

Introduction to AI

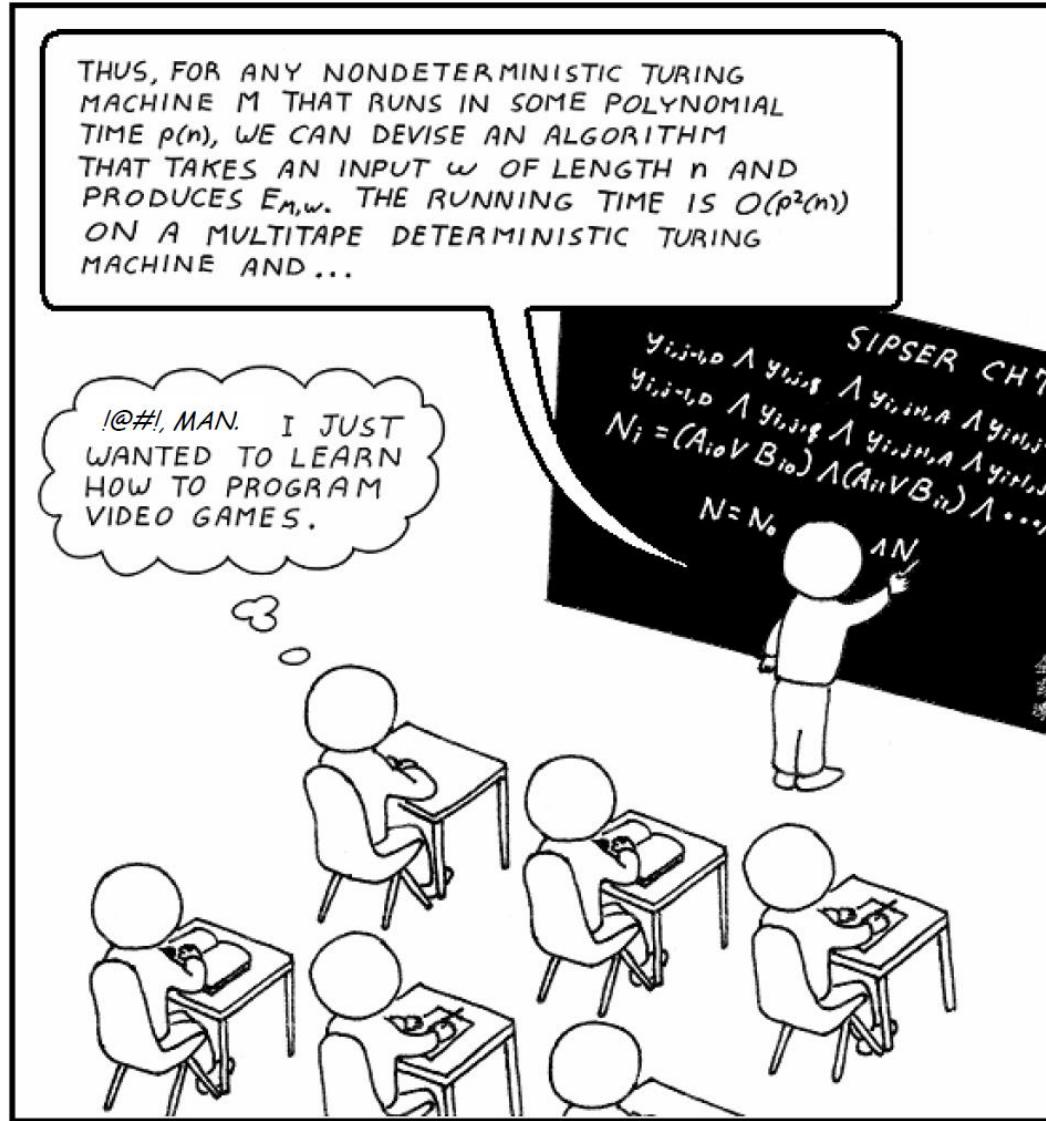
Lecture 1: What is Artificial Intelligence?

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Welcome to AI program



Recommended Text Book:



Artificial Intelligence: A Modern Approach

by Stuart Russell and Peter Norvig

For most people AI evokes



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- **But intelligence need not be embodied!**

Are these intelligent?



