Technische Hochschule Rosenheim

Artificial Intelligence

A journey to the center – via the buzzwords machine learning, big data, deep learning, data science, ...

Prof. Dr. Markus Breunig


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ZUR
MAGALLANICA
The PACIFICK SEA
The INDIAN
SEA
The SOUTHERNE
UNKNOWNE LAND
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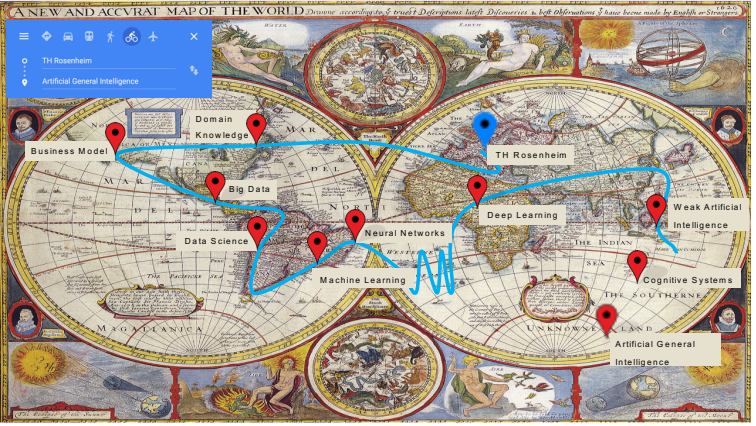
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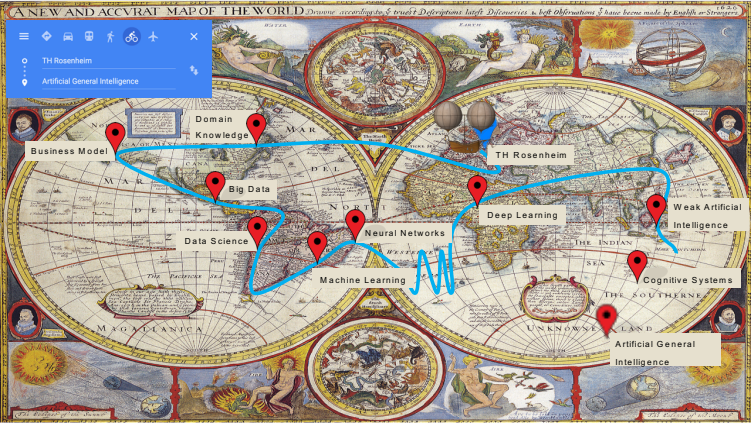
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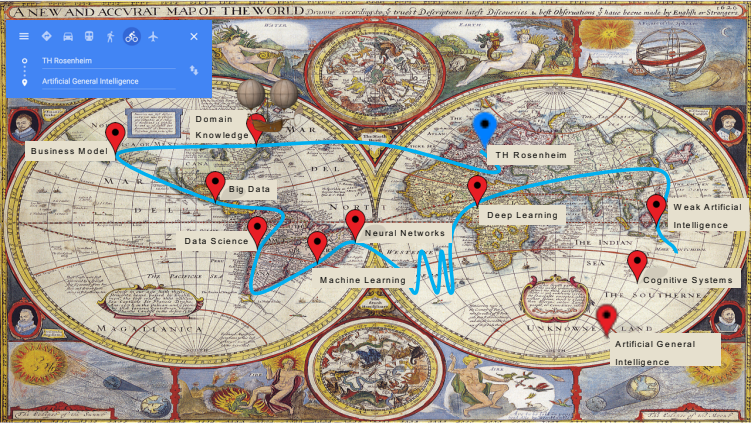
Domain Knowledge

