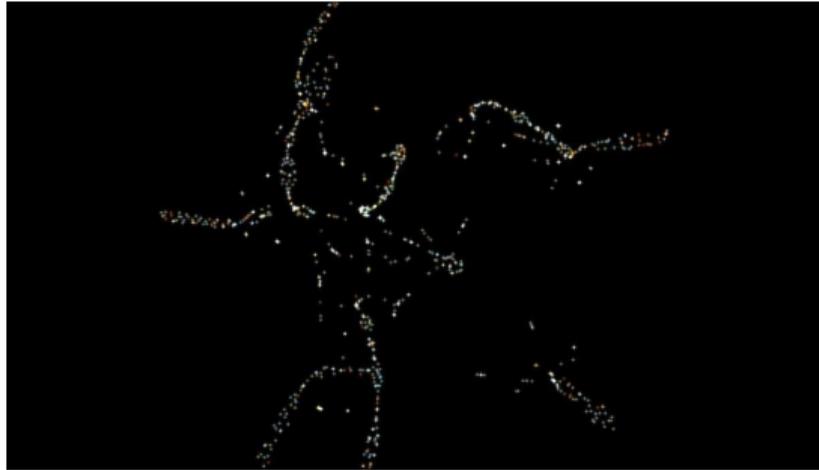


When Machines Program Machines

Sharing the Roadmap 2023



Prof. Dr. Jürgen Döllner

Hasso-Plattner-Institut, Digital Engineering Fakultät, Universität Potsdam

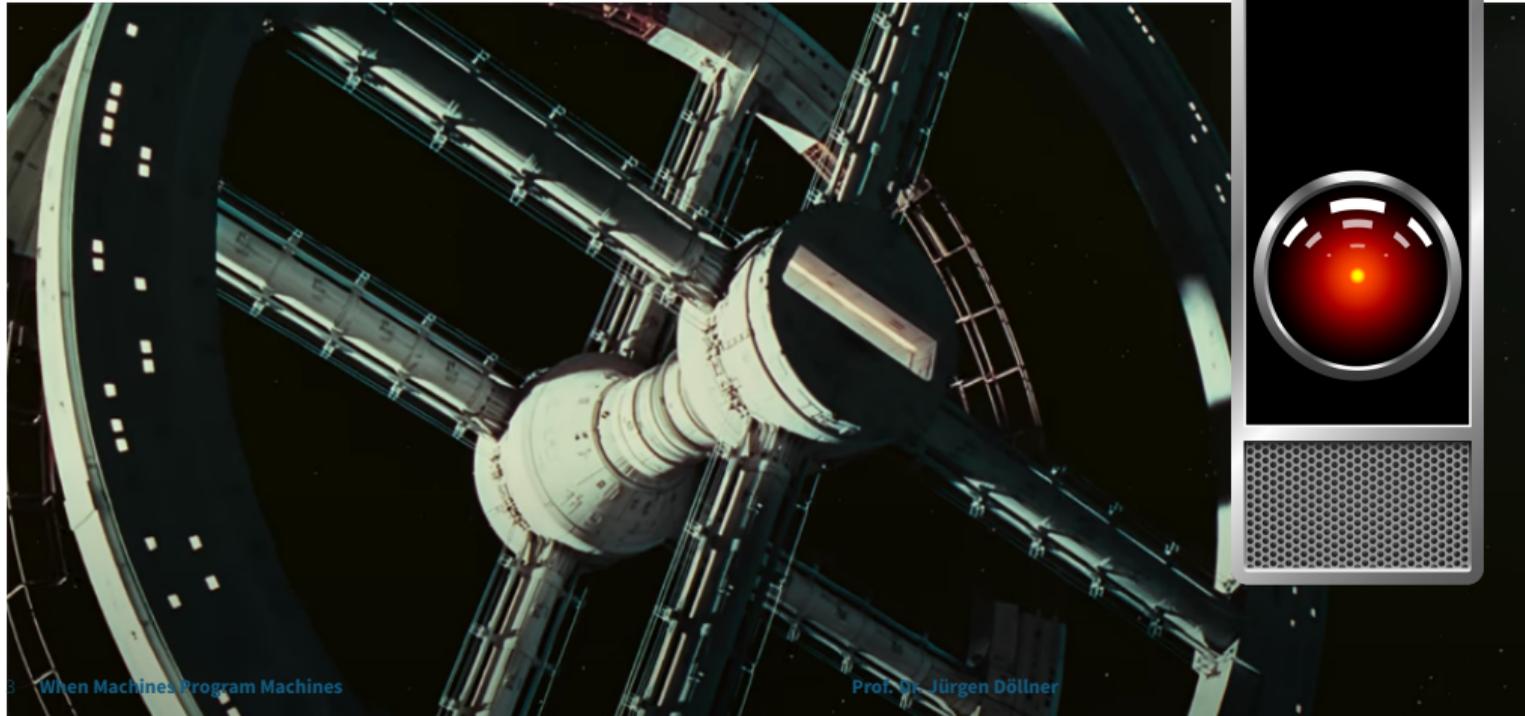
Anfänge der KI

- ELIZA, the first (impressive) chatbot
- Language-based simulation and interaction between patient and psychology robot
- Developed by Josef Weizenbaum (1966)
- *“What I had not realized is that extremely short exposures to a relatively simple computer program could induce powerful delusional thinking in quite normal people.”* (J. Weizenbaum, "Computer Power and Human Reasons", 1976)

```
ELIZA: Is something troubling you ?
YOU:  life is meaningless
ELIZA: Do you feel strongly about discussing such things ?
YOU:  everyone is born, grows and dies
ELIZA: Who, for example?
YOU:  you
ELIZA: You're not really talking about me -- are you ?
YOU:  me
ELIZA: That is interesting. Please continue.
YOU:  what is the purpose of sucess and happiness
ELIZA: Are such questions much on your mind ?
YOU:  all the time
ELIZA: Tell me more about that.
YOU:  why should i study
ELIZA: That's quite interesting.
YOU:  i cant take my knowledge with me
ELIZA: Is it important to you that your knowledge with you ?
YOU:  i cant take anything with me
ELIZA: Have you tried ?
YOU:  i'll have to die for that
ELIZA: Can you elaborate on that ?
YOU:  █
```

AI in Science Fiction

- HAL 9000: “Heuristically Programmed ALgorithmic Computer” in “2001: A Space Odyssey” (Stanley Kubrick, 1968)



AI in Everyday Life

- AI, starting as hype, converges in the perception of users to "ordinary" technology over time.
- AI is hardly or no longer perceived as "AI" as an everyday technology.
- Example: Autopilot in airplanes.

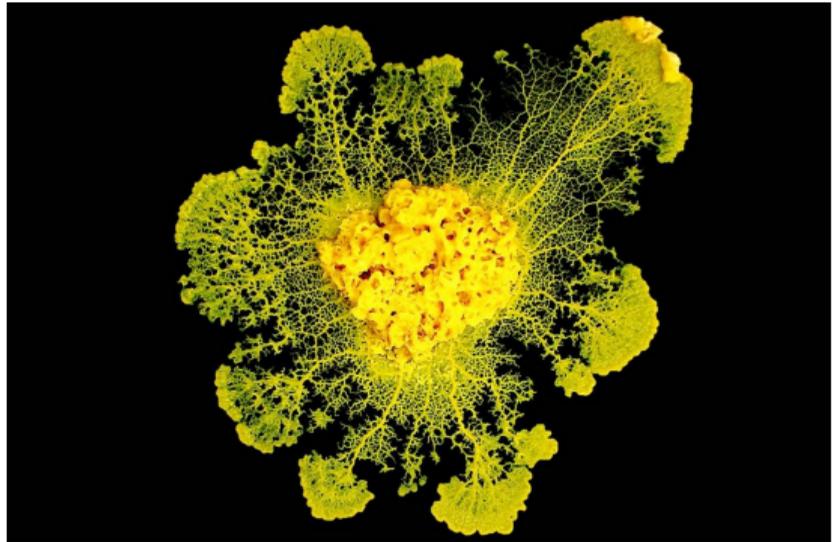


The Questionn of Defining Intelligence

AI is a fuzzily defined and inconsistently used term for a number of different concepts, methods, and procedures that reference aspects of intelligence as perceived by humans. Intelligence in general exhibits manifold facets, include a kind of "dark side".

