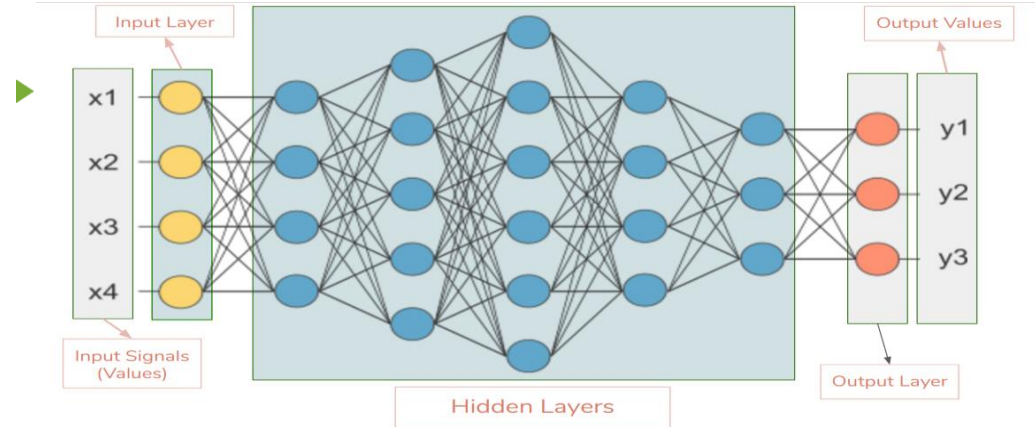


Achieving AI

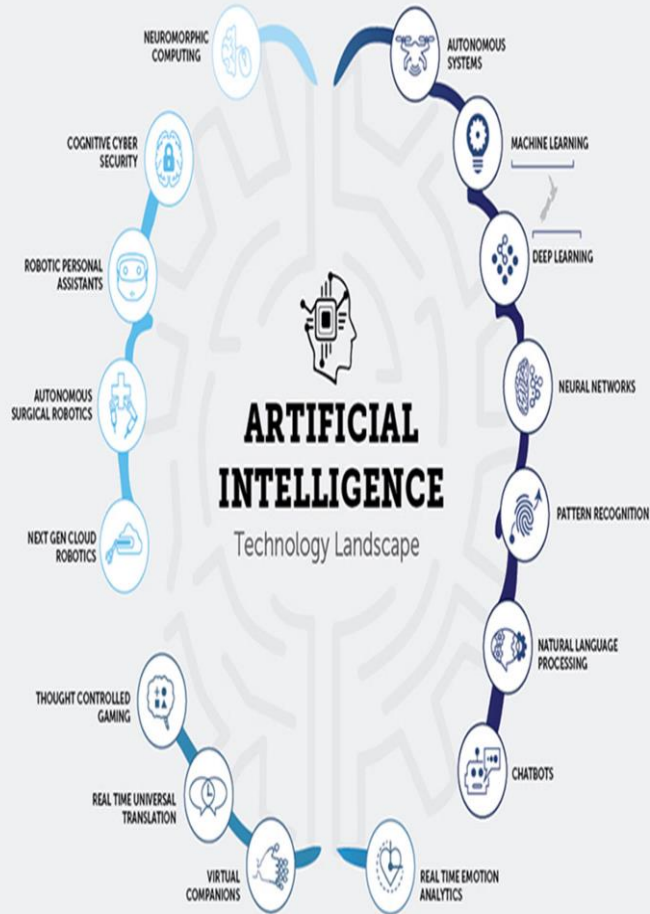
- **Artificial intelligence** is a science like mathematics or biology. It studies ways to build intelligent programs and machines that can creatively solve problems, which has always been considered a human prerogative.
- **Machine learning** is a subset of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. In ML, there are different algorithms (e.g. neural networks) that help to solve problems. The learning refers to software self adjustments to fine tune algorithms to increase accuracy.
- **Deep learning, or deep neural learning**, is a subset of machine learning, which uses the neural networks to analyze different factors with a structure that is similar to the human neural system. Deep Learning makes sense of patterns, noise, and other sources of confusion in data.



Deep Learning



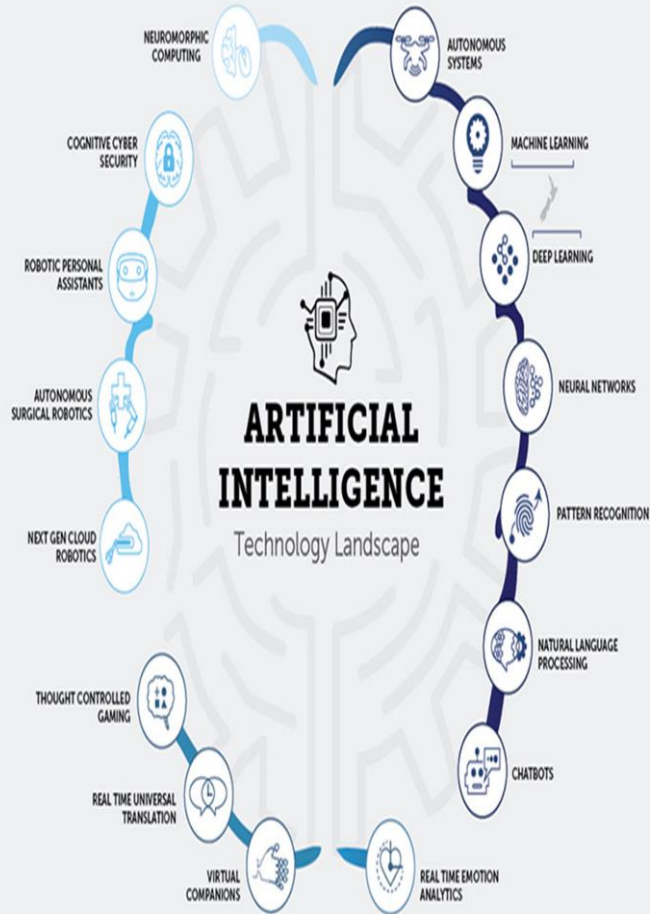
In **neural networks**, a **hidden layer** is located between the **input** and **output** of the algorithm, in which the function applies weights to the **inputs** and directs them through an activation function as the **output**. In short, the **hidden layers** perform nonlinear transformations of the **inputs** entered into the network.



