

From Intuition to Algorithm: The Role of AI in Transplantation

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Disclosures

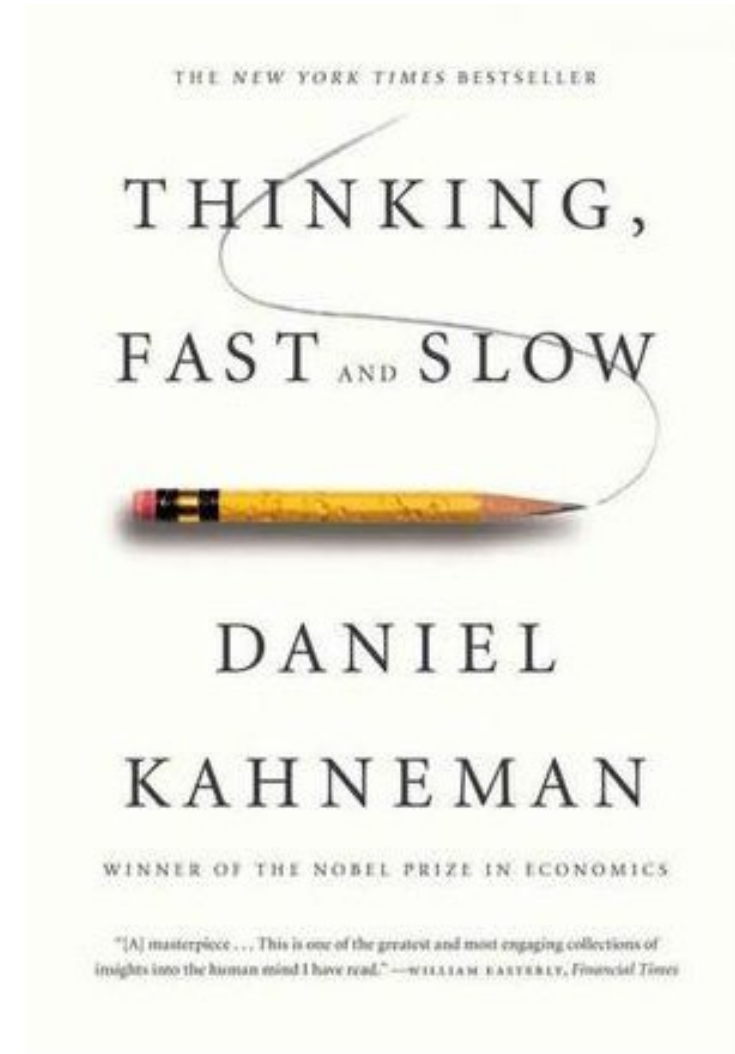
- I have no significant financial or fiduciary conflicts of interest.
- I will not recommend the off-label use of FDA-regulated drugs or devices