Was ist *Intelligenz*?

- Human Intelligence
- Natural Intelligence
- Swarm Intelligence
- Machine Intelligence
- Artificial Intelligence
- ...



Physarum polycephalum (Slime Fungus)

AI for Software Engineering

“Artificial Intelligence (AI) is changing the way IT solutions are designed, built and operated, whereby AI is not being limited to specific application areas—it is currently finding its way into all industries.”

(HPI, AI Lab for IT Systems Engineering, 2019)

Approaches

- Big Data Management
- Sensor Technology
- Machine Learning
- Deep Learning
- Genetic Algorithms
- Functional Programming
- Quantum Computing
- Generative AI
- ...

AI for Software Engineering

Traditional Software Engineering

- Principles are human-centered, i.e. they derive from the ways and structures in which people think about systems and their implementation and how they organize them.
- Examples:
 - Object-Orientation
 - Software Development Methodologies
 - Software Development Cycles

AI for Software Engineering

From human-centric to machine-centric programming

- Humans translating human thoughts and processes into code
- Machines generating code based on objectives and constraints, not necessarily mirroring human thought processes
- Automating software testing, debugging, optimization
- AI-driven DevOps: Continuous integration and deployment powered by AI.

AI for Software Engineering

Selected Research Challenges

- Should AI use human-readable programming languages?
- Does AI even need higher level programming languages?
- What are AI-stable elements of software engineering?
- How do we deal with established stable operating systems and middleware?
- How do we keep humans in the software development process?
- How do we build robust boundary interfaces between generative and traditional code?
- How can we ensure traceability - at least analytically?

Vielen Dank!

- **Prof. Dr. Jürgen Döllner**
<https://hpi.de/doellner>
juergen.doellner@hpi.de

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des Deutschen Bundestages