

# Intelligente Informationssysteme

## 0 - Overview

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- Organisatorisches
- Wechselspiel zwischen Vorlesung und Anwendung
- Wünschenswerte Voraussetzung: Grundkenntnisse in Python
- Ziel der Vorlesung
- Überblick über die Inhalte der Vorlesung
- Prüfung: Referate und Projektarbeit

# Inhaltliche Zusammenlegung Intelligente Informationssysteme und Maschinelles Lernen mit Python

Block	Intelligente Informationssysteme HS Reutlingen	Maschinelles Lernen mit Python PSE
Einführung in Python und Neuronale Netze	18.10.25 08:00 - 17:00 Uhr HSR	25.10.25 09:00 - 17:00 Uhr online
LLMs und Conversational AI	15.11.25 08:00 - 17:00 Uhr HSR	08.11.25 09:00 - 17:00 Uhr online
Multi Agent Systems	06.12.25 08:00 - 17:00 Uhr HSR	28.11.25 09:00 - 17:00 Uhr KWH
Context Engineering & Retrieval Augmented Generation	10.01.26 08:00 - 17:00 Uhr HSR	09.01.26 09:00 - 17:00 Uhr online (13.12.25 alternative)
Referate/Projektvorstellung	31.01.26 08:00 - 17:00 Uhr HSR	24.01.26 09:00 - 17:00 Uhr (23.01.26 alternative)



Ziel 1: Grundverständnis für Maschinelles Lernen mit Neuronalen Netzen

Ziel 2: Grundverständnis für generative künstliche Intelligenz (GenAI) und Sprachmodelle ((Large) Language Models)

Ziel 3: (Gen) AI-Anwendungsfälle verstehen, bewerten und dafür geeignete Software-Architekturen designen können.

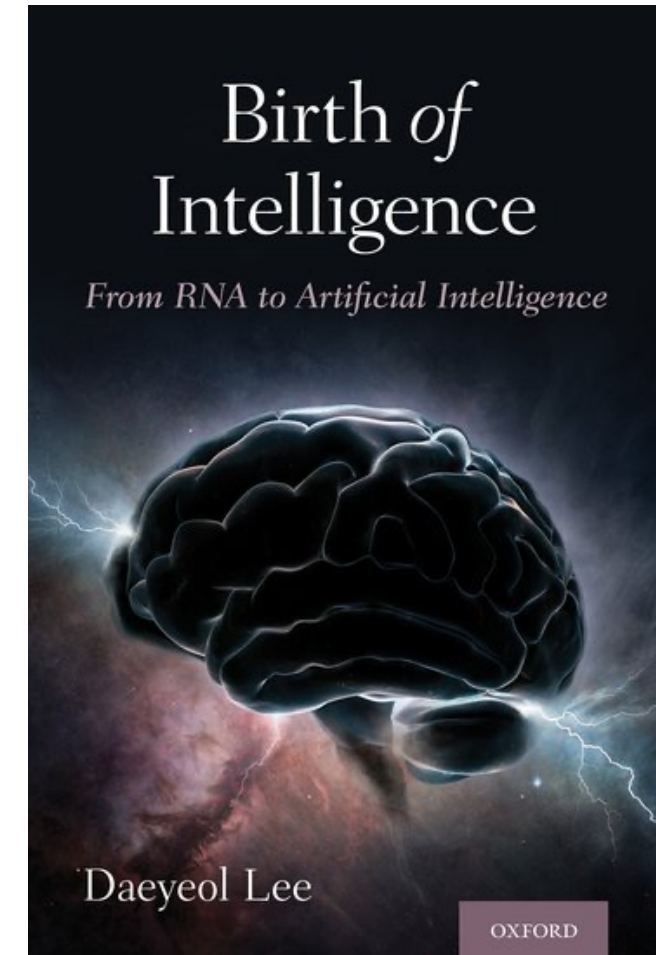


# 00.01 Artificial Intelligence



# Intelligence

- Intelligence can be defined as the ability to solve complex problems or make decisions with outcomes benefiting the actor and has evolved in lifeforms to adapt to diverse environments for their survival and reproduction.
- For animals, problem-solving and decision-making are functions of their nervous systems, including the brain, so intelligence is closely related to the nervous system.

