Photo by Modestas Urbonas on Unsplash

Technische Hochschule Rosenheim

Artificial Intelligence

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

Special thanks to Prof. Dr. Markus Breunig

A NEW AND ACCVRAT MAP OF THE WORLD

Drawne according to ye truest Descriptions latest Discoueries & best Observations yt haue beene made by English or Strangers.

1626

The Heavens and Elements

WATER

EARTH

A Figure of the Sphear

The North Hemisphere

The South Hemisphere

NORTH

SOUTH

THE NORTH FROSEN ZONE

THE TEMPERATE ZONE

THE TORRID ZONE

THE SOUTH FROSEN ZONE

NORTH AMERICA OR MEXICANA

MAR DEL NORTH

MAR DEL ZUR

SOUTH AMERICA OR PERU

THE PACIFICKE SEA

MAGALLANICA

THE ATLANTICKE SEA

THE TARTARIAN SEA

ASIA

AFRICA

THE INDIAN OCEAN

THE SOUTHERNE UNKNOWNE LAND

THE WESTERNE OCEAN

MARE LANTCHIDOL

The Tropicke of Cancer

The Aequinoctial Line

The Tropicke of Capricorne

The Arctick Circle

The Antarctick Circle

The Straits of Magellan

Sr Francis Drake

Ferdinandus Magellanus

M. Thomas Candish

Oliverius vander Noort

Iwise in our age hath these straights beene passed by English men, the first was by that valiant Sea Captaine Sir Francis Drake Ano. 1578. in the Pelican and ye second by that famous Gentelman master Thomas Candish in the desire 1586

The Eclipse of the Sunne

The Eclipse of the Moone

FIRE

AIRE

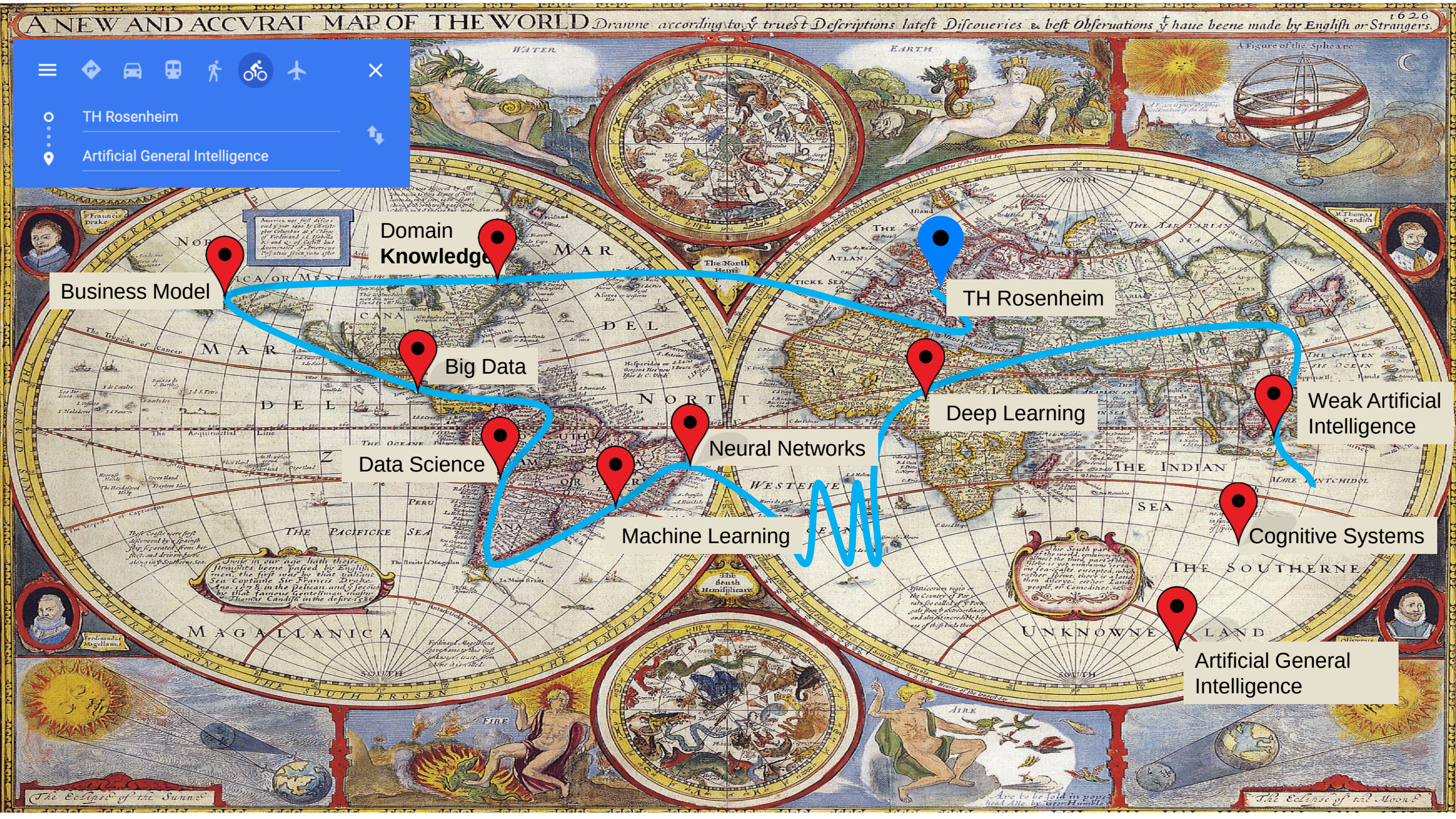
Are to be Sold in Pope head Alley by Geor: Humble.

