
# Künstlich Intelligent?

Stefan Igel, Matthias Richter

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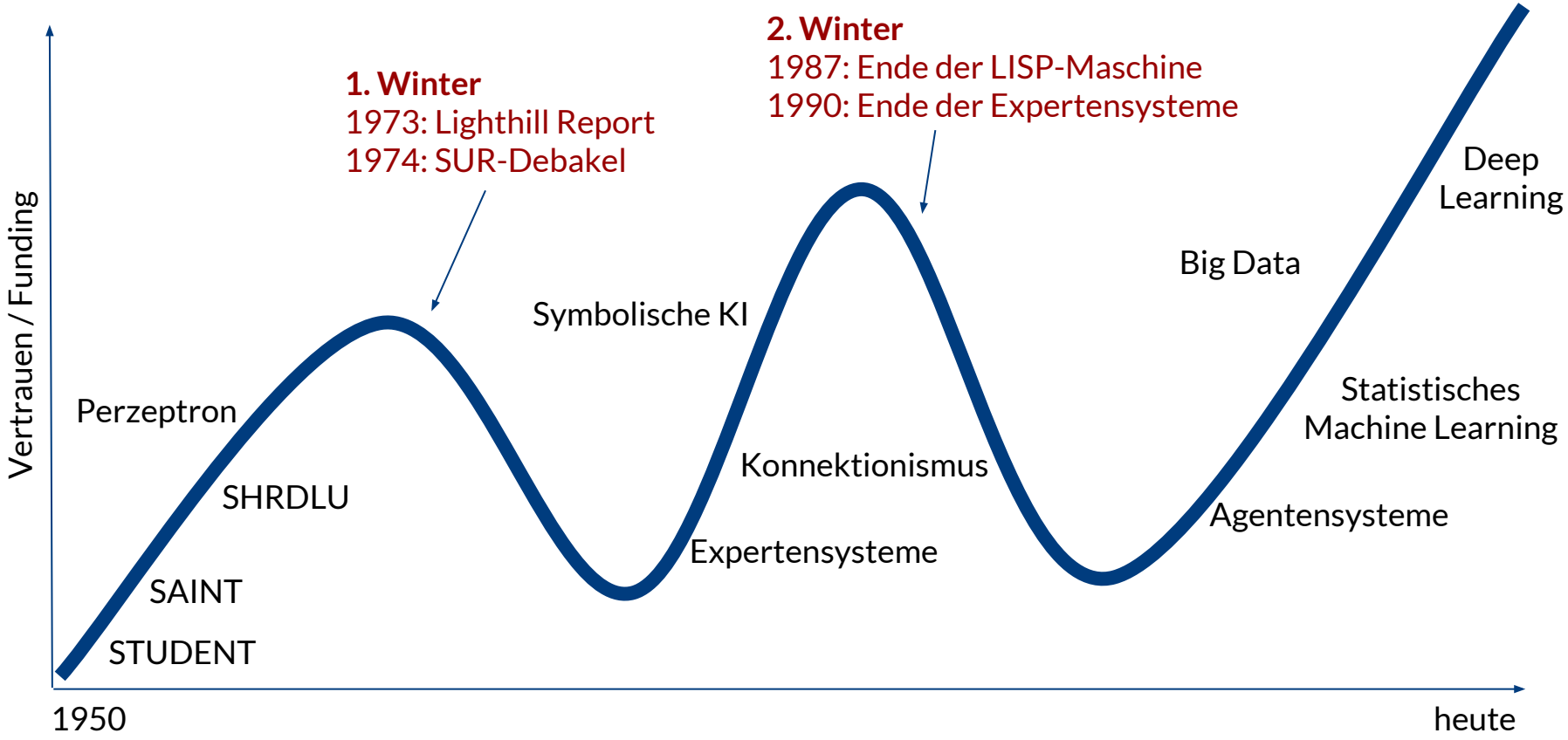
# Die Jahreszeiten der KI



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# Was ist künstliche Intelligenz?

# Künstliche Intelligenz im Film




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# Deep Blue vs. Garri Kasparov (1997)


Quelle: Pedro Villavicencio via flickr

Quelle: S.M.S.I., Inc. - Owen Williams, The Kasparov Agency



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# Deep Blue vs. Garri Kasparov (1997)


„nur Brute Force"

Quelle: Pedro Villavicencio via flickr

Quelle: S.M.S.I., Inc. - Owen Williams, The Kasparov Agency



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# IBM Watson vs. Ken Jennings, Brad Rutter (2011)


Quelle: Atomic Taco via Wikimedia



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# IBM Watson vs. Ken Jennings, Brad Rutter (2011)


„nur eine Datenbank"

Quelle: Atomic Taco via Wikimedia



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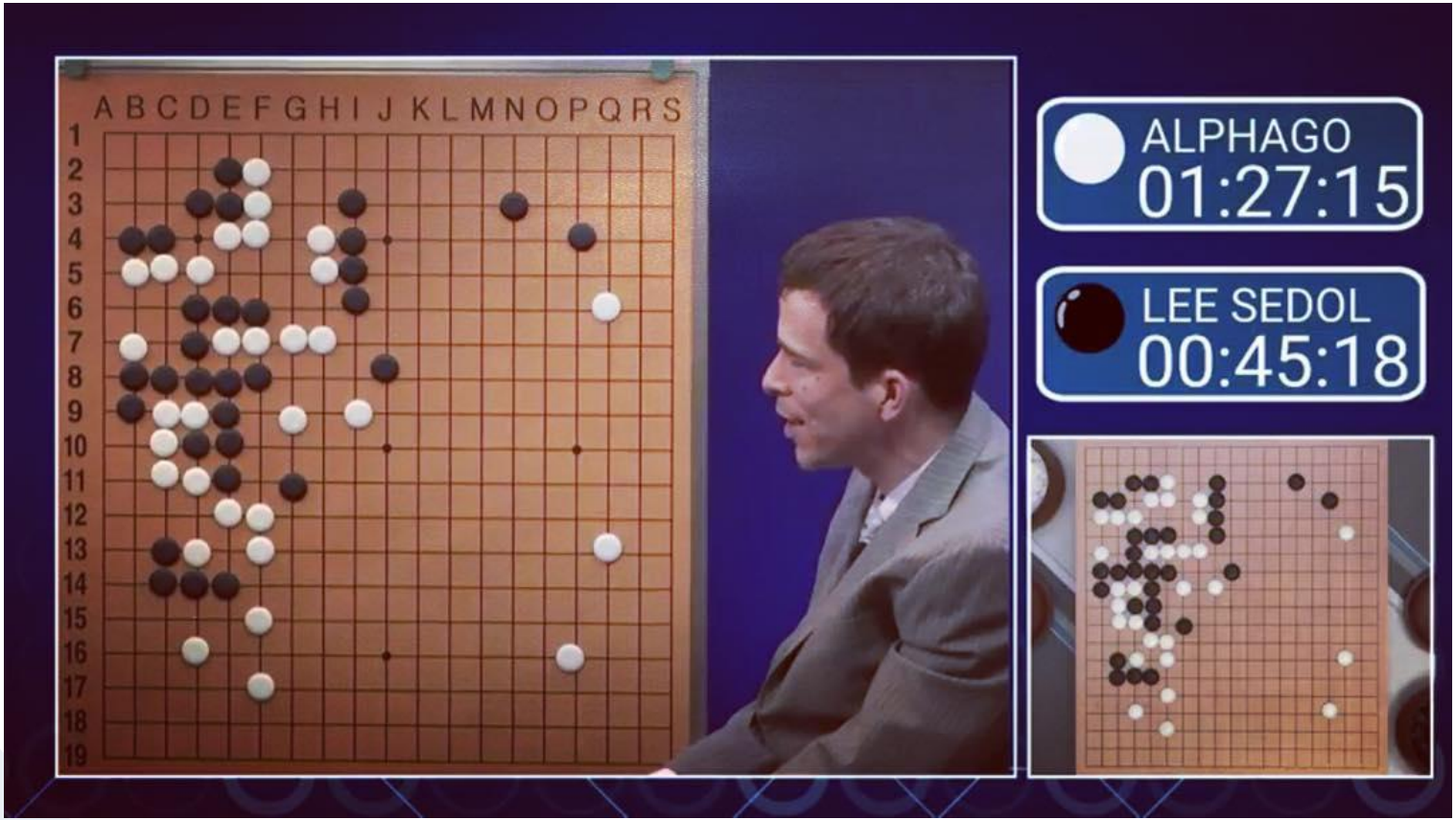
# Alpha Go vs. Lee Sedol (2016)




Quelle: Buster Benson via flickr



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# Alpha Go vs. Lee Sedol (2016)


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# Alpha Go vs. Lee Sedol (2016)


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# Alpha Go vs. Lee Sedol (2016)


Quelle: Buster Benson via flickr



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# MENACE (1960)

## Machine Educable Noughts And Crosses Engine

**Experiments on the mechanization of game-learning**
**Part I. Characterization of the model and its parameters**

*By* Donald Michie

**This paper describes a trial-and-error device which learns to play the game of Noughts and Crosses. It was initially constructed from matchboxes and coloured beads and subsequently simulated in essentials by a program for a Pegasus 2 computer. The parameters governing the adaptive behaviour of this automaton are described and preliminary observations on its performance are briefly reported.**

