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Introduction to Intelligent Systems

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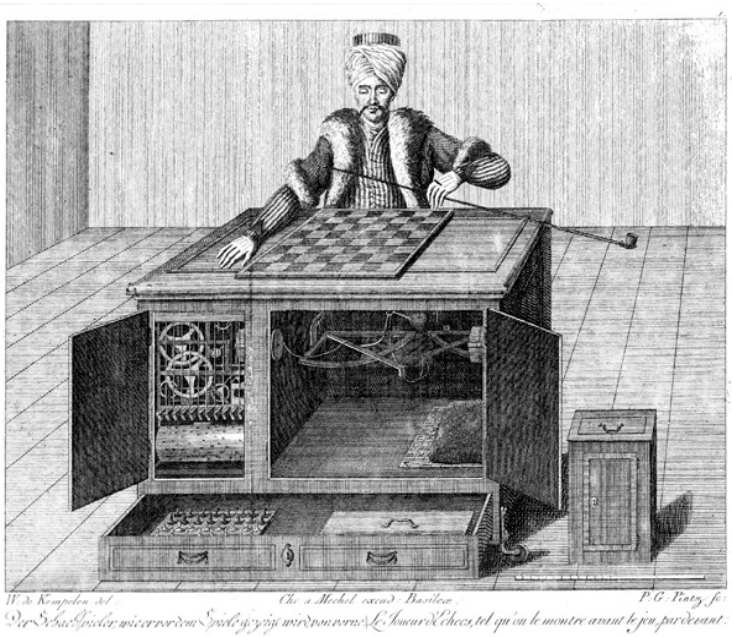
machine intelligence ?

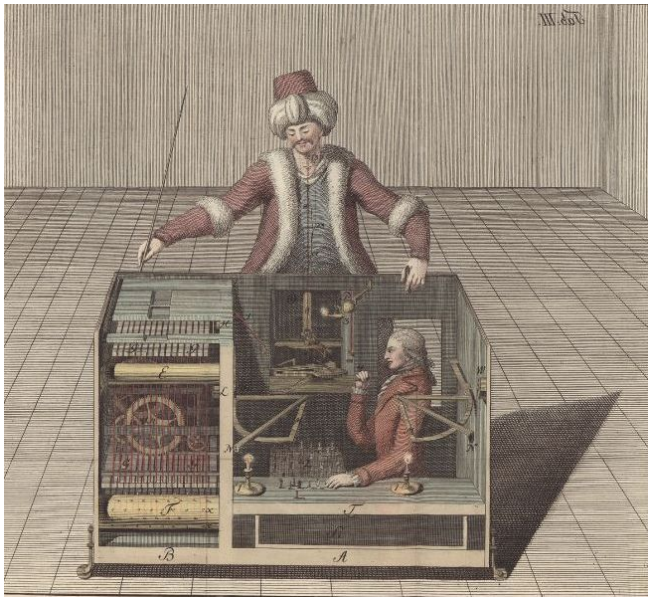
Can *machines* (automata, computers, programs) be intelligent ?

… think ?

"The automaton chess player" 1770 (–1854)



Source: Mary Hillier, *Automata and Mechanical Toys: An Illustrated History* (London: Jupiter Books, 1976)