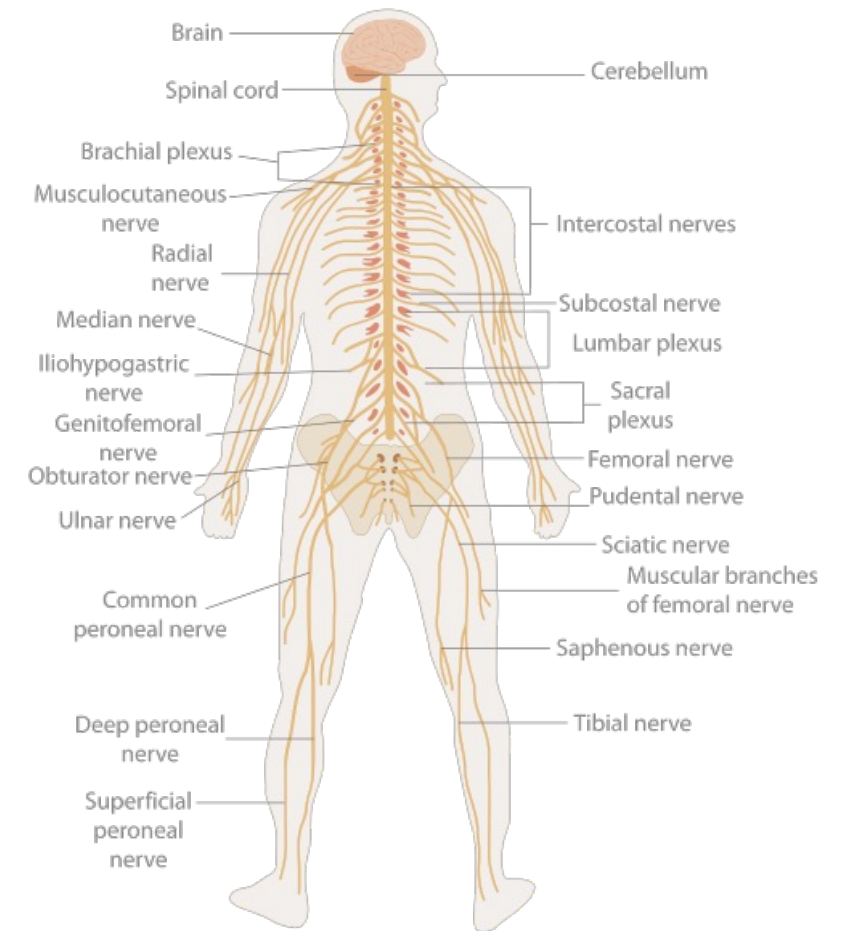


<https://www.hopkinsmedicine.org/news/articles/2020/10/qa-what-is-intelligence>



“In biology, the nervous system is the highly complex part of an animal that **coordinates its actions and sensory information** by transmitting signals to and from different parts of its body.

The nervous system **detects environmental changes** that impact the body, then works in tandem with the endocrine system **to respond to such events.**”



[https://en.wikipedia.org/wiki/Nervous\\_system](https://en.wikipedia.org/wiki/Nervous_system)





# Intelligence

Human intelligence is the ability

- to think,
- to learn from experience,
- to solve problems, and
- to adapt to new situations





# Artificial Intelligence

Artificial Intelligence (AI), a term coined by emeritus Stanford Professor John McCarthy in 1955, was defined by him as

“the science and engineering of making intelligent machines”

[https://en.wikipedia.org/wiki/John\\_McCarthy\\_\(computer\\_scientist\)](https://en.wikipedia.org/wiki/John_McCarthy_(computer_scientist))

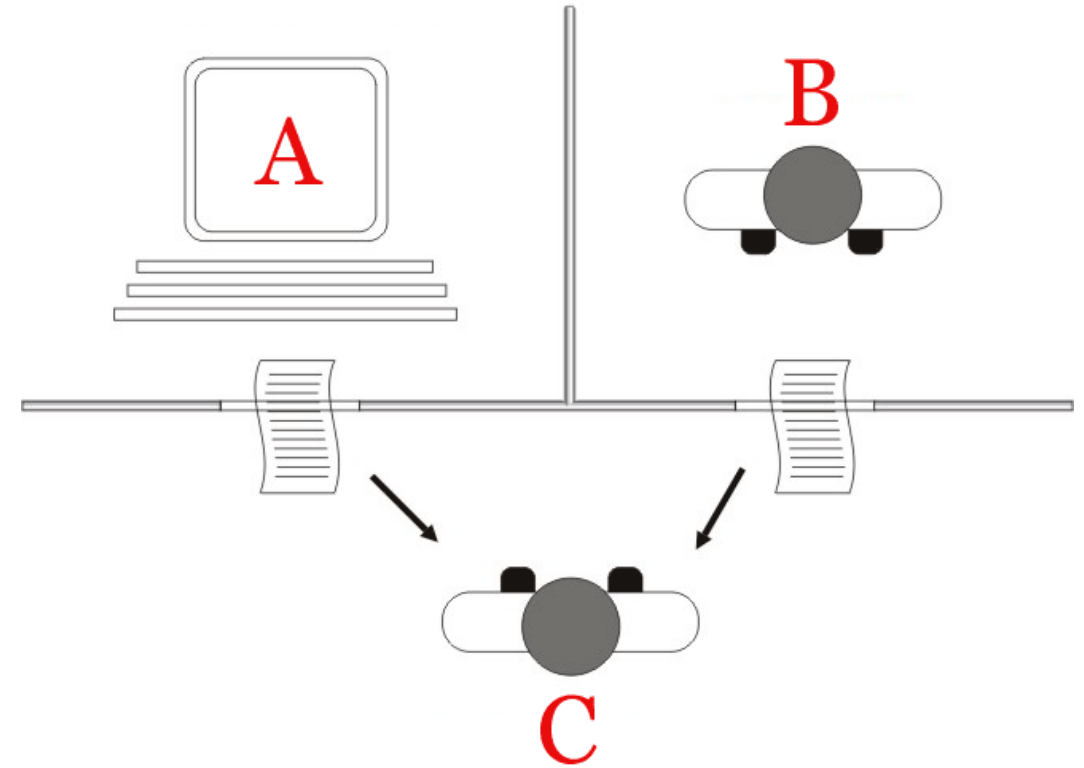


# Turing Test approach

The Turing Test proposed by Alan Turing (1950), was designed to provide a satisfactory operational definition of intelligence.

