



WORDING DEFINED

Lecturer: Mark Gillan

SOME RELATED WORDING TO KNOW

Some of the wording and terms you will come across.

Only a sample of words and terms.

More to learn, only a brief definition.

As with any course, additional research and investigation will be required.

Algorithms

Neuroscience
and Neural
Networks

Big Data

Artificial
Intelligence

Machine
Learning

Deep Learning

Quantum
Computing

Narrow Artificial
Intelligence

Backpropagation

Philosophy

Robot Right

Machine Ethics



THE HUMAN BRAIN AND HUMAN LEARNING

Investigate and consider the human brain

- ☐ How do we learn from early age?
- ☐ How does the brain develop?
- ☐ What makes the brain work?
- ☐ How much do we know about the brain?
- ☐ What are neural paths?



ALGORITHMS

- Step-by-step procedure forming a solution to a problem or performing a task
- Used in a wide variety of fields including computer science, mathematics, and engineering (STEM)
- Can be as simple as a recipe for baking scones, or complex, such as powering search engines and self-driving motor vehicles
- Precision, Unambiguous, Effective, Efficient
- Used to automate, decision making, solving problems, encrypting, sort/search



NEUROSCIENCE AND NEURAL NETWORKS

Neuroscience

- Scientific study of the human nervous system, including:
 - Brain
 - Spinal Cord
 - Nerves
- Encompasses wide ranging disciplines:
- Biology, Chemistry, Physics, Mathematics, Psychology
- Techniques:
 - Electrophysiology
 - Imaging (MRI)
 - Genetics
 - Behaviour

Neural Networks

- Type of Machine Learning algorithm
- Inspired by the structure and function of the human brain
- Composed of interconnected nodes or neurons that process and learn from data
- Achieve state-of-the-art results in a variety of tasks such as:
- Image Recognition
- Natural Language Processing
- Speech Recognition



BIG DATA

- Big Data refers to the collection of large datasets
- So large and complex, they are impossible to process using traditional data management tools
- Characterised by the 3 V's:
- **Volume:** can involve enormous amount of data into petabytes or even zettabytes
- **Velocity:** constantly being generated and updated, near real-time processing
- **Variety:** wide ranging formats including structured, unstructured, semi-structured data