Source: Wikipedia

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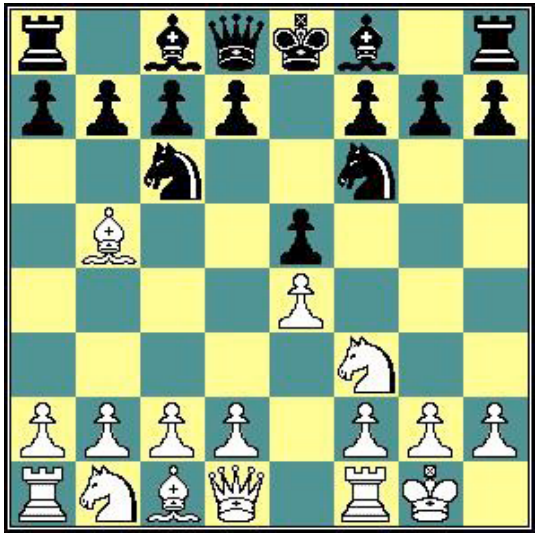
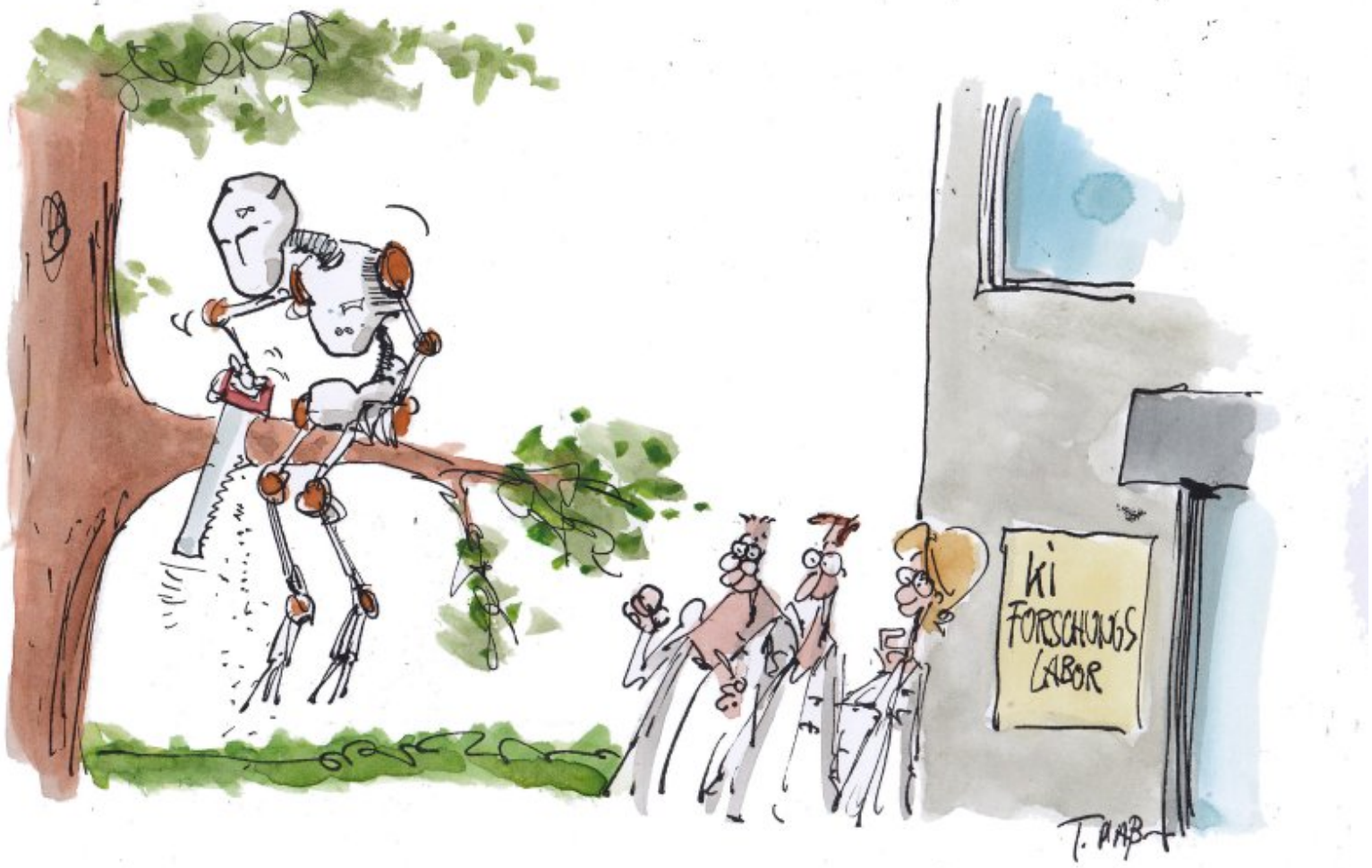


Computer chess

- Deep Blue beats Kasparov (May 1997)
- Matches expert level performance
- 'Thinks' differently from human expert …
  by examining ~ 200 million possible situations

real intelligence or *"just computation"* ???



Milestone! August 2021... Artificial Intelligence reaches human level

What is Intelligence ?