AI Terms

- Syntactic Pattern Recognition – provides mechanisms for analysis of the problem of pattern recognition containing significant syntactic content
- Natural Language Processing – a machine learning field in which a computer could understand, analyze, and manipulate data to generate language
- Computer Vision – a field of study to develop techniques for computers to visualize and understand digital content such as images, photos, videos
- Machine Perception – the ability of a machine to take sensory inputs and interpret the data in a human-like way



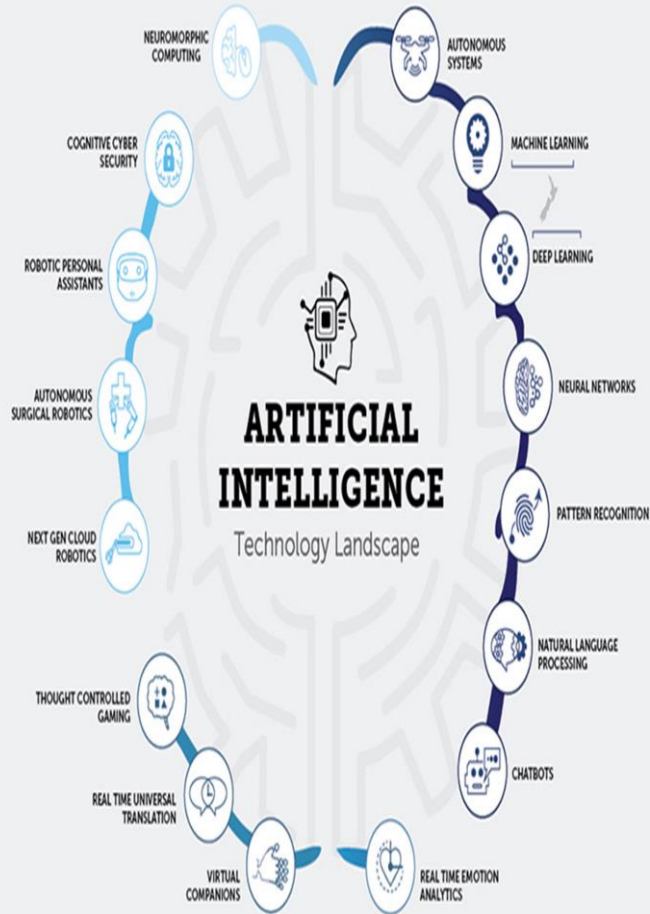


AI – Blessing or Threat?

- Stephen Hawking, Physicist – “Success in creating effective AI could be the biggest event in the history of our civilization Or the worst. We just don’t know. So we can’t know for sure if we’ll be infinitely helped by AI, or ignored by it and sidelined, or conceivably destroyed by it.”
- January 2015, Hawkins, Elon Musk, and other AI experts signed an **open letter on artificial intelligence** calling for research on the societal impacts of AI.

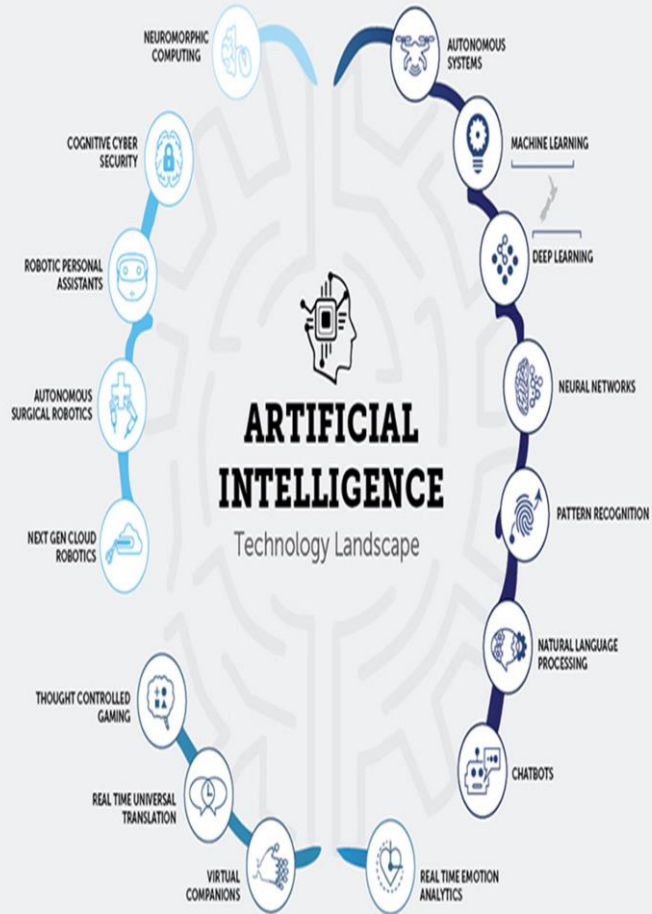
<https://futureoflife.org/ai-open-letter/>

https://futureoflife.org/data/documents/research_priorities.pdf?x96845



AI – Blessing or Threat?

- The blessing of AI would be to promote an effortless way of living that attempts to mimic human decisions and actions without natural human shortcomings such as fatigue, emotion, limited time, confusion.
- Low error rate compared to humans is appropriately coded
- Hostile environments will not affect them
- Replace humans for repetitive tasks.
- Predict what a user will want, type, ask.
- Can detect fraud, maintain and organize records. think logically without emotion.
- Don't need to sleep, take breaks, rest.