To pass the Turing Test an AI system would need to possess the following capabilities:

- **Natural Language Processing** to be able to communicate
- **Knowledge Representation** to store what it knows or hears
- **Automated Reasoning** to use the stored information to answer questions and to draw new conclusions
- **Machine Learning** to detect patterns and adapt to new circumstances



Turing Test

[https://en.wikipedia.org/wiki/Turing\\_test](https://en.wikipedia.org/wiki/Turing_test)



## Artificial Intelligence is

- technology that enables computers and machines to **simulate human intelligence** and **problem-solving capabilities**.
- the ability of machines to think, analyze, learn and decide in **a rational way** that is **analogous to how human beings do**.
- refers to systems that **display intelligent behavior** by analyzing their environment and taking actions – with some degree of autonomy – to achieve specific goals.

Thinking Humanly

Thinking Rationally

Acting Humanly

Acting Rationally

To determine whether a system is intelligent,  
we have to observe it.



# Artificial Intelligent System (European Commission)

An AI system is thus first and foremost **rational**. But how does an AI system achieve rationality? It does so by:

- **perceiving the environment** in which the system is immersed through some sensors, thus collecting and interpreting data,
- **reasoning** on what is perceived or processing the information derived from this data,
- **deciding** what the best action is,
- and then **acting** accordingly, through some actuators, thus possibly modifying the environment.

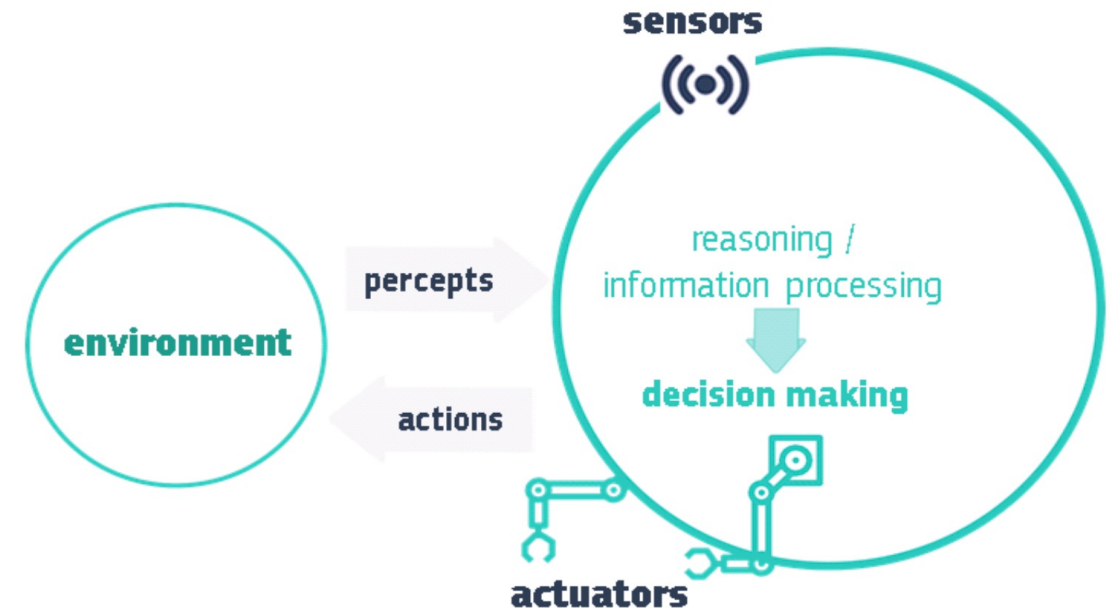


Figure 1: A schematic depiction of an AI system.

AI systems can either use

- symbolic rules or
- learn a numeric model, and

they can also adapt their behavior by analyzing how the environment is affected by their previous actions.

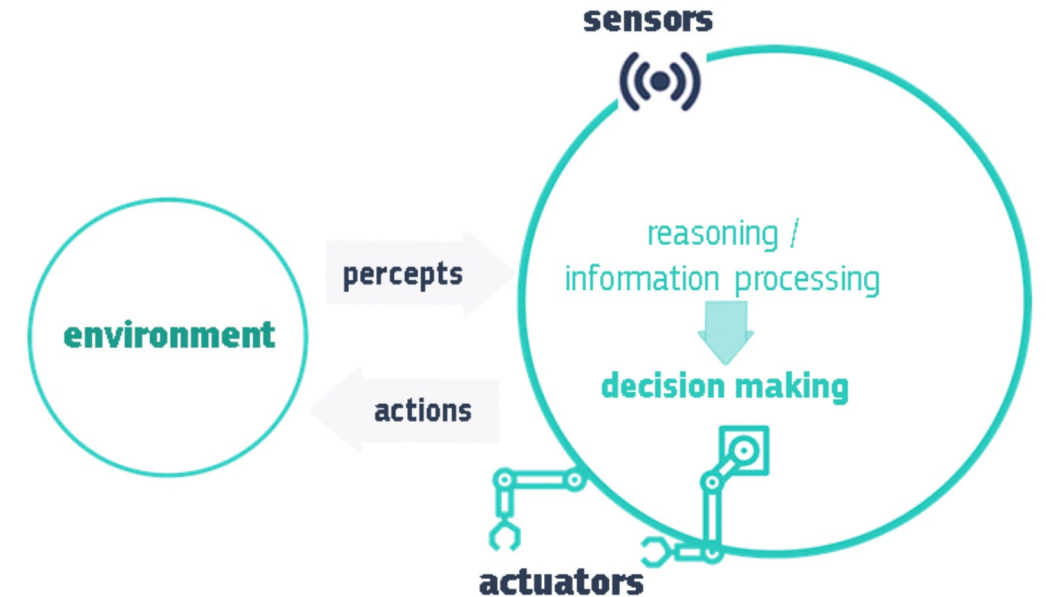


Figure 1: A schematic depiction of an AI system.