Wikipedia: Intelligence

… is an umbrella term used to describe a property of the mind that encompasses many related abilities, such as the capacities to reason , to plan, to solve problems, to think abstractly, to comprehend ideas, to use language, and to learn.

Some attempts to define intelligence:

Alfred Binet:
Judgment, otherwise called good sense, practical sense, initiative, the faculty of **adapting** to circumstances.

David Wechsler
The aggregate or global capacity of the individual to act **purposefully**, to think rationally, and to deal effectively with his **environment**

Cyril Burt
Innate general **cognitive ability**

Linda Gottfredson
The ability to deal with **cognitive complexity**

Sternberg & Salter
Goal-directed **adaptive behavior**

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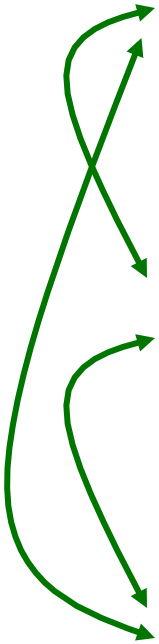
goal-directed adaptive behavior

Some aspects of **Intelligent Systems** in Computer Science



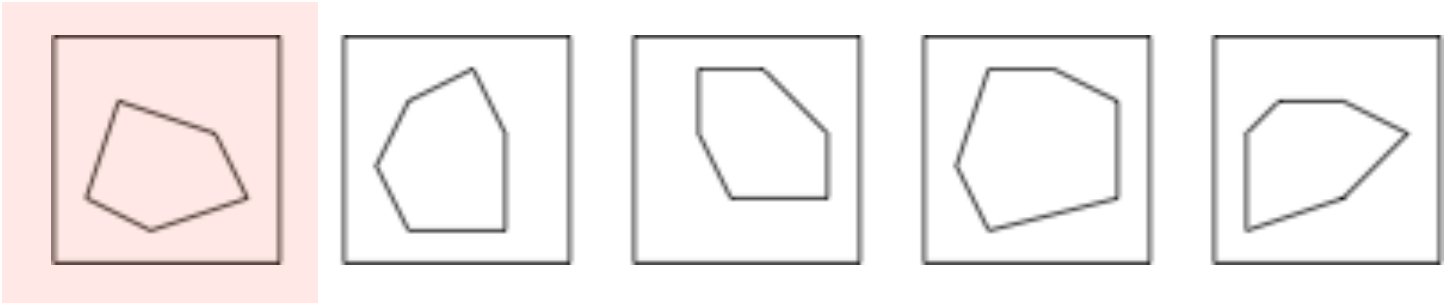
Perception:
interaction with environment requires cognitive processes,
e.g. computer **vision**, speech **recognition**, motion **detection,**
scene **analysis,** object **classification**

Decision making:
processing of incoming information, **analysis** of a situation,
selection of possible **actions** in order to achieve a **goal**,
e.g. path finding, sorting of objects

Learning:
data driven **adaptation** of the system based on **observations** only
(*unsupervised)* or together with **feed-back** from the environment
(supervised), e.g. **classification, clustering, regression**

an actual IQ test problem

Which figure does not belong to the group ?



a) b) c) d) e)

Perception: "polygons!"

Feature selection: "count number of edges"

Sorting/clustering: "group objects according to number of edges"

Decision/Action: "(a) is different from the others"

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intelligent systems group

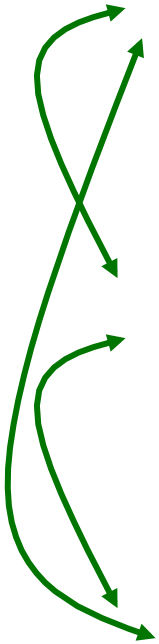
currently ca. 12 PhD students
staff members:

Kerstin Bunte

Michael Wilkinson

Michael Biehl

Nicolai Petkov



Computer Vision/ Image Processing
processing of image (or video) data
object recognition, scene analysis, etc.

Pattern Recognition:
search for characteristic features in data
choice of actions based on the observations

Machine Learning
adapt properties of a system based on observations and feed-back
in order to achieve/maintain desired performance

more buzz-words related to intelligent systems