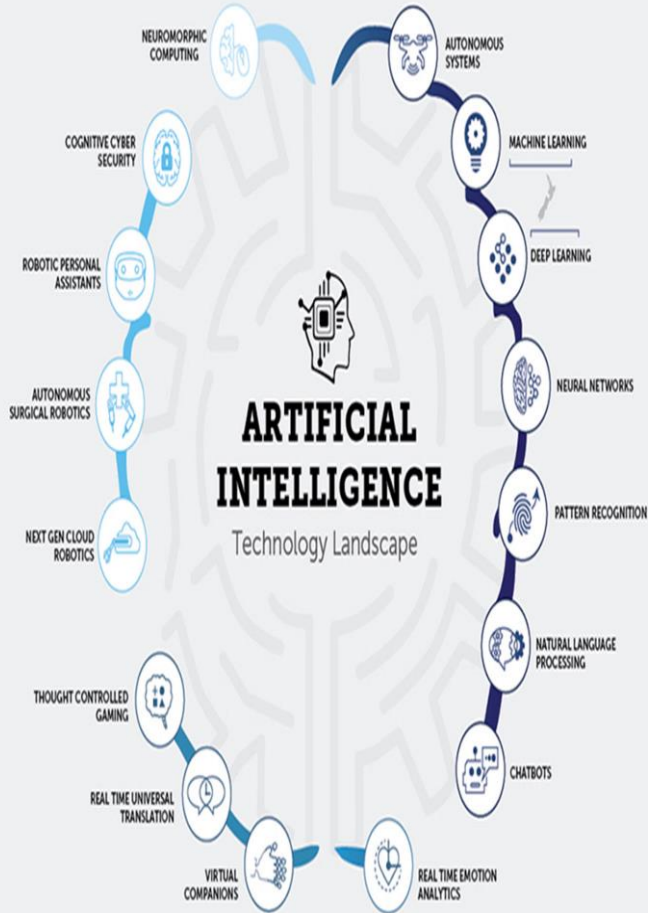


AI – Significant Savings

- For the US
 - ▶ • The potential healthcare savings could reach \$150 billion by 2025
 - Half of this savings from clinical operations and the other half represents financial and operational costs.

(Frost & Sullivan, 2018).

AI – Not A Solution but a Capability



- ▶ AI tools will facilitate and enhance human work and not replace the work of clinicians as such (Boher & Memarzadeh, 2020).

