

Applied Artificial Intelligence

01 - Foundations

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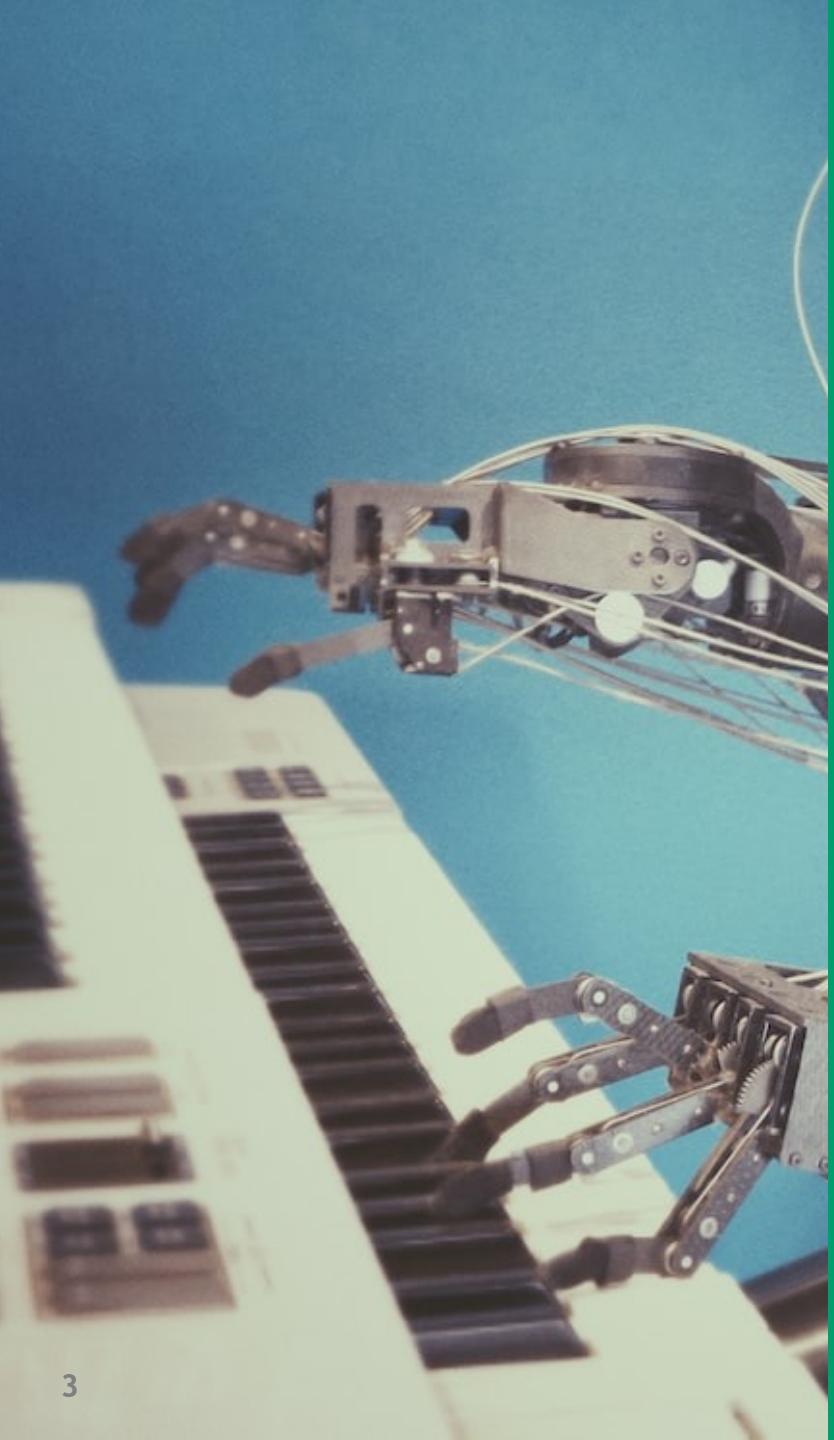
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Objectives of this lecture

Become familiar with the terminology, in particular Artificial Intelligence, Machine Learning and Systems Thinking

Gain a first understanding of the AI lifecycle



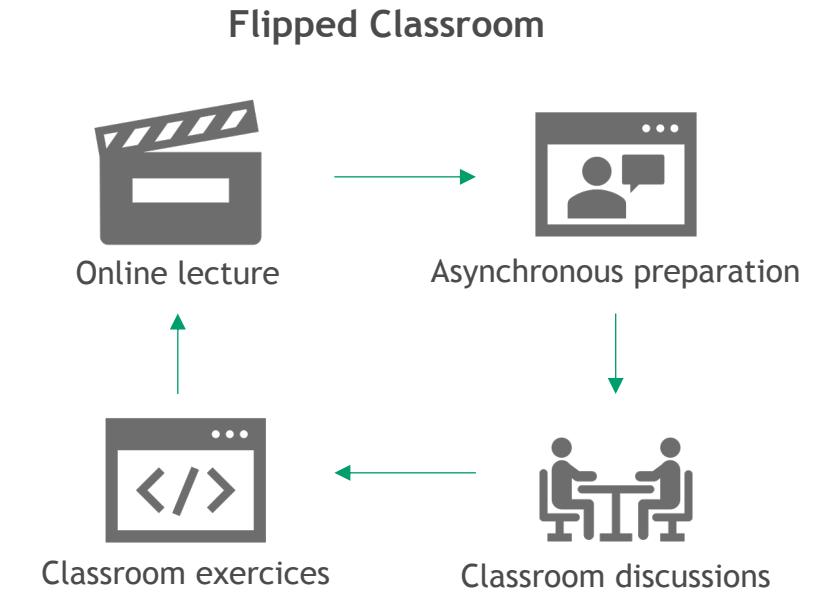
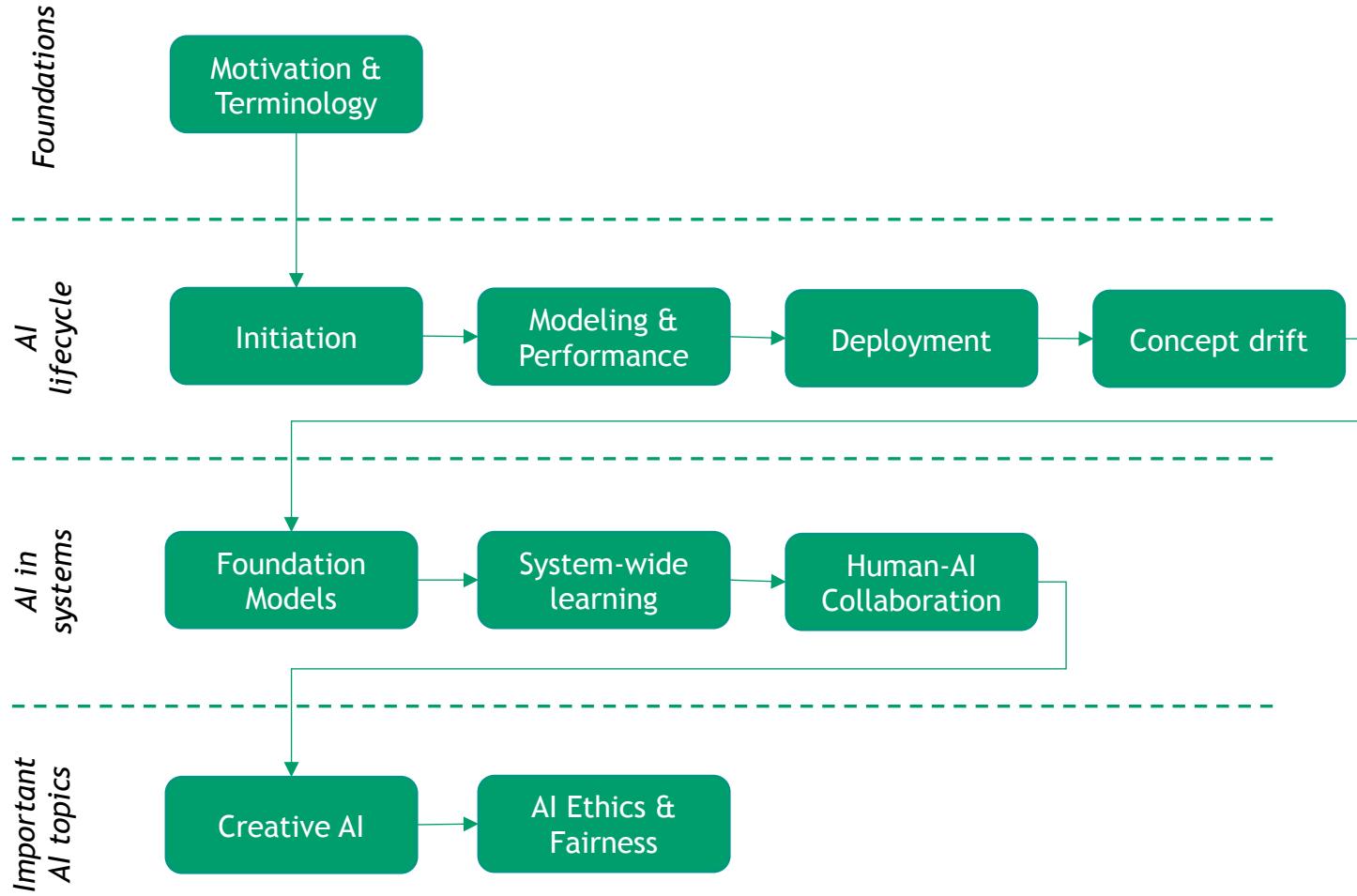
- 1 Organizational
- 2 Artificial Intelligence & Machine Learning
- 3 Systems Thinking
- 4 The AI Lifecycle