- Know-How about the application domain
- Talk to the experts!
- Key for building deployable AI systems
- Goal: common language, common terms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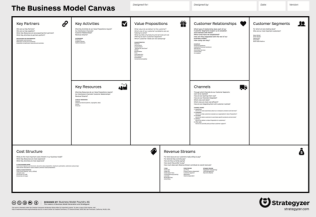
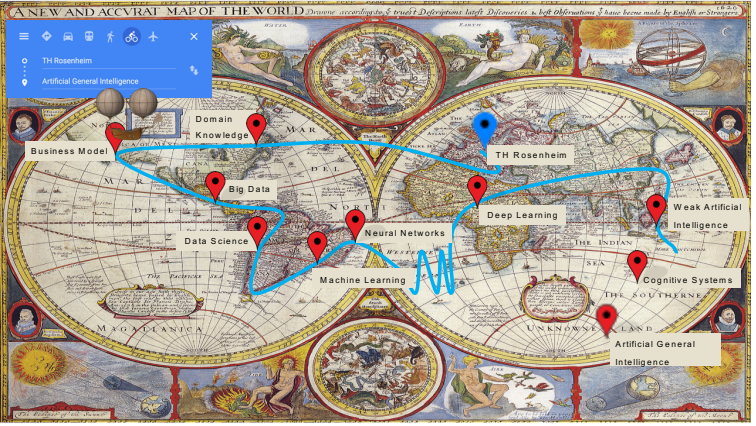
Business Model

- What is the Value-Proposition?
- Understand, Improve, Innovate
- Tool: BMC = Business Model Canvas
- Three horizons of innovation

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Big Data

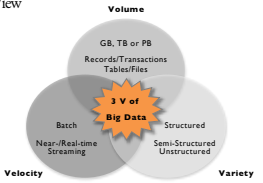
IT View

- Properties of the Data
- 3V - Volume / Velocity / Variety
- Infrastructure: NoSQL / Cloud / etc.

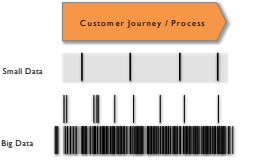
Business View

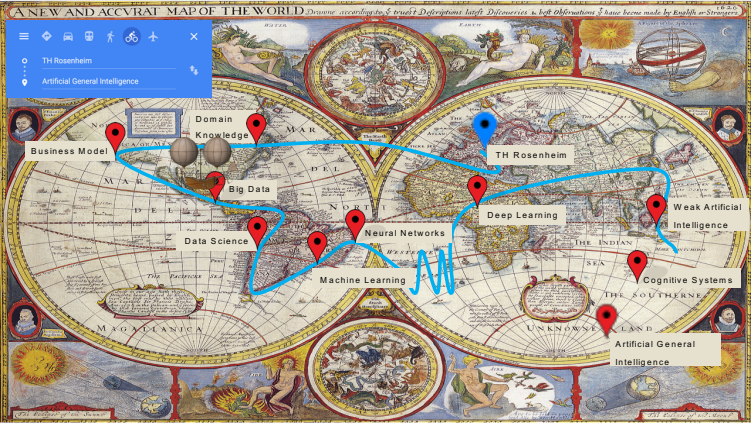
- Use Cases

IT View



Business View

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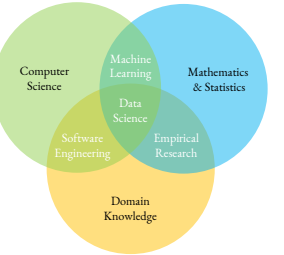
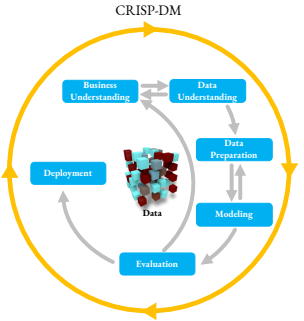
Data Science

- Extract Knowledge from Data
- Goal: Generate Business Value
- Interdisciplinary Field
- Basis: Scientific Processes and Algorithms