Administrative workflow

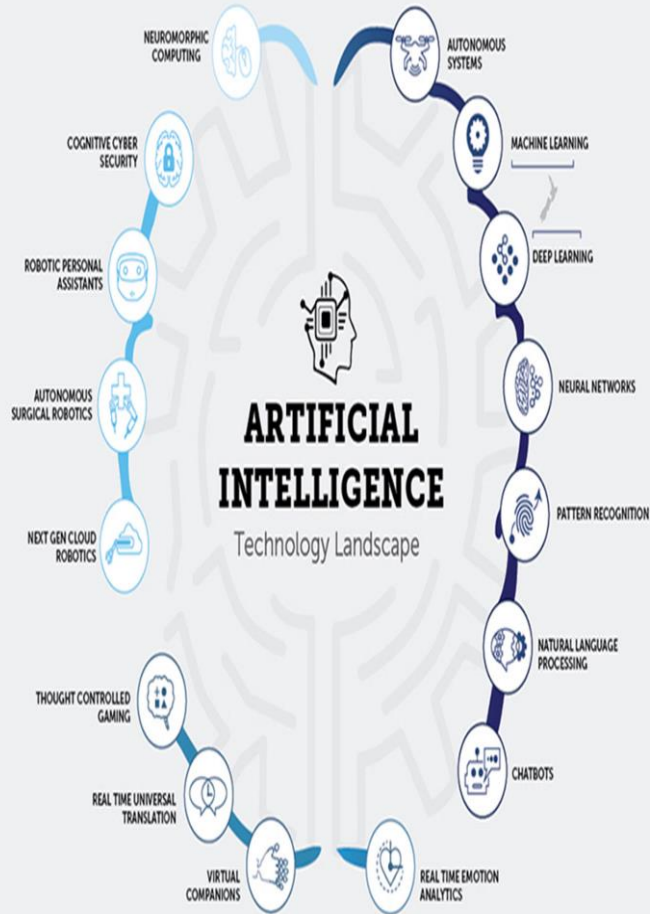
Clinical documentation

Patient outreach and support

Image analysis

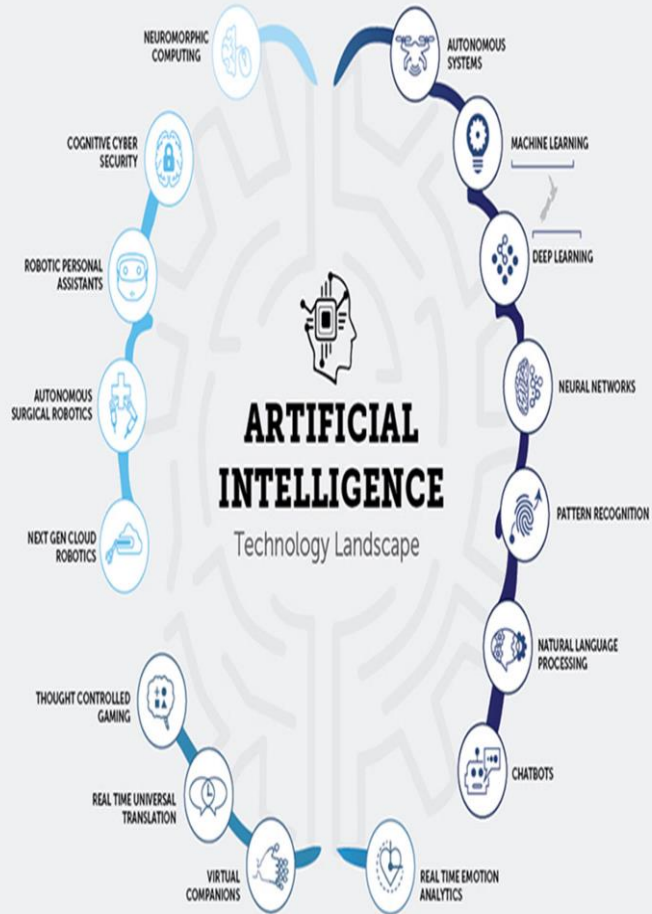
Medical device automation

Patient monitoring



AI – Not A Solution but a Capability

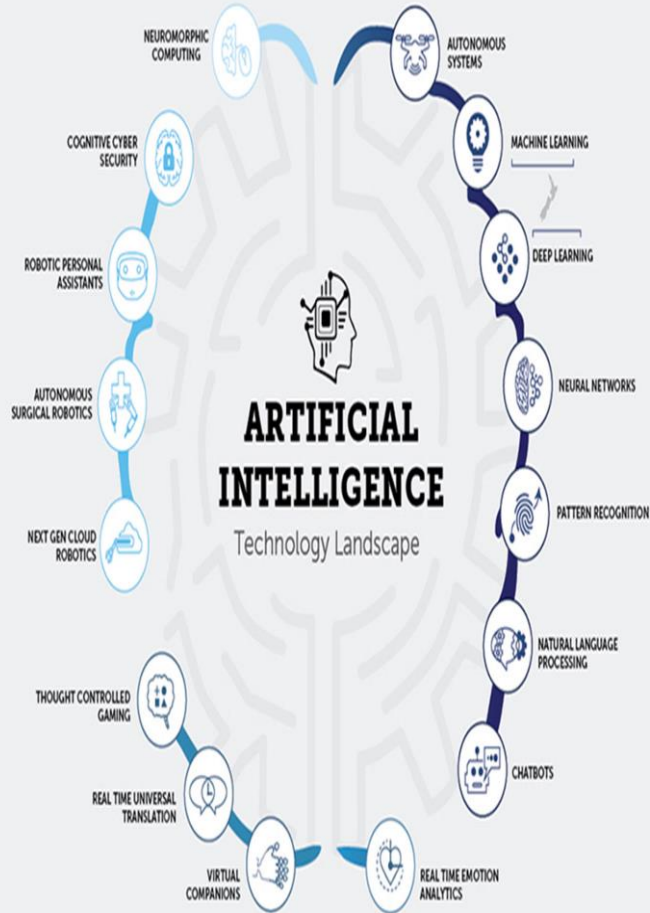
- Precision Medicine - tailor healthcare interventions to individuals and populations based on disease profile diagnostic information, genomic variations, demographics, family history, immune profile, microbiome, environmental vulnerability.
- Digital health applications - processing data added by patients such as food intake, emotional state, activity coming from wearables, mobile apps, sensors
- Genetics based solutions – interfacing genotype and phenotype along with other physiological data
- Drug discovery – use drug compound activity and biomedical data to determine new patterns



AI – Not A Solution but a Capability

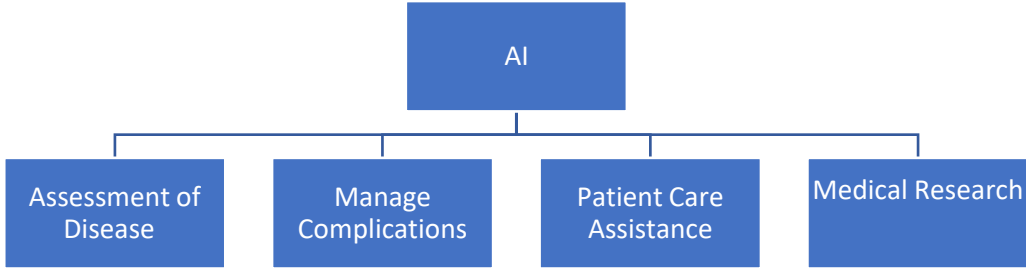
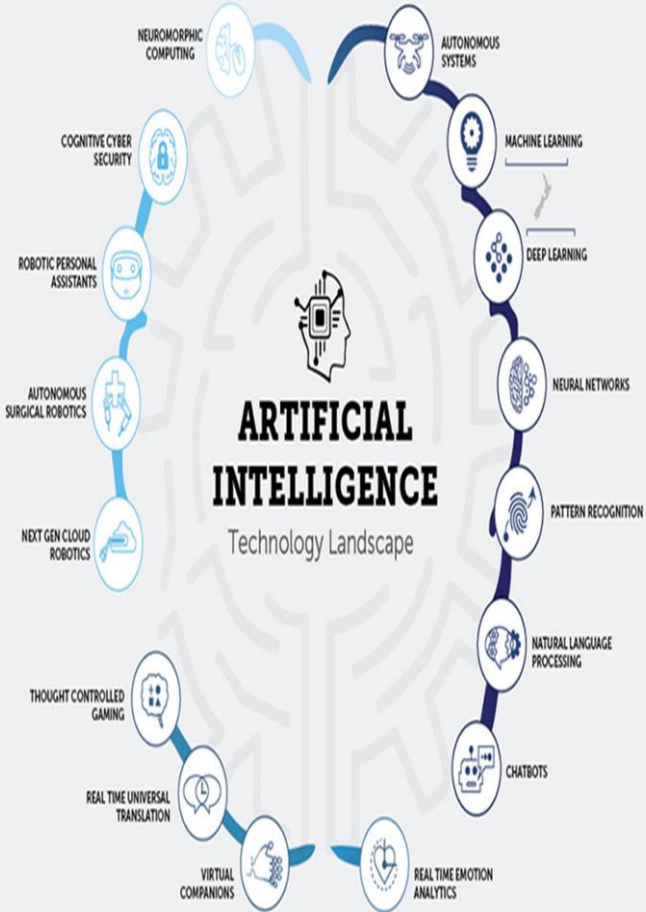
- Medical Visualization – interpretation of images and videos (image based diagnosis and image guided surgery)
- Augmented and virtual reality for students and patients teaching/learning interaction with surroundings control pain and discomfort
- Intelligent personal health records for patient self management and better outcomes
- Health monitoring and wearables
- Natural language processing