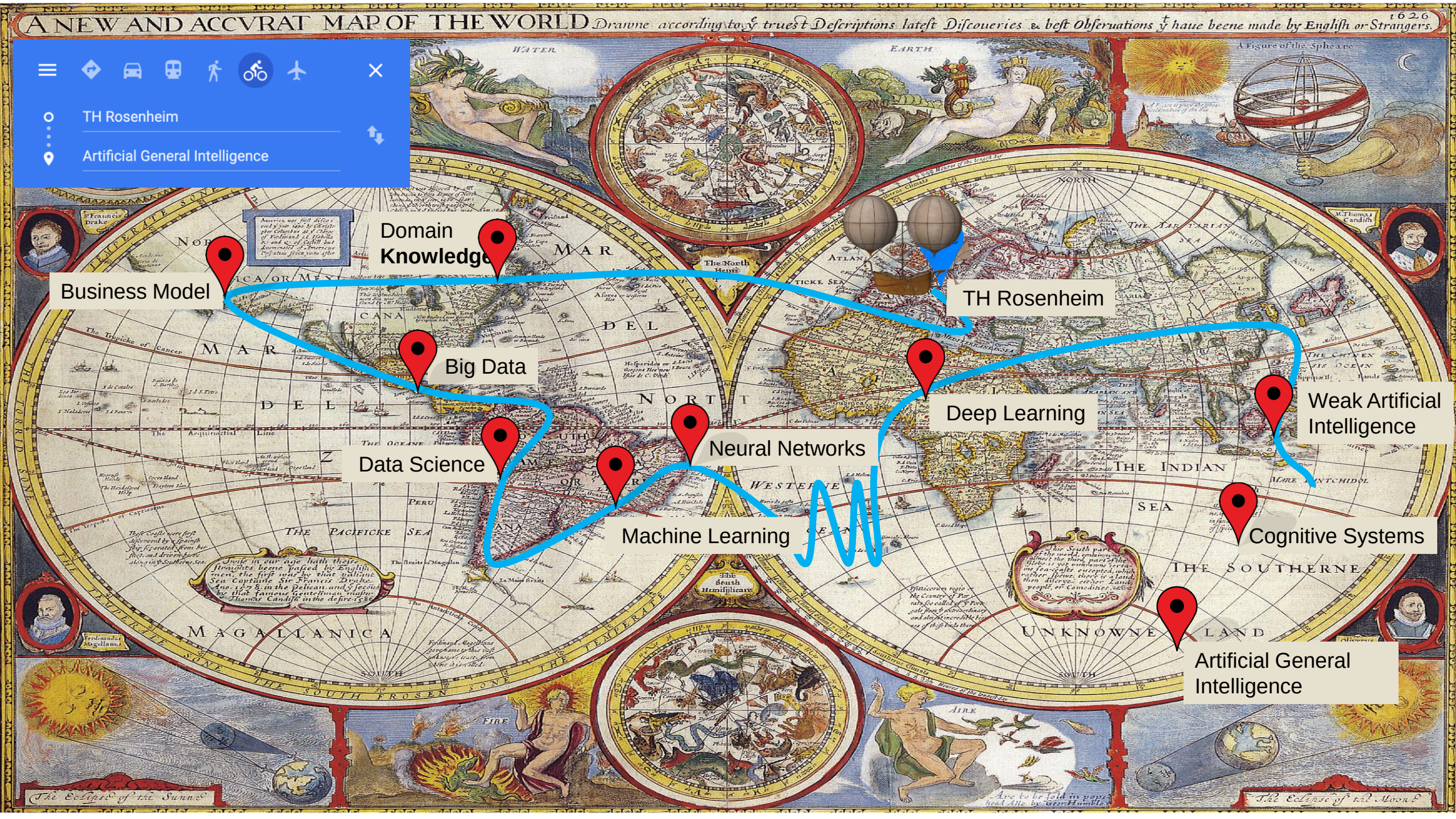

A NEW AND ACCVRAT MAP OF THE WORLD Drawne according to ye truest Descriptions latest Discoueries & best Observations yt haue beene made by English or Strangers.
1626
Search Google Maps
The Heavens
WATER
EARTH
A Figure of the Sphear
The North Hemisphere
The South Hemisphere
NORTH
SOUTH
AMERICA OR MEXICANA
NORTH AMERICA
SOUTH AMERICA OR PERU
THE PACIFICKE SEA
MAGALLANICA
THE ATLANTICKE OCEAN
THE WESTERNE OCEAN
THE INDIAN SEA
THE SOUTHERNE UNKNOWNE LAND
ASIA
AFRICA
THE TARTARIAN SEA
THE CHINEN SIS OCEAN
MARE LANTCHIDOL
The Tropicke of Cancer
The Tropicke of Capricorne
The Aequinoctial Line
The Arctique Circle
The Antarctique Circle
The Golfe of Mexico
The Straits of Magellan
S. Francis Drake
Ferdinandus Magellanus
M. Thomas Candish
Oliverius vander Noort
The Eclipse of the Sunne
The Eclipse of the Moone
FIRE
AIRE


A NEW AND ACCVRAT MAP OF THE WORLD Drawne according to ye truest Descriptions latest Discoueries & best Observations yt haue beene made by English or Strangers.
1626
TH Rosenheim
Technische Hochschule Rosenheim Hochschulstraße, ...
Bibliothek der Technischen Hochschule Rosenheim ...
Forschung und Entwicklung - Technische Hochschul...
Campus Mühldorf der Technischen Hochschule Ros...
WATER
EARTH
A Figure of the Sphear
The Heavens
NORTH
SOUTH
The North Hemisphere
The South Hemisphere
MAR DEL NORT
MAR DEL ZUR
THE PACIFICKE SEA
MAGALLANICA
THE INDIAN OCEAN
THE SOUTHERNE UNKNOWNE LAND
ASIA
AFRICA
AMERICA
The Tropicke of Cancer
The Aequinoctial Line
The Tropicke of Capricorne
The Antarctick Circle
THE TORRID ZONE
THE TEMPERATE ZONE
THE SOUTH FROSEN ZONE
Ferdinandus Magellanus
M. Thomas Candish
Oliverus vander Noort
FIRE
AIRE
The Eclipse of the Sunne
The Eclipse of the Moone


A NEW AND ACCVRAT MAP OF THE WORLD Drawne according to ye truest Descriptions latest Discoueries & best Observations yt haue beene made by English or Strangers.
1626
TH Rosenheim
TH Rosenheim
NORTH
SOUTH
AMERICA OR MEXI
MAR DEL NORTH
MAR DEL ZUR
THE PACIFICKE SEA
MAGALLANICA
THE WESTERNE OCEAN
THE INDIAN SEA
THE SOUTHERNE UNKNOWNE LAND
ASIA
AFRICA
The North Hemisphere
The South Hemisphere
The Eclipse of the Sunne
The Eclipse of the Moone

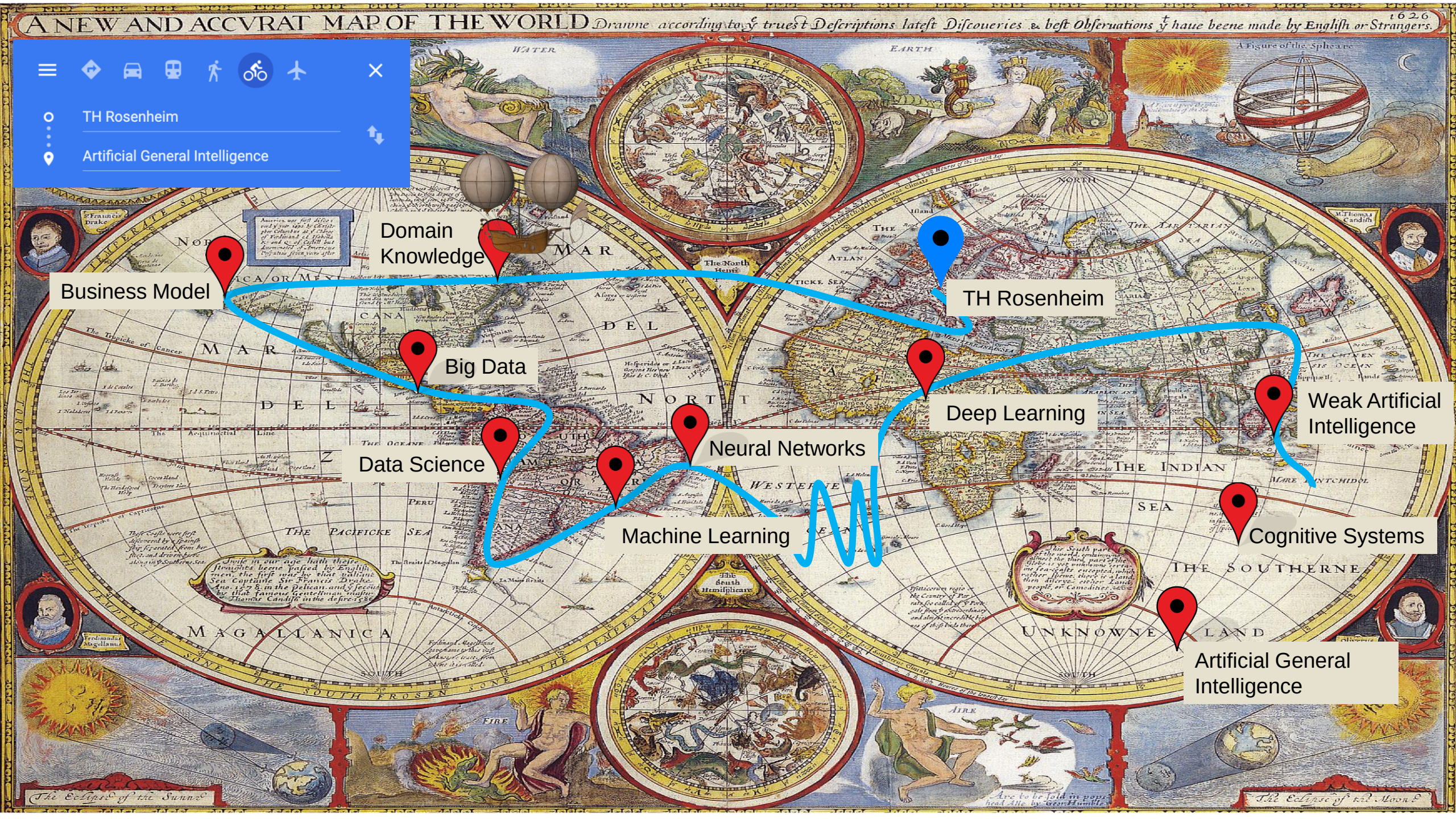

A NEW AND ACCVRAT MAP OF THE WORLD Drawne according to ye truest Descriptions latest Discoueries & best Observations yt haue beene made by English or Strangers.
1626
Artificial Intelligence
TH Rosenheim
Artificial General Intelligence
NORTH
SOUTH
AMERICA OR MEXI
MAR DEL NORTH
MAR DEL ZUR
THE PACIFICKE SEA
MAGALLANICA
THE WESTERNE OCEAN
THE INDIAN SEA
THE SOUTHERNE
UNKNOWNE LAND
ASIA
AFRICA
The North Hemisphere
The South Hemisphere
The Eclipse of the Sunne
The Eclipse of the Moone


A NEW AND ACCVRAT MAP OF THE WORLD Drawne according to ye truest Descriptions latest Discoueries & best Obseruations yt haue beene made by English or Strangers. 1626
TH Rosenheim
Artificial General Intelligence
Domain
Knowledge
Business Model
TH Rosenheim
Big Data
Deep Learning
Weak Artificial Intelligence
Neural Networks
Data Science
Machine Learning
Cognitive Systems
Artificial General Intelligence


A NEW AND ACCVRAT MAP OF THE WORLD Drawne according to ye truest Descriptions latest Discoueries & best Obseruations yt haue beene made by English or Strangers. 1626
TH Rosenheim
Artificial General Intelligence
Domain
Knowledge
Business Model
TH Rosenheim
Big Data
Deep Learning
Weak Artificial Intelligence
Neural Networks
Data Science
Machine Learning
Cognitive Systems
Artificial General Intelligence