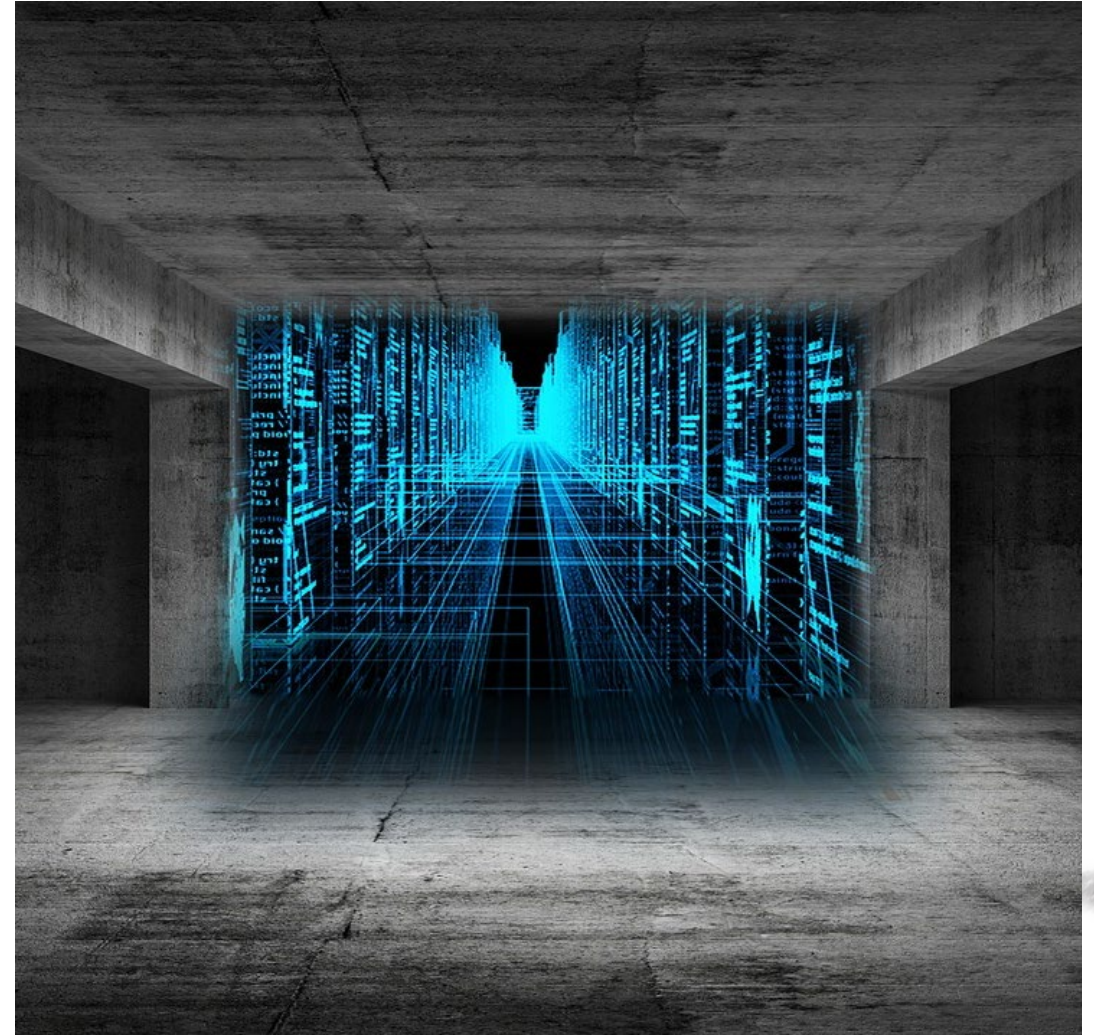
ARTIFICIAL INTELLIGENCE

- Processes simulating human intelligence by machines, particularly computer systems
- AI systems are capable of:
 - Learning
 - Reasoning
 - Problem-solving
 - Decisions that would normally require a human
- Examples of AI applications:
 - Virtual assistants such as Siri, Alexa, Google Assistant
 - Self-drive motor vehicles
 - Fraud detection systems
 - Medical diagnosis systems
 - Recommendation systems