# MENACE (1960)

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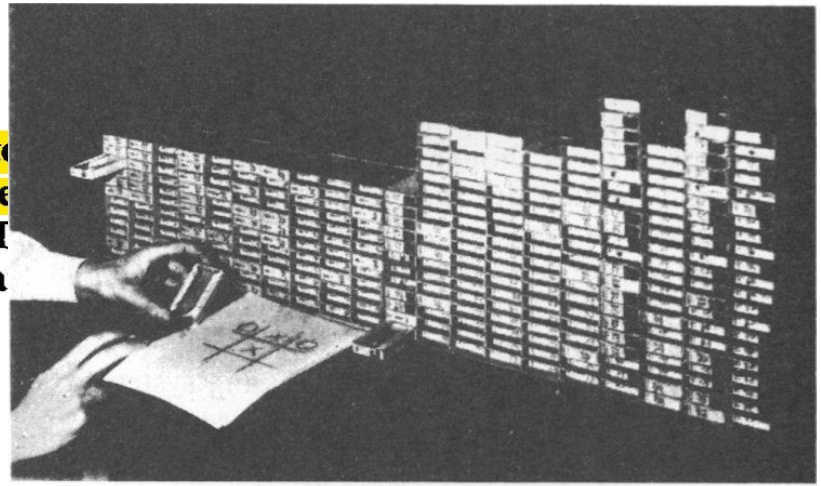

**Fig. 2.—The matchbox machine—MENACE**

# MENACE (1960)

## Machine Educable Noughts And Crosses Engine

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**es T**
**be ina**
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Matt Parker – MENACE: the pile of matchboxes which can learn

https://youtu.be/R9c-_neaxeU

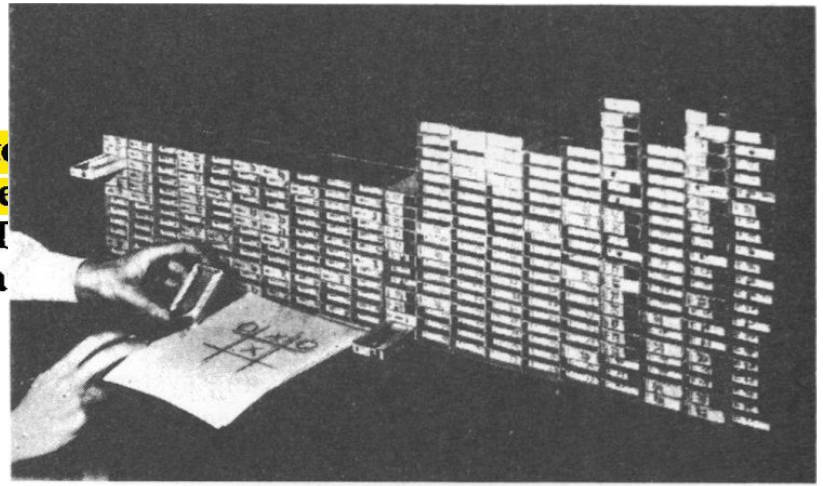

**Fig. 2.—The matchbox machine—MENACE**



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# Was ist ~~künstliche~~ Intelligenz?

# Definitionen von KI

## Dimensionen

Was? Denken vs. Handeln

Wie? Menschlich vs. Rational

| | |
|---|---|
| Menschlich Denkend | Rational Denkend |
| Menschlich Handelnd | Rational Handelnd |



Quelle: Artificial Intelligence - A Modern Approach (Norvig & Russell 2003)

# Definitionen von KI

## Menschlich Handelnd

"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 and Knight, 1991)



Quelle: Artificial Intelligence - A Modern Approach (Norvig & Russell 2003)

# Definitionen von KI

## Menschlich Handelnd

“The art o ons that require in
(Kurzweil, 19

“The stud which, at the mome
(Rich and Knight, 1991)

The Turing Test approach



Quelle: Artificial Intelligence - A Modern Approach (Norvig & Russell 2003)

# Definitionen von KI

## Menschlich Denkend

"The exciting new effort to make computers think . . . *machines with minds*, in the full and literal sense."
(Haugeland, 1985)

"[The automation of] activities that we associate with human thinking, activities such as decision-making, problem solving, learning . . ."
(Bellman, 1978)



Quelle: Artificial Intelligence - A Modern Approach (Norvig & Russell 2003)

# Definitionen von KI

## Menschlich Denkend

"The excit . . .
*machines*
(Haugeland,

"[The aut ith
human th g, problem
solving, learning . . ."
(Bellman, 1978)

The cognitive modeling approach



Quelle: Artificial Intelligence - A Modern Approach (Norvig & Russell 2003)

# Definitionen von KI

## Rational Denkend

"The study of mental faculties through the use of computational models."
(Charniak and McDermott, 1985)

"The study of the computations that make it possible to perceive, reason, and act."
(Winston, 1992)



Quelle: Artificial Intelligence - A Modern Approach (Norvig & Russell 2003)

# Definitionen von KI

## Rational Denkend

"The study
computat
(Charniak an

"The stud
perceive,
(Winston, 1992)

ble to

The "laws of thought" approach



Quelle: Artificial Intelligence - A Modern Approach (Norvig & Russell 2003)

# Definitionen von KI

## Rational HandeInd

"Computational Intelligence is the study of the design of intelligent agents."
(Poole *et al.*, 1998)

"AI … is concerned with intelligent behavior in artifacts."
(Nilsson, 1998)



Quelle: Artificial Intelligence - A Modern Approach (Norvig & Russell 2003)

# Definitionen von KI

## Rational HandeInd

“Computa sign of intelligen
(Poole *et al.*,

“AI … is co facts.”
(Nilsson, 199

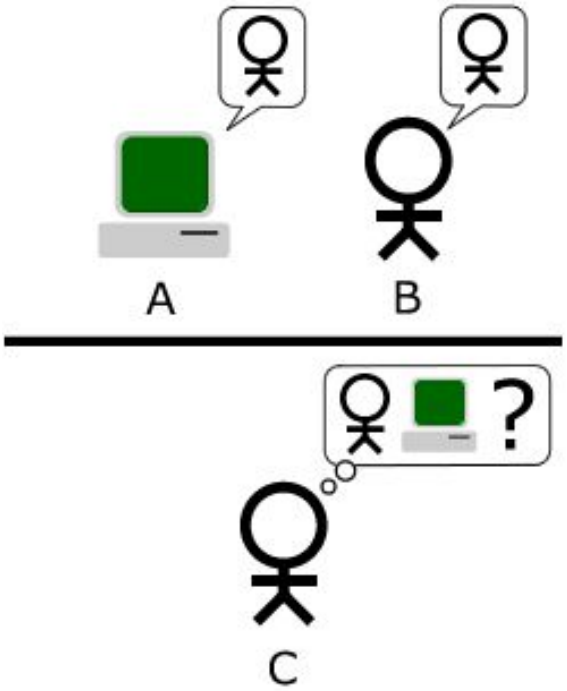
The rational agent approach



Quelle: Artificial Intelligence - A Modern Approach (Norvig & Russell 2003)

# Der Werkzeugkasten der KI

# Der Turing Test



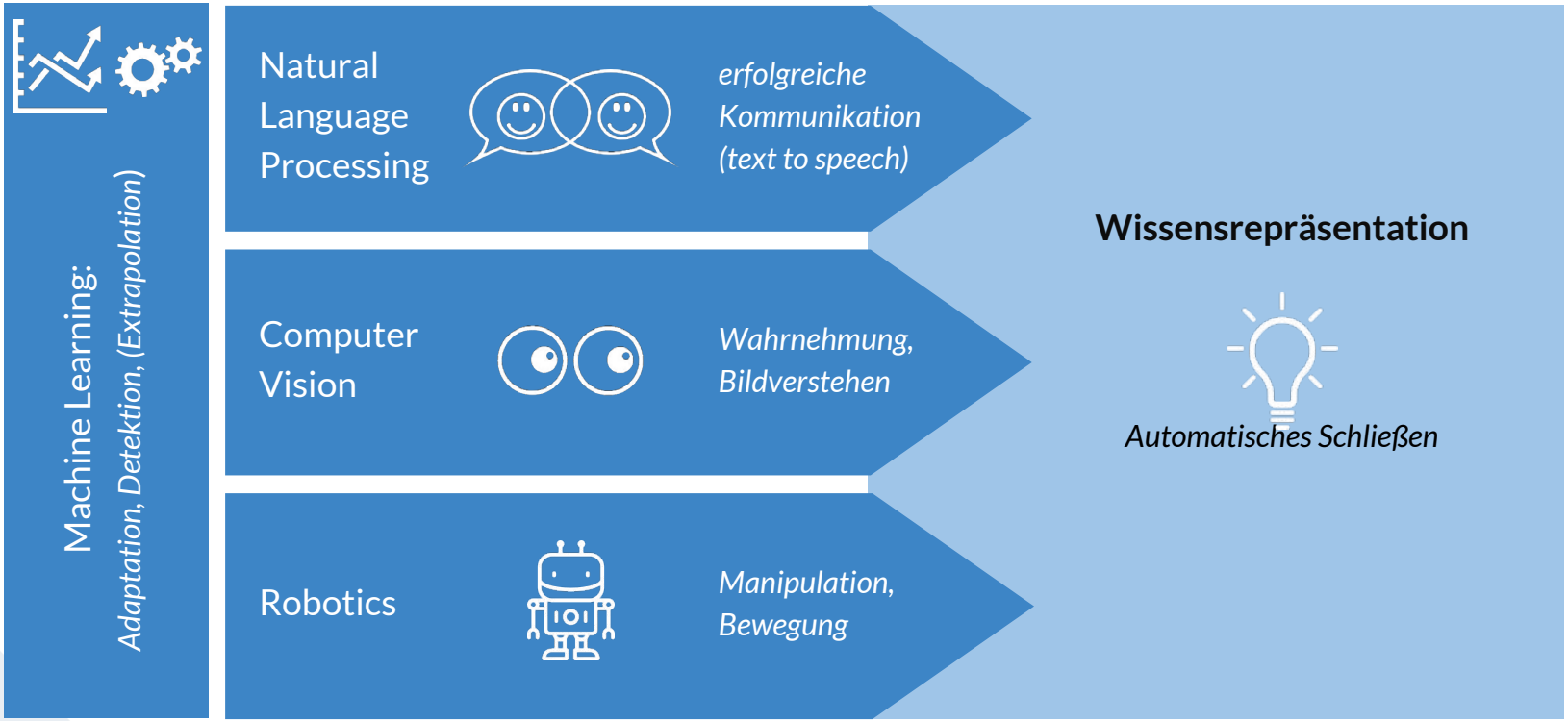

**einfacher Turing Test**

- kommunizieren
- Wissen speichern
- antworten und schlussfolgern
- adaptieren und extrapolieren