What is AI? (Some Definitions of AI, Organized into 4 Categories)

Systems that think like human	Systems that think rationally
<ul style="list-style-type: none">• “The exciting new effort to make computers thinks ... <i>machine with minds</i>, in the full and literal sense” (Haugeland 1985)• “The automation of activities that we associate with human thinking, activities: decision-making, problem-solving, learning....” (Bellman 1978)	<ul style="list-style-type: none">• “The study of mental faculties through the use of computational models” (Charniak et al. 1985)• “The study of the computations that make it possible to perceive, reason, and act.” (Winston 1992)
Systems that act like human	Systems that act rationally
<ul style="list-style-type: none">• “The art of creating machines that perform functions that require intelligence when performed by people” (Kurzweil, 1990)• “The study of how to make computers do things at which, at the moment, people are better.” (Rich&Knight 1991)	<ul style="list-style-type: none">• A field of study that seeks to explain and emulate intelligent behavior in terms of computational processes” (Schalkol, 1990)• “AI Is concerned with intelligent behavior in artifacts.” (Nilsson 1998)

What is AI? (Some Definitions of AI, Organized into 4 Categories)

- Theses definitions vary along two dimentions:
 1. Thought Processes and Reasoning (thinking)
 2. Behavior (acting)
- The definitions on the **left** measure success in terms of fidelity to human performance
- The definitions on the **right** measure against an *ideal concept of intelligence*, which is called **Rationality**.
- A system is **rational** if it does the “**right thing**”, **given what it knows**.

What is AI? Four Approaches

- Human-centered approaches (Empirical Science) that involves : Hypothesis and Experimental confirmation

Acting Humanly: The Turing Test

Thinking Humanly: Cognitive Science

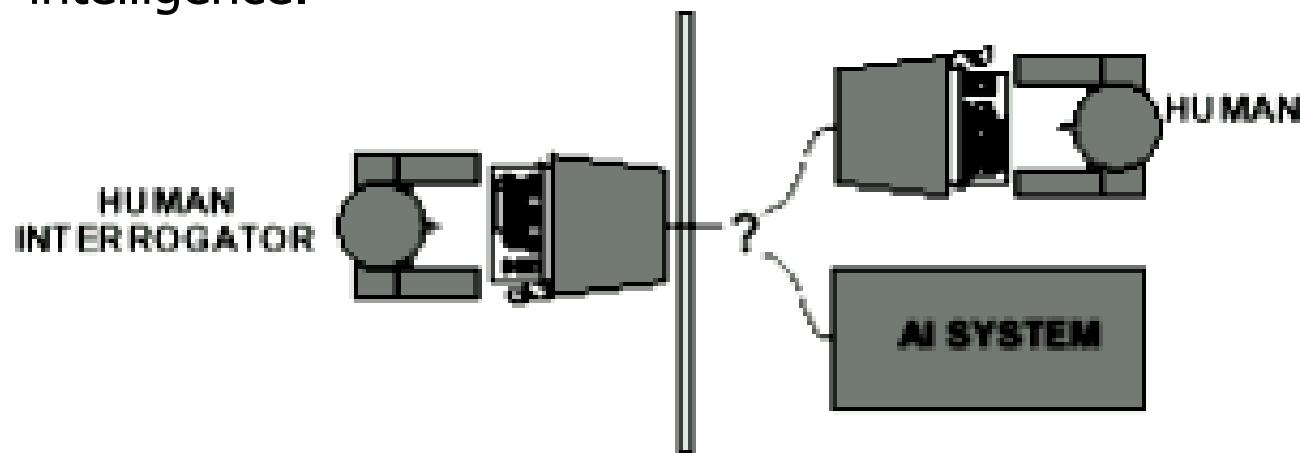
- Rationalist approach that involves: Combination of Mathematics and Engineering