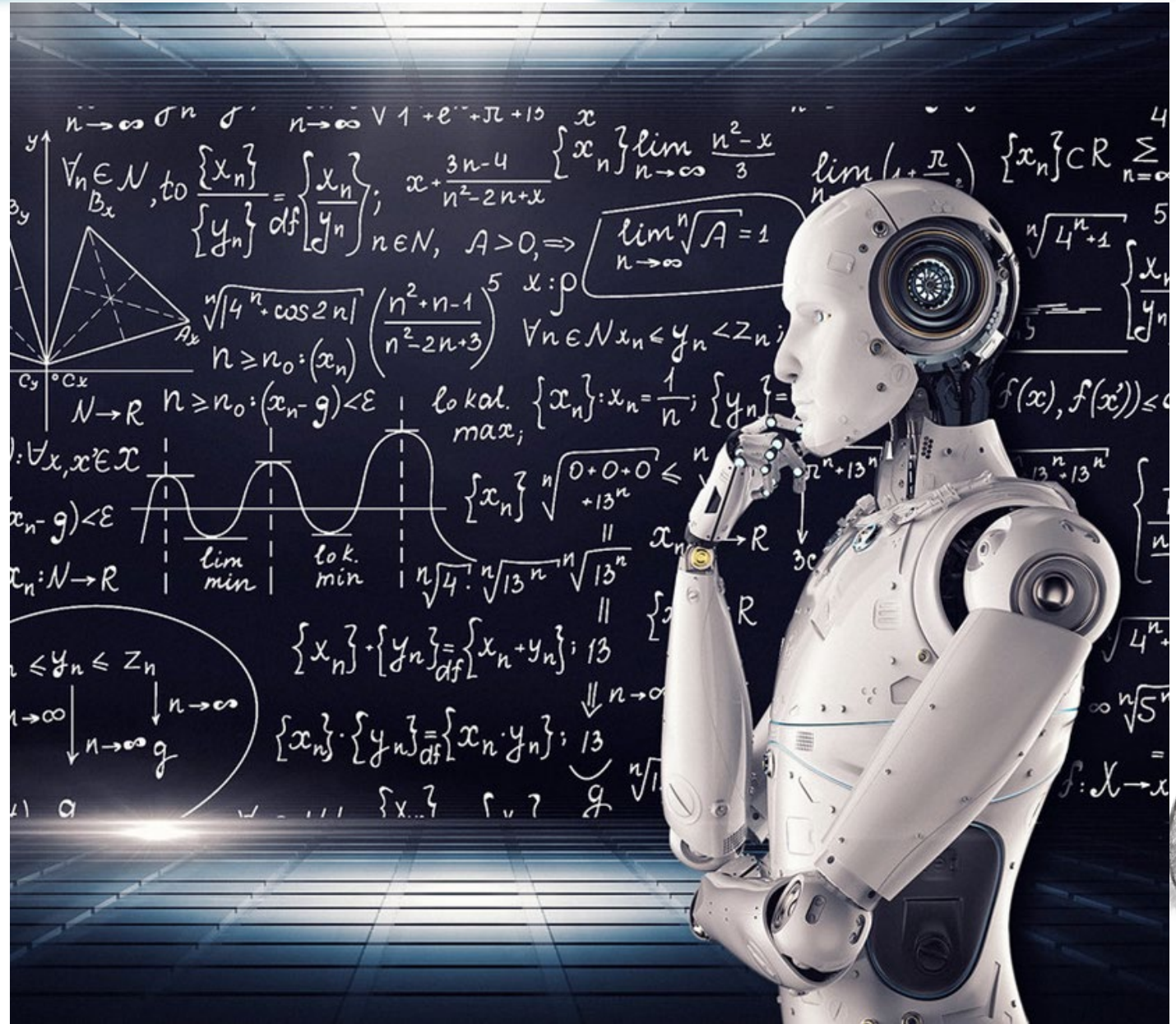
MACHINE LEARNING

- Subfield of AI
- Focus on enabling computers learn from data without specifically being programmed
- Algorithms trained on large datasets
- Use data to identify patterns and make predictions, to autonomously or semi-autonomously improve, based upon large dataset patterns