**totaler Turing Test**

- Objekte erkennen
- Objekte manipulieren und bewegen

# Teilbereiche der Künstlichen Intelligenz



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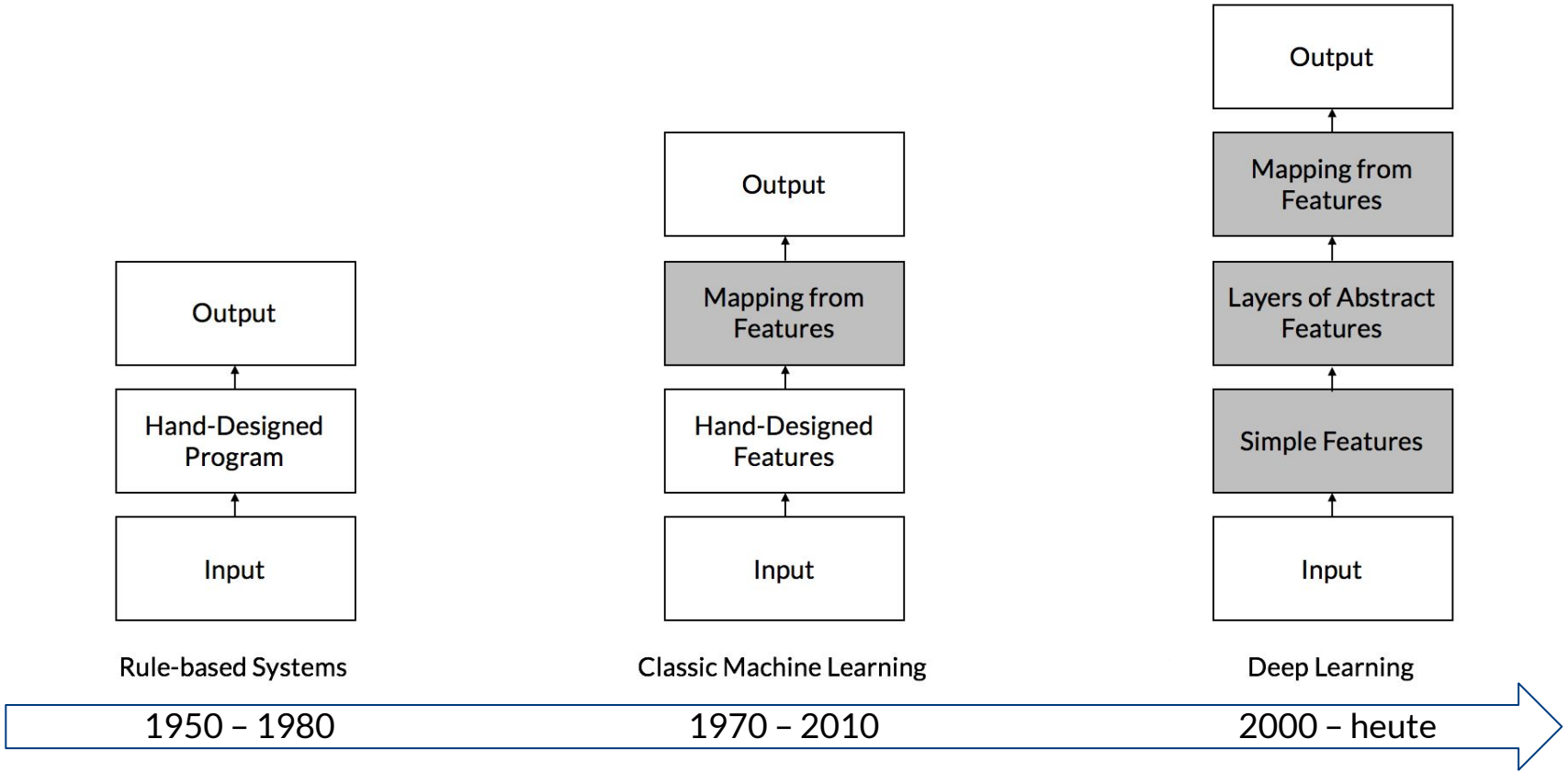
# Umsetzung von KI-Fähigkeiten



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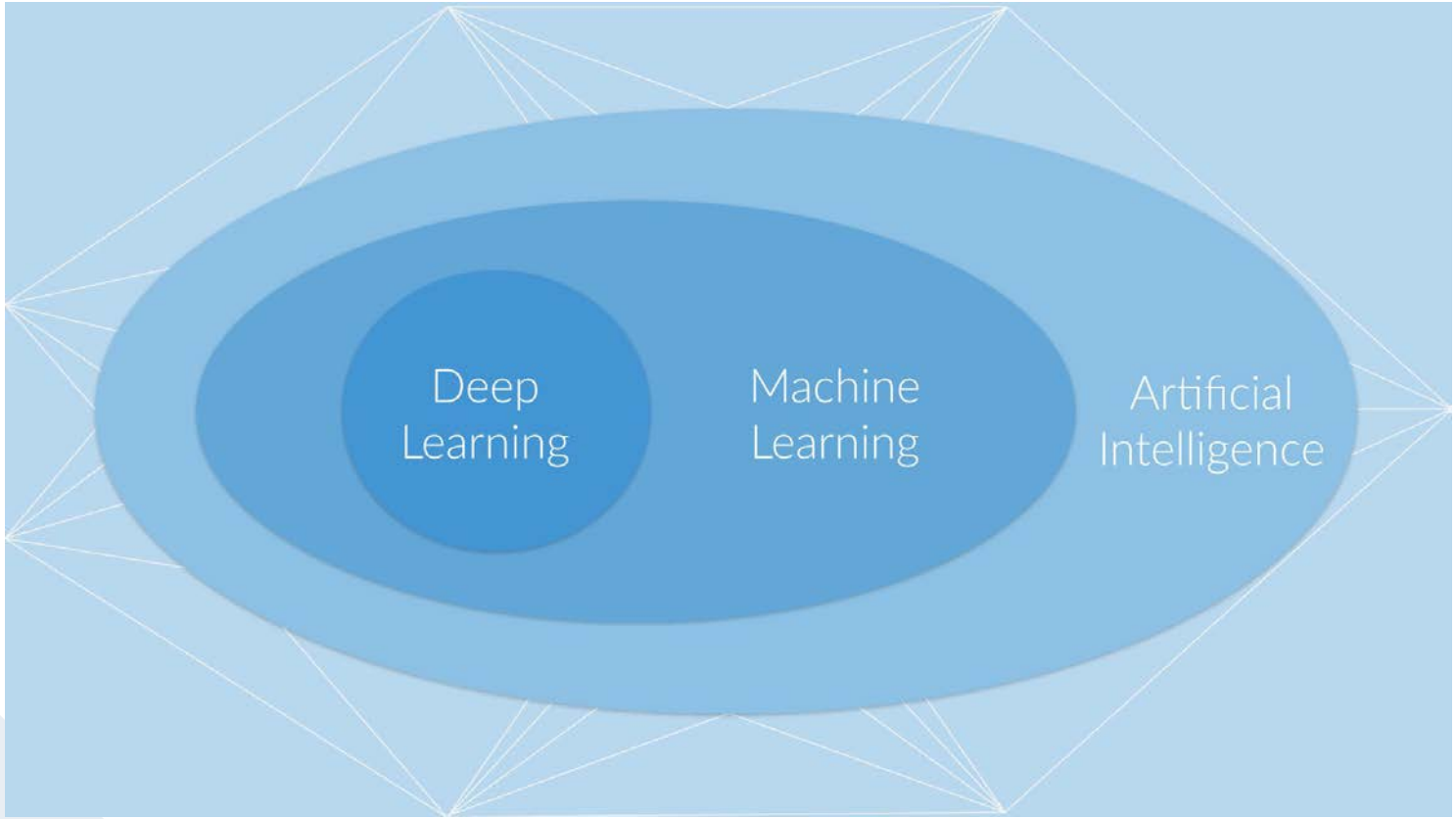
# Künstliche Intelligenz = Deep Learning?