- 1 Organizational
- 2 Artificial Intelligence & Machine Learning
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Organizational

The story of the lecture

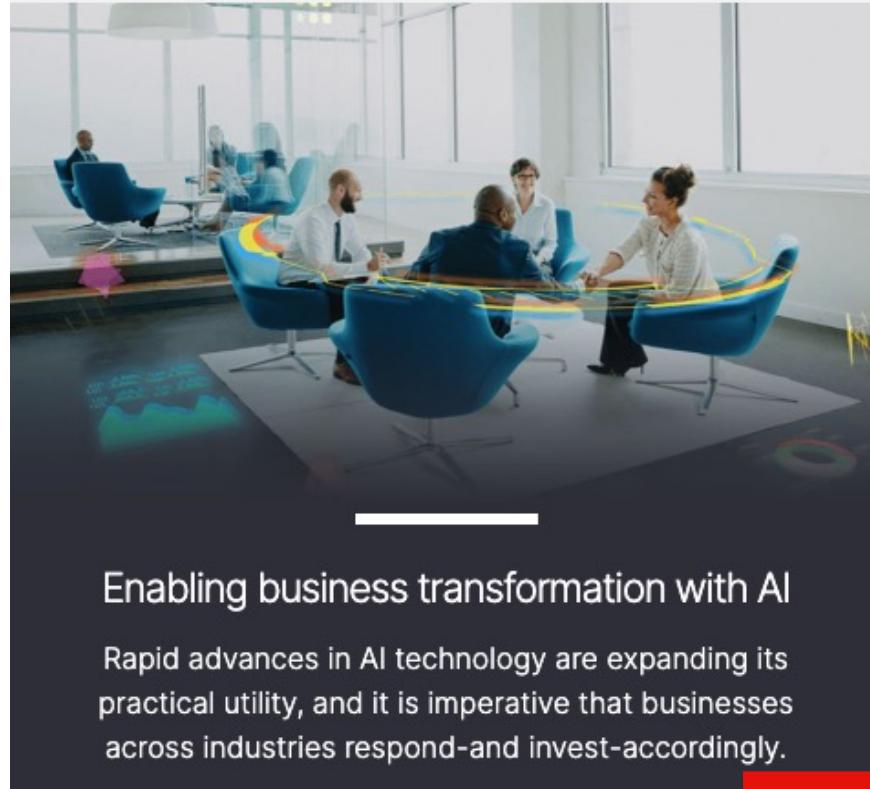




- 1 Organizational
- 2 Artificial Intelligence & Machine Learning
- 3 Systems Thinking
- 4 The AI Lifecycle

Artificial Intelligence & Machine Learning

Why AI? A business perspective.



February 12th 2024

The
Economist

Artificial intelligence
is driving real
business innovation

How organizations can build and
scale game-changing generative AI
services



June 14th 2024

The
Washington
Post

<https://impact.economist.com/projects/facing-the-future-with-ai/enabling-business-transformation-with-ai/> [1]
<https://www.washingtonpost.com/creativegroup/aws/artificial-intelligence-is-driving-real-business-innovation/> [2]

Artificial Intelligence & Machine Learning

Why AI? A research perspective.

 www.nature.com/jbg

REVIEW ARTICLE **OPEN** 

Advances in AI and machine learning for predictive medicine

Alok Sharma^{a,1,2}, Artem Lysenko^{2,3}, Shangru Jia^a, Keith A. Boroevich^{2,4} and Tatsuhiko Tsunoda^{2,4,5}

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The field of omics, i unprecedented opp analysis and interpret models in omics as This review explore convolutional neur in tabular (table-like effectiveness. This app and improving per issues related to the approach, involving illuminates these co analysis and related

Health Sciences Review 10 (2024) 100150

Contents lists available at ScienceDirect

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journal homepage: www.elsevier.com/locate/hsr

Journal of Human G

INTRODUCTION
Recent advances in g deep learner into t. Among these, one example of approach greatly improved our understanding many import this research. We propose solutions to unlock its I from the insufficient capture of full disease numbers of variants, vari often small and conte isms that translate gen integration of genetic i

Talha Iqbal^{a,b,*}, **Mehedi Masud**^a, **Bilal Amin**^{a,c}, **Conor Feely**^d, **Mary Faherty**^d, **Tim Jones**^d, **Michelle Tierny**^e, **Atif Shahzad**^{a,e}, **Patricia Vazquez**^b

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ARTICLE INFO

Kyoword:
Artificial intelligence
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Personalized healthcare
Performance validation

ABSTRACT

In the era of big data, artificial intelligence (AI) algorithms have the potential to revolutionize healthcare by improving patient outcomes and reducing healthcare costs. AI algorithms have frequently been used in health care for predictive modelling, image analysis and drug discovery. Moreover, as a recommender system, these algorithms have shown promising impacts on personalized healthcare. A recommender system is a system that recommends the behaviour of the user and predicts the user's next purchase (or preference) based on their previous preferences. Implementing AI as a recommender system improves this prediction accuracy and solves cold start and data sparsity problems. However, most of the methods and algorithms are tested in a simulated setting which cannot recapitulate the influencing factors of the real world. This review article systematically reviews prevailing research in AI-based recommender systems and discusses AI algorithms as a recommender system. A comprehensive review of the field of healthcare. It also provides a summary around the latest AI-based cutting-edge academic and practical contributions present in the literature, identifies challenges in the implementation of AI as a recommender system, and acceptance of AI-based recommender systems by clinicians. The findings of this article direct researchers and professionals to comprehend currently developed recommender systems and the future of medical devices integrated with real-time recommender systems for personalized healthcare.

Medical

frontiers | Frontiers in Environmental Science

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Artificial intelligence and IoT driven technologies for environmental pollution monitoring and management

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Review

The synergistic interplay of artificial intelligence and digital twin in environmentally planning sustainable smart cities: A comprehensive systematic review

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Environmental planning

Environmental sustainability

ABSTRACT

The development of sustainable smart cities is undergoing a significant transformation due to the integration of emerging computational technologies and innovative models. These advances are reshaping data-driven planning strategies, practices, and approaches, thereby facilitating the achievement of environmental sustainability goals. This transformative wave signals a fundamental shift – marked by the synergistic operation of artificial intelligence (AI), artificial intelligence of things (AIoT), and data-driven environmental planning. The study aims to comprehensively explore the integration of AIoT and UDT in isolation, a significant knowledge gap exists regarding their synergistic interplay, collaborative integration, and collective impact on data-driven environmental planning in the dynamic context of sustainable smart cities. To address this gap, this study presents a comprehensive systematic review to answer the following research questions: 1. What theoretical and practical frameworks support the integration of AIoT and UDT in data-driven environmental planning processes in the context of sustainable smart cities? 2. What are the components of AIoT and UDT that can be synthesized into a novel comprehensive framework? 3. How does integrating AI and AIoT reshape the landscape of data-driven planning to improve the environmental performance of sustainable smart cities? 3. How can AI and AIoT augment the capabilities of UDT to enhance data-driven environmental planning processes in sustainable smart cities? 4. What challenges and opportunities exist in integrating and implementing AI, AIoT, and UDT in data-driven environmental urban planning, and what strategies can be devised to surmount or mitigate them? Methodologically, this study involves a rigorous analysis and synthesis of studies

Environmental

www.nature.com/scientificreports/

scientific reports

OPEN

Opportunities and challenges of integrating artificial intelligence in

Information Development
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<https://doi.org/10.1177/0266669231200628>

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Original Manuscript

Artificial intelligence in developing countries: The impact of generative artificial intelligence (AI) technologies for development

Nishith Reddy Mannuru, Sakib Shahriar, Zoë A Teel, Ting Wang, Brady D Lund , Solomon Tijani, Chatterjee Oak Pobhoom, Daniel Aghabi , Joy Alhassan, AkJLyn Galley, Raana Kousari, Lydia Ogbadu-Oladapo, Shubham Kumar Saurav , Aishwarya Srivastava, Sai Priya Tamurmu, Sravya Uppala, and Praveenkumar Vaidya

Abstract

This paper explores the potential impact of Generative Artificial Intelligence (Generative AI) on developing countries, considering both positive and negative effects across various domains of information, culture, and industry. Generative Artificial Intelligence refers to artificial intelligence (AI) systems that generate content, such as text, audio, or video, aiming to produce novel and creative outputs based on training data. Compared to conversational artificial intelligence, generative artificial intelligence systems have the unique capability of not only providing replies but also generating the content of those responses. Recent advancements in Artificial Intelligence during the Fourth Industrial Revolution, exemplified by tools like ChatGPT, have gained popularity and reshaped content production and creation. However, the benefits of generative artificial intelligence are not equally accessible to all, especially in developing countries, where limited access to cutting-edge technologies and inadequate infrastructure pose challenges. This paper seeks to understand the potential impact of generative AI technologies on developing countries, considering economic growth, access to technology, and the potential paradigm shift in education, healthcare, and the environment. The findings emphasize the importance of providing the necessary support and infrastructure to ensure that generative AI contributes to inclusive development rather than deepening existing inequalities. The study highlights the significance of integrating Generative AI into the context of the Fourth Industrial Revolution in developing countries, where technological change is a crucial determinant of progress and equitable growth.