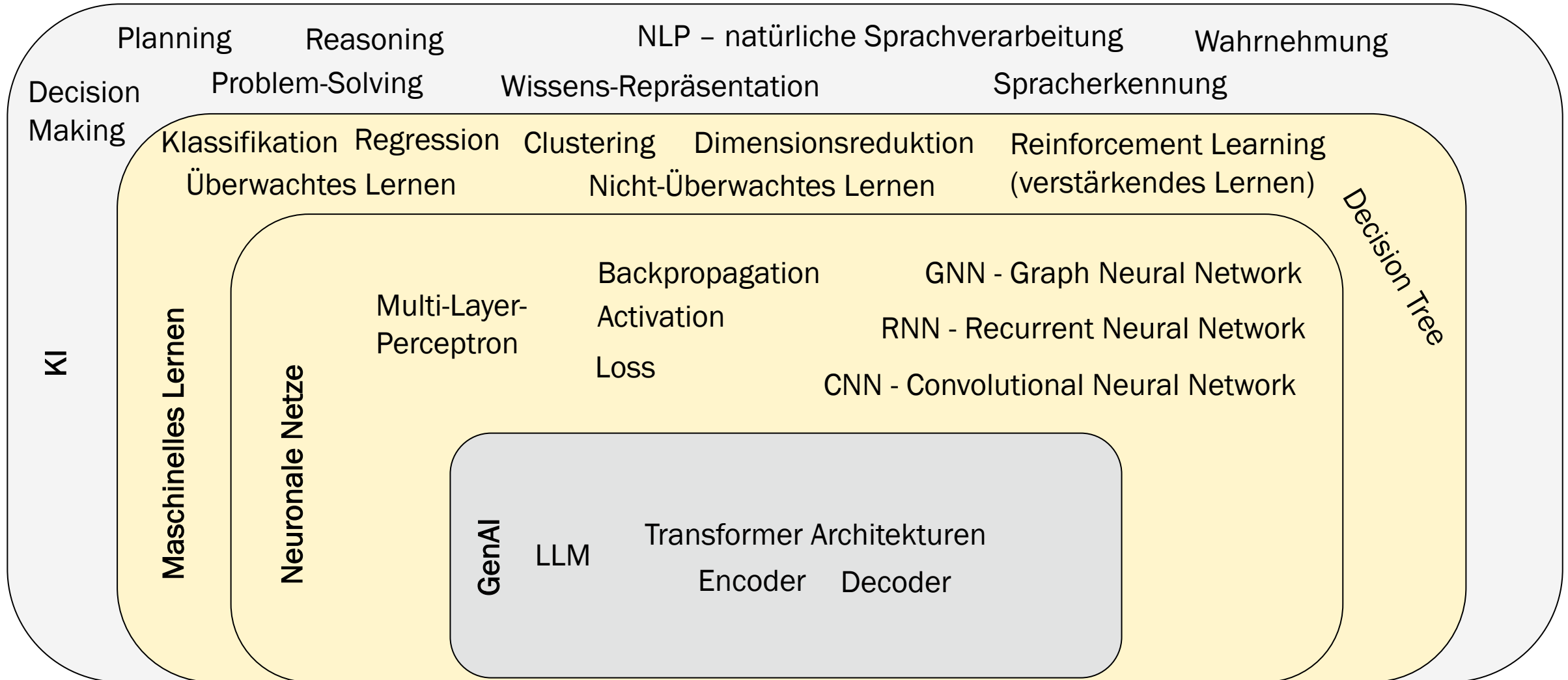
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KI ist das Bestreben, intellektuelle Aufgaben zu automatisieren, die normalerweise von Menschen ausgeführt werden.

Francios Chollet







## Conversational AI

Simulate a conversation with the feeling of having a conversation with a human.

- conversational memory
- dialogue generation

## Retrieval Augmented Generation

Knowledge Retrieval and understanding is key

- Access to contextual data
- Retrieval and Augmentation Strategies

## CoPilot

Assists a human in his work.

The key differentiator for becoming a CoPilot is understanding of the environment in which the human works.

- access to tools and data,
- reasoning and planning capabilities,
- and specialized profiles