AI – Not A Solution but a Capability

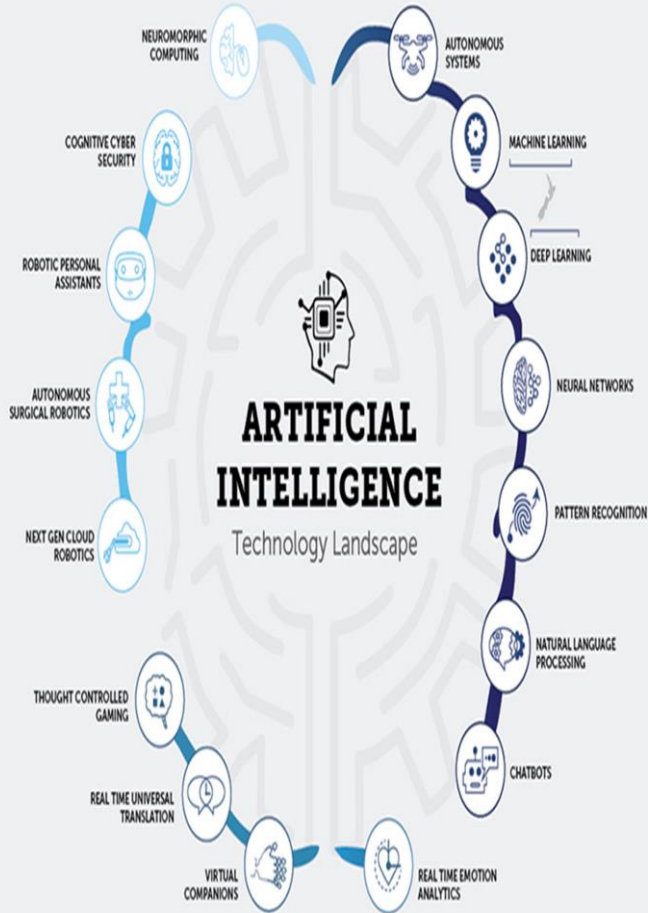


- Natural language processing
 - ▶ Efficient billing
 - Authorization approval
 - Clinical decision support
- Assisted Living
 - Smart Homes
 - Assistive Robots
 - Cognitive assistants
 - Social and emotional stimulation