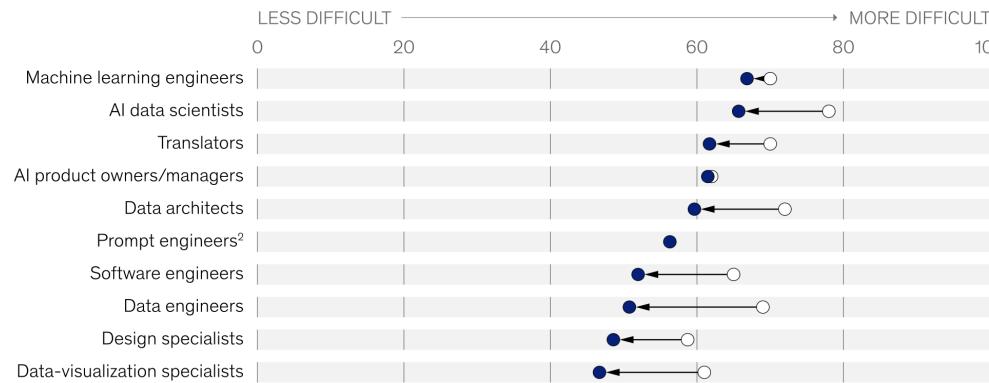
Social

Artificial Intelligence & Machine Learning

...but why now? It is not just ChatGPT.

Hiring for AI-related roles remains a challenge, though reported difficulty has decreased since 2022 for many roles.

Share of respondents reporting difficulty in organizations' hiring of AI-related roles,¹ %



¹Asked only of respondents whose organizations have adopted AI in at least 1 function and who said their organization hired the given role in the past 12 months. Respondents who said "easy," "neither difficult nor easy," or "don't know" are not shown.

²Not asked of respondents in 2022.

Source: McKinsey Global Survey on AI, 1,684 participants at all levels of the organization, April 11–21, 2023

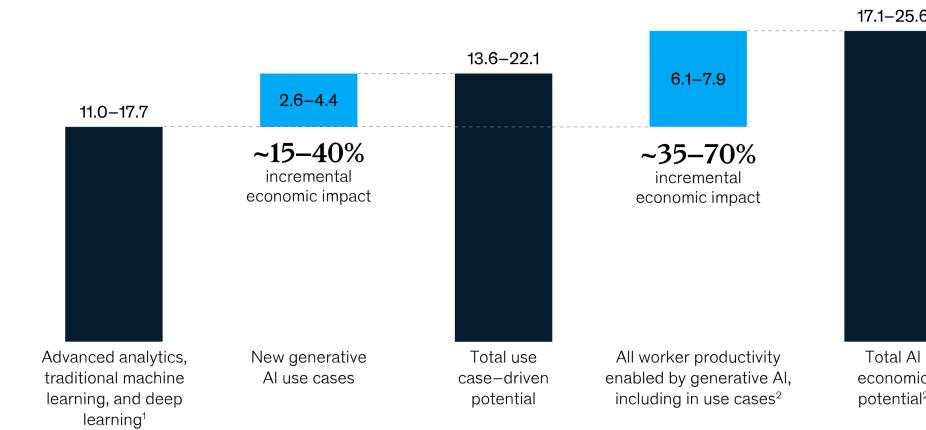
McKinsey & Company

Report August 1, 2023

www.mckinsey.com/capabilities/quantumblack/our-insights/the-state-of-ai-in-2023-generative-ais-breakout-year

Generative AI could create additional value potential above what could be unlocked by other AI and analytics.

AI's potential impact on the global economy, \$ trillion



¹Updated use case estimates from "Notes from the AI frontier: Applications and value of deep learning," McKinsey Global Institute, April 17, 2018.

²The range of potential value from the combined impact of new generative AI use cases and the increased worker productivity they could enable is \$6.1 trillion to \$7.9 trillion, including revenue impacts conservatively translated into productivity impact as difference between total impact and cost-isolated impact.

McKinsey & Company

Report: August 25, 2023

<https://www.mckinsey.com/featured-insights/mckinsey-explainers/whats-the-future-of-generative-ai-an-early-view-in-15-charts>

Artificial Intelligence & Machine Learning

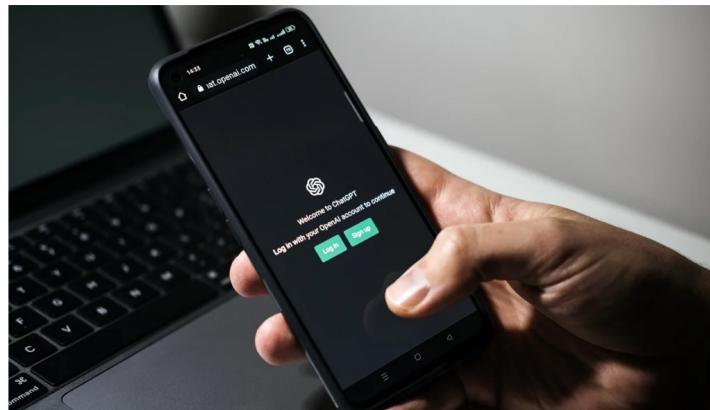
What are the challenges in application?

Bias in Data

[1]

AI can be racist, sexist and creepy. What should we do about it?

 Analysis by Zachary B. Wolf, CNN
Published 9:29 AM EDT, Sat March 18, 2023



The ChatGPT chatbot developed by OpenAI.

Labor Conditions

[2]

News • Policy & Finance
AI boom is dream and nightmare for workers in Global South

Lax labour regulations and low wages are the norm for data annotation workers in poorer nations, but many have no choice.



In the Philippines - long an outsourcing destination for its young, English-speaking population - freelance data annotation on platforms such as Upwork has become highly competitive. Image: ILO Asia-Pacific, CC BY-SA 3.0, via Flickr.

Thomson Reuters Foundation

6 minute read • March 16, 2023

Sustainability

[3]

Artificial Intelligence Is Booming—So Is Its Carbon Footprint

Greater transparency on emissions could also bring more scrutiny



Pipes pass through the chiller plant at a Google data center in Changhua, Taiwan. Photographer: Ashley Pory/Bloomberg

By [Josh Saul](#) and [Dina Bass](#)

9 March 2023 at 15:00 CET

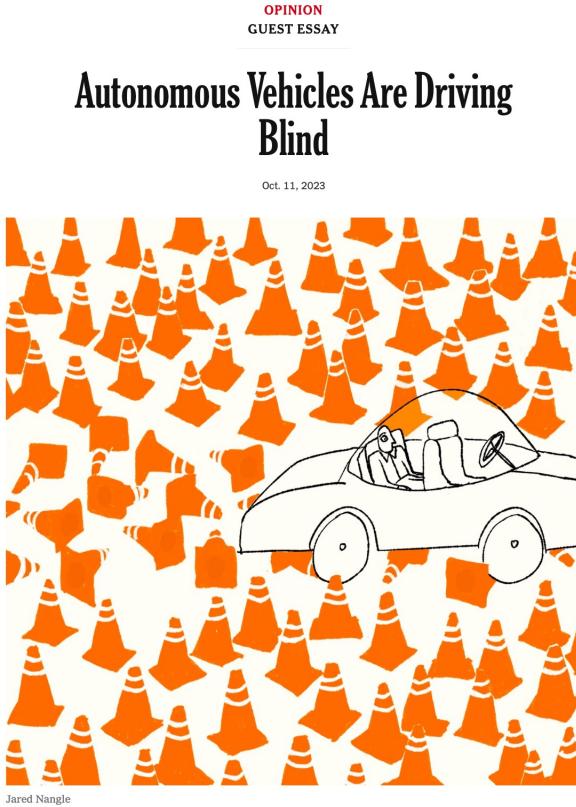
<https://edition.cnn.com/2023/03/18/politics/ai-chatgpt-racist-what-matters/index.html> [1]

<https://www.eco-business.com/news/ai-boom-is-dream-and-nightmare-for-workers-in-global-south/> [2]

<https://www.bloomberg.com/news/articles/2023-03-09/how-much-energy-do-ai-and-chatgpt-use-no-one-knows-for-sure?embedded-checkout=true> [3]

Artificial Intelligence & Machine Learning

Is it safe though? Appropriate Reliance.



[1]

ChatGPT provided better customer service than his staff. He fired them.

Artificial intelligence is rapidly changing the world of customer service and call centers. Developing economies worry they'll face the brunt.

By Pranshu Verma

October 3, 2023 at 7:00 a.m. EDT



(Davide Bonazzi for The Washington Post)

[2]

[https://www.nytimes.com/2023/10/11/opinion/driverless-cars-san-francisco.html#:~:text=When%20it%20comes%20to%20self,drive%20thousands%20of%20cars%20through \[1\]](https://www.nytimes.com/2023/10/11/opinion/driverless-cars-san-francisco.html#:~:text=When%20it%20comes%20to%20self,drive%20thousands%20of%20cars%20through)

[https://www.washingtonpost.com/technology/2023/10/03/ai-customer-service-jobs/ \[2\]](https://www.washingtonpost.com/technology/2023/10/03/ai-customer-service-jobs/)

[https://dl.acm.org/doi/abs/10.1145/3581641.3584066 \[3\]](https://dl.acm.org/doi/abs/10.1145/3581641.3584066)

Appropriate Reliance on AI Advice: Conceptualization and the Effect of Explanations

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ABSTRACT

AI advice is becoming increasingly popular, e.g., in investment and medical treatment decisions. As this advice is typically imperfect, decision-makers have to exert discretion as to whether actually follow that advice: they have to "appropriately" rely on correct and turn down incorrect advice. However, current research on appropriate reliance still lacks a common definition as well as an operational measurement concept. Additionally, no in-depth behavioral experiments have been conducted that help understand the factors influencing this behavior. In this paper, we propose Appropriate Reliance of Advice (AoR) as an underlying, quantifiable two-dimensional concept of advice seeking. We propose a research model that analyzes the effect of providing explanations for AI advice. In an experiment with 200 participants, we demonstrate how these explanations influence the AoR and, thus, the effectiveness of AI advice. Our work contributes fundamental concepts for the analysis of reliance behavior and the purposeful design of AI advisors.