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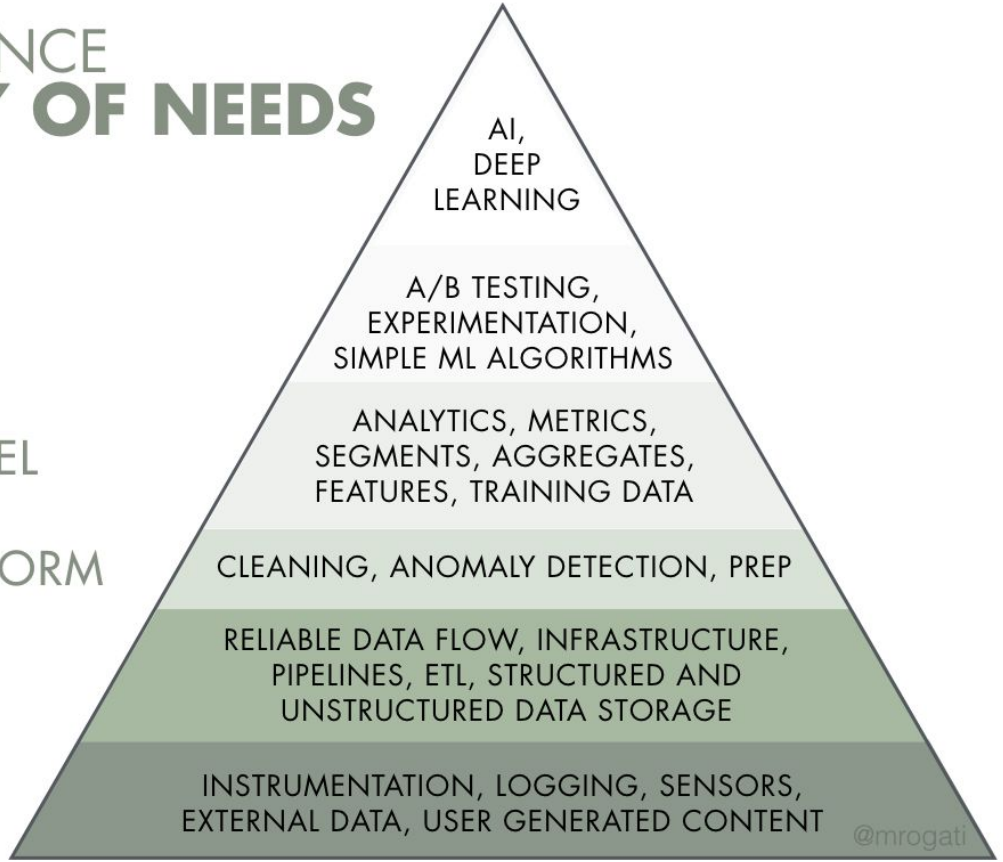
# THE DATA SCIENCE HIERARCHY OF NEEDS




LEARN/OPTIMIZE

AGGREGATE/LABEL

EXPLORE/TRANSFORM

MOVE/STORE

COLLECT

https://hackernoon.com/the-ai-hierarchy-of-needs-18f111fcc007

https://www.digitalsource.io/data-engineer-vs-data-scientist

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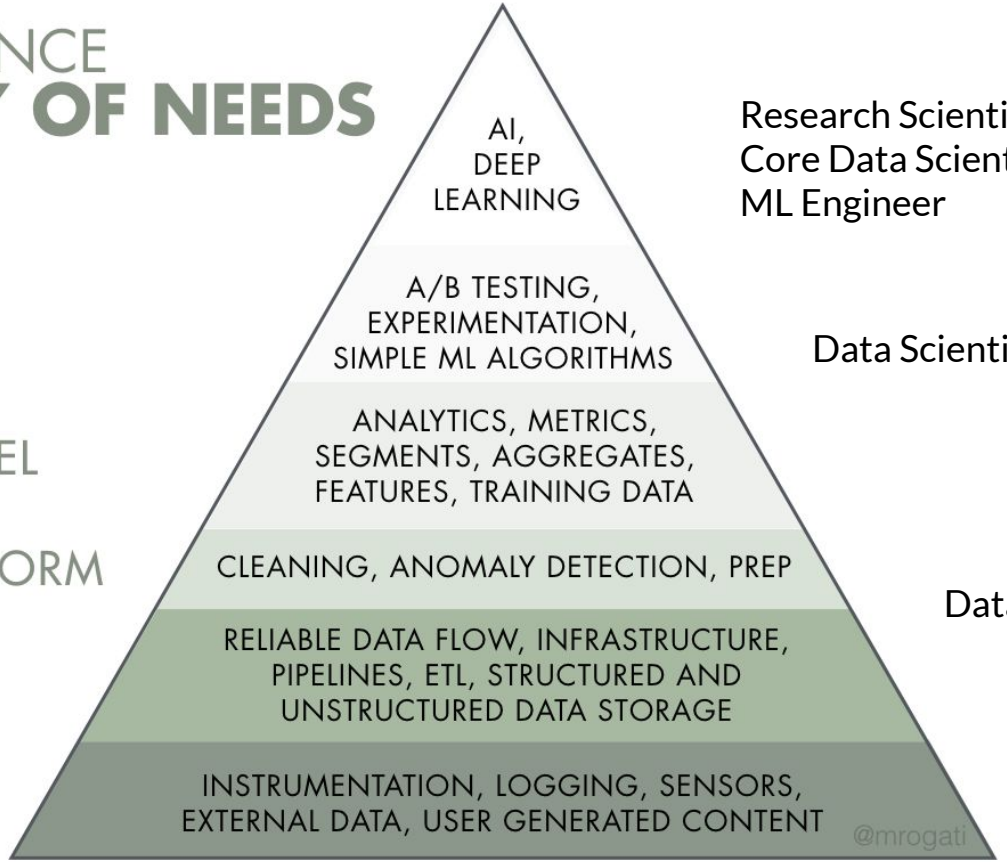


LEARN/OPTIMIZE

AGGREGATE/LABEL

EXPLORE/TRANSFORM

MOVE/STORE

COLLECT

Research Scientist
Core Data Scientist
ML Engineer

Data Scientist / Analyst

Data Engineer

Software Developer

https://hackernoon.com/the-ai-hierarchy-of-needs-18f111fcc007
https://www.digitalsource.io/data-engineer-vs-data-scientist



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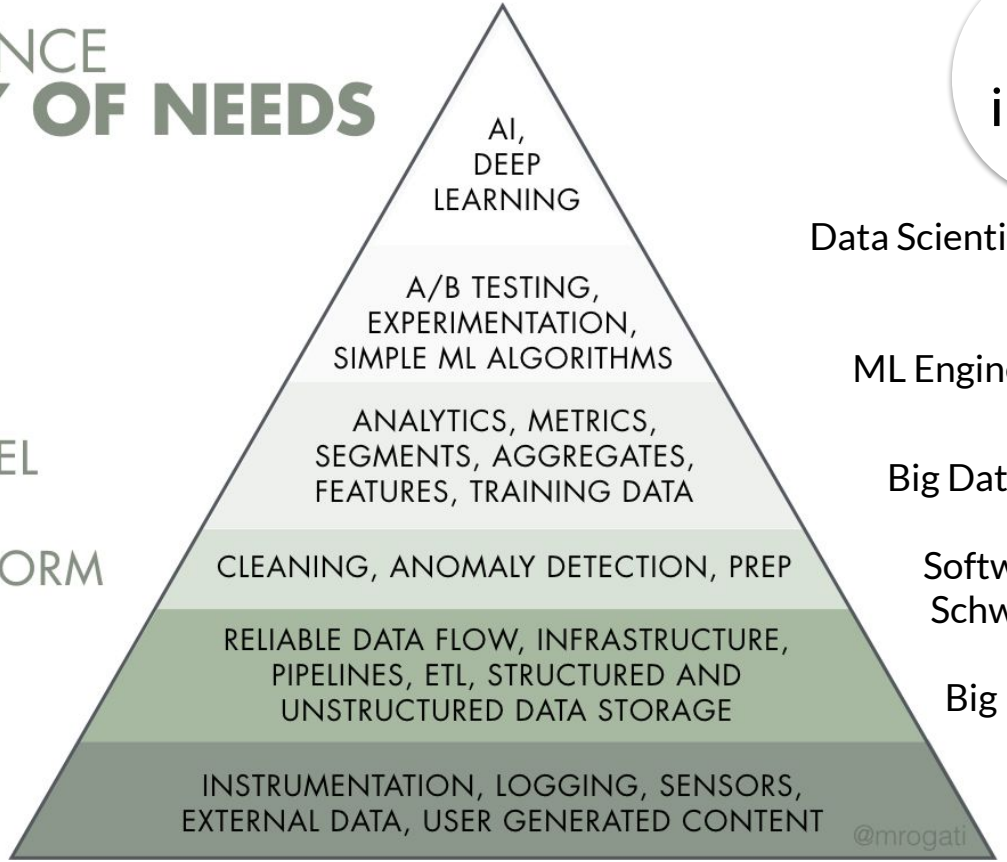