## Multi Agent Problem Solver

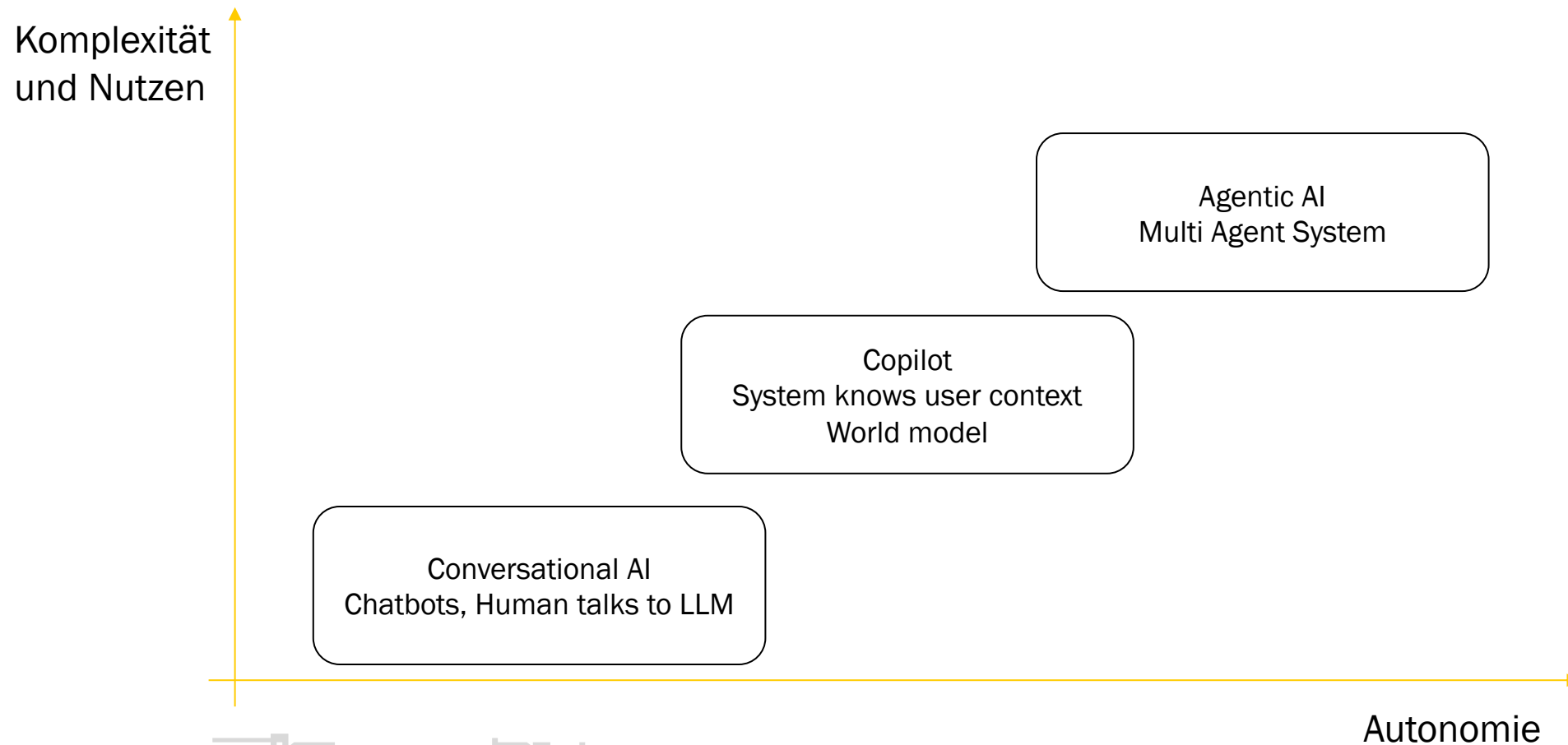
Agents collaborate to solve a problem

Each agent has access to it's own set of tools and can assume a very specific role while reasoning and planning it's actions.