CCS CONCEPTS

• Human-centered computing → Empirical studies in HCI • Computing methodologies → Artificial intelligence.

KEYWORDS

Appropriate Reliance, Explainable AI, Human-AI Collaboration, Human-AI Complementarity

ACM Reference Format:

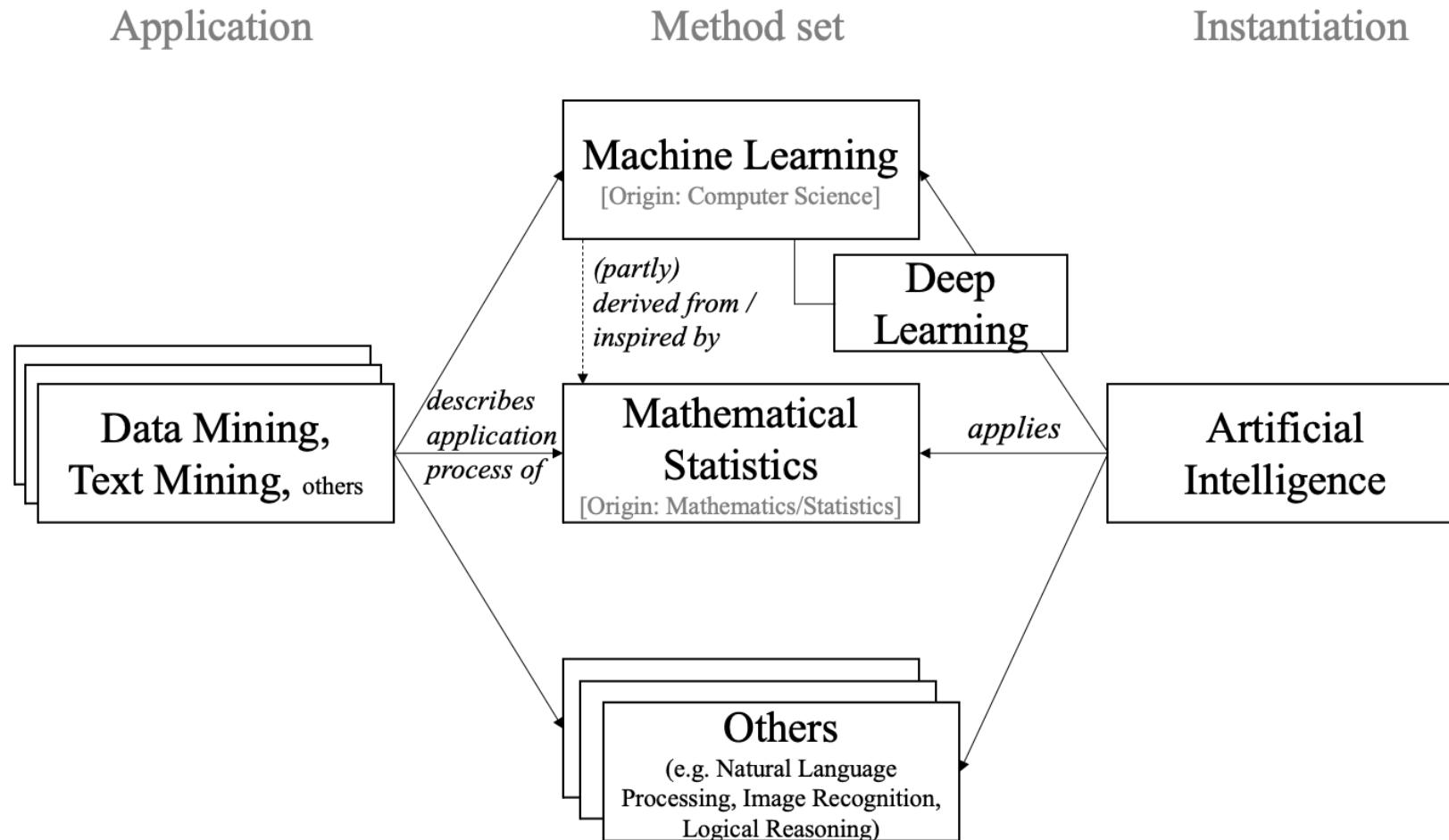
Max Schemmer, Niklas Kühl, Carina Benz, Andrea Bartos, and Gerhard Satzger. 2023. Appropriate Reliance on AI Advice: Conceptualization and the Effect of Explanations. In *28th International Conference on Intelligent User Interfaces (IUI '23)*, March 27–31, 2023, Sydney, NSW, Australia. ACM, New York, NY, USA, 13 pages. <https://doi.org/10.1145/3581641.3584066>

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<https://doi.org/10.1145/3581641.3584066>

[3]

Artificial Intelligence & Machine Learning

So many terms - What do they mean?



Artificial Intelligence & Machine Learning

What is AI? Is Mark Zuckerberg really talking about AI?



[1]

In Mark Zuckerberg's US senate hearing in April 2018,
he stressed the necessary capabilities of Facebook's

**“AI tools (...) to (...) identify hate speech (...)” or “
(...) terrorist propaganda”**

The Washington Post (2018), Transcript of Mark Zuckerberg's Senate hearing [1]

Artificial Intelligence & Machine Learning

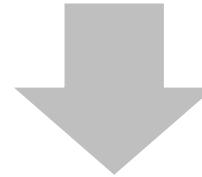
Different views on AI definitions.

Research Currents:

Different scientific viewpoints on what constitutes important aspects of AI research

Agent-based AI:

Agents are the central instantiation of AI

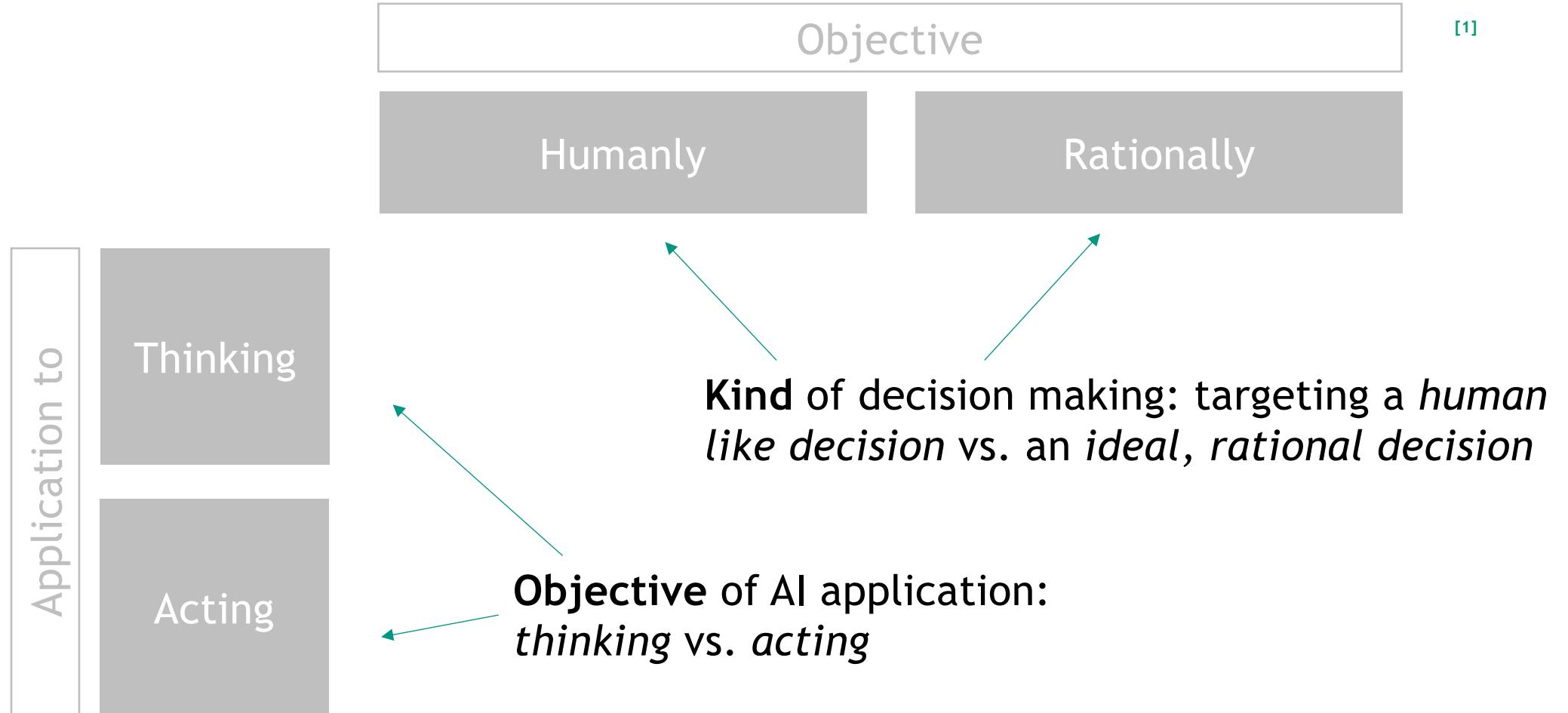


Level of Intelligence:

AI can be differentiated by its cognitive capabilities

Artificial Intelligence & Machine Learning

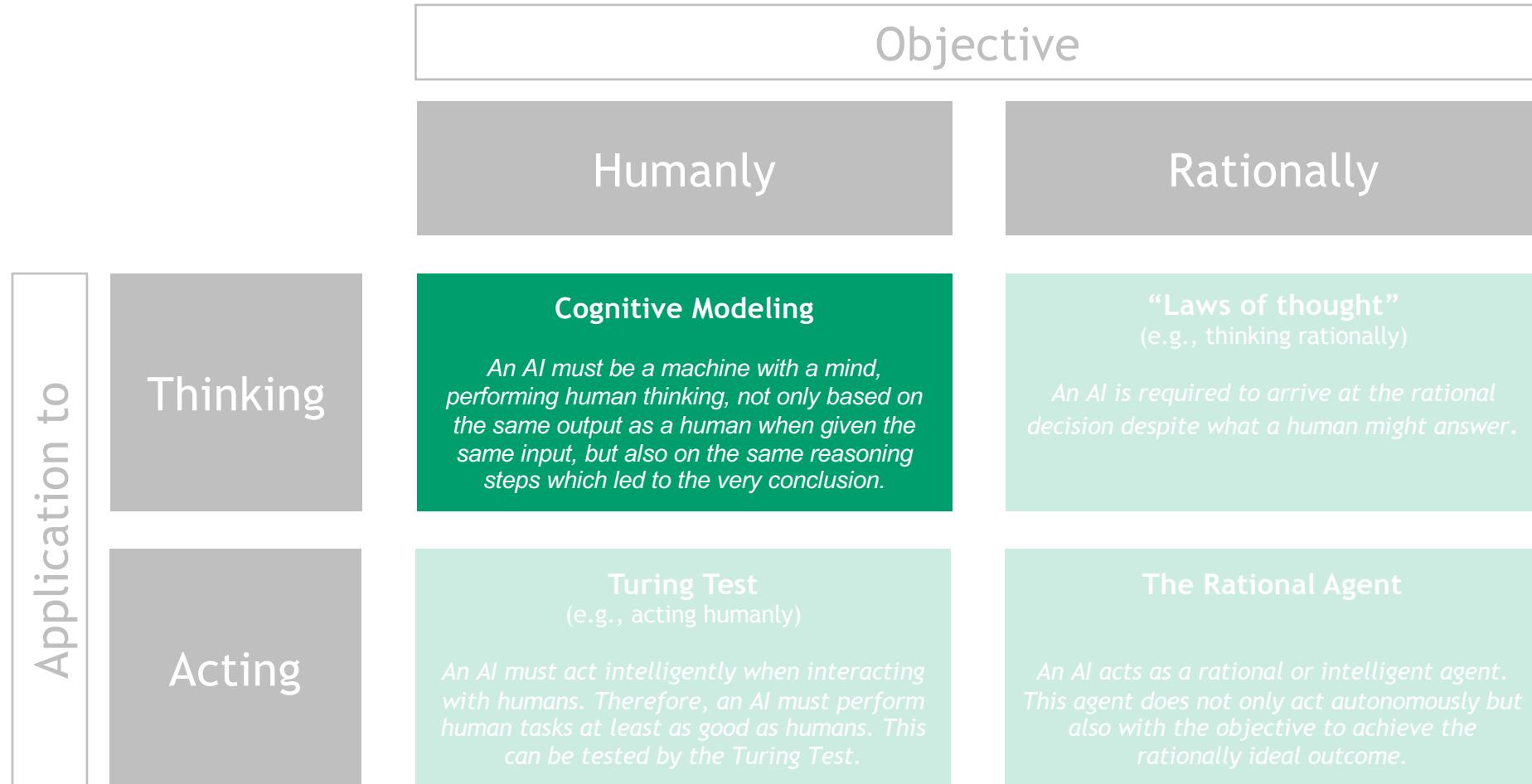
Research currents of AI.



Russel and Norvig (2015), Artificial Intelligence: A Modern Approach ; Haugeland (1989), Artificial Intelligence: The very idea ; Bellmann (1978), An Introduction to Artificial Intelligence: Can Computers Think? ; Newell and Simon (1961), GPS, a program that simulates human thought ; Kühl, Goutier, Hirt, Satzger (2019): Machine Learning in Artificial Intelligence: Towards a Common Understanding [1]