LEARN/OPTIMIZE

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COLLECT

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Data Scientist

ML Engineer

Big Data Engineer

Software Entwickler mit Schwerpunkt Big Data

Big Data Systems Engineer



https://hackernoon.com/the-ai-hierarchy-of-needs-18f111fcc007

# Künstliche Intelligenz am Beispiel

mehr unter https://www.inovex.de/blog/category/analytics/

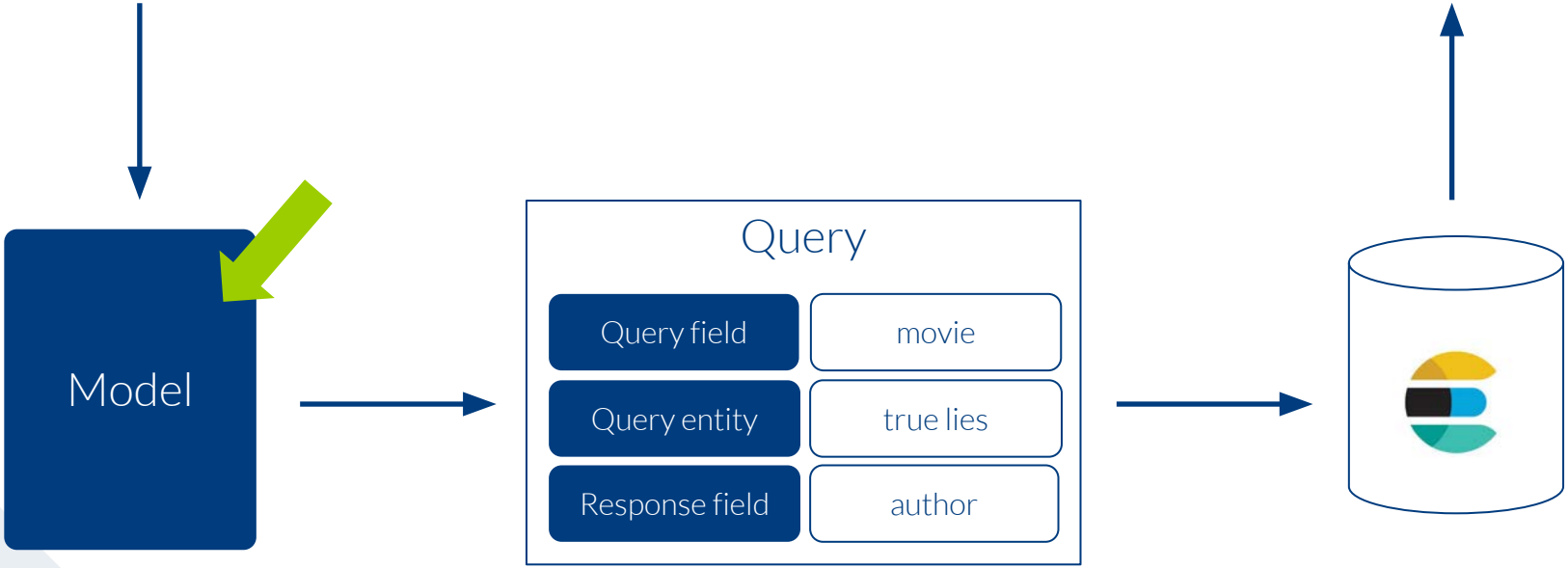
# State-of-the-Art in NLP

| mostly solved | making good progress | still really hard |
| --- | --- | --- |
| Spam detection | Sentiment Analysis | Question Answering (QE) |
| Part-of-speech (POS) tagging | Coreference resolution | Dialog |
| Named entity recognition (NER) | Word sense disambiguation (WSD) | Summarization |
| | Parsing | Paraphrase |
| | Machine Translation | |
| | Information extraction | |
| | Topic models | |

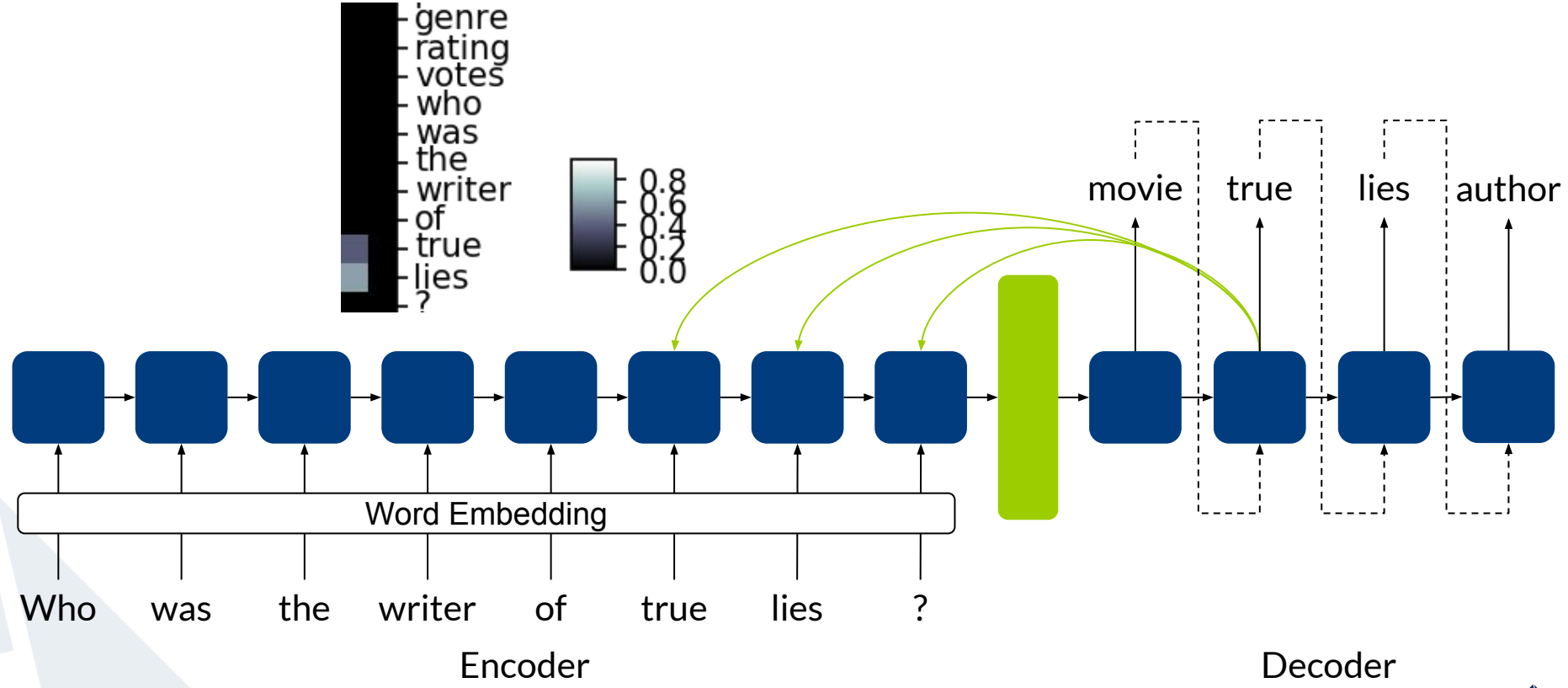
# NLP in Action: What do you want to know?

› Who was the writer of **True Lies**?

› James Cameron



# NLP in Action: What do you want to know?



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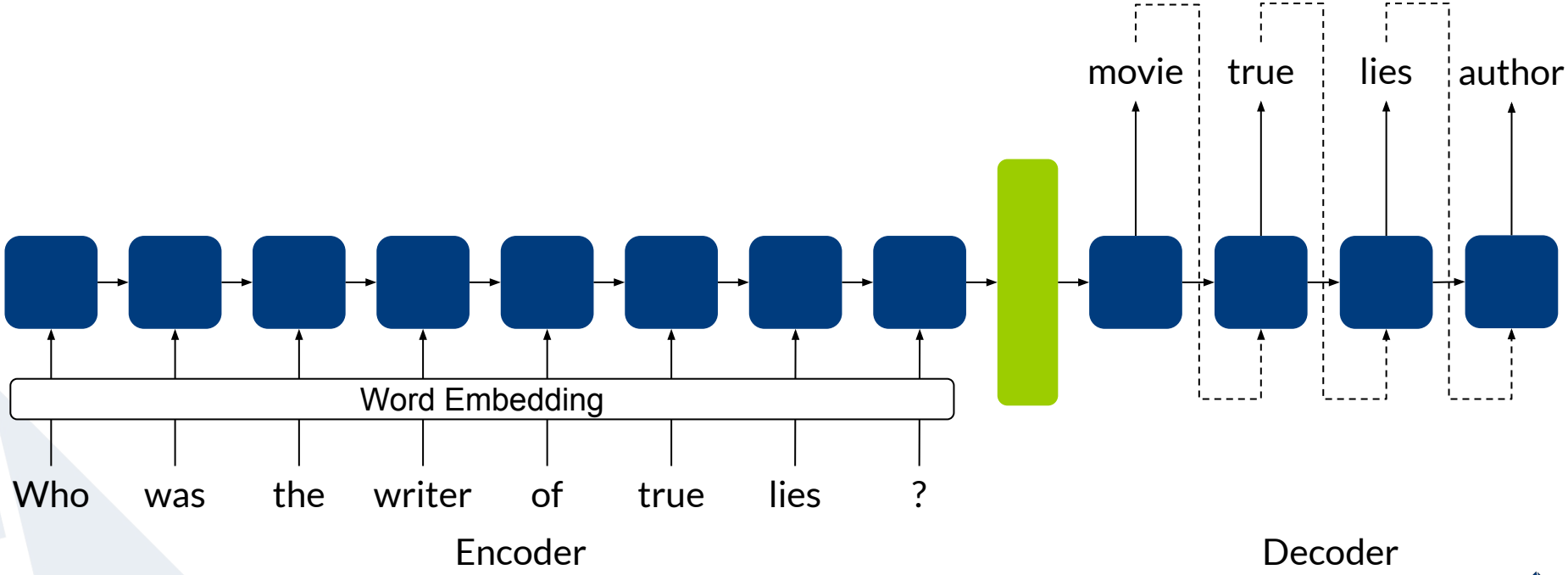
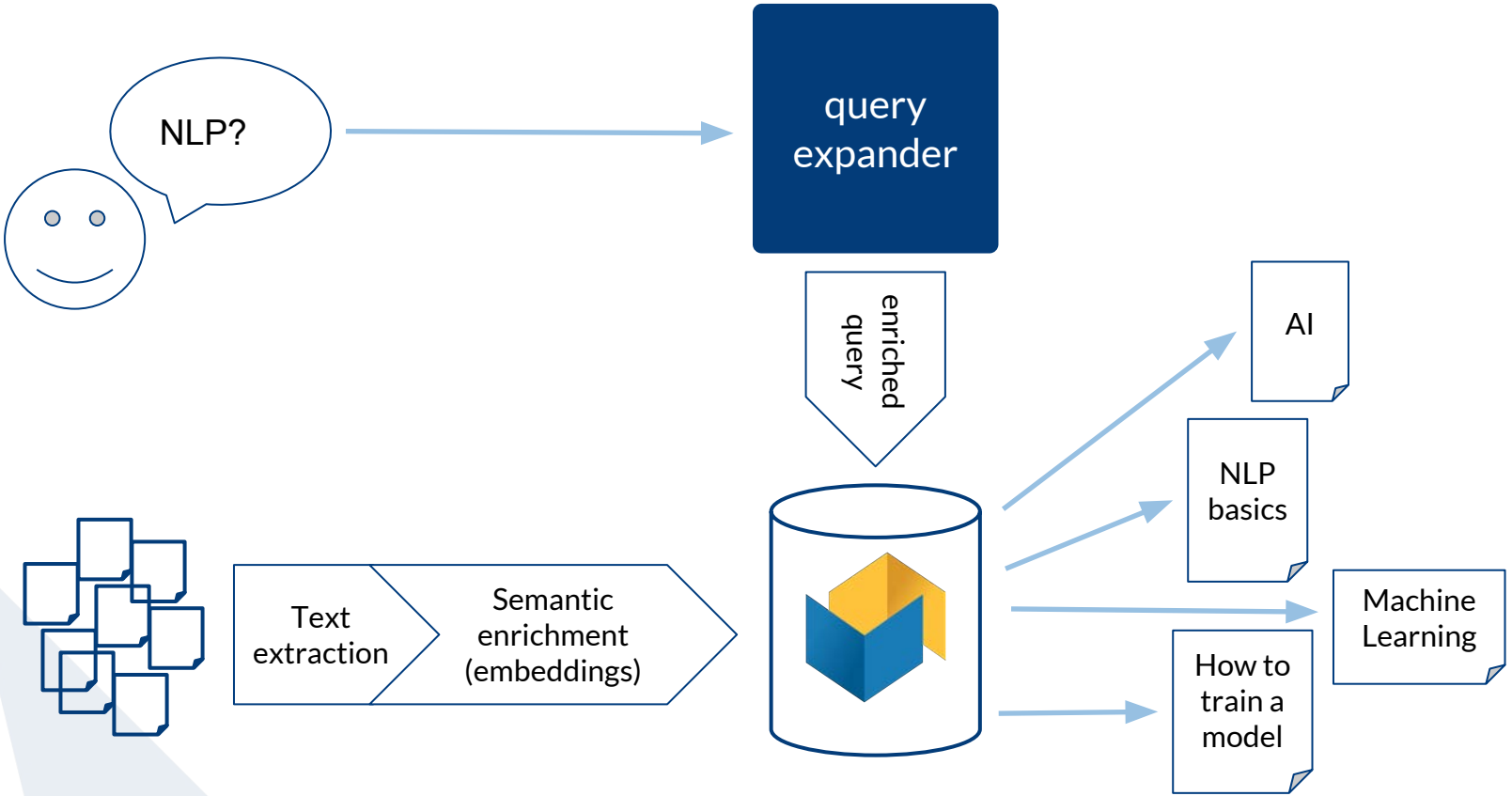
# NLP in Action: What do you want to know?