- Perceiving the environment
- Reasoning & decision making
- Acting



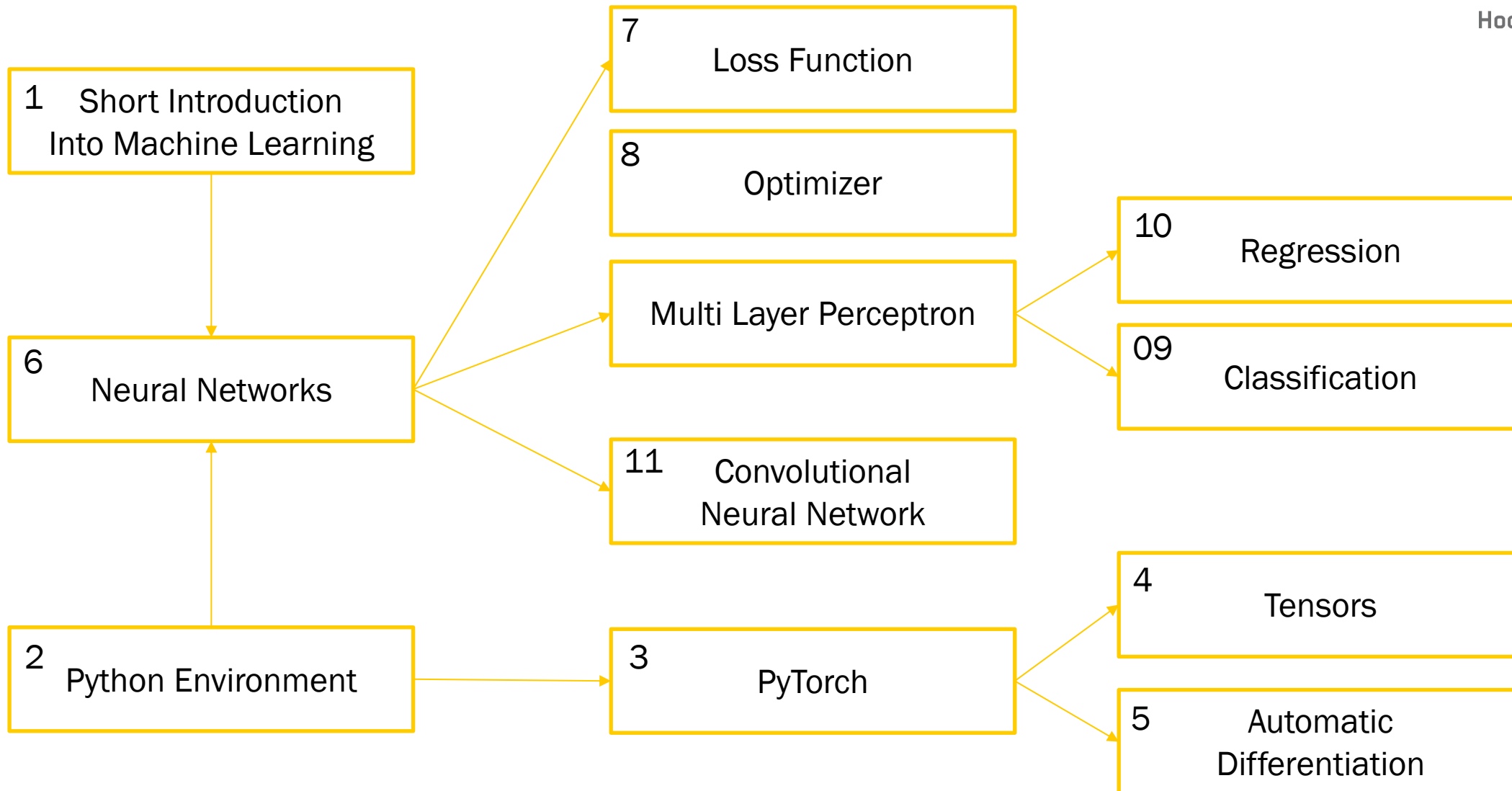
# Complexity versus Autonomy



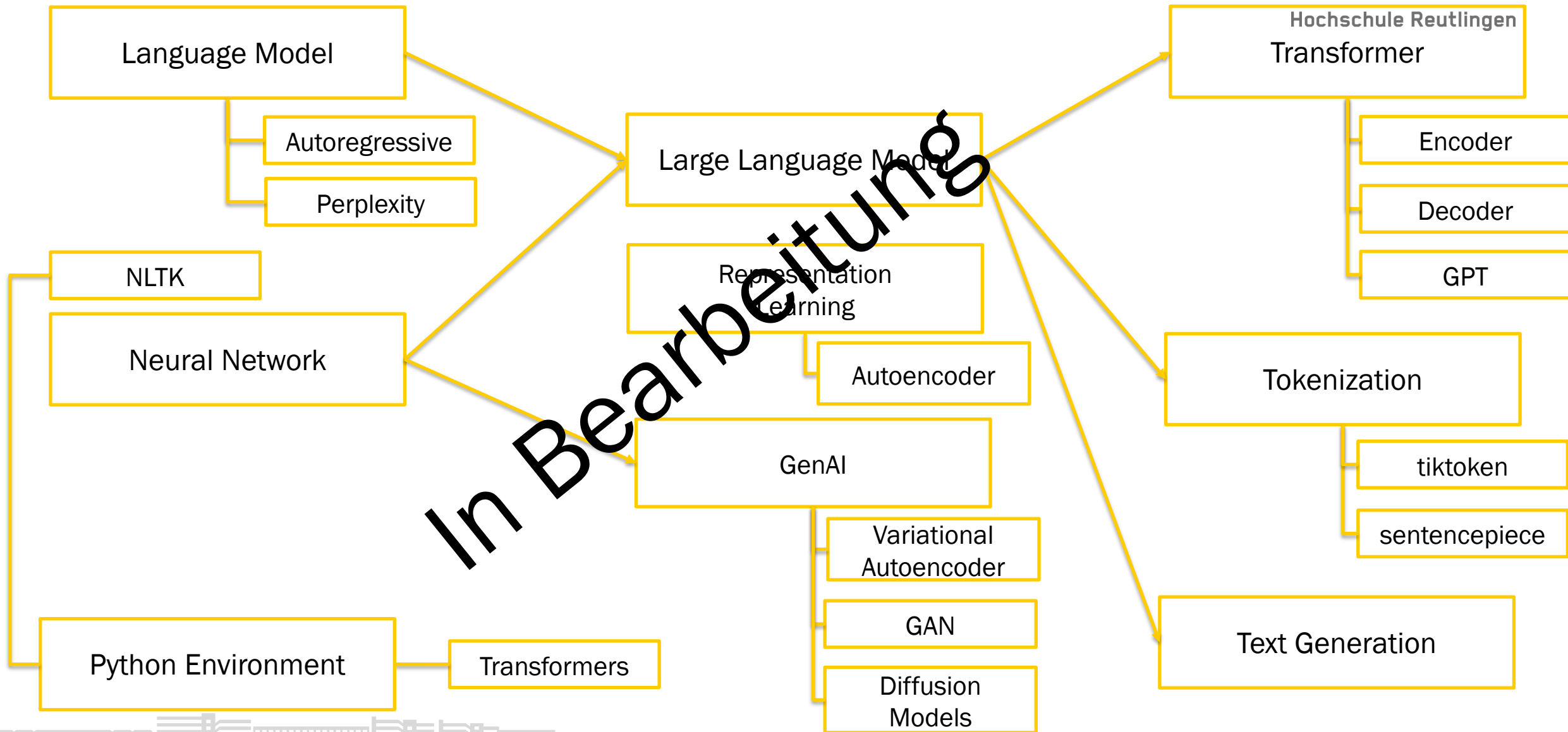
## 00.02 Content



# Bock 1 – Neural Network



# Bock 2 – Generative AI & Transformer



# Bock 2 – Conversational AI

Large Language Model