Artificial Intelligence & Machine Learning

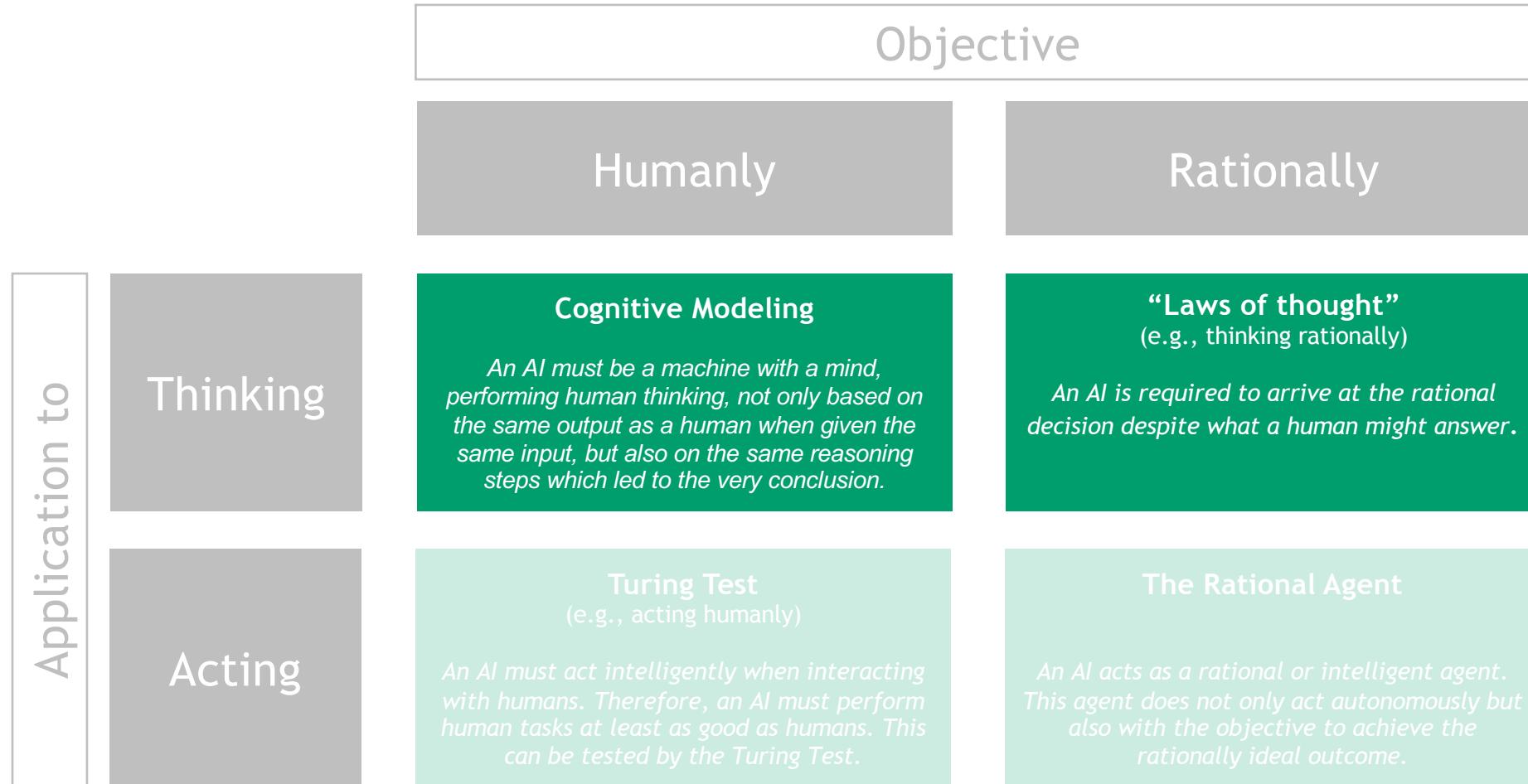
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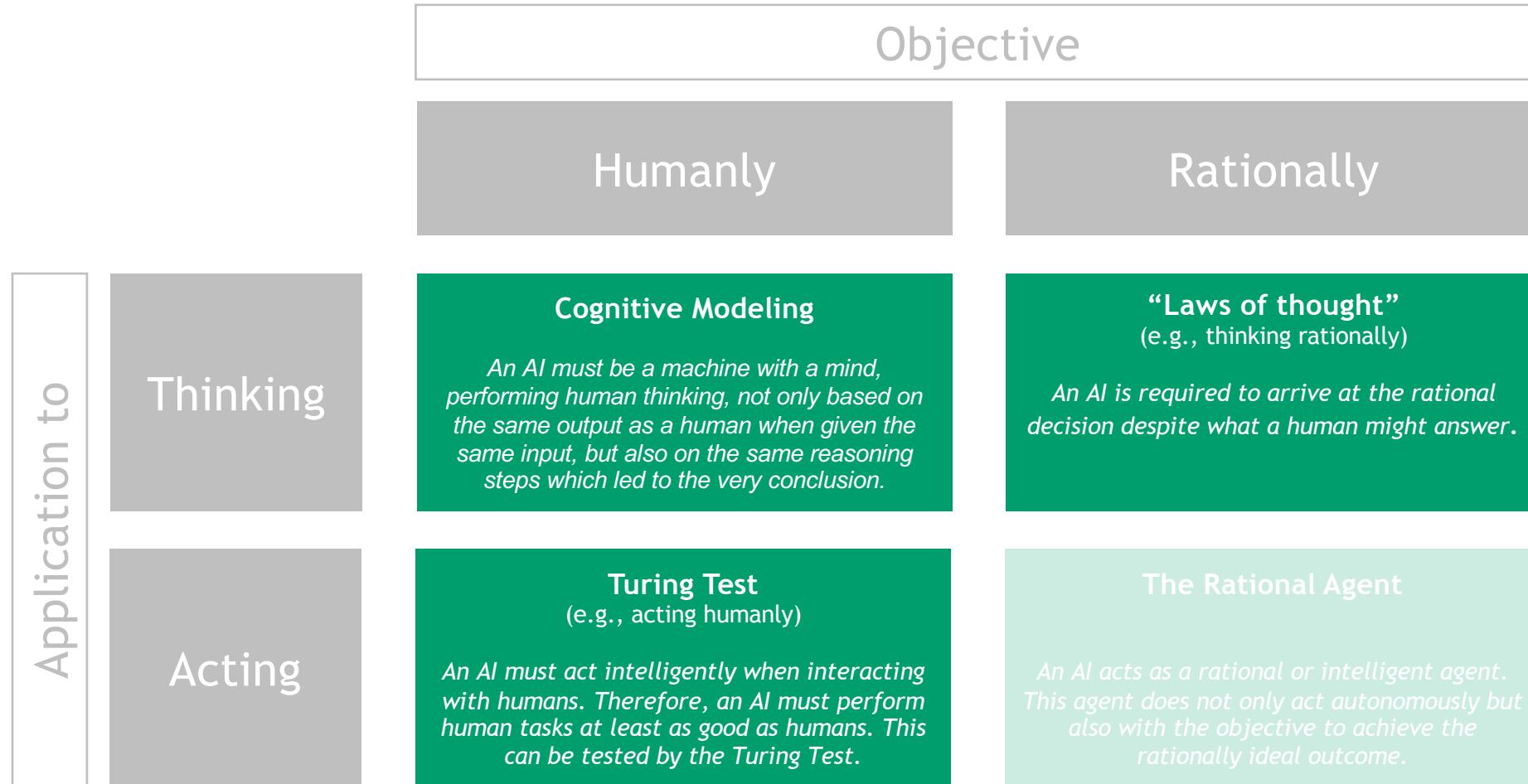
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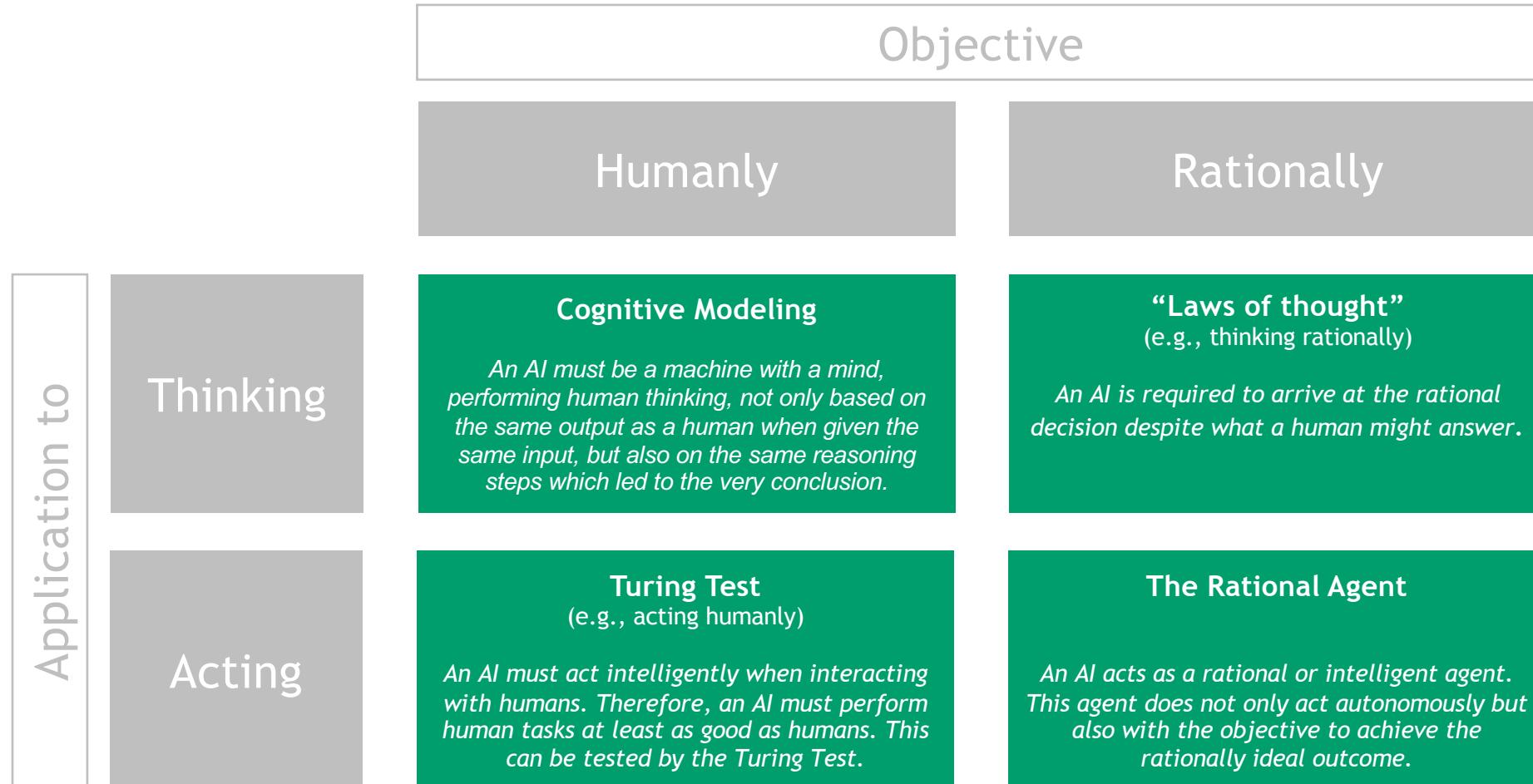
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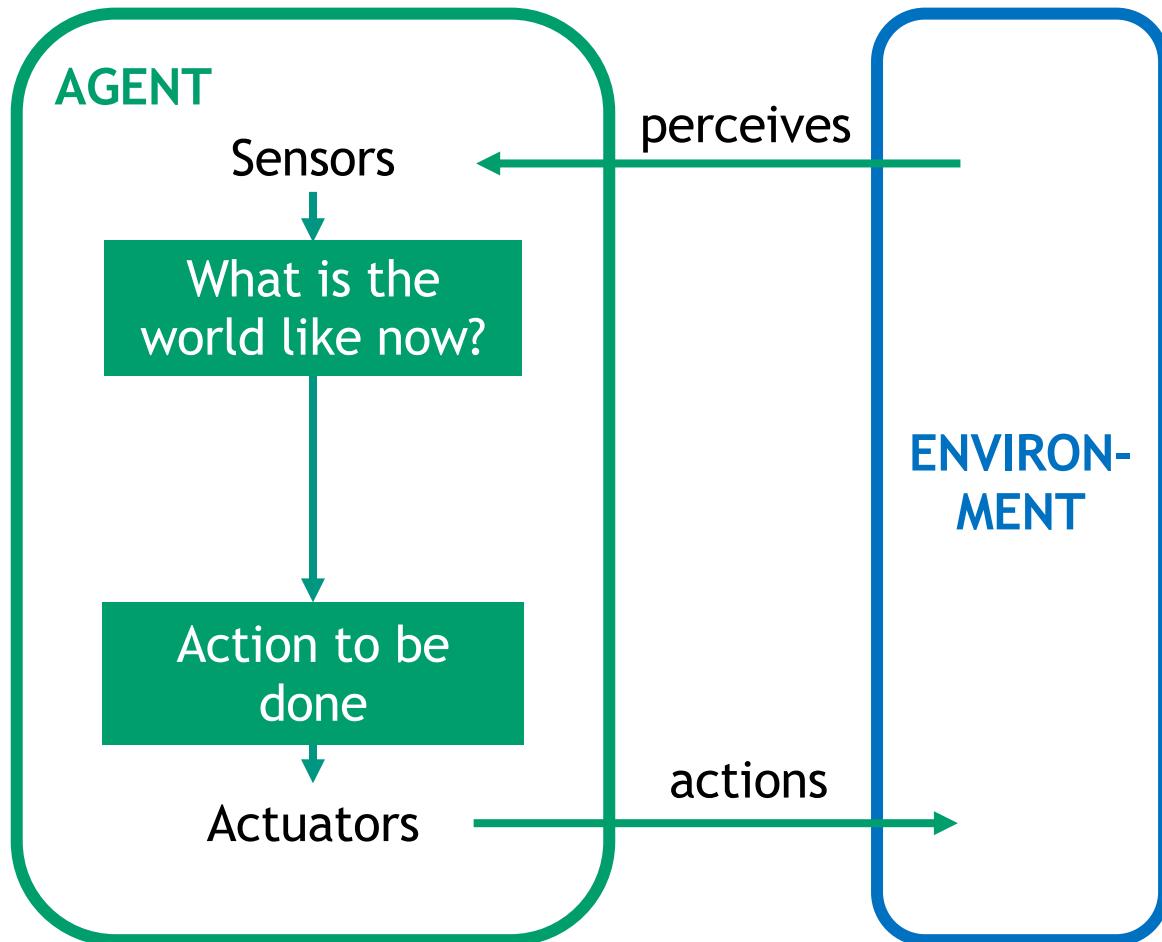
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Artificial Intelligence & Machine Learning

Definition of AI: An agent-oriented view.