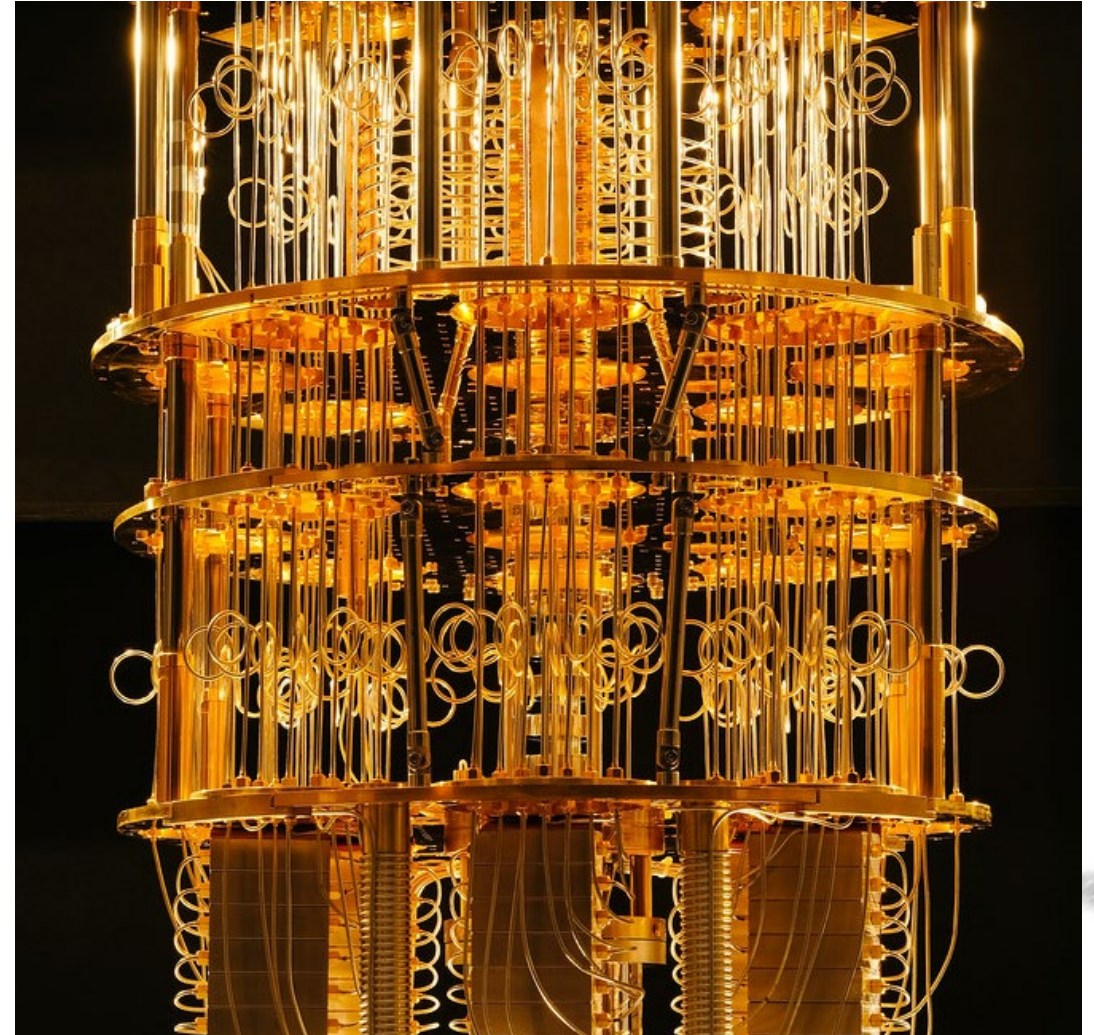
DEEP LEARNING

- Deep Learning a subfield of Machine Learning, slightly different ...
- Deep Learning has a focus upon developing algorithms inspired by the structure and function of the human brain
- Artificial Neural Networks (ANN's)
- Composed of interconnected layers of nodes or neurons that can process and learn from large amounts of data



QUANTUM COMPUTING

- Traditional bits represent either a 1 or 0
- Quantum computing uses quantum bits (qubits)
- Qubit can be in a superposition of one and zero, simultaneously, until its state is measured
- Multiple qubits can be entangled, meaning they are linked quantum mechanically to each other by manipulating electrically charged atoms
- Manufacturing / printing method of lithography to produce artificial atoms using nanoengineering
- This 'superposition' and 'entanglement' provide quantum computers with capabilities unknown to traditional computers



NARROW ARTIFICIAL INTELLIGENCE

- ANI, also known as 'weak AI'
- Type of AI designed to perform a specific task or set of tasks
- Typically focus on a particular domain such as medical diagnosis, chess, natural language processing, finance, transport
- Achieve high levels of performance in their narrow domain
- Unable to generalise knowledge across other domains or undertake other tasks



BACKPROPAGATION

- Algorithm in Machine Learning
 - Train artificial neural networks, fine-tuning the weights of connection between neurons and a neural network based upon the error in the network's predictions
 - Algorithm works by circulating the error backward through the network, adjusting the weights of each connection slightly at each step
 - Powerful complex algorithmic tool that has been used to train a wide variety of successful neural networks
1. Forward propagation: input for prediction
 2. Error calculation: error between prediction and actual target value is calculated
 3. Backward propagation: Error is distributed back through the network, layer by layer. At each layer, adjusted based on how much the layer contributed to the error
 4. Repeat: Steps 1-3 repeated until the network's predictions are sufficiently accurate