Thinking Rationally: Laws of Thought

Acting Rationally: The Rational Agent

Acting Humanly: The Turing Test

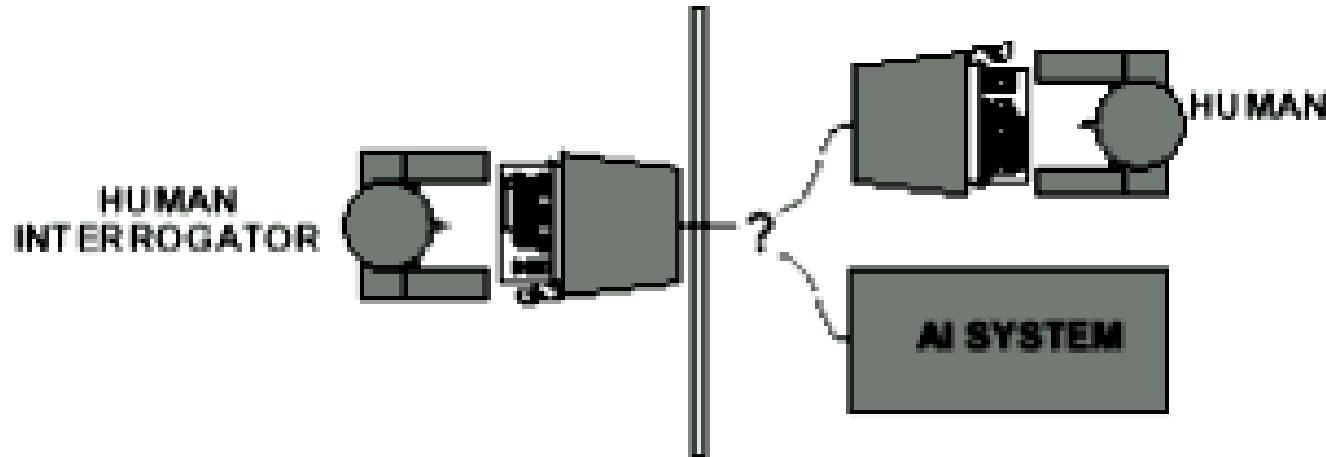
- Alan Turing's 1950 article *Computing Machinery and Intelligence* discussed conditions for considering a machine to be intelligent
 - “Can machines think?” \longleftrightarrow “Can machines behave intelligently?”
 - The Turing test (The Imitation Game): Operational definition of intelligence.



Versions of the Turing test : *Imitation Game*

- Turing's original game described a simple party game involving three players: Player A is a man, player B is a woman and player C (who plays the role of the interrogator) is of either sex.
- In the Imitation Game, player C is unable to see either player A or player B, and can communicate with them only through written notes. By asking questions to both players, player C tries to determine which of the two is the man and which is the woman.
- Player A's role is to trick the interrogator into making the wrong decision, while player B attempts to assist the interrogator in making the right one.
- Turing proposed : that the role of player A be filled by a computer so that its task was to pretend to be a woman and attempt to trick the interrogator into making an incorrect evaluation.
- The success of the computer was determined by comparing the outcome of the game when player A is a computer against the outcome when player A is a man.
- Turing stated : if "the interrogator decide wrongly as often when the game is played [with the computer] as he does when the game is played between a man and a woman", it may be argued that the computer is intelligent.

Acting Humanly: The Turing Test



- **What computer needs to possess:** Natural language processing, Knowledge representation, Automated reasoning, and Machine learning

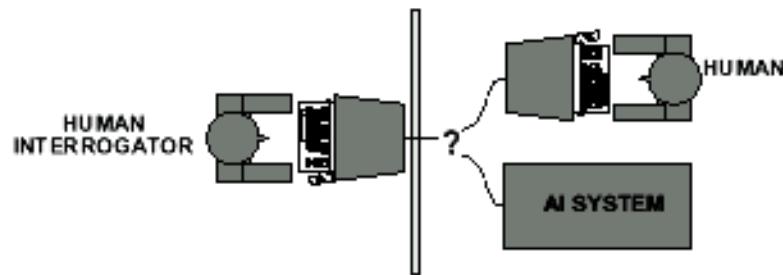
What would a computer need to pass the Turing test?



- **Natural language processing:** to communicate with examiner.
- **Knowledge representation:** to store and retrieve information provided before or during interrogation.
- **Automated reasoning:** to use the stored information to answer questions and to draw new conclusions.
- **Machine learning:** to adapt to new circumstances and to detect and extrapolate patterns.

Acting Humanly: The Full Turing Test

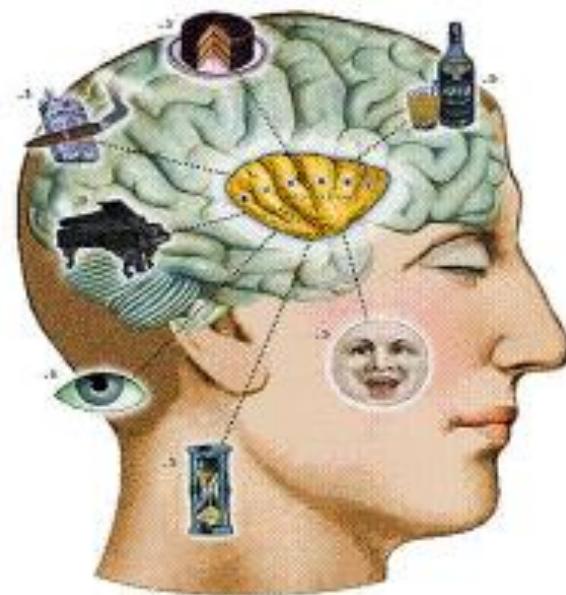
Are there any problems/limitations to the Turing Test?