# NLP in Action: Give me similar things!



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# NLP in Action: Give me similar things!

**Word Embeddings**

Model semantic content (Word2Vec)

**Query Expansion**

Capture what user really *means*

**Preprocessing**

Process and enrich huge amounts of documents

**Data Exploration**

Classification (multinomial Bayes, SVM, LSTM + Attention)

Topic Modeling (LDA)

Named Entity Recognition (CRFs)





# State-of-the-Art in CV

| mostly solved | making good progress | still really hard |
|---|---|---|
| Object Detection | Object Detection | Object Detection |
| Small-set Recognition / Matching | Content-based retrieval | Action Recognition |
| Pose Estimation (rigid bodies) | Pose Estimation (non-rigid) | Scene Understanding |
| Object Tracking | Object Categorization | Viewpoint Transfer |
| | Image Restoration/Inpainting | Domain Transfer |
| | Segmentation/Semantic Labeling | Object Hierarchies |
| | 3D-Reconstruction | Novelty Detection |

# CV in Action: Image Augmentation

## Grow a temporary moustache


other uses

- Recognize identity
- Estimate age, drowsiness, expression, …

- Extract shape and pose
- Estimate attention and gaze direction



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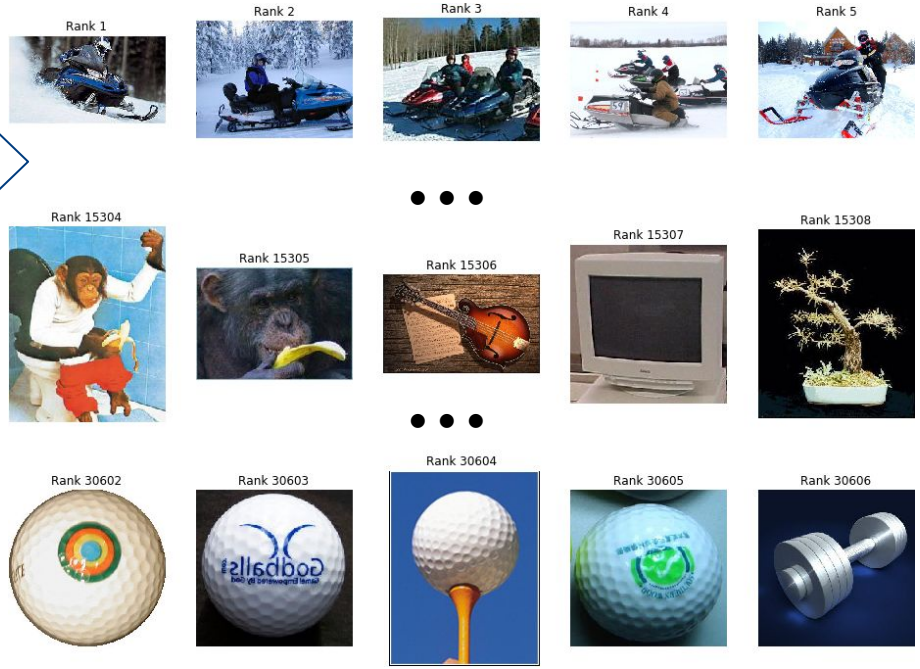
# CV in Action: Image Retrieval

Query Image

CNN Features

Similarity Measure

Database ranked according to similarity




learned from

Database

CNN Features



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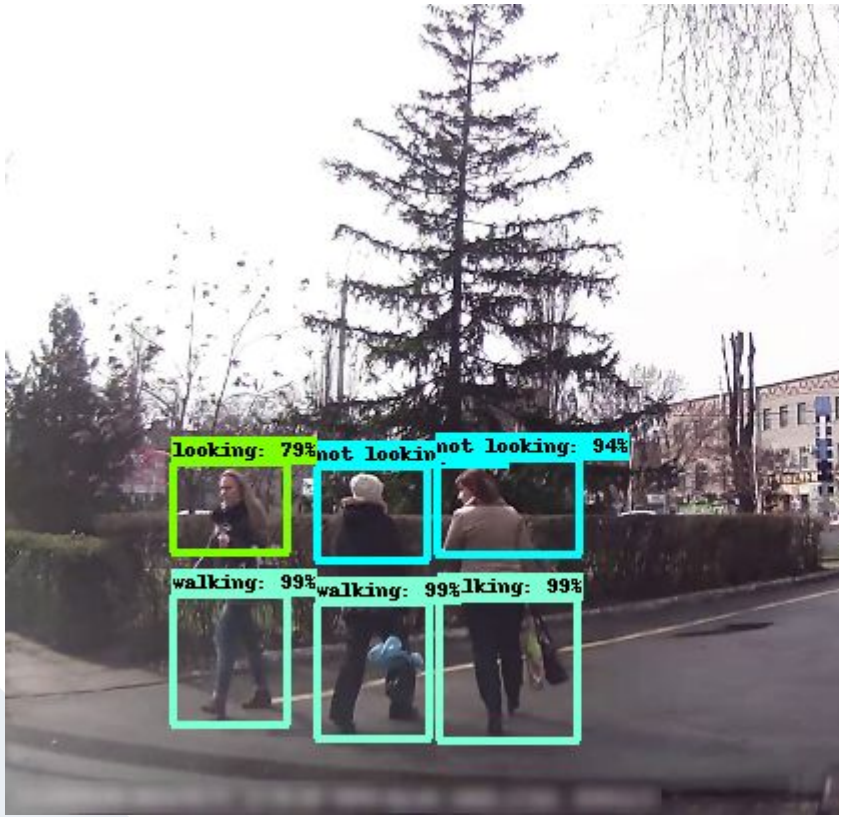
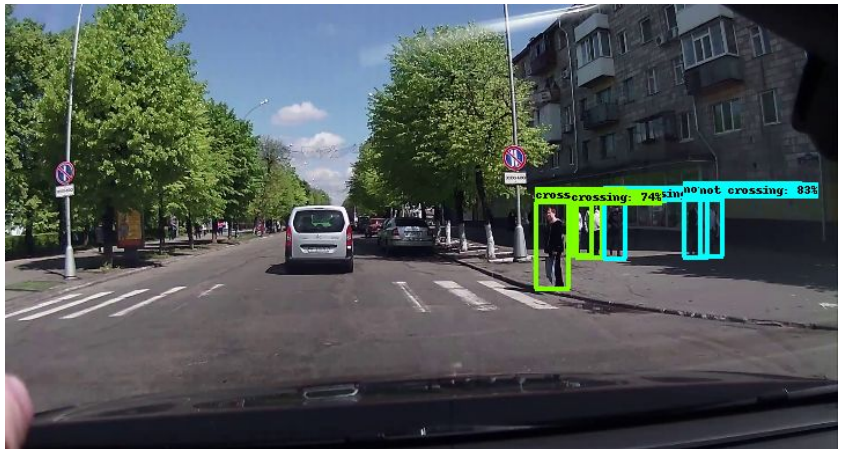
# CV in Action: Pedestrian Crossing Intention