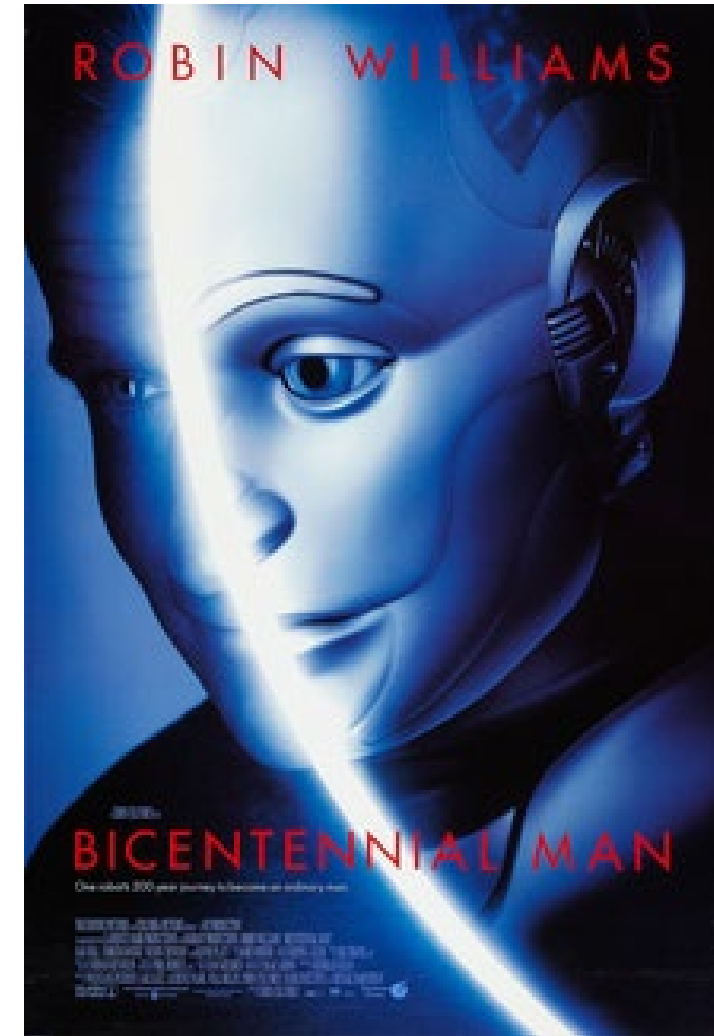
PHILOSOPHY

- The study of fundamental questions about existence, knowledge, values, reason, mind, and language
- Study of the relationship between humans and the world around us
- Broad and diverse field encompassing:
 - Ethics
 - Metaphysics
 - Logic
 - Politics
 - Morality
 - Meaning of Life
- Considered 'Mother of all disciplines'
- Key Characteristics:
 - Critical Thinking
 - Conceptual Analysis
 - Broad-mindedness
 - Creativity
- Valuable for problem-solving and decision-making for humankind
- Practical and enriching part of everyday life, offering a deeper understanding of ourselves and the world around us



ROBOT RIGHTS

- Concept of robots or other AI's should have rights or moral status similar to humans or animals
- Based upon the possibility of AI becoming sufficiently sophisticated as to possess sentience, consciousness, self-awareness, possibly experiencing pain, pleasure, or other emotions
- Could be argued these characteristics could be exploited and should be protected through robot rights, to enjoy freedoms and autonomy
- Watch the movie with Robin Williams ... Bicentennial Man



MACHINE ETHICS



- Field of study examining ethical and philosophical implications of Artificial Intelligence
- ❖ What moral obligations do we have to robots or AI's?
- ❖ How can we ensure that AI systems are designed and used responsibly?
- ❖ What ethical guidelines should be established for the development and deployment of AI?
- ❖ How can we avoid the potential risks of AI, such as bias, discrimination, unintended consequences?