AI – Not A Solution but a Capability

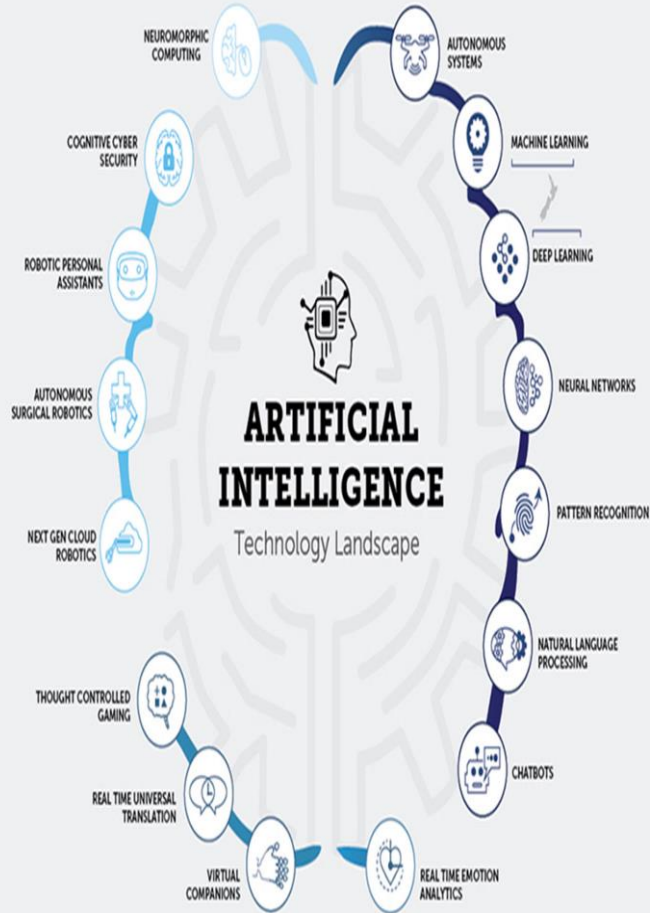


AI – Not A Solution but a Capability

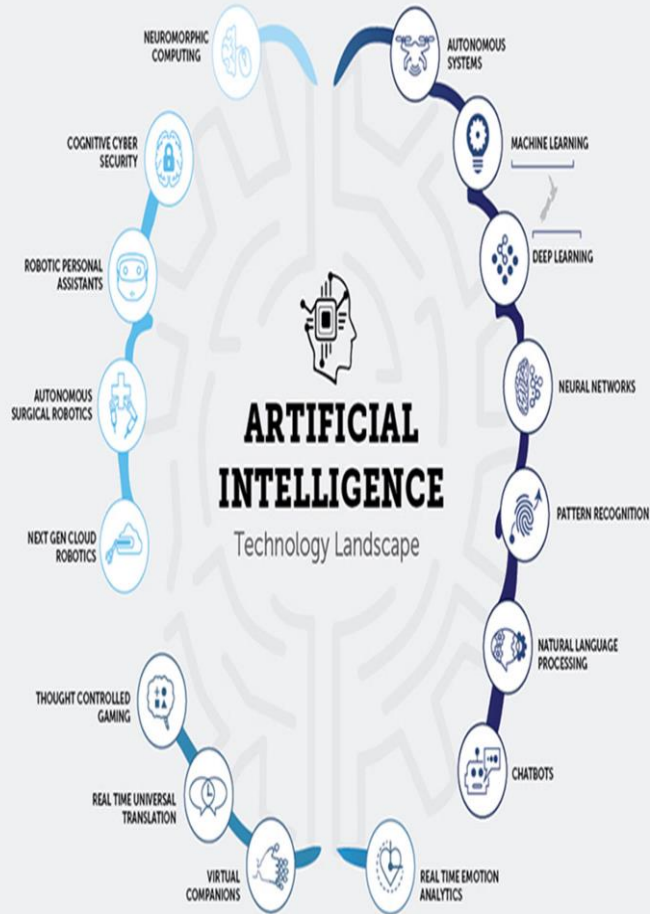


- Natural language processing
 - ▶ Efficient billing
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 - Smart Homes
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AI – Not A Solution but a Capability (Nursing)



- Machine learning
 - ▶ Predict fall severity
 - Patient monitoring of arrhythmias, hemodynamic changes
 - Decrease alarm fatigue
- Deep learning – advanced pattern recognition
 - Identify at risk patients for intervention
- Natural Language Processing – nursing notes,

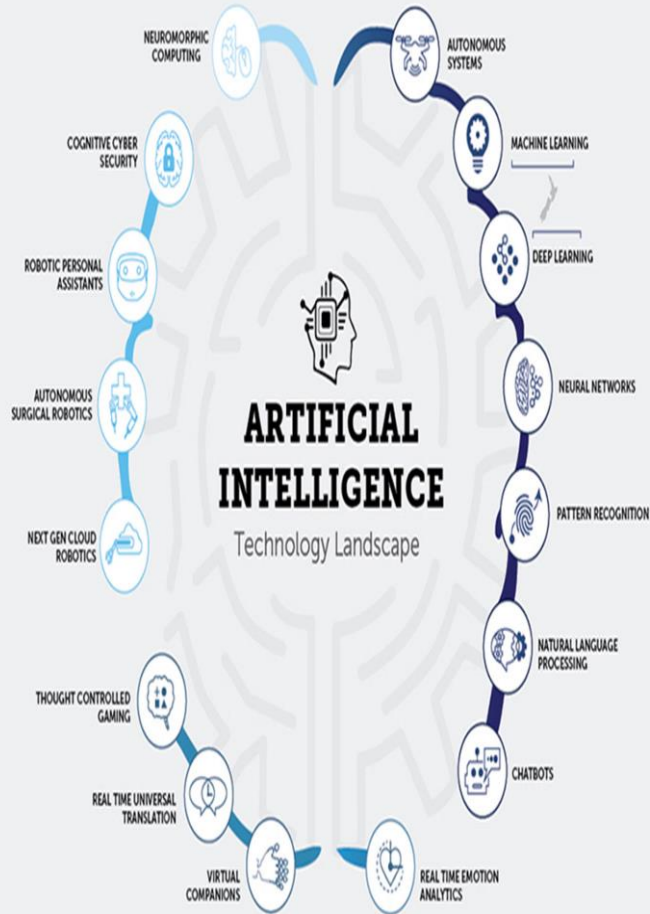


AI – Issues

AI (machine and deep learning) is built from data

▶ An algorithm trained on using data from predominantly one demographic is not accurate.

Missing data drives inaccurate algorithms.
The Hidden Layers are important to understand.



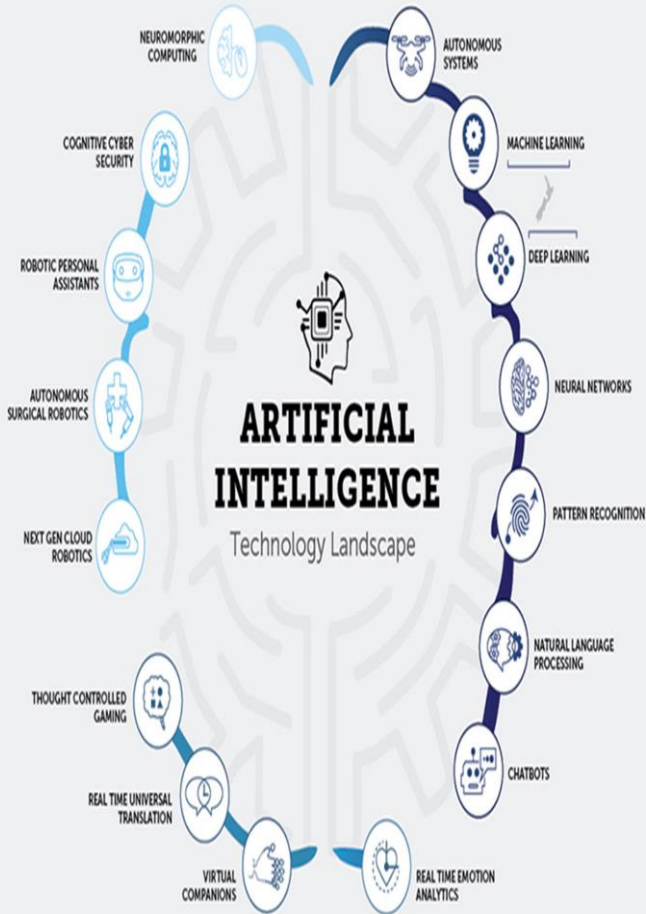
AI programs smart suggestion and recommendation machines

The quality of the data for successful AI use is vital.

- ▶ The data must be complete, structured, cleaned, unbiased.

More data is best as the volume of data helps machines to learn, predict and process semantics languages better.

AI programs guide decision-making by enhancing critical thinking and the nursing process which enables patterns and semantics detection that ultimately thinks more like humans and in clinical environments.