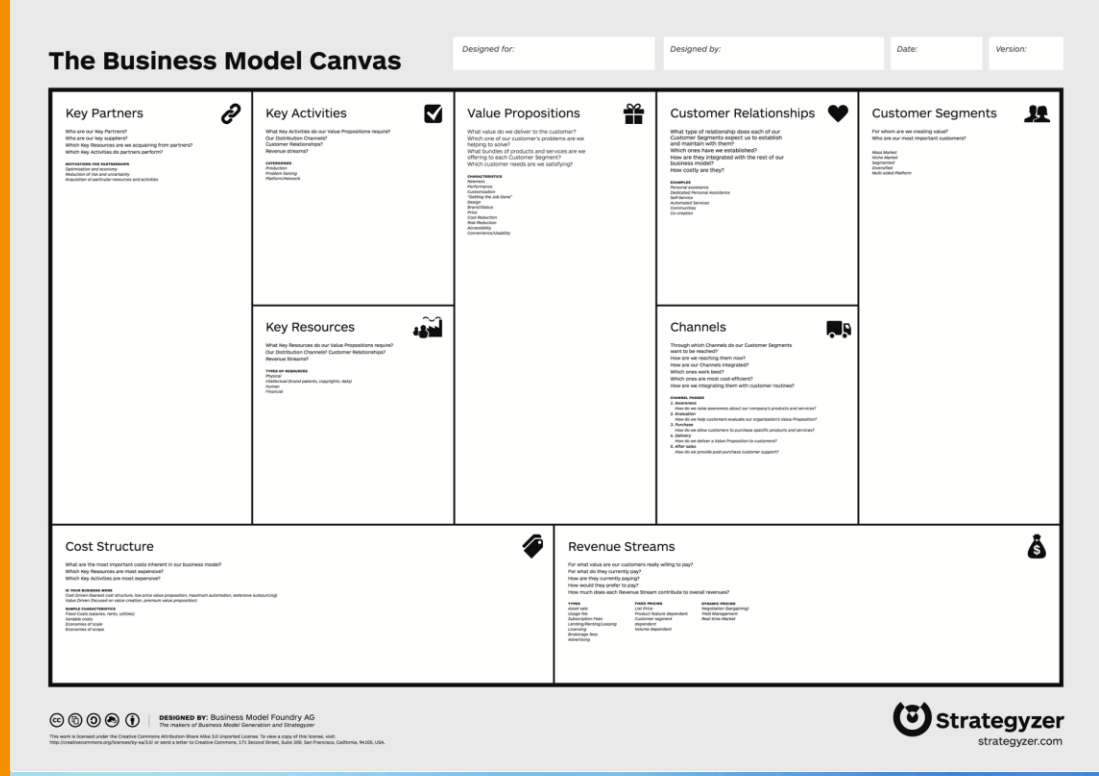
Domain Knowledge

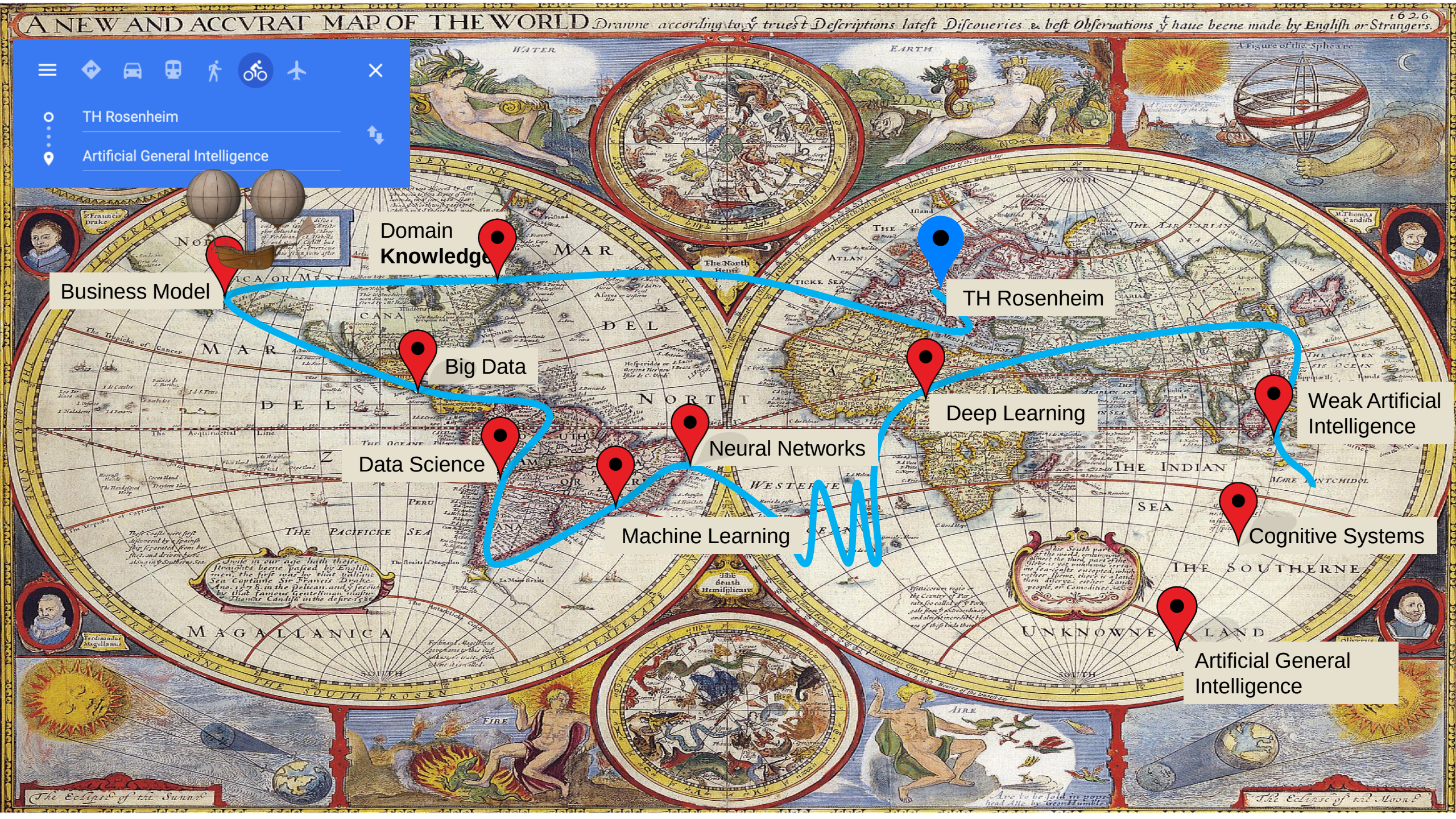
- Know-How about the application domain
- Talk to the experts!
- Key for building deployable AI systems
- Goal: common language, common terms


A NEW AND ACCVRAT MAP OF THE WORLD Drawne according to ye truest Descriptions latest Discoueries & best Obseruations yt haue beene made by English or Strangers.
1626
TH Rosenheim
Artificial General Intelligence
Domain Knowledge
Business Model
Big Data
Data Science
Neural Networks
Machine Learning
Deep Learning
TH Rosenheim
Weak Artificial Intelligence
Cognitive Systems
Artificial General Intelligence

Business Model

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




A NEW AND ACCVRAT MAP OF THE WORLD Drawne according to ye truest Descriptions latest Discoueries & best Obseruations yt haue beene made by English or Strangers. 1626
TH Rosenheim
Artificial General Intelligence
Domain
Knowledge
Business Model
TH Rosenheim
Big Data
Deep Learning
Weak Artificial Intelligence
Neural Networks
Data Science
Machine Learning
Cognitive Systems
Artificial General Intelligence