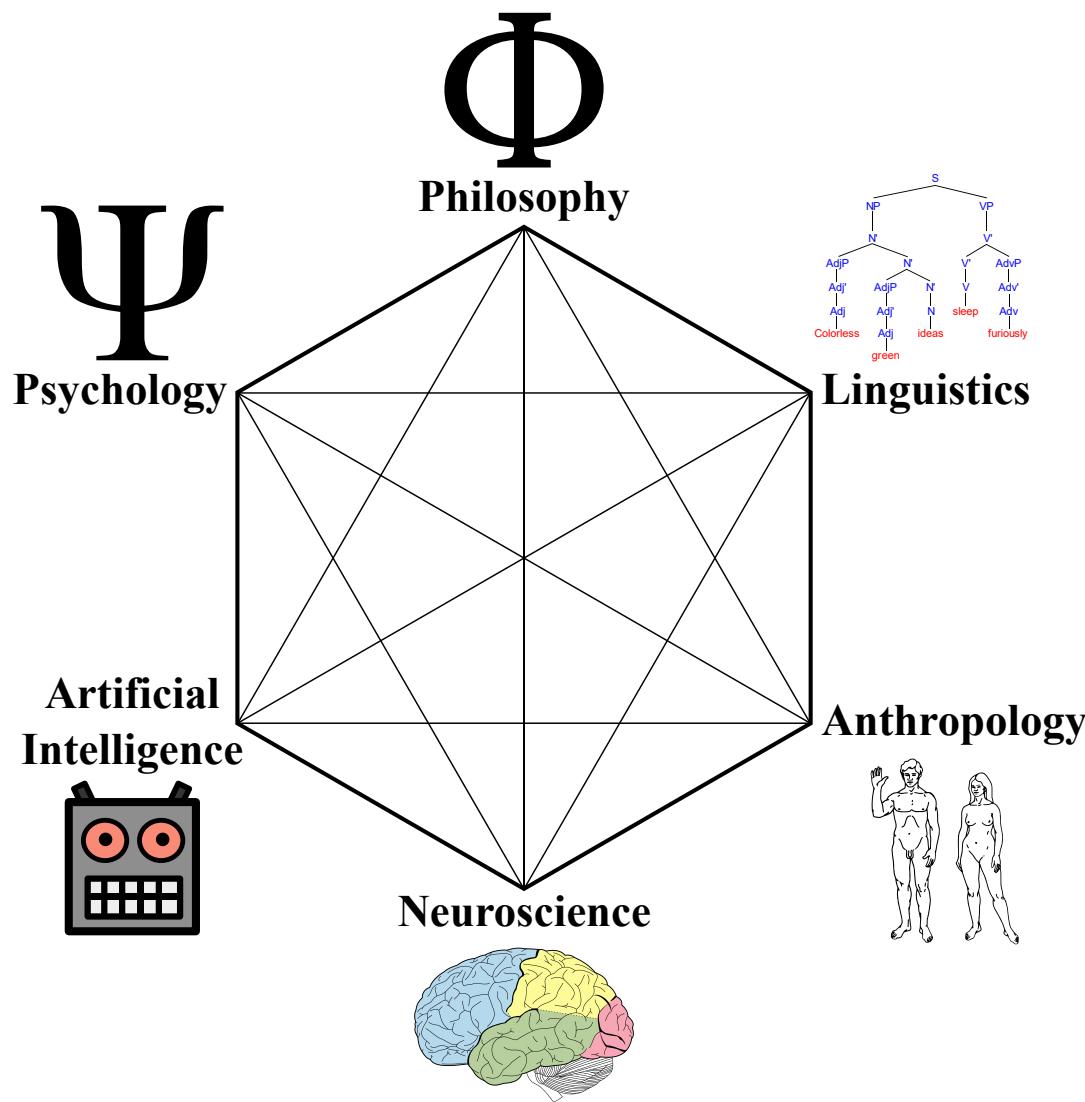
- Problem:
- 1) Turing test is not reproducible, constructive, and amenable to mathematic analysis.
- 2) What about physical interaction with interrogator and environment?