AI – Issues

Ethical

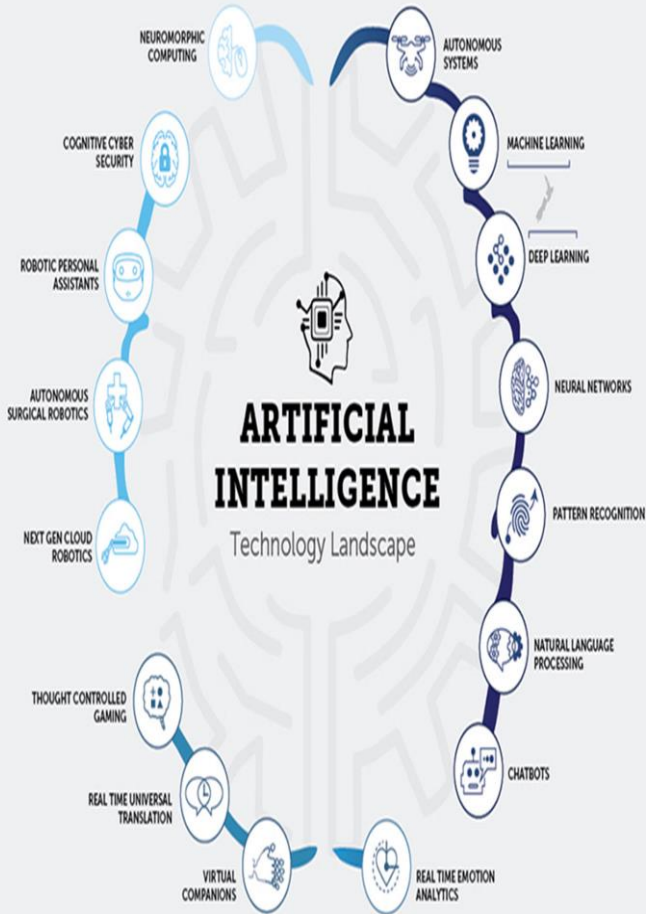
- ▶ Informed Consent
- Safety and Transparency
- Algorithmic fairness and biases
- Data privacy

Legal

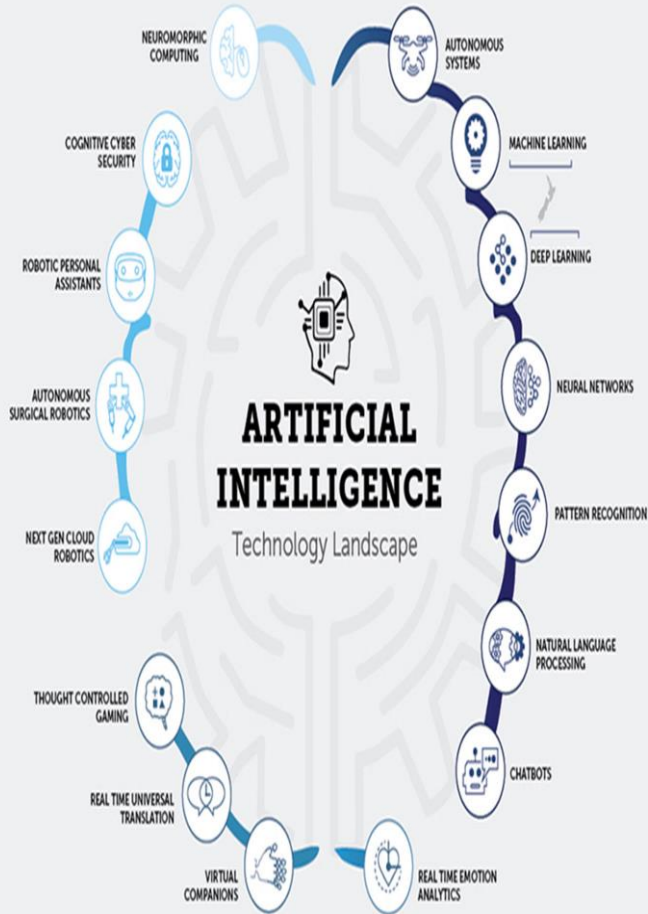
- Safety and Effectiveness
- Liability
- Cybersecurity
- Intellectual property law

(Gerke, Minssen, & Cohen, 2020)

ANI Response to ANA Center for Ethics and Human Rights Advisory Board



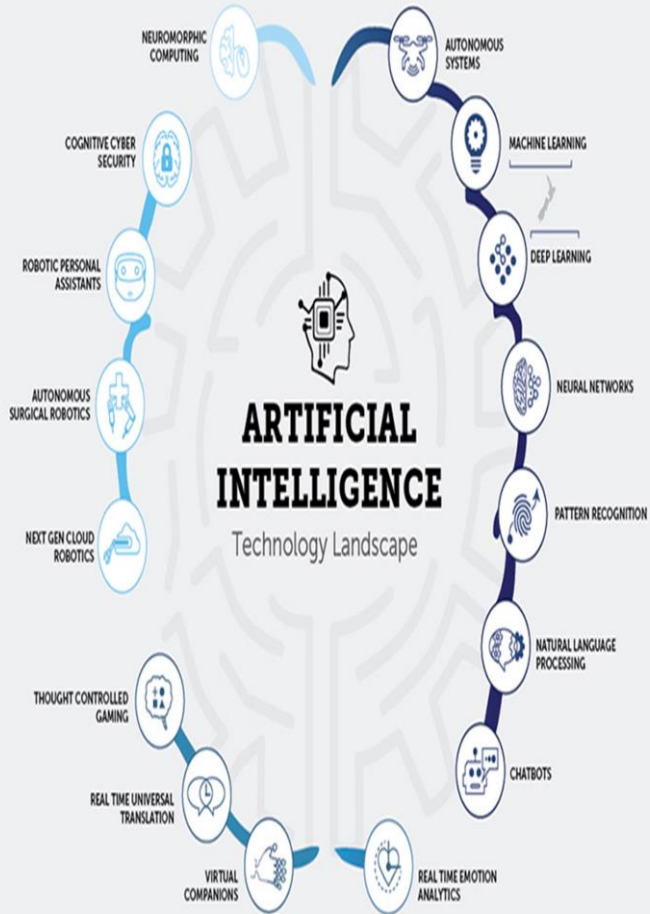
- Alliance for Nursing Informatics (ANI) cosponsored by AMIA and HIMSS
- ▶ ANI represents 20,000 nurse informaticists
 - Engage nursing informatics stakeholders with expertise in advanced technologies.
 - Shift to a paradigm that accounts for the diversity of AI enabled technologies.
 - Provide clear, consistent and empirically founded definitions.
 - In addition to autonomy, privacy, and dignity, ensure inclusion of bias, transparency, traceability, reliability, safety, inclusivity, social accountability, and governance of advanced technologies.
 - <https://www.allianceni.org/sites/allianceni.org/files/ANI%20COMMENTS%20on%20ANA%20Position%20Statement%20Ethics%20and%20AI%20FINAL.pdf>