Big Data

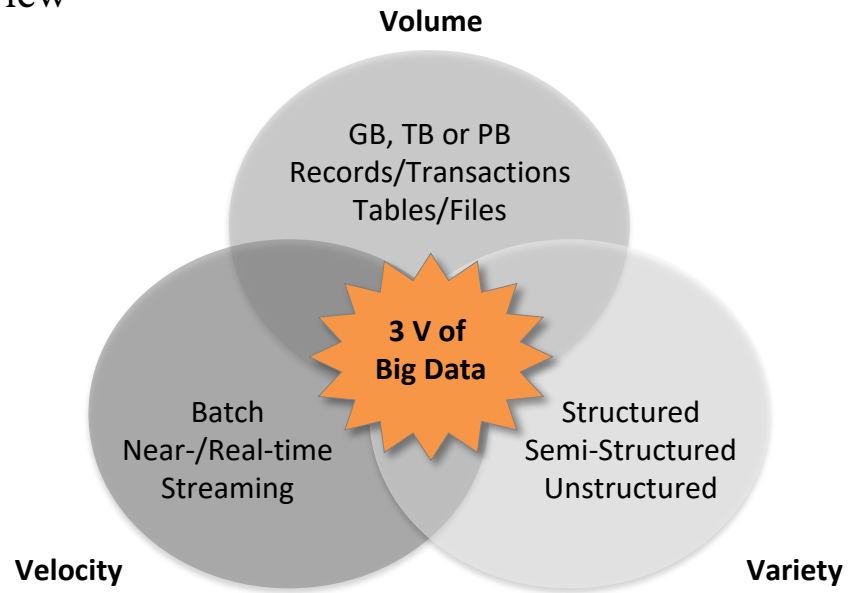
IT View

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

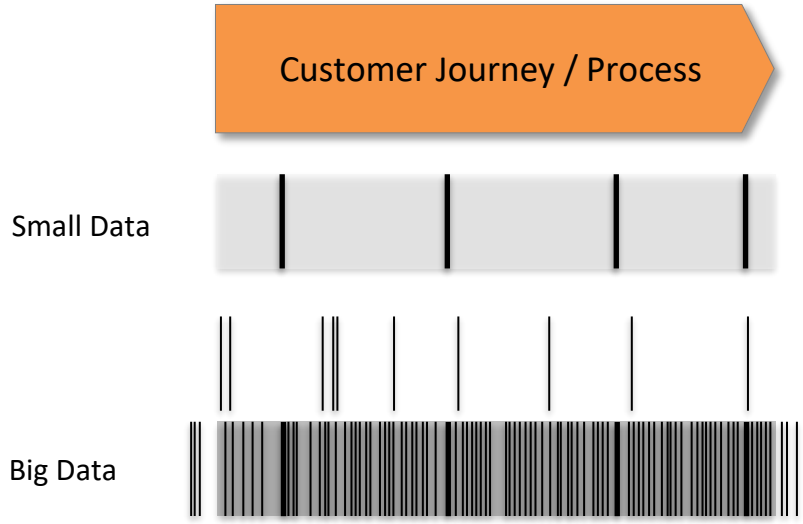
Business View

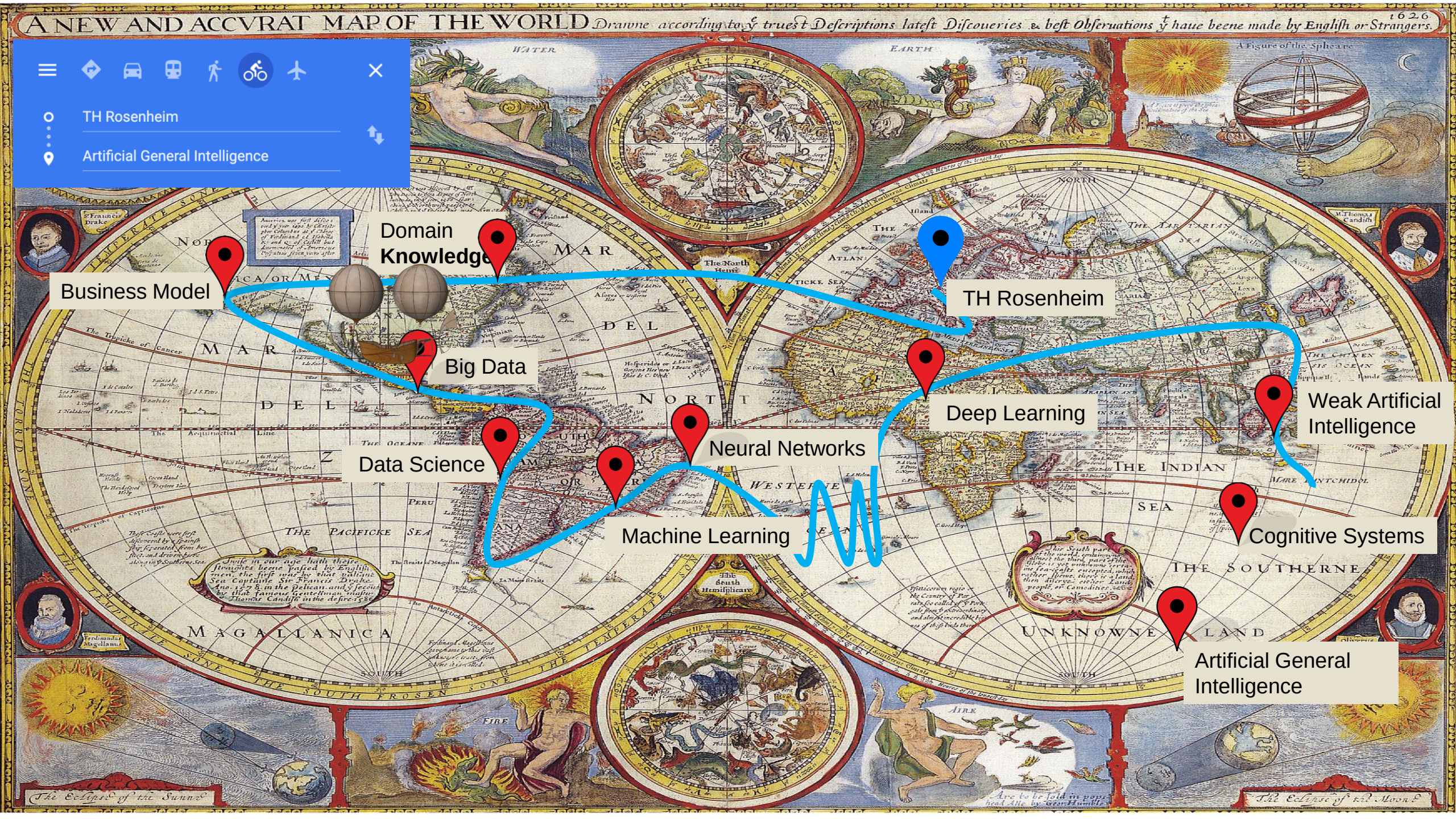
- Use Cases

IT View



Business View




A NEW AND ACCVRAT MAP OF THE WORLD Drawne according to ye truest Descriptions latest Discoueries & best Obseruations yt haue beene made by English or Strangers. 1626
TH Rosenheim
Artificial General Intelligence
Domain
Knowledge
Business Model
Big Data
Data Science
Neural Networks
Machine Learning
Deep Learning
TH Rosenheim
Weak Artificial Intelligence
Cognitive Systems
Artificial General Intelligence