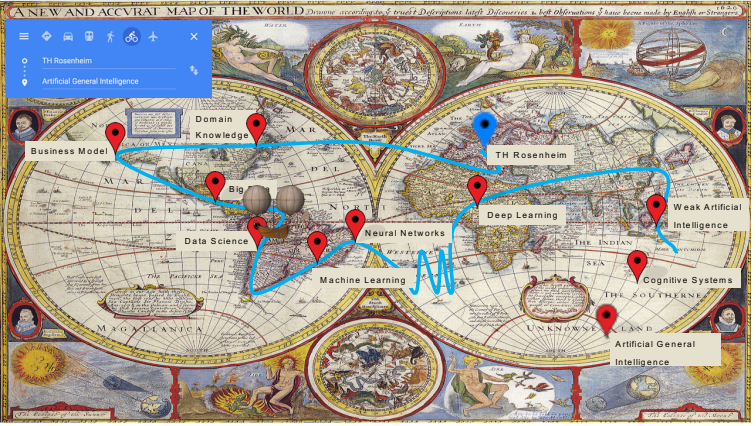


Data Science - Process

- Business Problem vs. Data Science Problem
- EDA, Visuell, Data Acquisition
- Data Cleaning, Feature Engineering
- Modelling and Model Optimization (→ ML / AI Algorithms)
- Qualitative Evaluation of the Model
- Deployment



Source: based on Kenneth Jensen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Machine Learning

- Computer solves a problem without an explicitly coded algorithm
- Instead: use a highly parameterized algorithm
- Set of parameter values = Model
- Compute the parameter values (the model) using a training algorithm and (lots of) examples

➔ Most ML methods employ 2 algorithms

- one for training the model and
- one for model execution

Source: https://scikit-learn.org/stable/tutorial/machine_learning_map/index.html, BSD Lizenz

original dataset

polynomial regression of degree 3

Quelle: eigene Darstellung


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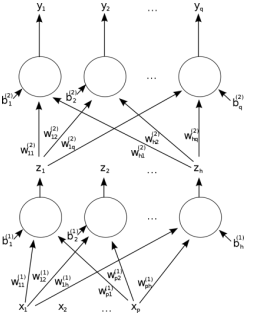
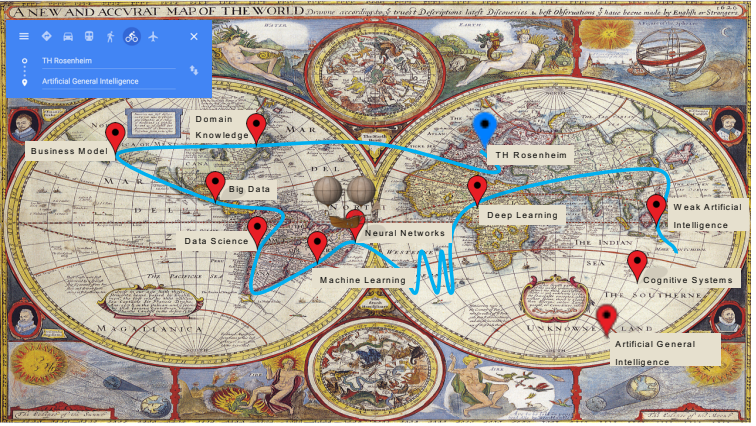
Artificial Neural Networks (ANN)

- Originally inspired by the working of the brain
- Invented 1943, lots of research/progress until 1975
- First "AI Winter" from ~1974 until ~1980
  Second "AI Winter" from ~1987 until ~2006
- ANN = Collection of artificial neurons (perceptrons) connected with weighted edges
- Model: weights. Evaluation usually Feed-Forward.
- Primary training algorithm: backpropagation (backprop)