[1]

- An **intelligent agent** interacts with an environment
- The **agent** perceives states of an **environment** and decides about what actions to take depending on these states
- Receiving sensors and executing actuators exist in a circular relationship

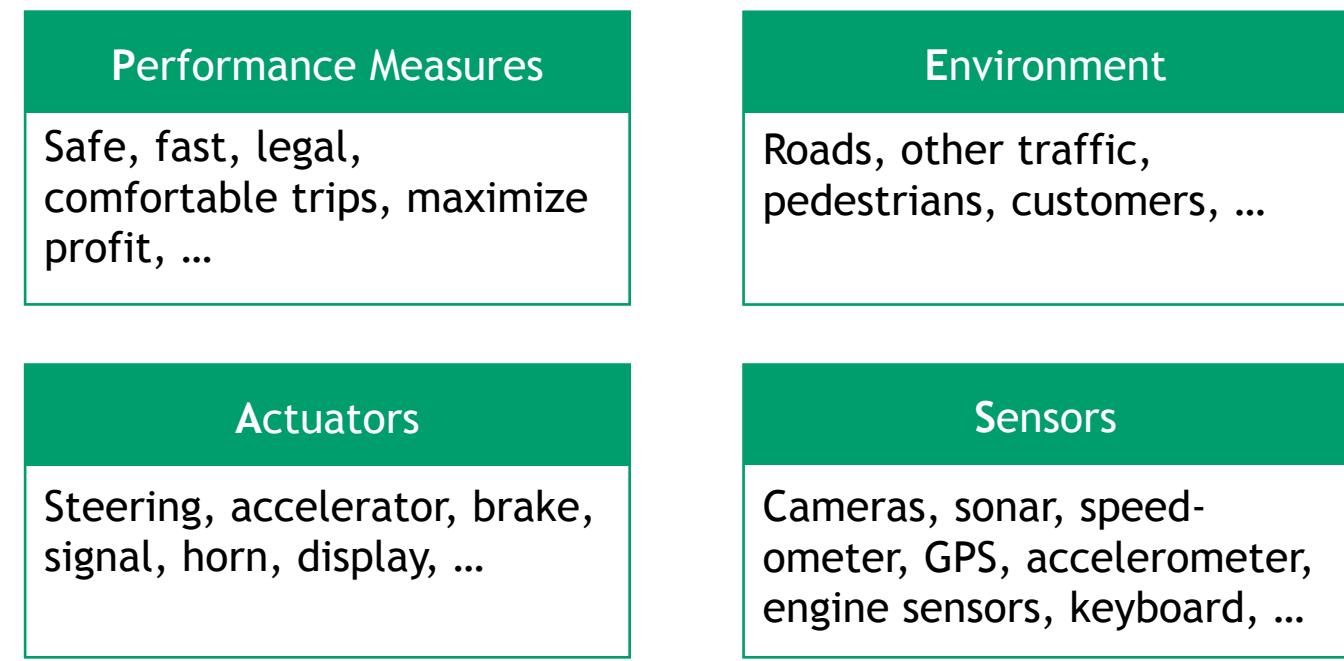
Russel and Norvig (2015), Artificial Intelligence: A Modern Approach [1]

Artificial Intelligence & Machine Learning

The PEAS model.

[1]

Example:
The agent is a taxi driver



A simple aggregation of an agent's performance measures, in an environment with actuators and sensors (PEAS)

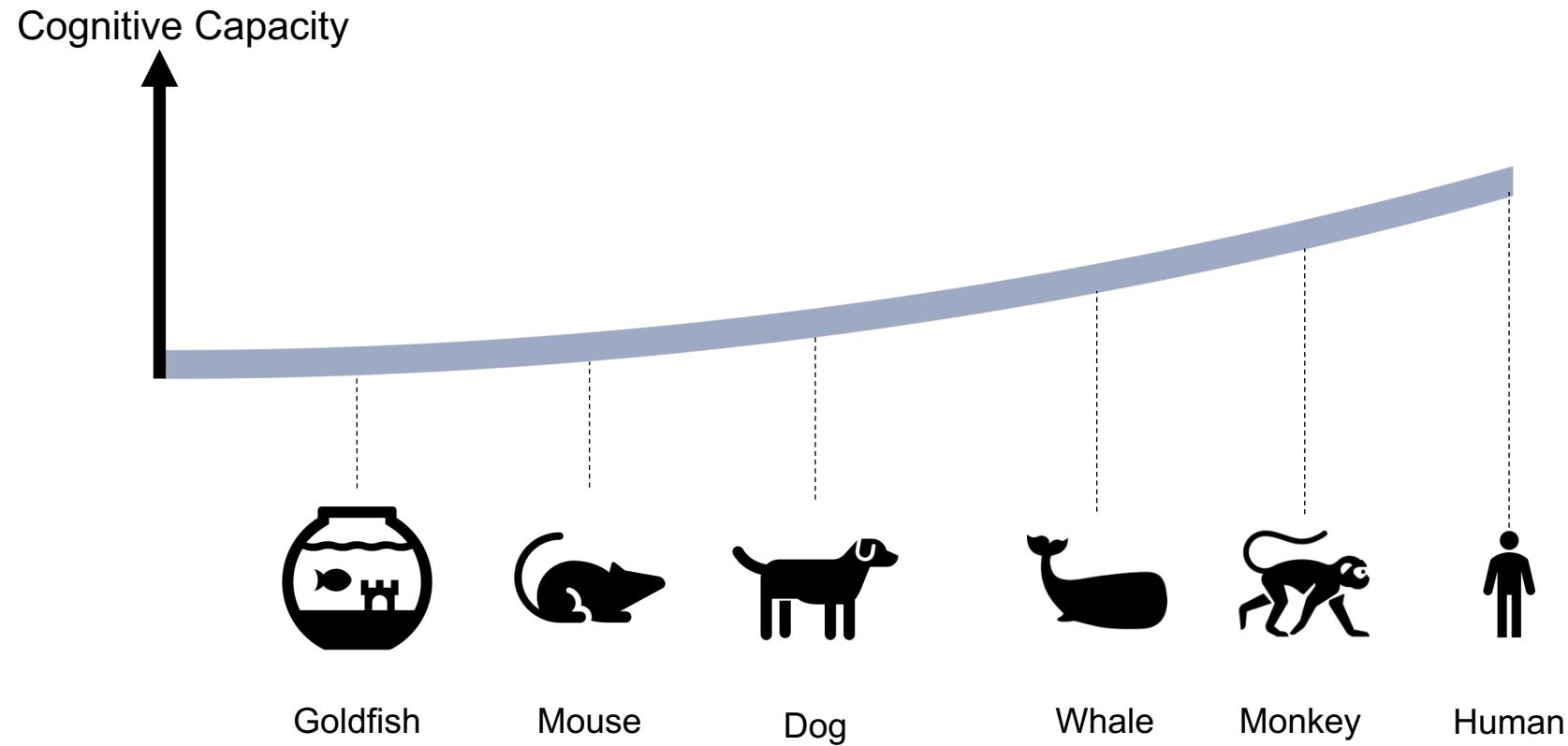
Russel and Norvig (2015), Artificial Intelligence: A Modern Approach [1]

Artificial Intelligence & Machine Learning

Definition of AI: An intelligence-level-oriented view

Intelligence: *The ability to perceive information, to retain it as knowledge and to apply it towards adaptive behaviors within an environment.*

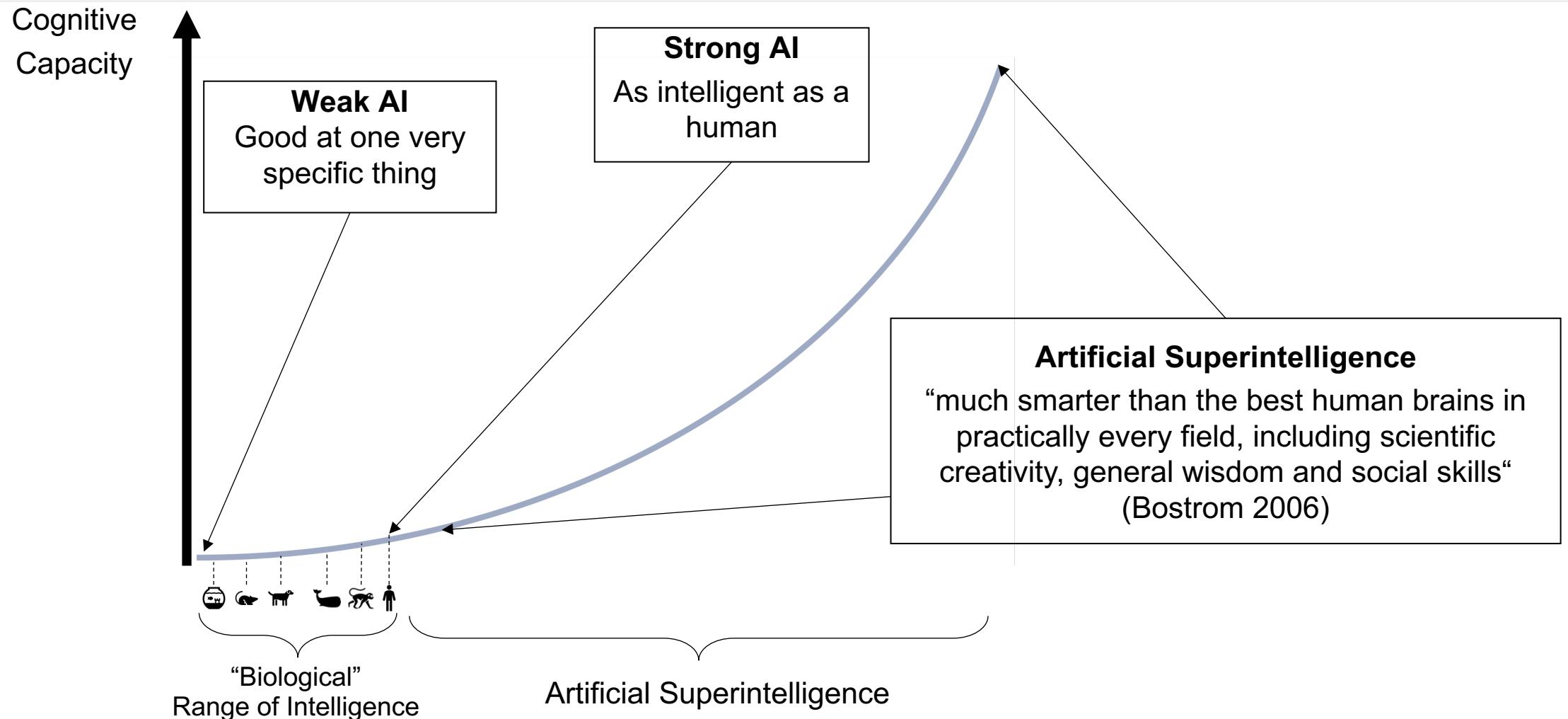
[1]



Cairo (2011) [1]

Artificial Intelligence & Machine Learning

What “levels” of AI can we define?