O. G. Intelligence

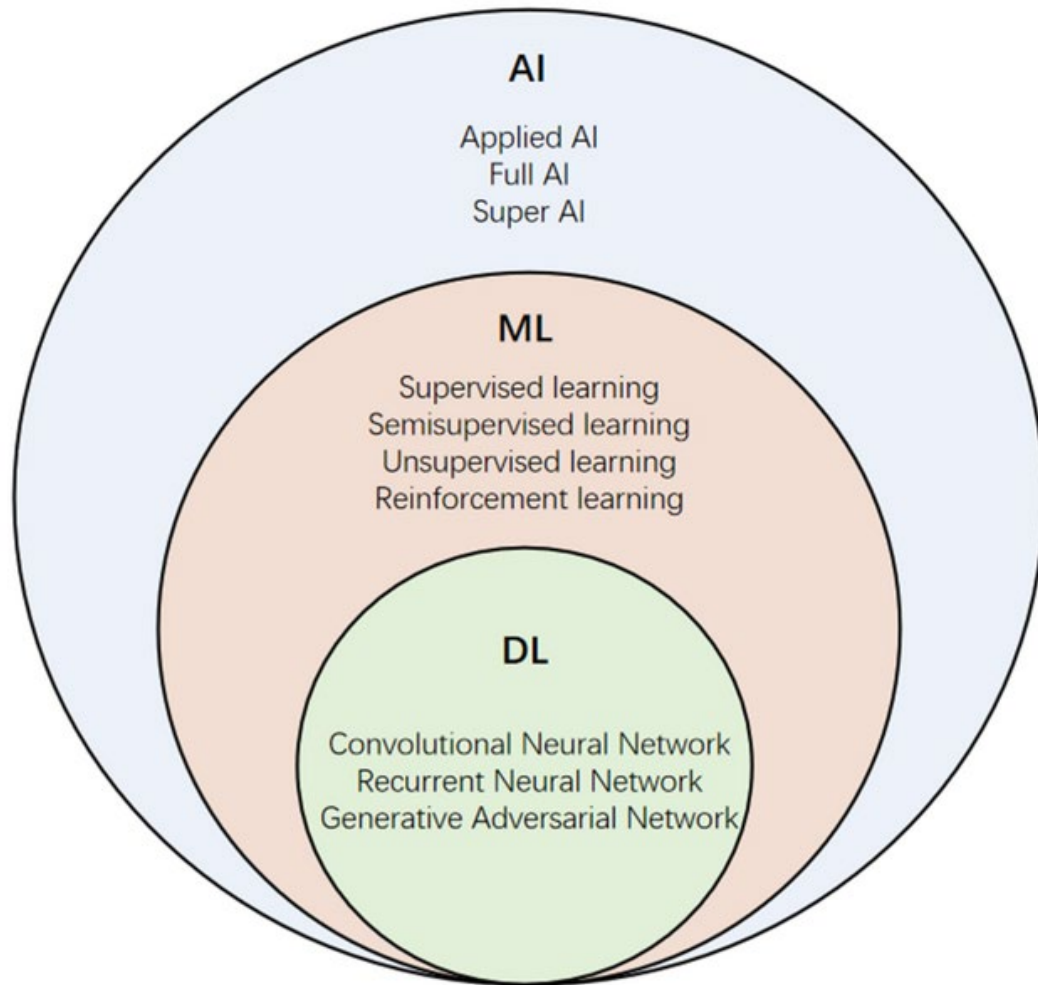


How We Think

- Intuition vs. Conscious Reasoning
- Intuition (System 1) Fast and Error Prone
- Reasoning (System 2) Slow and Deliberate
- Efficiency
- Intuition is More than Instinct!



What is Artificial Intelligence?



The Power of Computing

- Moore's Law (and House's Conclusion)
 - $2^1 = 2$
 - $2^{10} = 1024$
 - $2^{20} = 1$ million
 - $2^{30} = 1$ billion

Algorithms and Statistics

- Simulations, Markov Chains, Monte Carlo Method
- Faster processing has opened new predictive statistical modeling including basically incalculable probabilistic predictions

Chess

- Simple, easily digestible parameters and rules
- Just enough complexity to stay new
- 10,000 games, openings only last for the first 10-15 moves