Prompt Engineering

Inference Engine

FastAPI

Scaling Law

In-Context Learning

Fine-Tuning

Zero- / Few-Shot

Reasoning / Logic

Reduce Hallucination

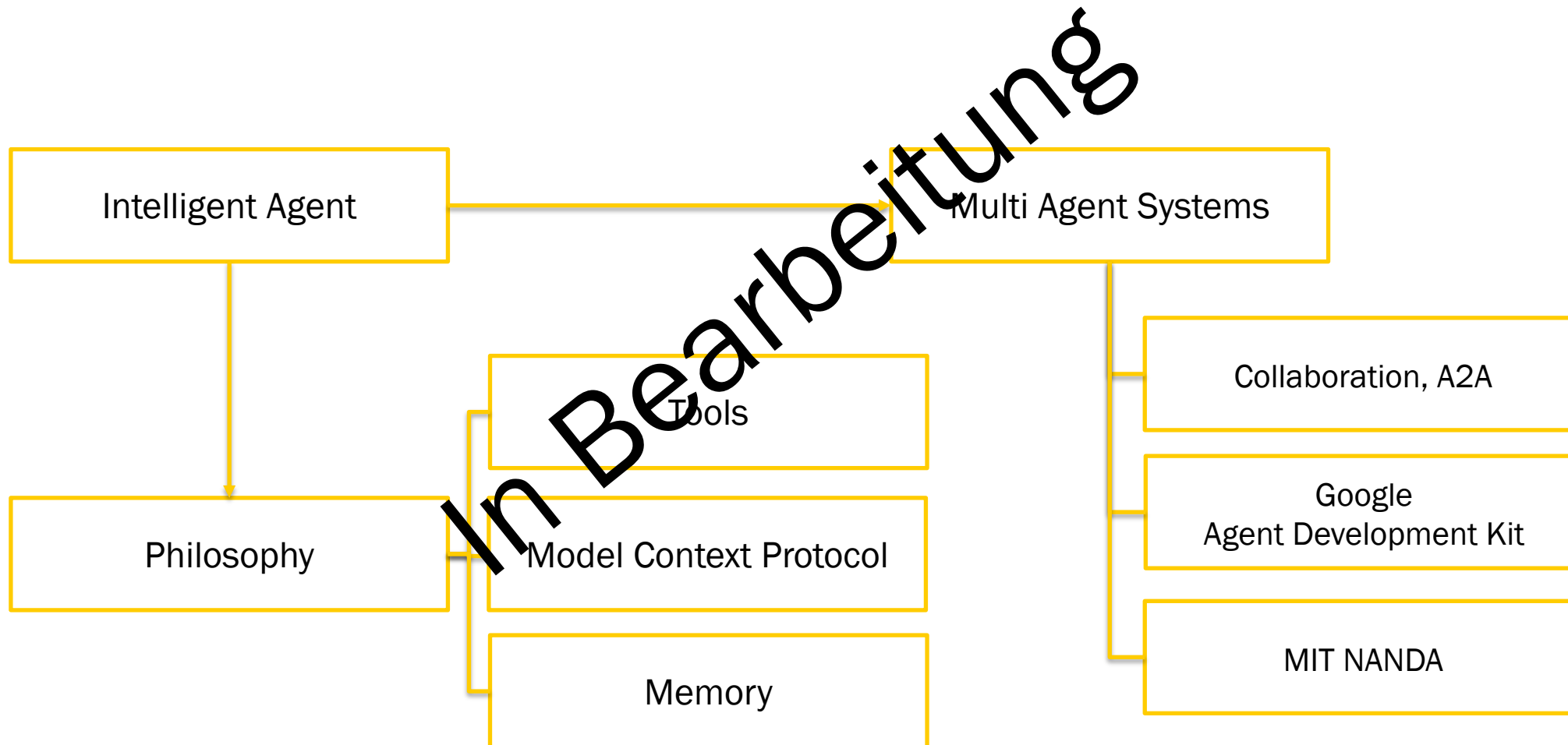
Streamlit

User Interface

Conversational AI

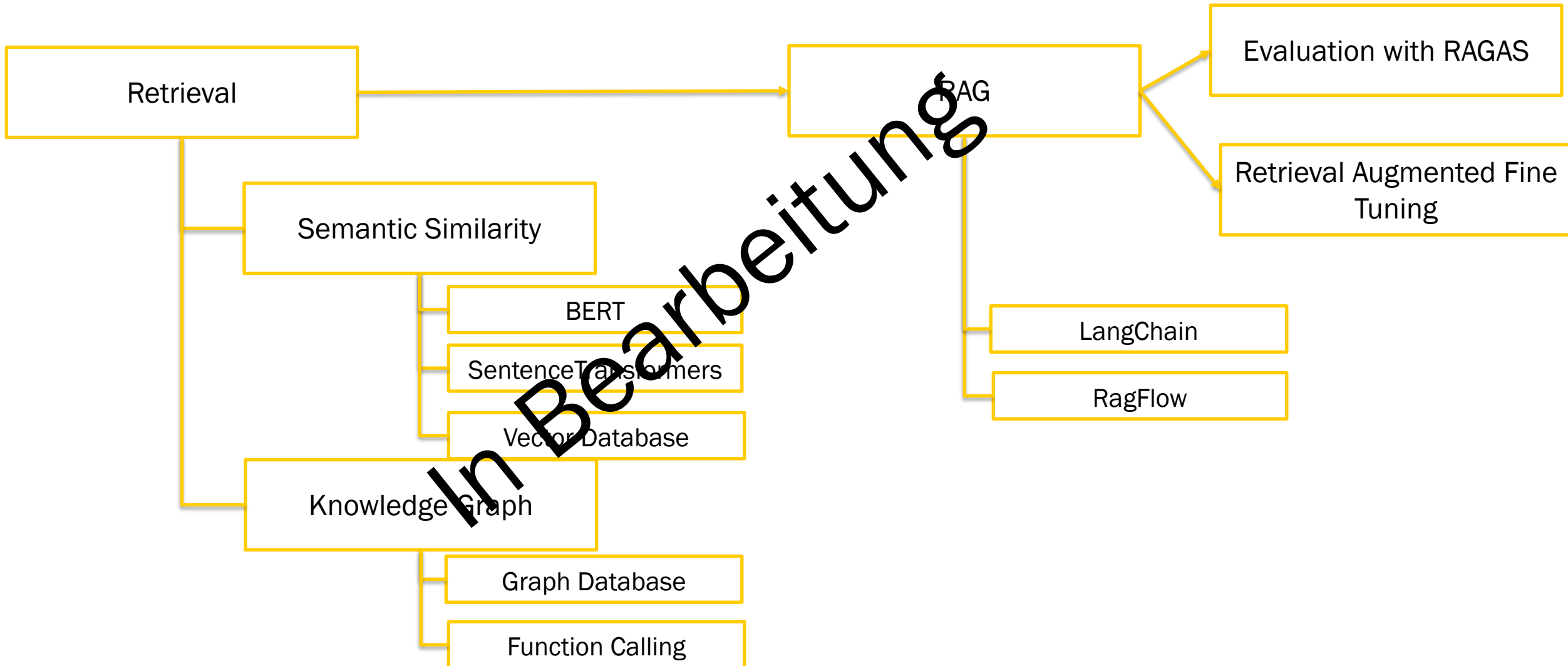
In Bearbeitung