Data Science

Extract Knowledge from Data

Goal: Generate Business Value

Interdisciplinary Field

Basis: Scientific Processes and Algorithms

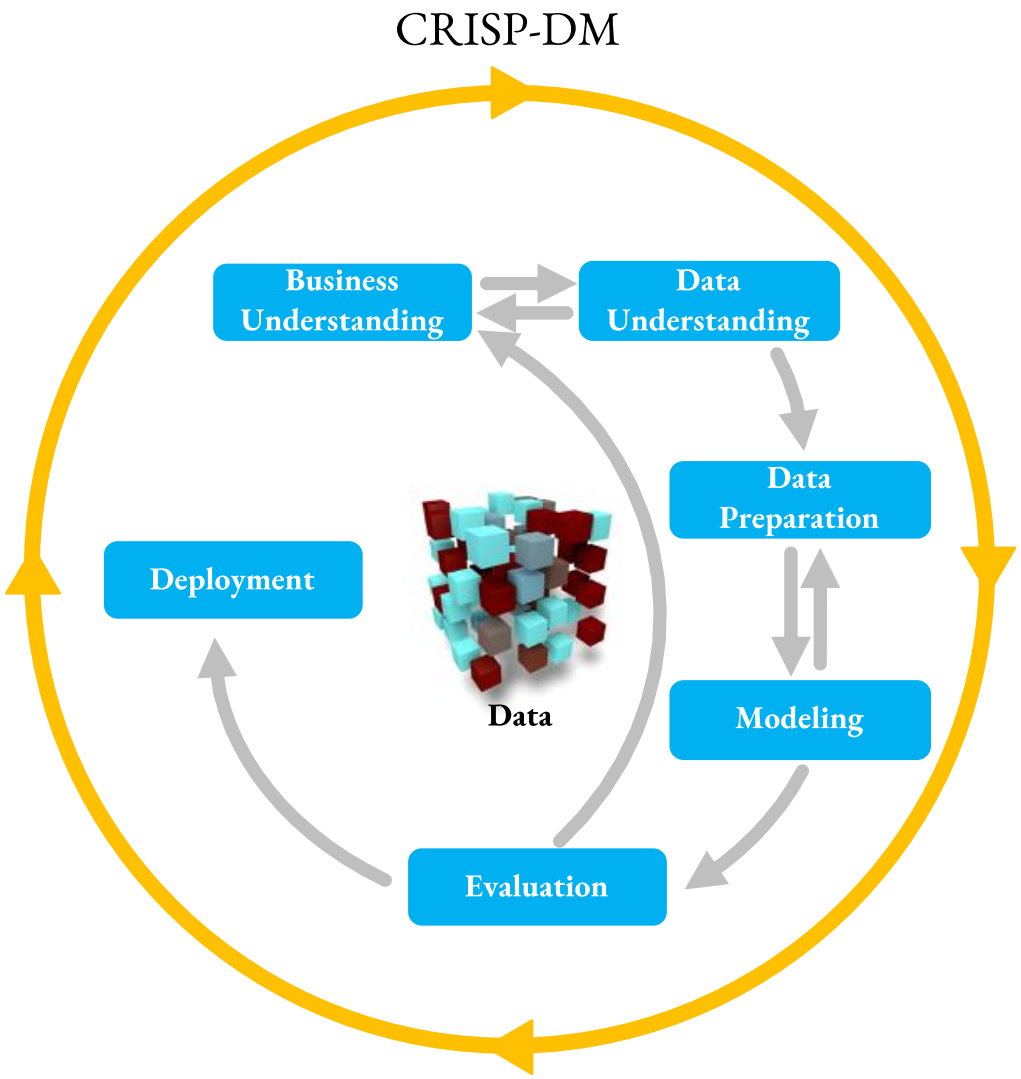
Computer Science

Mathematics & Statistics

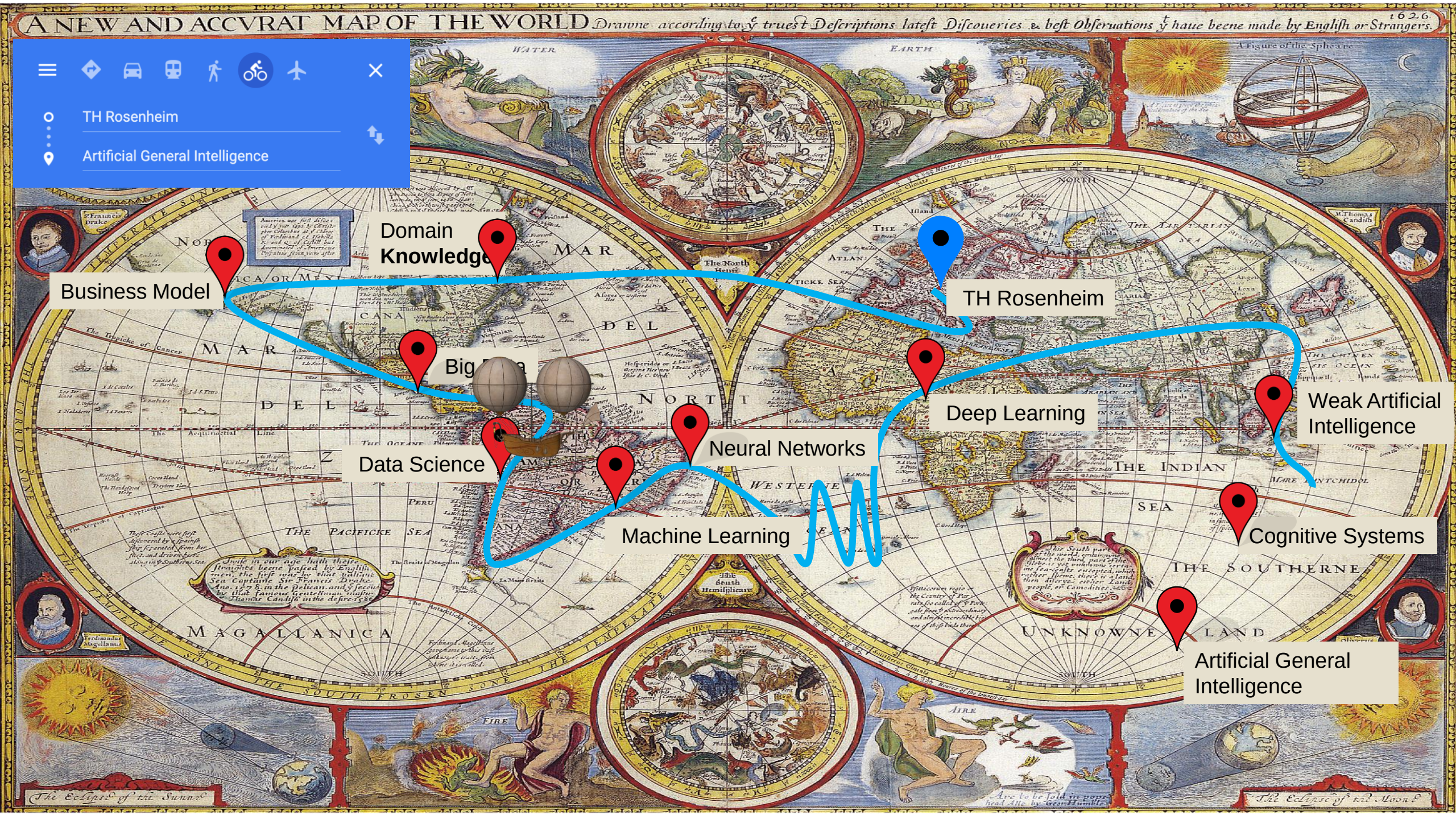
Domain Knowledge

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



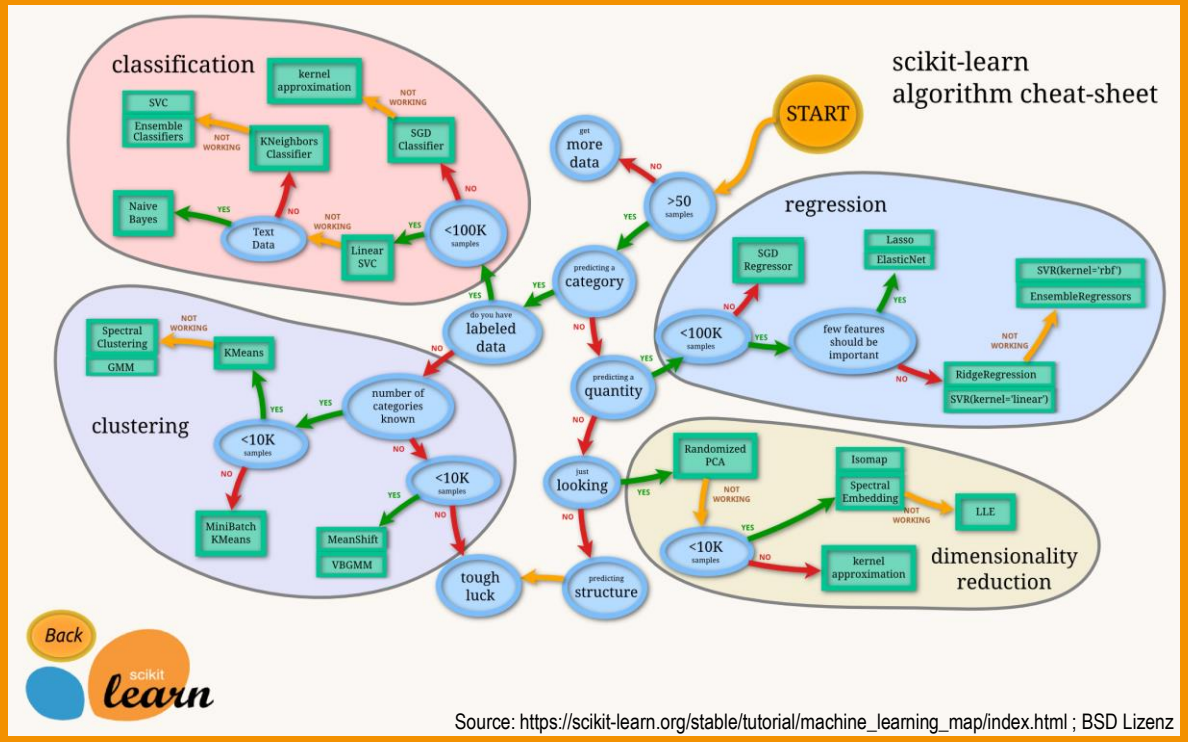
Source: based on Kenneth Jensen


A NEW AND ACCVRAT MAP OF THE WORLD Drawne according to ye truest Descriptions latest Discoueries & best Obseruations yt haue beene made by English or Strangers. 1626
TH Rosenheim
Artificial General Intelligence
Domain
Knowledge
Business Model
TH Rosenheim
Big Data
Deep Learning
Weak Artificial Intelligence
Neural Networks
Data Science
Machine Learning
Cognitive Systems
Artificial General Intelligence