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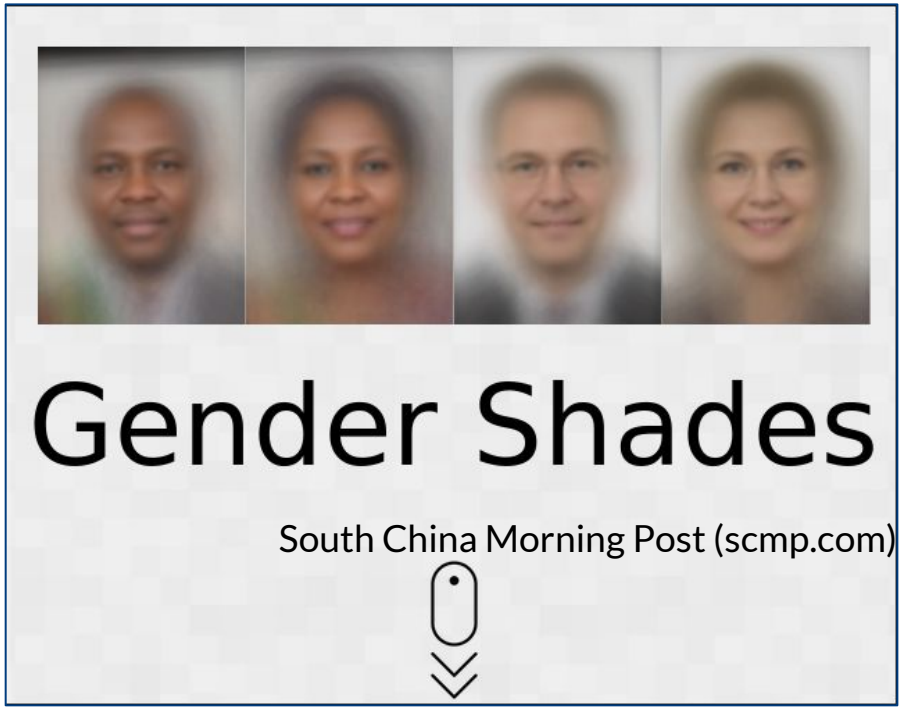
# Datenqualität bestimmt Modellqualität


http://gendershades.org/



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# Datenqualität bestimmt Modellqualität


Society

**Chinese woman offered refund after facial recognition allows colleague to unlock iPhone X**

Zhuang Pinghui
Updated: Friday, 20 Apr, 2018 2:25pm

South China Morning Post (scmp.com)

http://gendershades.org/



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# Datenqualität bestimmt Modellqualität

## Panzerabwehrhund

Ein **Panzerabwehrhund**, auch bekannt als *Minenhund* oder *Hundemine*, war ein mit Sprengstoff beladener Hund, der dazu ausgebildet wurde, unter feindliche Panzer zu laufen. Auf der Oberseite der umgeschnallten Sprengvorrichtung befand sich ein Knickzünder, der die Ladung zur Detonation brachte.

Ausbildung sowjetischer Militärhunde (1931)

Panzerabwehrhunde wurden von der Roten Armee während des Zweiten Weltkrieges ausgebildet, um Panzer der Wehrmacht zu bekämpfen. Sie wurden trainiert, unter einen Panzer zu kriechen, indem Nahrung unter einen Panzer gelegt wurde. Die Panzer sahen aus der Hundeperspektive aber in der Regel alle gleich aus; außerdem rochen die sowjetischen Panzer durch ihre Öle und Fette anders als die deutschen: So ergab sich das Problem, dass während einer Schlacht häufiger die eigenen Panzer, auf welche die Panzerabwehrhunde zuvor im Training konditioniert worden waren, und seltener die der Deutschen von den Hunden angelaufen wurden.[1] Zudem waren die Panzerabwehrhunde zu ängstlich, um sich in die Richtung eines aktiven Panzers zu wagen, und liefen meist in Richtung der eigenen Reihen zurück, so dass sie zu einer Bedrohung für jeden auf dem Schlachtfeld wurden.[1]

Wikipedia



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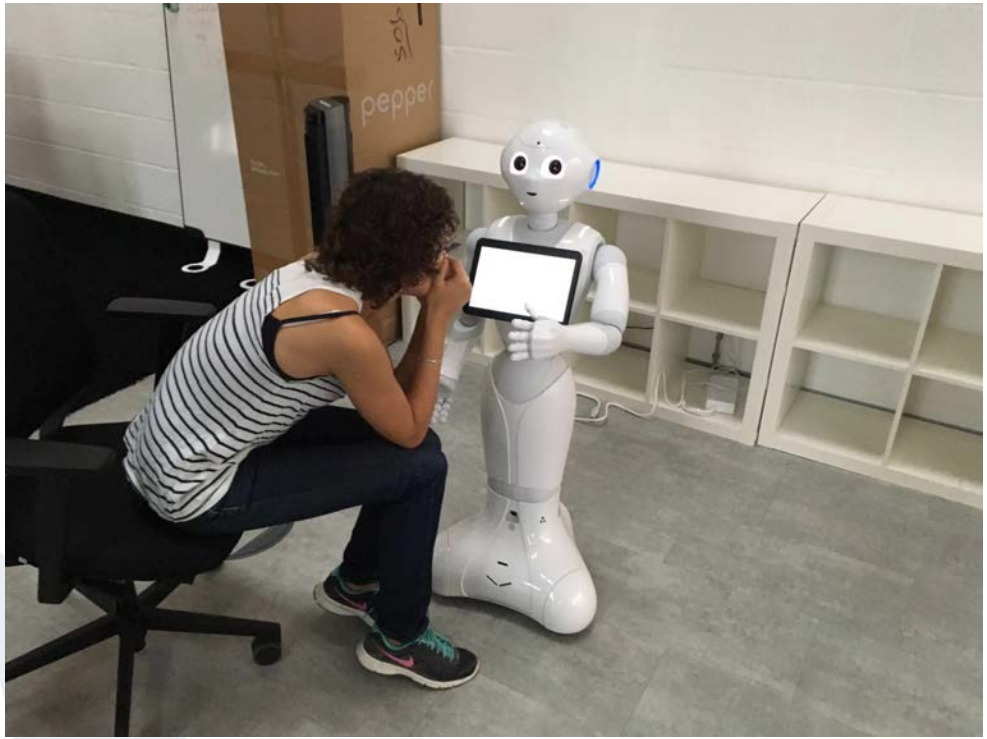
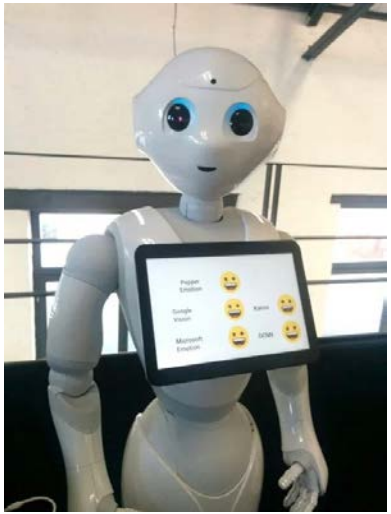
# Robotics

## Pepper & Nao



### Pepper

- Benutzerinteraktion
- Informationsquelle
- Emotionserkennung

### Nao

- Erste Programmiererfahrung (nicht nur) für Kinder
- Perfekte Plattform für junge Talente (devoxx4kids, Girls' Day, ...)