# Block 3 - Multi Agent Systems





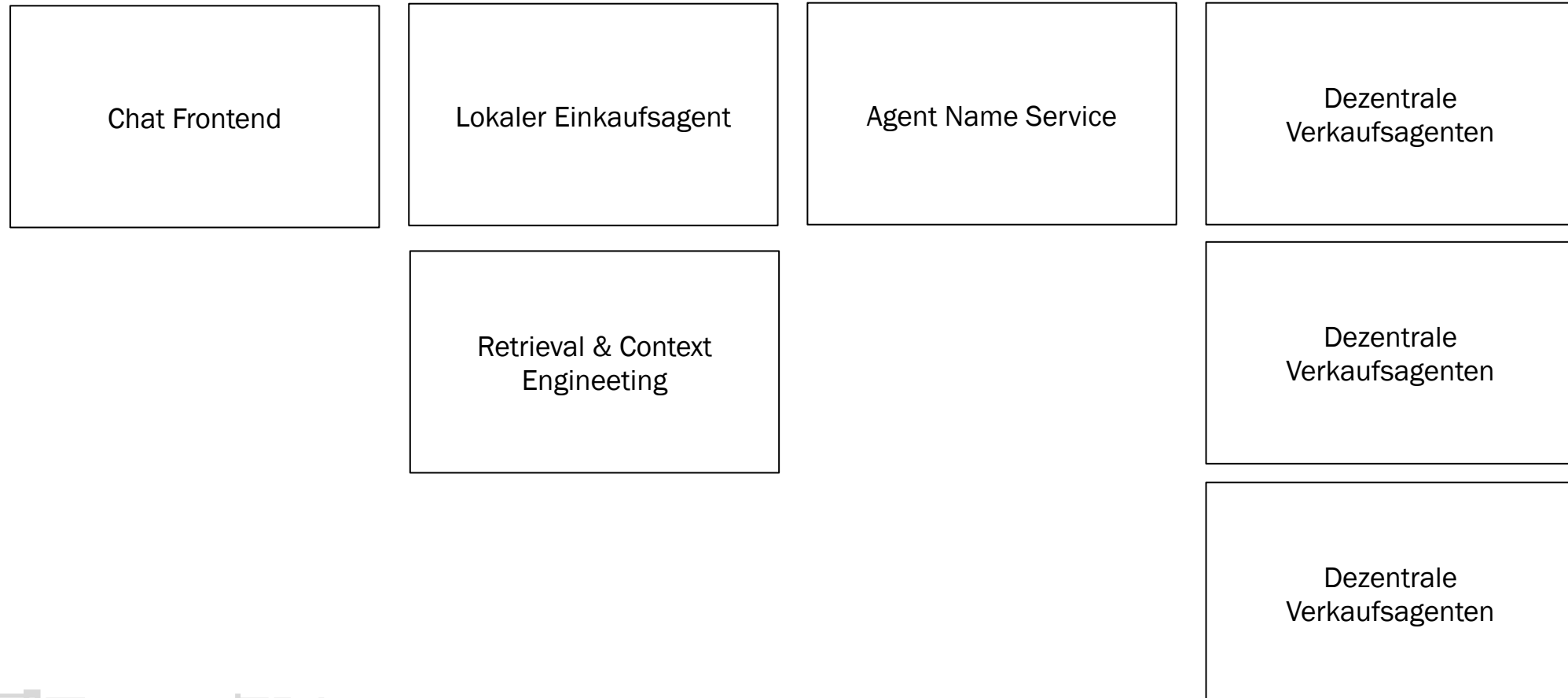
# Block 4 –Context Engineering



# 00.03 Projektarbeit



- Idee: Wir erstellen als gemeinsames Projekt auf Basis von MIT NANDA ein agentisches Netzwerk das eine Intent-Driven Architecture implementiert



# 00.04 Literatur



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