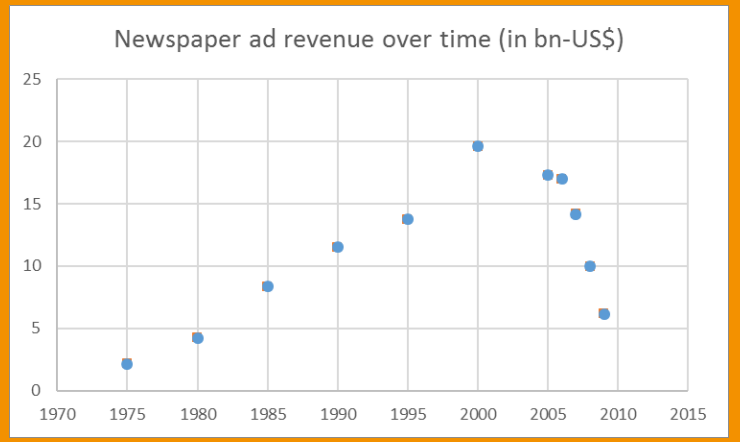
Machine Learning

- 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

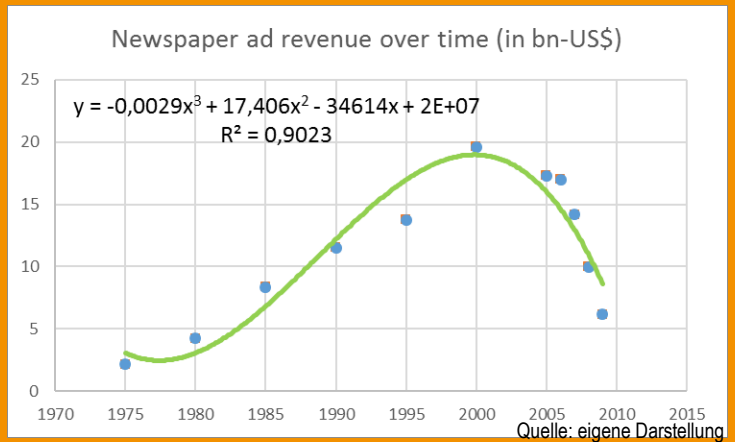
➔ Most ML methods employ 2 algorithms
  - one for training the model and
  - one for model execution