Thinking Humanly: Cognitive Science

- Cognitive science brings together theories and experimental evidence to model internal activities of the brain.
- How information is represented, processed, and transformed (in faculties such as perception, language, memory, attention, reasoning, and emotion) within nervous systems (humans or other animals) and machines (e.g. computers).



Thinking Humanly: Cognitive Science research disciplines



Thinking Rationally: Laws of Thought

- Aristotle (~ 450 B.C.) attempted to codify "right thinking"
What are correct arguments/thought processes?
- E.g., "Socrates is a man, all men are mortal; therefore Socrates is mortal"
- Logic: argument structures always yield correct conclusions when given correct premises

Thinking Rationally: Laws of Thought



- Problems:

1) Uncertainty: Not all facts are certain (e.g., *the flight might be delayed*).

2) Resource limitations:

- Not enough time to compute/process
- Insufficient memory/disk/etc
- Etc.

Acting Rationally: The Rational Agent



- Rational behavior: Doing the right thing!
- The right thing: That which is expected to maximize the expected return
- A rational agent is one that acts autonomously to achieve the best outcome or, when there is uncertainty, the best expected outcome.

Acting Rationally: The Rational Agent



- Provides the most general view of AI because it includes:
 - Correct inference ("Laws of thought")
 - Uncertainty handling
 - Resource limitation considerations (e.g., reflex vs. deliberation)
 - Cognitive skills (NLP, knowledge representation, ML, etc.)
- In the early decades, rational agents were built on logical foundations and formed definite plans to achieve specific goals. Later, methods based on probability theory and machine learning allowed the creation of agents that could make decisions under uncertainty to attain the best expected outcome.

How to Learn Artificial Intelligence



Start with Math & Statistics

- *Math, Math, Math*
- *If you want to learn AI, and apply them efficiently, you need to be friend with "MATH".*

How to Learn Artificial Intelligence

Programming Languages

- *Intelligent system is nothing other than a software, therefore you need to learn computer programming.*
- *Today, the following programming languages are being used the most for Artificial Intelligence:*
 - **Python**
 - *Go! Lang*
 - *R*
 - *Julia*
 - *etc.*