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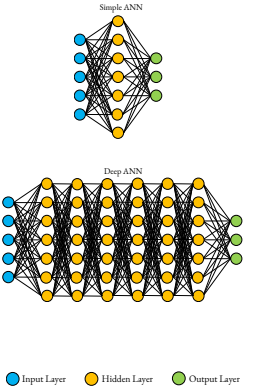
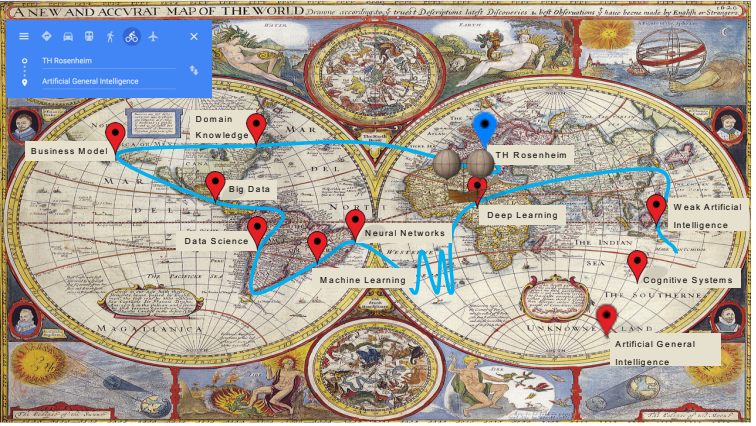
Deep Neural Networks (DNN)

- Deep = Many hidden layers
- Can model complex, non-linear functions
- Popular since ~2012: ImageNet Moment
- Many architectural variants, e.g.
  - RNN and LSTM for language modelling
  - CNN for computer vision
  - Encode-Decoder for text processing
- Training and Model Evaluation usually like ANNs (feed-forward and backprop)

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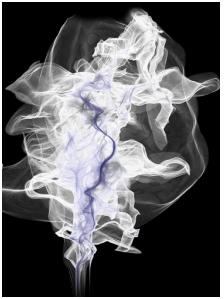
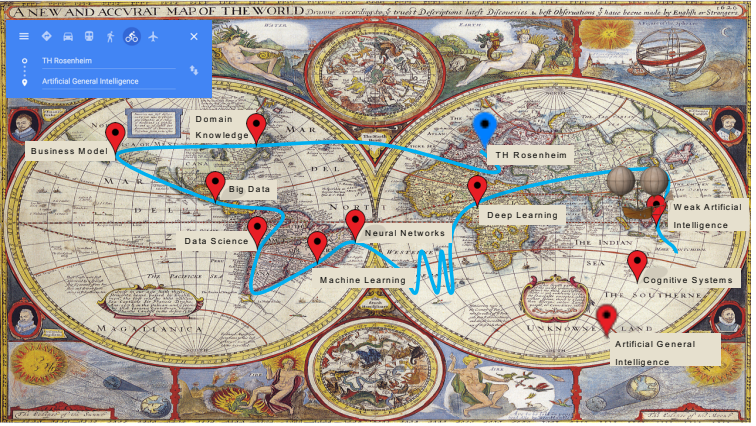
Weak AI

vs.

Strong AI (AGI)

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Cognitive Systems

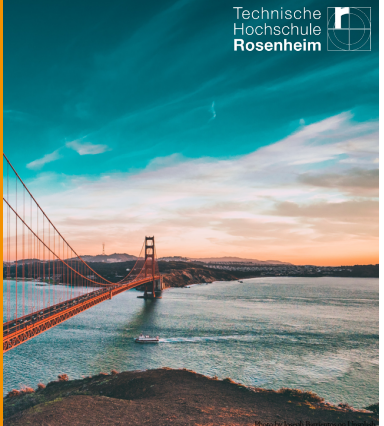
- Also called: Cognitive Computing
- Simulate human thinking and learning using AI
- Adaptive, Interactive, Stateful, Contextual
- Example: IBM Watson

Marketing Hype
or
The Next Big Thing?

Terms and Statements

Key Take Aways

- Definition of and Distinction between
  - Domain Knowledge
  - Business Model
  - Big Data
  - Data Science
  - Machine Learning
  - ANN and Deep Learning
  - Weak AI, AGI, Cognitive Systems
- What is a Model?
- Training vs. Model Evaluation



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