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

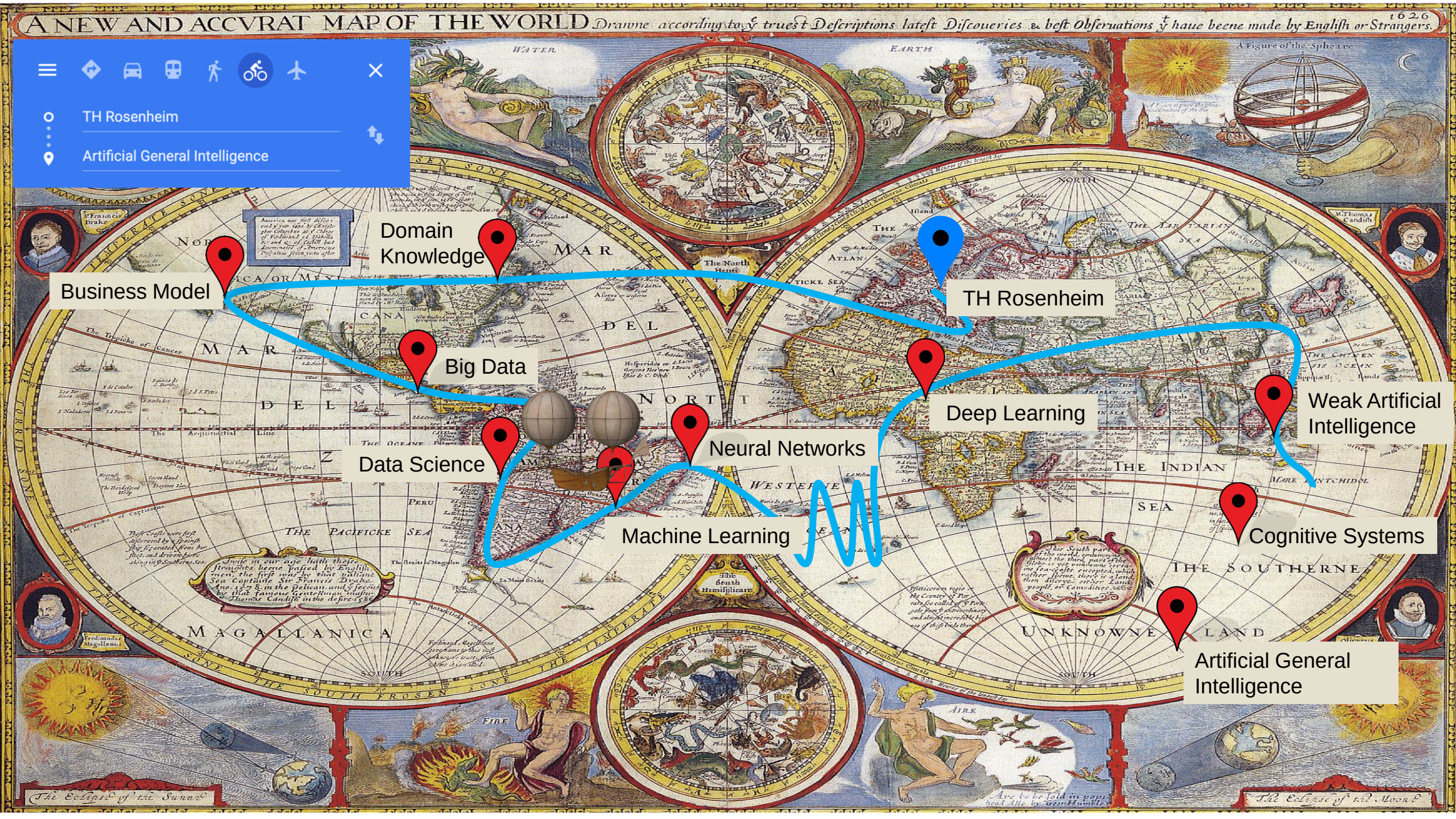


original dataset



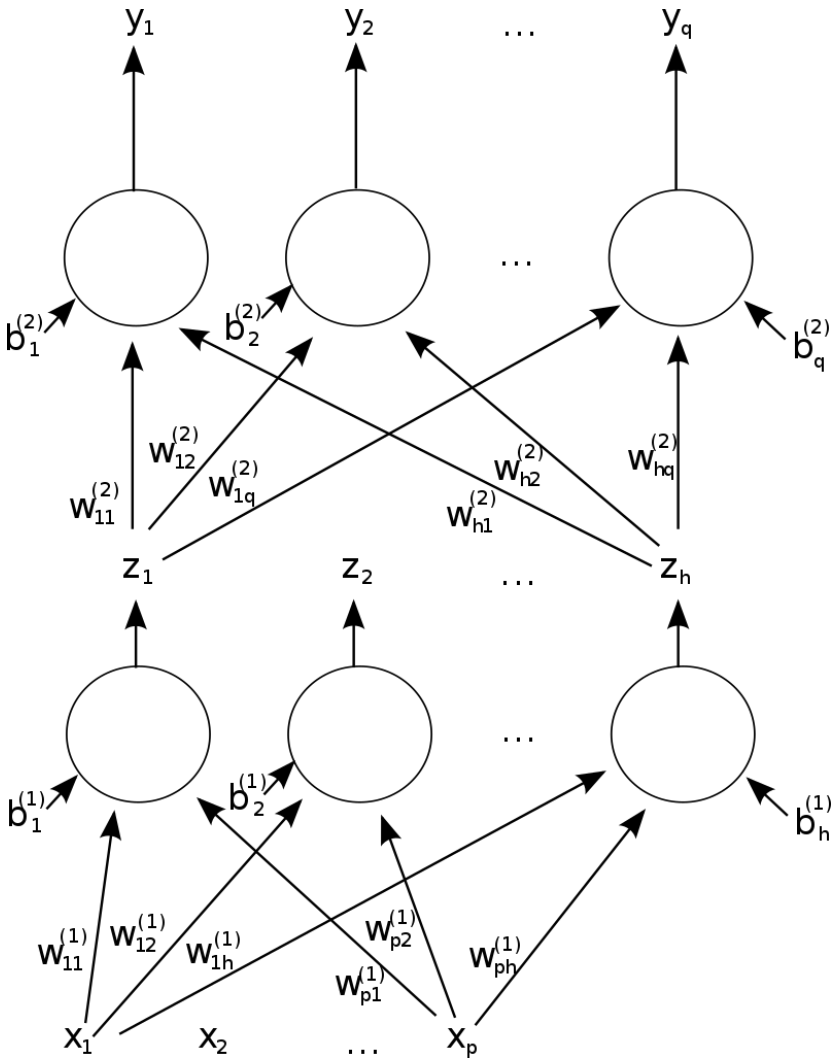
Quelle: eigene Darstellung

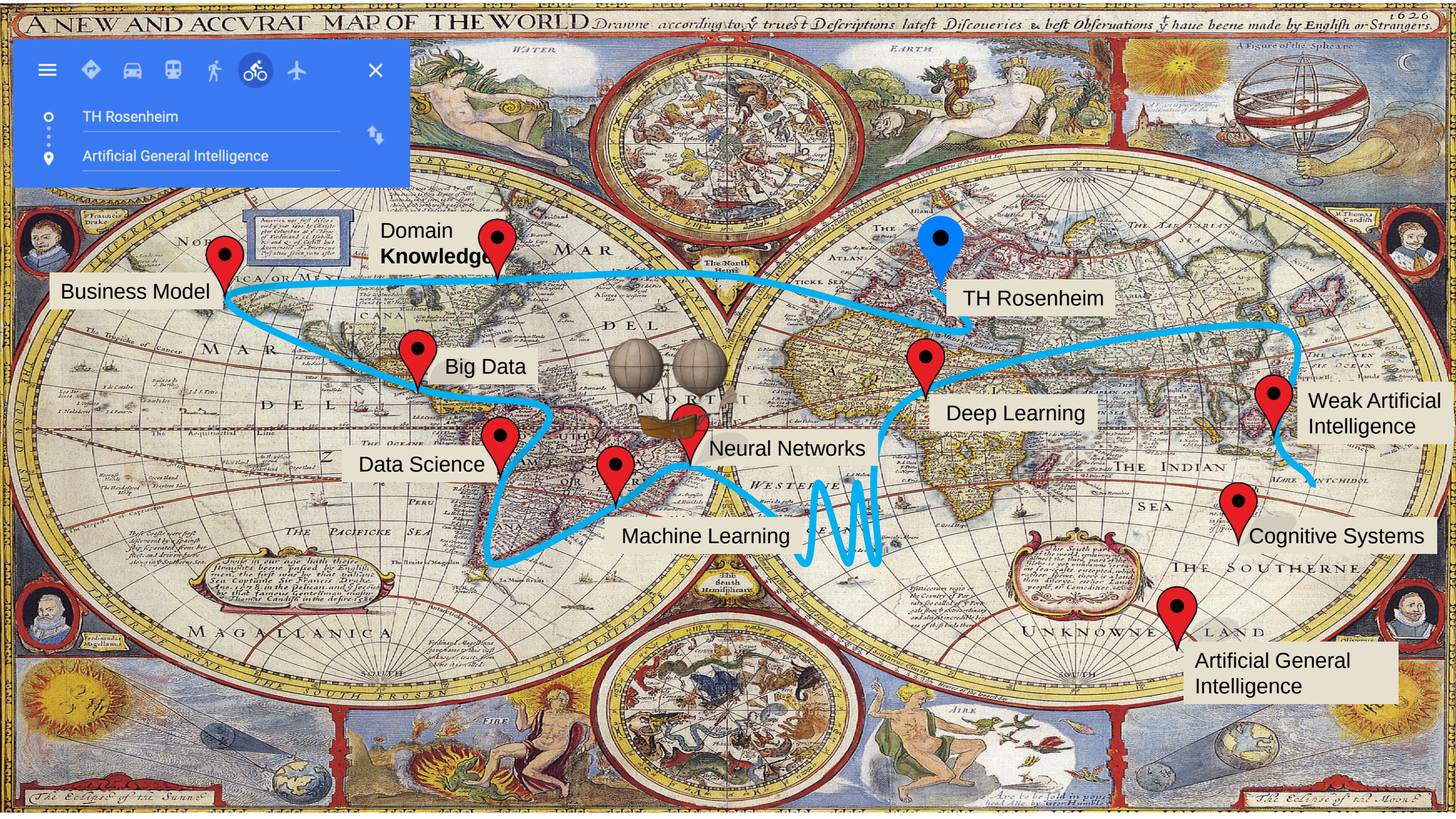
polynomial regression of degree 3


A NEW AND ACCVRAT MAP OF THE WORLD Drawne according to ye truest Descriptions latest Discoueries & best Obseruations yt haue beene made by English or Strangers.
1626
TH Rosenheim
Artificial General Intelligence
Domain Knowledge
Business Model
Big Data
Data Science
Neural Networks
Machine Learning
TH Rosenheim
Deep Learning
Weak Artificial Intelligence
Cognitive Systems
Artificial General Intelligence

Artificial Neural Networks (ANN)

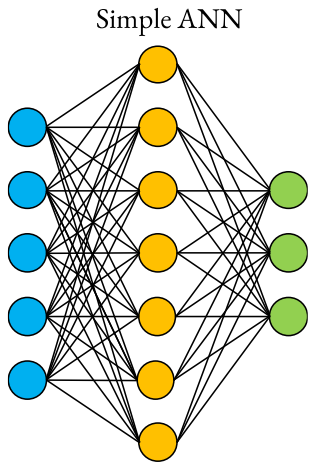
- Originally inspired by the working of the brain
- Invented 1943, lots of research/progress until 1975
- First “AI Winter” from ~1974 until ~1980
  Second “AI Winter” from ~1987 until ~2006
- ANN = Collection of artificial neurons (perceptrons) connected with weighted edges
- Model: weights. Evaluation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