- Shannon Number: 10^{120}
- Atoms in Observable Universe: 10^{80}

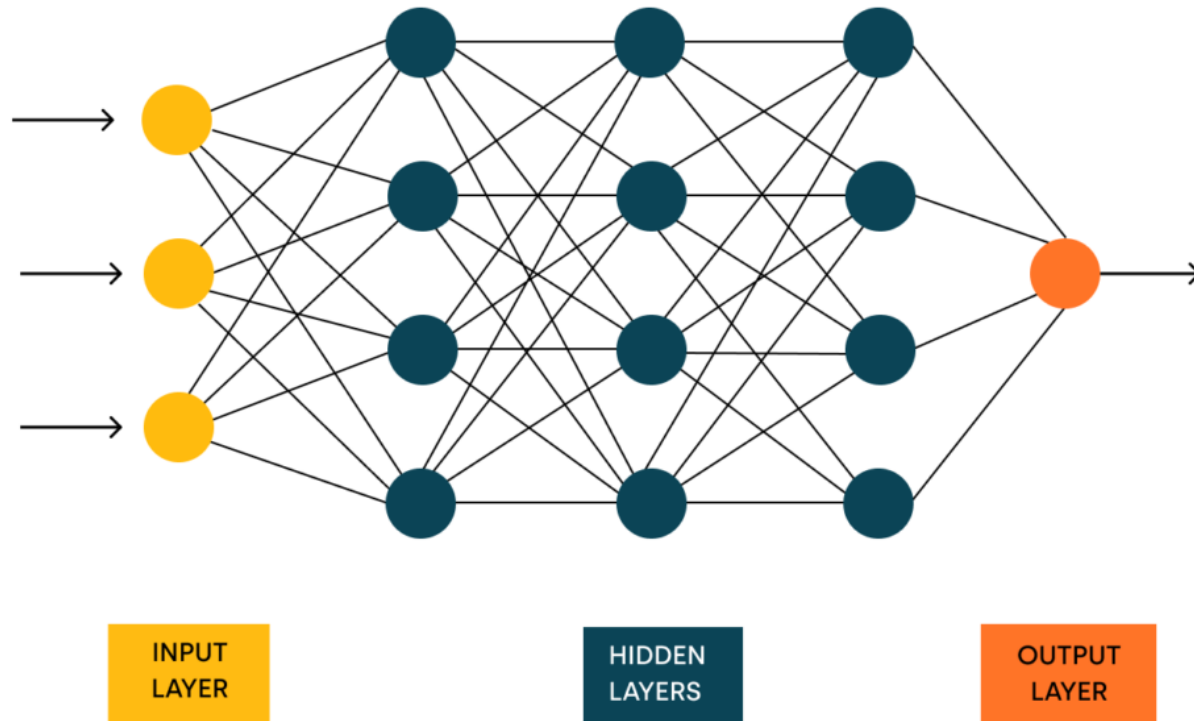
1997



Also 1997



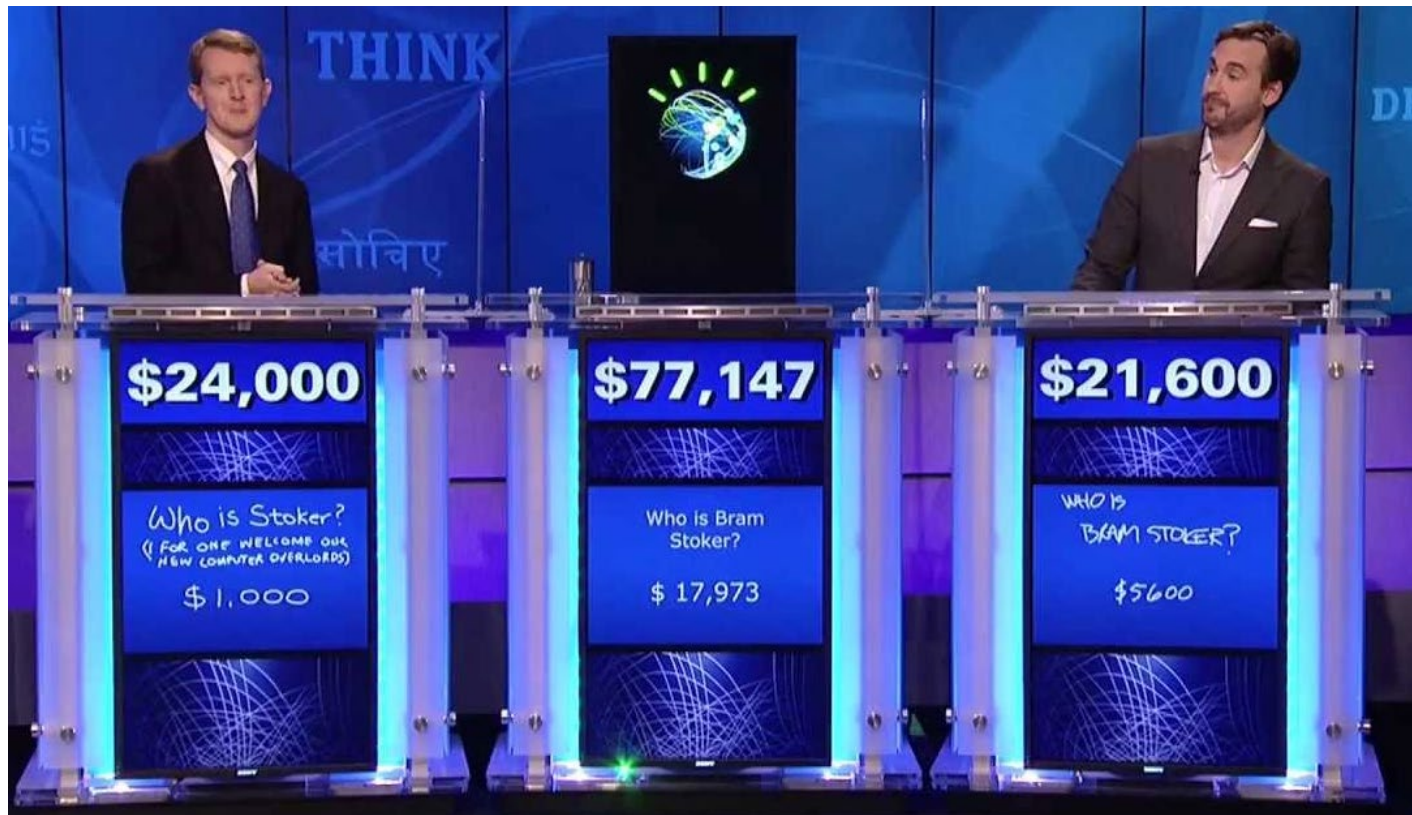
Neural Networks and Deep Learning



- Node = Neuron
- Brain: 90bn Neurons

2011

- Traffic Sign Recognition Competition



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Today's AI

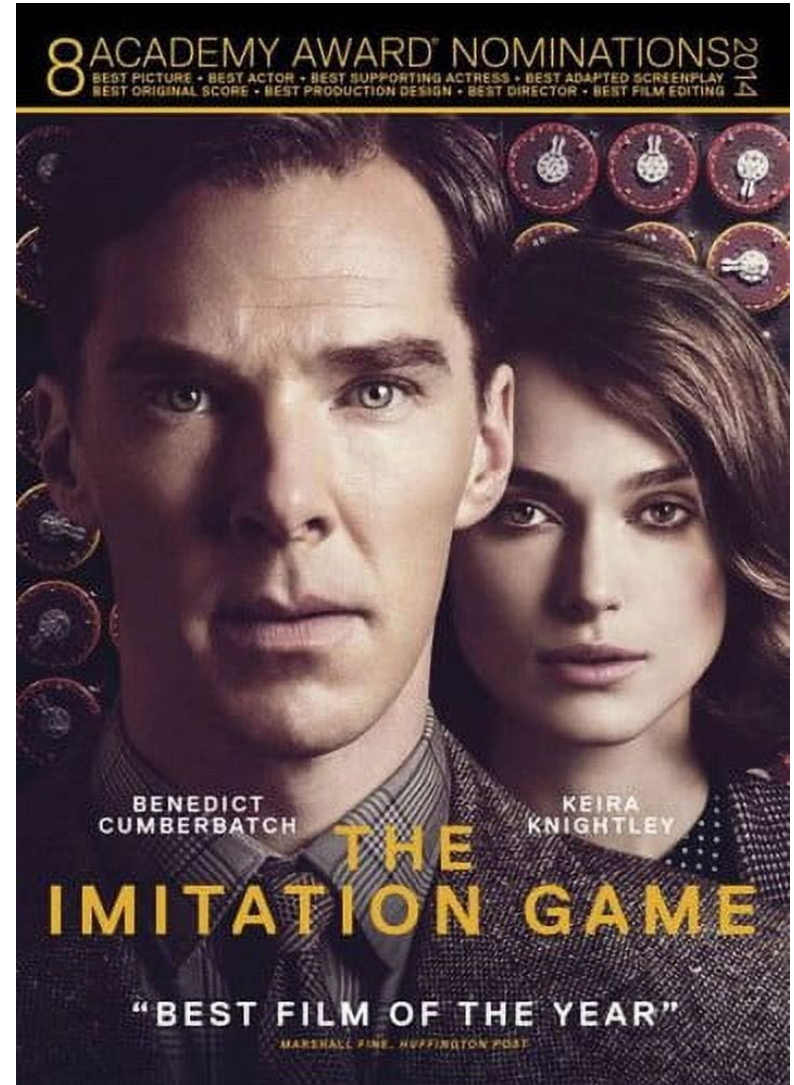
- Large Language Models
- Generative AI
- “Deepfakes”



ChatGPT

The Turing Test

- Controversial, but let's say 2022
- Chat GPT 4.5 Beat Humans 73-27 in 2025



Source: Jones, Cameron R.; Bergen, Benjamin K. (31 March 2025), *Large Language Models Pass the Turing Test*

Transplant Applications: Pattern Recognition

- AI is better in many reads in Radiology
- Pathology is a more complicated story
- I would rather have an AI-assisted radiologist or pathologist today
- Diagnostic Recommendations from EMR

Transplant Applications: Simulation

- Organ Allocation Policy
- Patient Decision Support Tools
- Bioartificial Organs
- Digital Twins

Transplant Applications: Predictive Algorithms

- Biological Target-Finding
- Drug and Biomarker Discovery
- Outcomes Prediction/Risk Stratification (iBox 0.8 c-stat 3,5,7 yrs)
- Automated Documentation

Limitations and Pitfalls

- AI is Extremely Error Prone
- AI is Poorly Understood
- Transplant Small n Problem



<https://www.nytimes.com/2026/01/26/technology/an-ai-pioneer-warns-the-tech-herd-is-marching-into-a-dead-end.html>

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Further Reading

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- <https://www.frontiersin.org/journals/transplantation/articles/10.3389/frtra.2024.1361491/full>
- Jan U. Becker, David Mayerich, Meghana Padmanabhan, Jonathan Barratt, Angela Ernst, Peter Boor, Pietro A. Cicalese, Chandra Mohan, Hien V. Nguyen, Badrinath Roysam. Artificial intelligence and machine learning in nephropathology. *Kidney International*. Volume 98, Issue 1, 2020: Pages 65-75

Thank you!

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