# Fingerfertigkeit


Quelle: https://blog.openai.com/learning-dexterity/

# Was ist künstliche Intelligenz?

# Was kann ich mit künstlicher Intelligenz machen?

# Wo stehen wir heute?



narrow AI

Lösungen für konkrete Probleme

Systeme mit AI Komponenten

wide AI

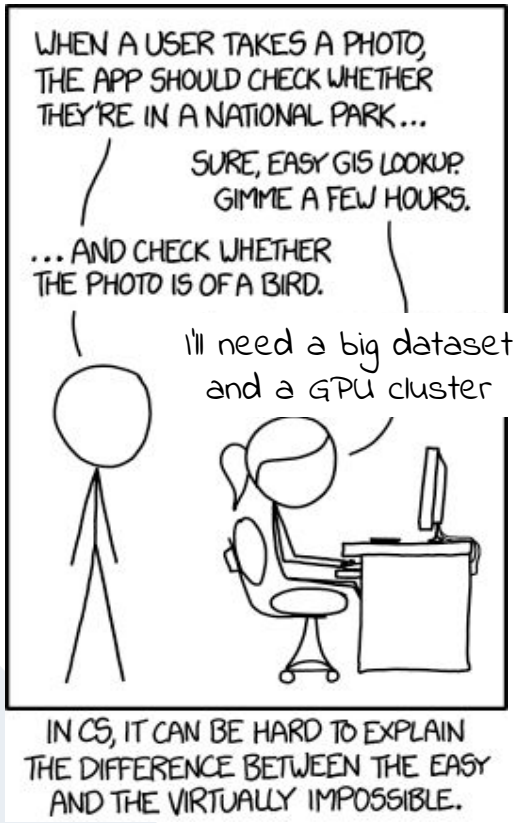
menschliches Lernen

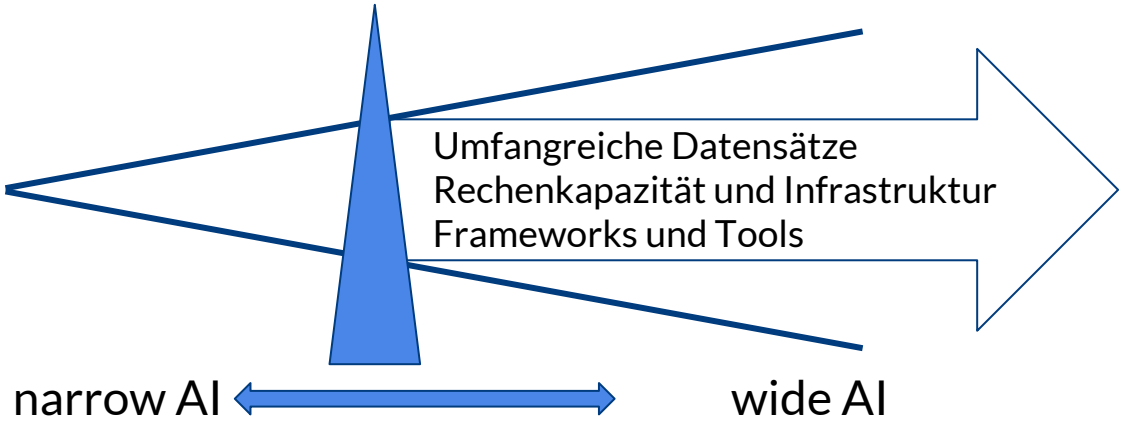
Extrapolation und Kausalität

Humor und Satire

https://xkcd.org/1425, vom 24.09.2014

# Wo stehen wir heute?




Lösungen für konkrete Probleme

Systeme mit AI Komponenten

menschliches Lernen

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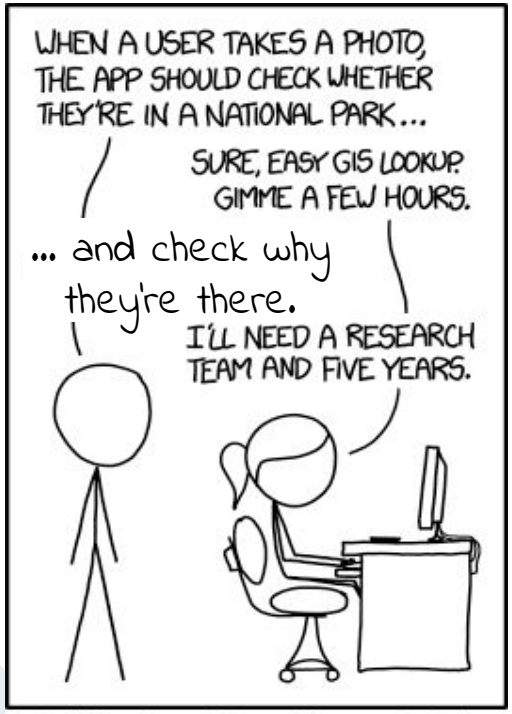
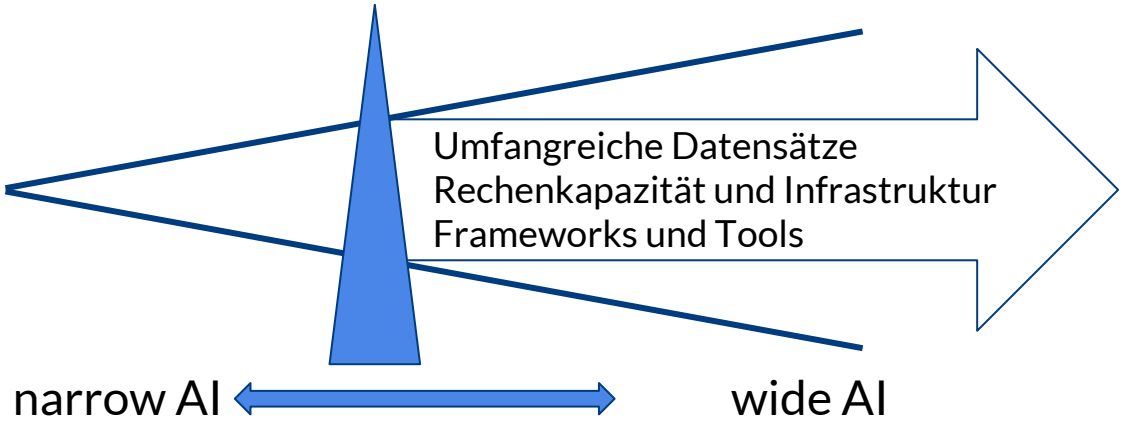



Lösungen für konkrete Probleme

Systeme mit AI Komponenten

menschliches Lernen

Extrapolation und Kausalität

Humor und Satire

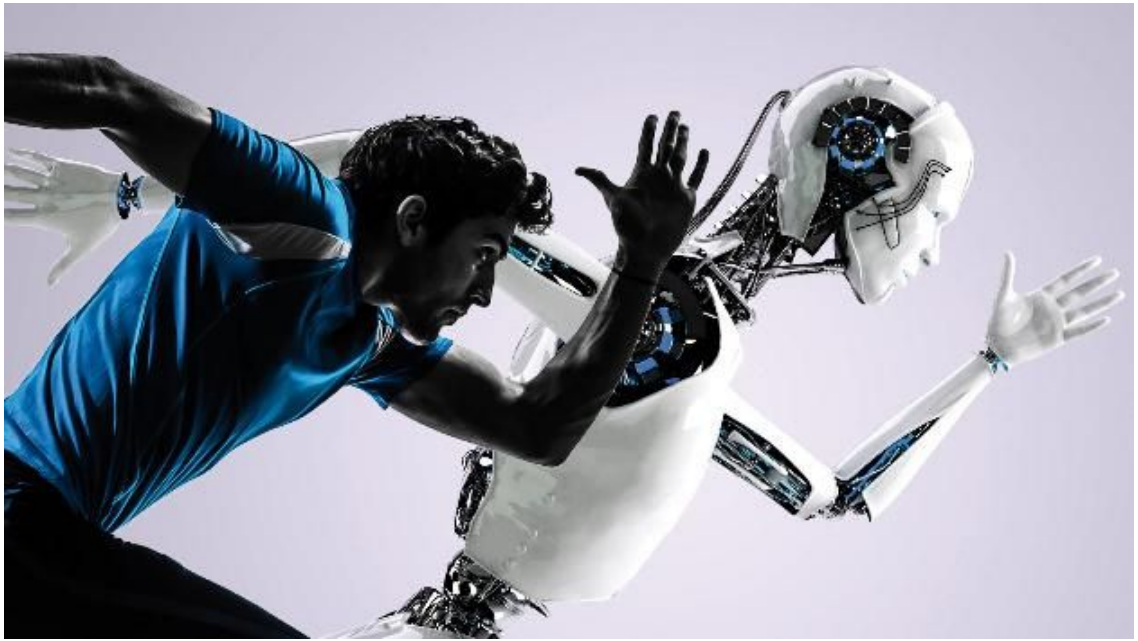


https://xkcd.org/1425, vom 24.09.2014

# Künstliche Intelligenz braucht Kreativität

Mensch:

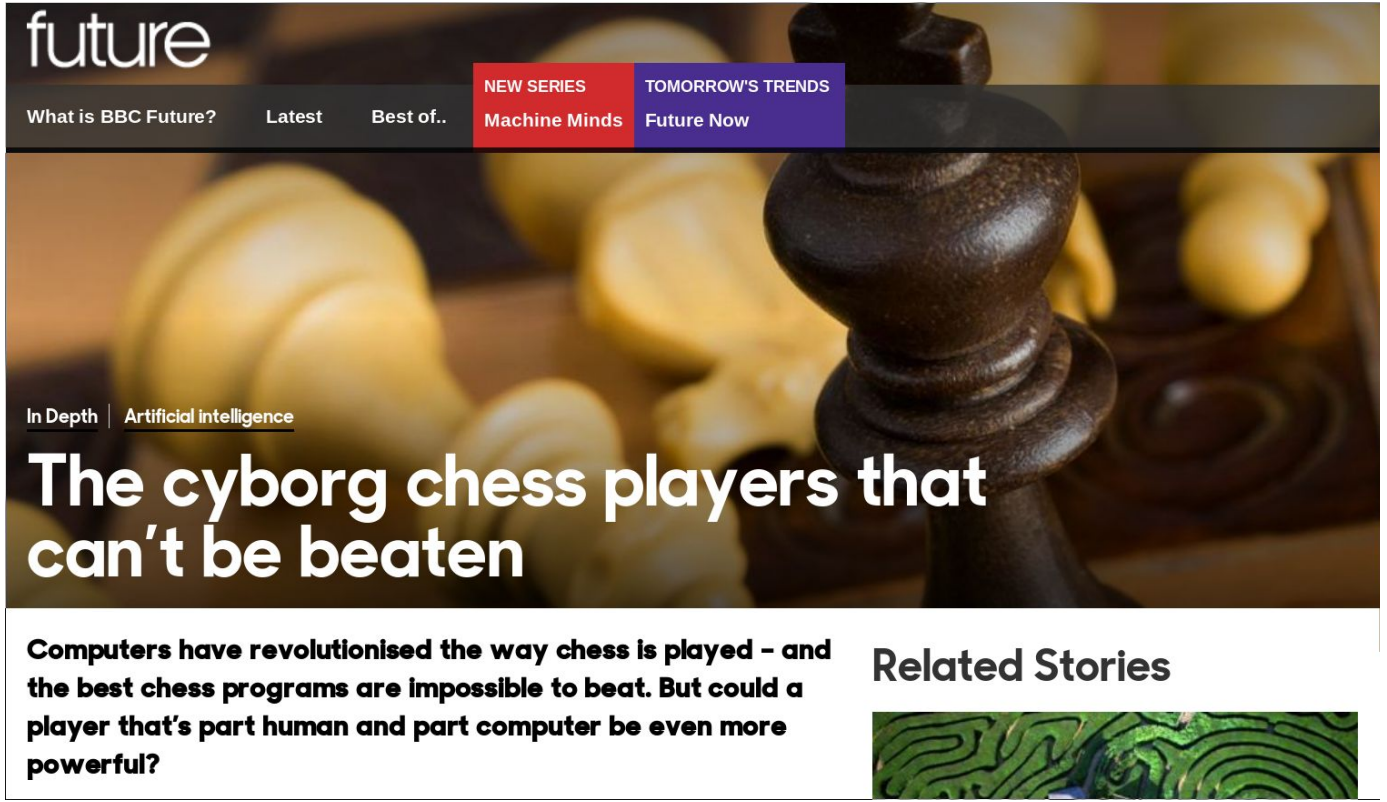
emotional,
irrational,
empathisch,
neugierig,
passioniert
und kreativ



Maschine:

präzise,
berechnend,
reproduzierbar,
realistisch und
getaktet

# Mensch + Maschine = Dream Team






http://www.bbc.com/future/story/20151201-the-cyborg-chess-players-that-cant-be-beaten

# Mensch + Maschine = Dream Team




http://www.bbc.com/future/story/20151201-the-cyborg-chess-players-that-cant-be-beaten