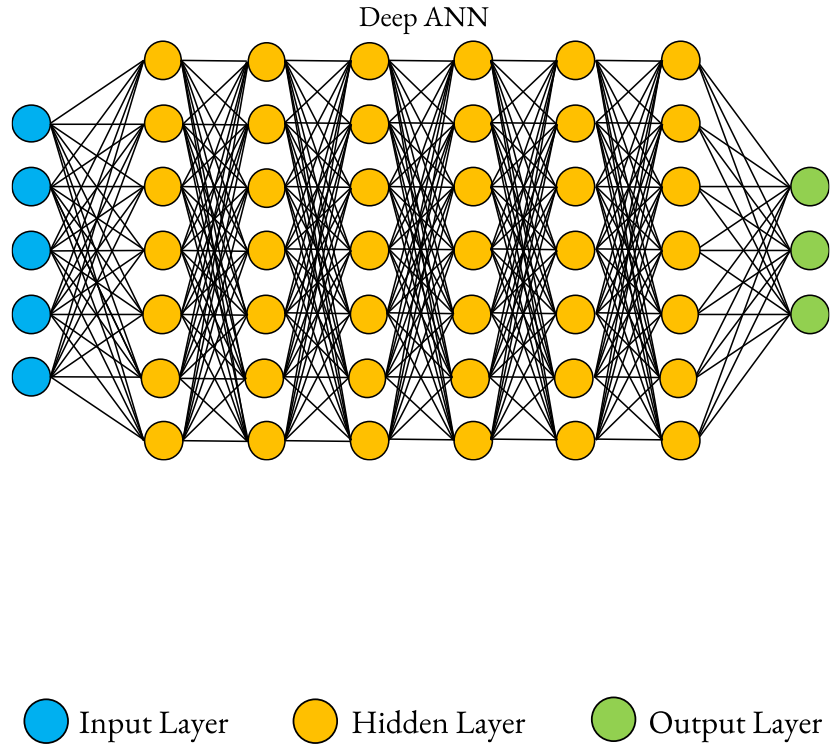


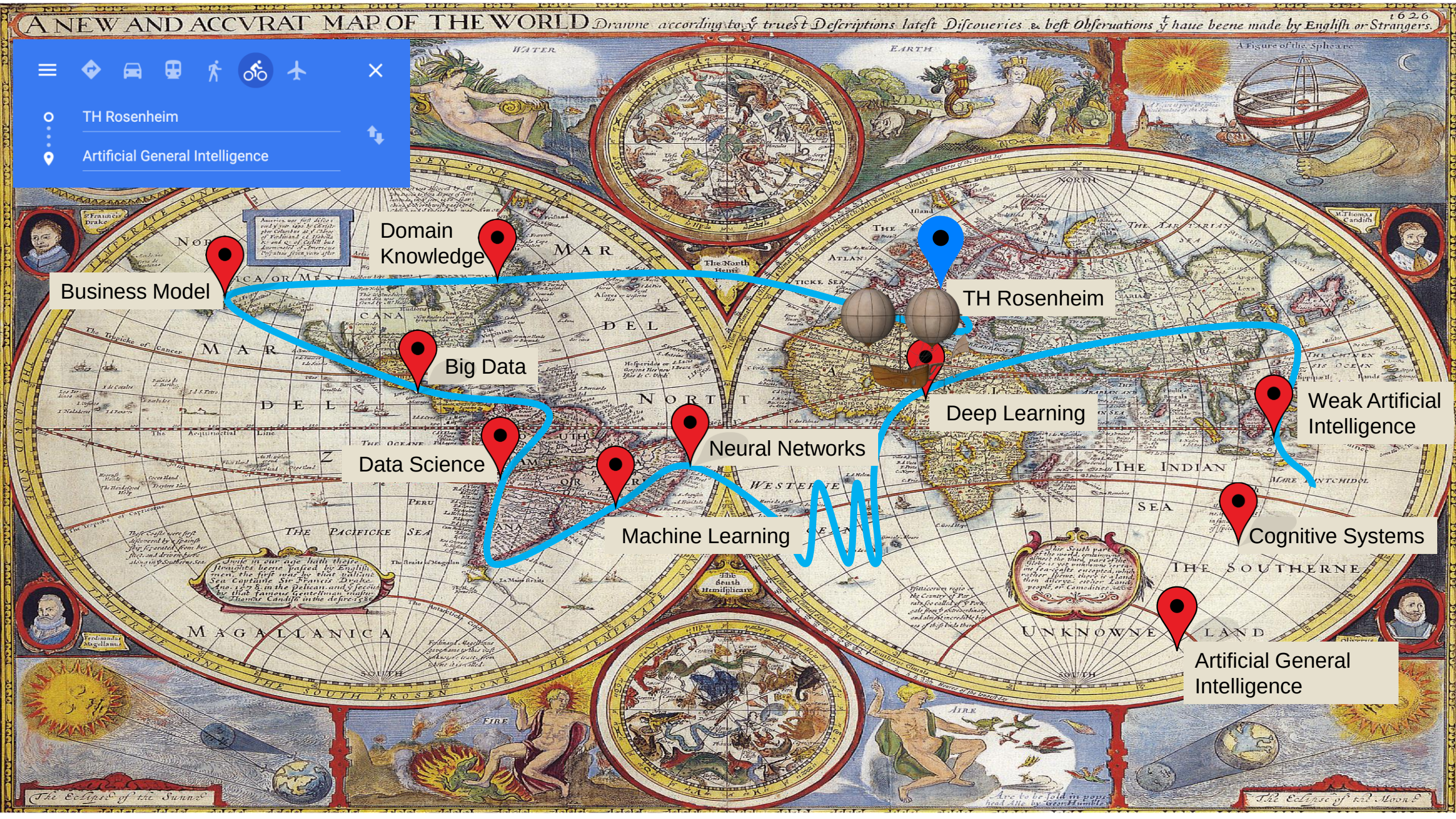

A NEW AND ACCVRAT MAP OF THE WORLD Drawne according to ye truest Descriptions latest Discoueries & best Obseruations yt haue beene made by English or Strangers. 1626
TH Rosenheim
Artificial General Intelligence
Domain
Knowledge
Business Model
TH Rosenheim
Big Data
Deep Learning
Weak Artificial Intelligence
Neural Networks
Data Science
Machine Learning
Cognitive Systems
Artificial General Intelligence

Deep Neural Networks (DNN)

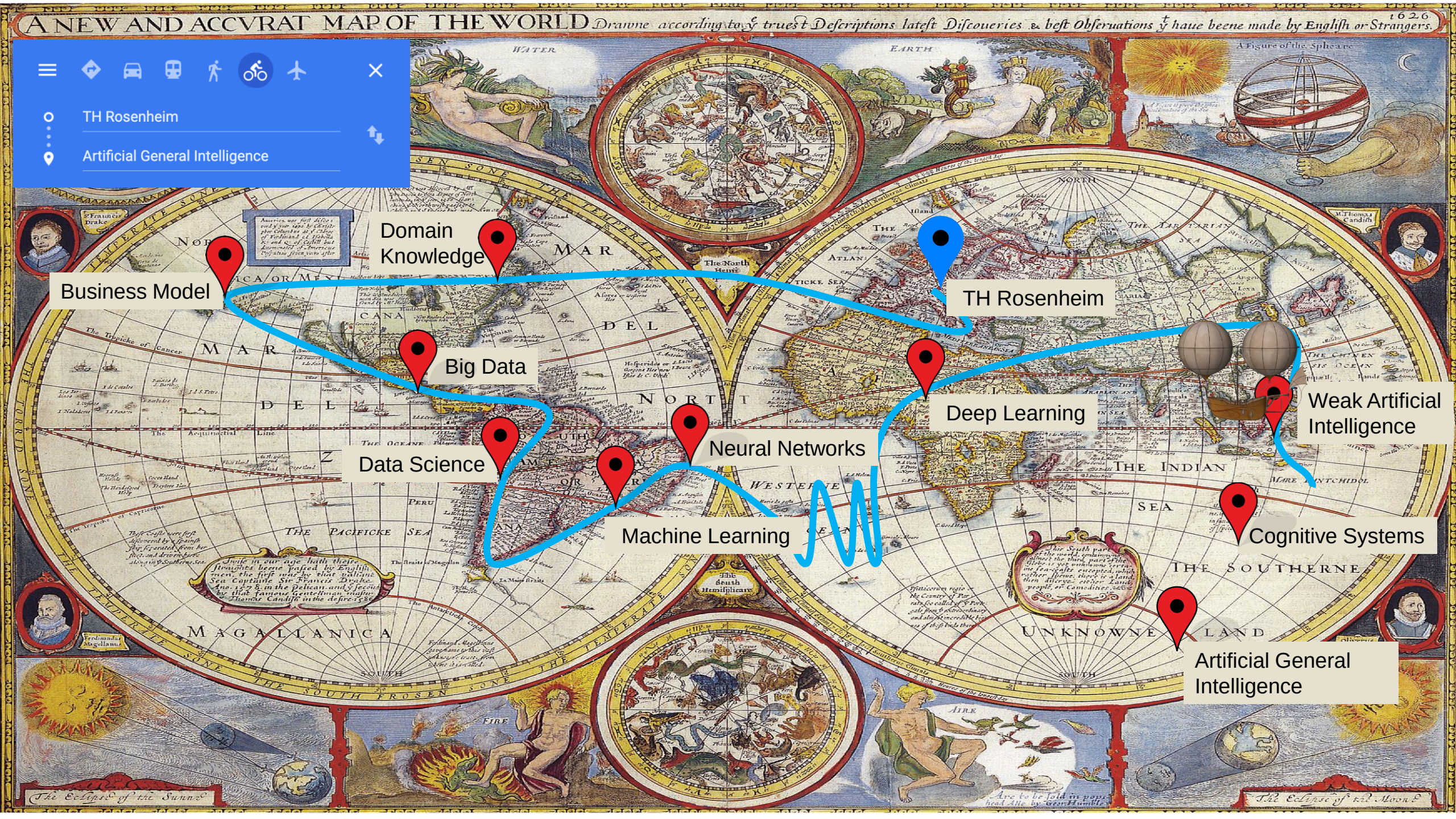
- Deep = Many hidden layers
- Can model complex, non-linear functions
- Popular since ~2012: ImageNet Moment
- Many architectural variants, e.g.
  - RNN and LSTM for language modelling
  - CNN for computer vision
  - Encode-Decoder for text processing
- Training and Model Evaluation usually like ANNs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






A NEW AND ACCVRAT MAP OF THE WORLD Drawne according to ye truest Descriptions latest Discoueries & best Obseruations yt haue beene made by English or Strangers. 1626
TH Rosenheim
Artificial General Intelligence
Domain Knowledge
Business Model
Big Data
Data Science
Neural Networks
Machine Learning
Deep Learning
TH Rosenheim
Weak Artificial Intelligence
Cognitive Systems
Artificial General Intelligence

Weak AI vs. Strong AI (AGI)

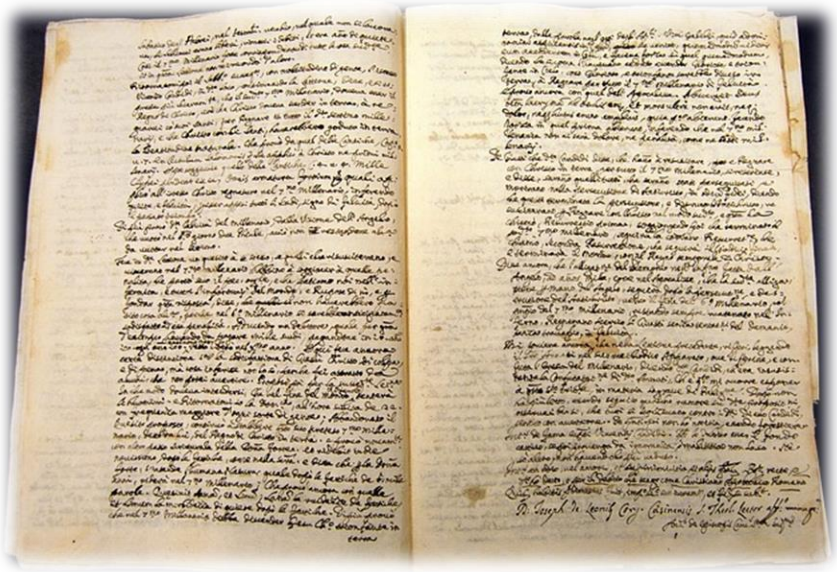

A NEW AND ACCVRAT MAP OF THE WORLD Drawne according to ye truest Descriptions latest Discoueries & best Obseruations yt haue beene made by English or Strangers. 1626
TH Rosenheim
Artificial General Intelligence
Domain Knowledge
Business Model
Big Data
Data Science
Neural Networks
Machine Learning
TH Rosenheim
Deep Learning
Weak Artificial Intelligence
Cognitive Systems
Artificial General Intelligence

Cognitive Systems

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

Exercises

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

Technische Hochschule Rosenheim

Photo by Joseph Barrientos on Unsplash