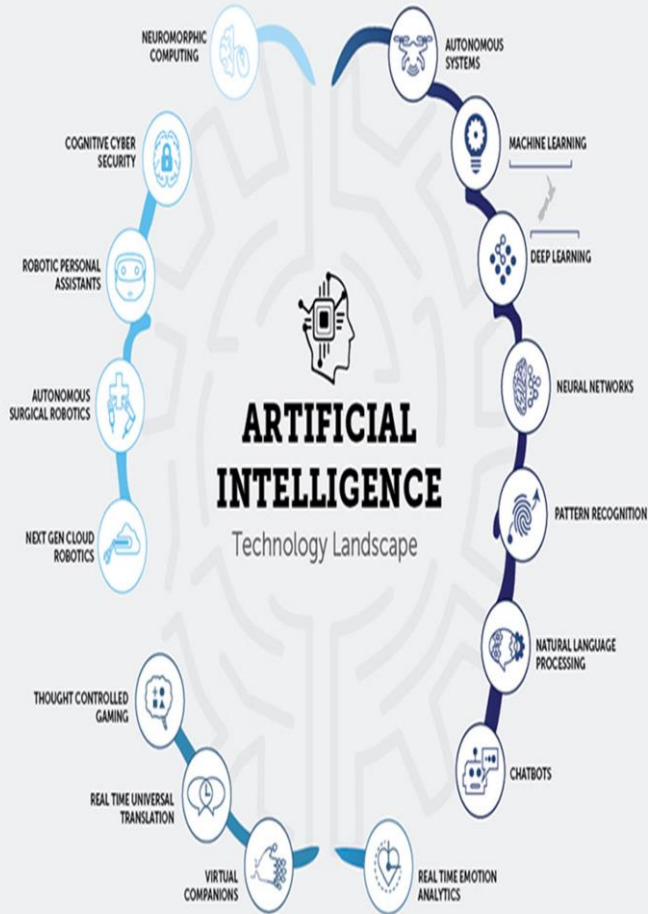
Example of Confusion

In Stokes and Palmer, (2020), they highlight robotics and the ethics of caring

- ▶ *Etzioni and Etzioni (2017) have argued that the correct model for introducing AI into nursing care uses AI as partners, not substitutes, and tasks are appropriately divided between human and AI caregiver according to relative competence (i.e., comparative advantage). While we agree that the partnership model is broadly correct, the relative competence criteria for assigning tasks risks having efficiency overshadow caring as the central feature of nursing practice. In this article, we argue that an ethical division of tasks between AI and human caregivers maintains caring as the core value and practice of nursing and protects or expands opportunities for caring acts, expressions and attitudes. Although much of our discussion involves nursing, our conclusions extend to caregiving professions generally.*



-
- ▶ Questions
 - Concerns
 - Comments



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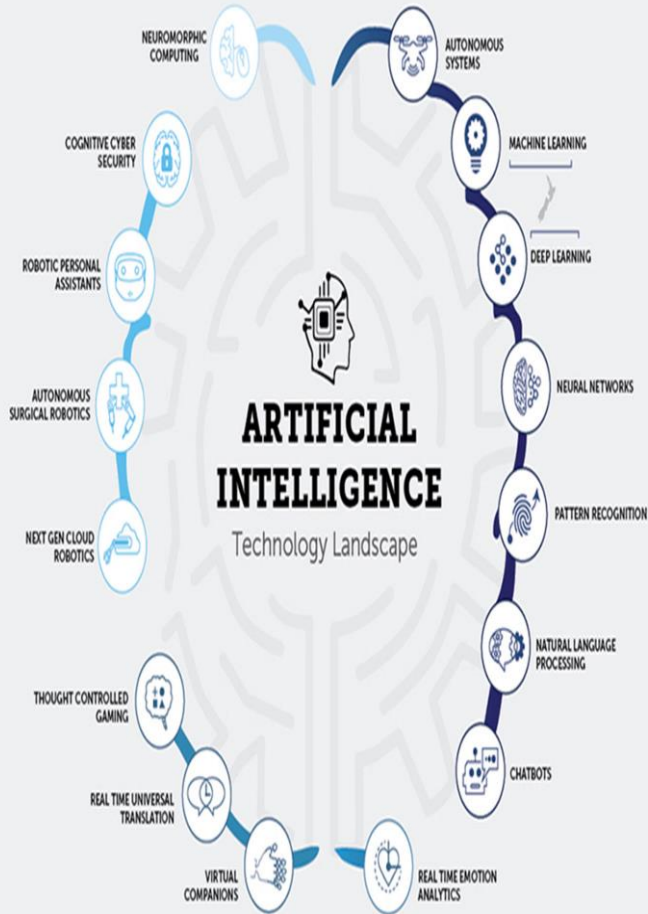
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