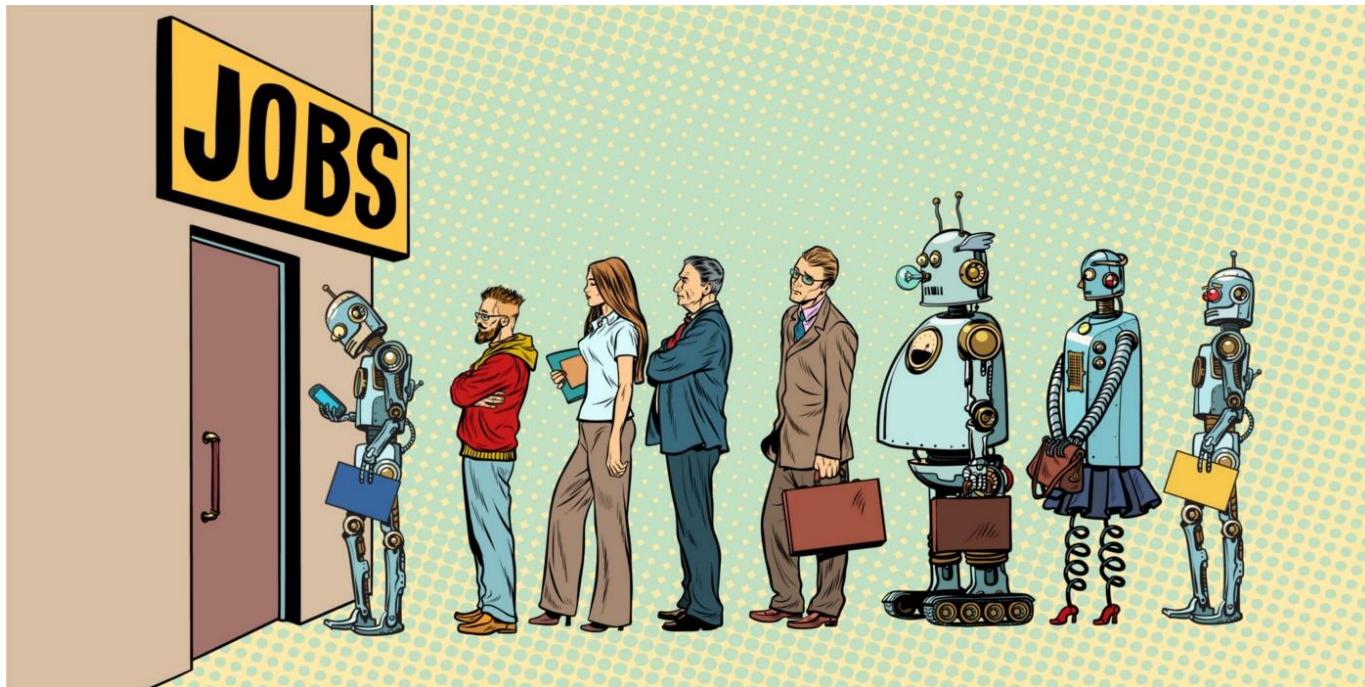
How to Learn Artificial Intelligence



Supplementary Tools

- ***Database / Big Data:*** *Using data is inevitable in AI, so, the knowledge of database and SQL is mandatory.*
- ***AI / Stats / Math tools:*** *There are various tools that can be a help to implement intelligent systems:*
 - *Rapid Miner*
 - *Weka*
 - *SPSS*
 - *Matlab*

Good, Bad and Ethics



AI can be FUN...

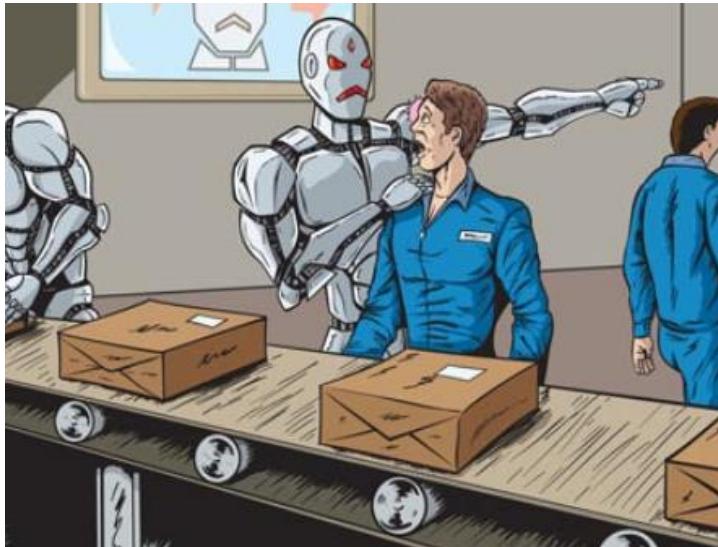


FaceApp



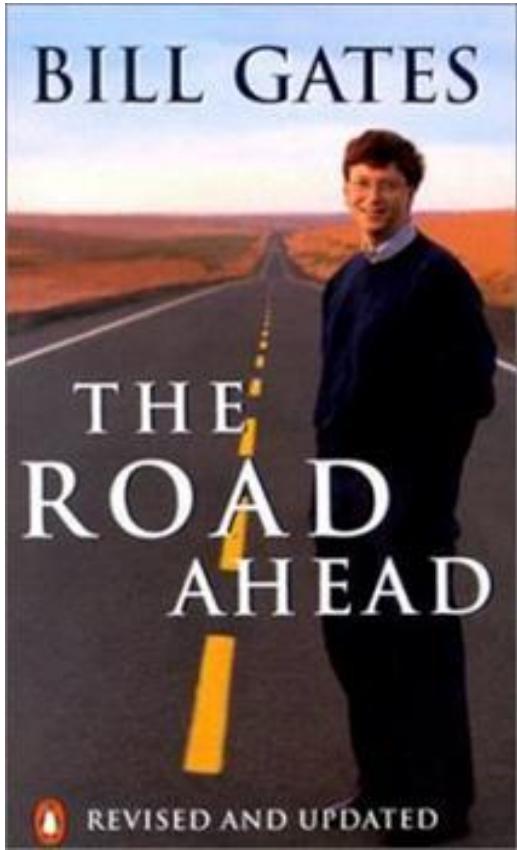
and Dangerous!

AI can become unethical and dangerous if it is trained and used for those purposes.



Deepfakes – Deep Nude

Last word...



But **we can no more imagine** what the information highway will carry in **twenty-five years** than a **Stone Age man using a crude knife** could have envisioned **Ghiberti's Baptistry doors in Florence**.

Only when the highway arrives will all its possibilities be understood.

However, the last twenty years of experience with digital breakthroughs allow us to understand some of the key principles and possibilities for the future.