Artificial Intelligence & Machine Learning

Three different types of machine learning are common.

Machine Learning Types

Supervised Learning

- Learn the mapping from the input to the output
- Typical: regression / classification
- Simplified example: Let a child sort toy cars and tell it there are sports cars and SUVs with distinct properties



[1]

Unsupervised Learning

- Identify previously unknown patterns in data
- Typical: clustering / association rules
- Simplified example: Let a child sort toy cars and let the child determine how to arrange/cluster them



[2]

Reinforcement Learning

- Get feedback (rewards) on actions taken
- Simplified example: Child picks toy car and labels it ("action") as truck vs. passenger car and gets response ("reward") from his dad



[3]

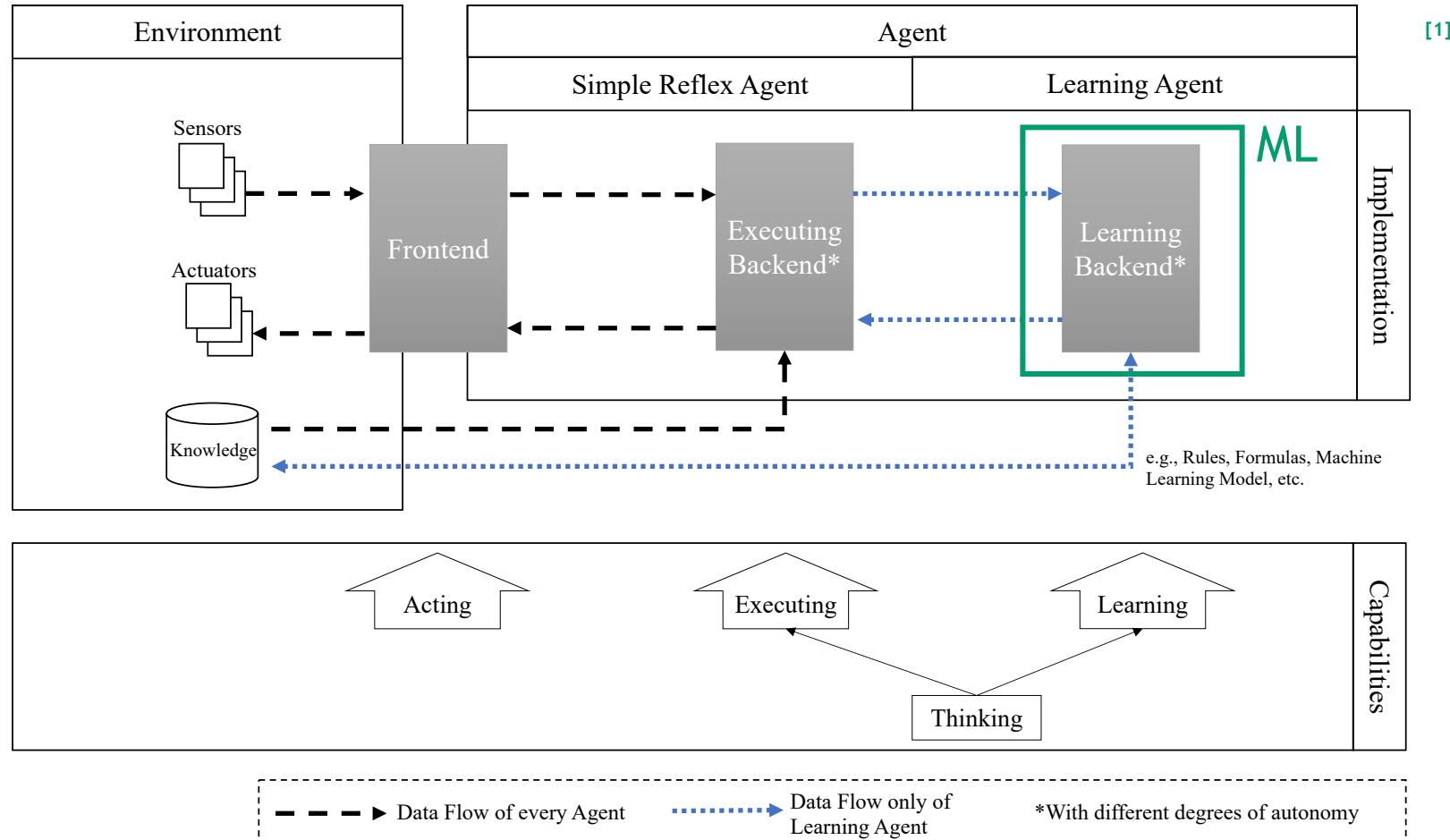
<https://www.pexels.com/photo/young-girls-playing-with-toy-cars-4491563/> [1]

<https://www.pickpik.com/child-toys-on-the-floor-floor-fun-car-82464> [2]

<https://www.pexels.com/photo/close-up-of-father-and-son-playing-with-plastic-toys-outdoors-4933608/> [3]

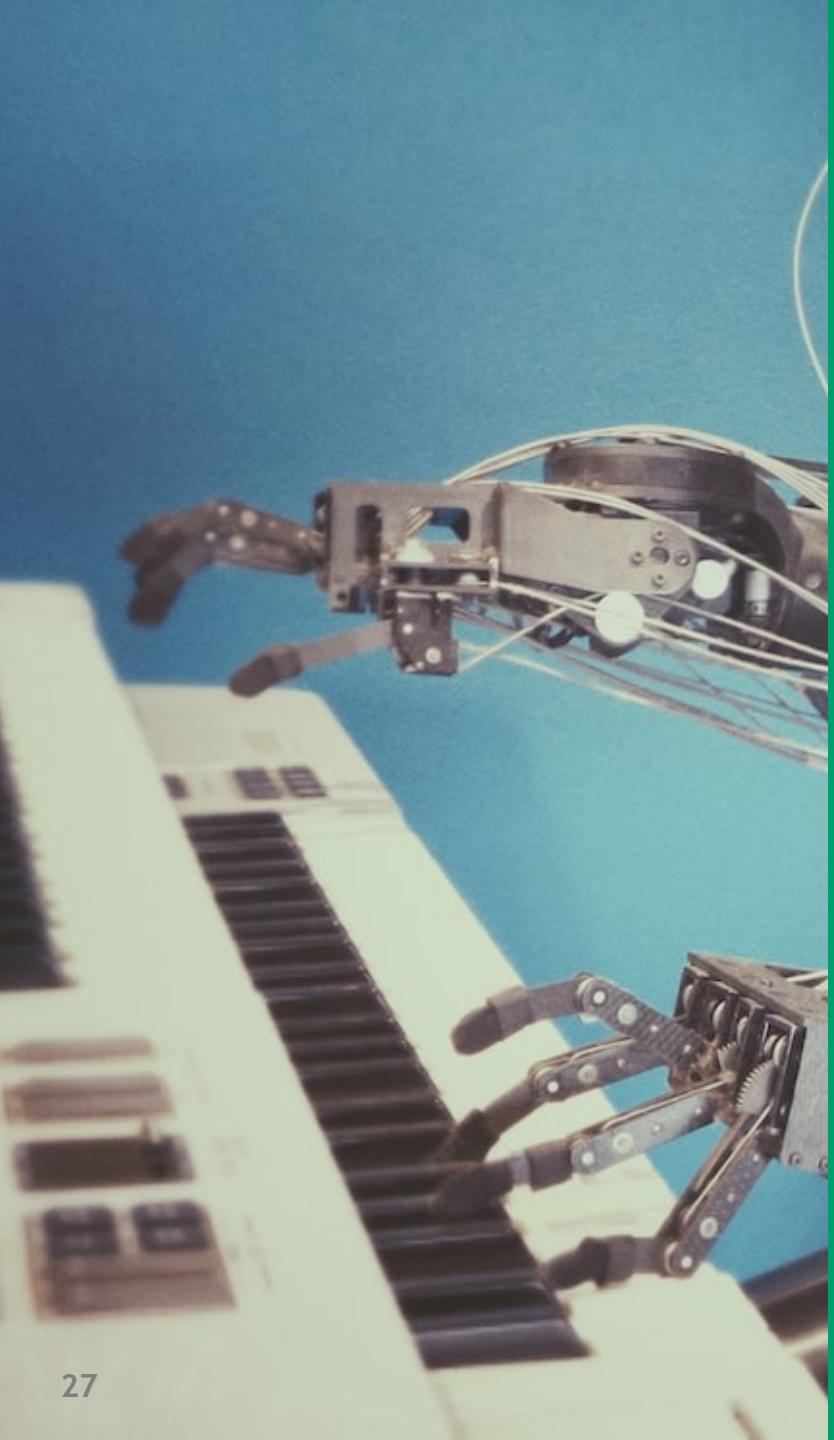
Artificial Intelligence & Machine Learning

What role does ML play in AI?



Artificial Intelligence & Machine Learning

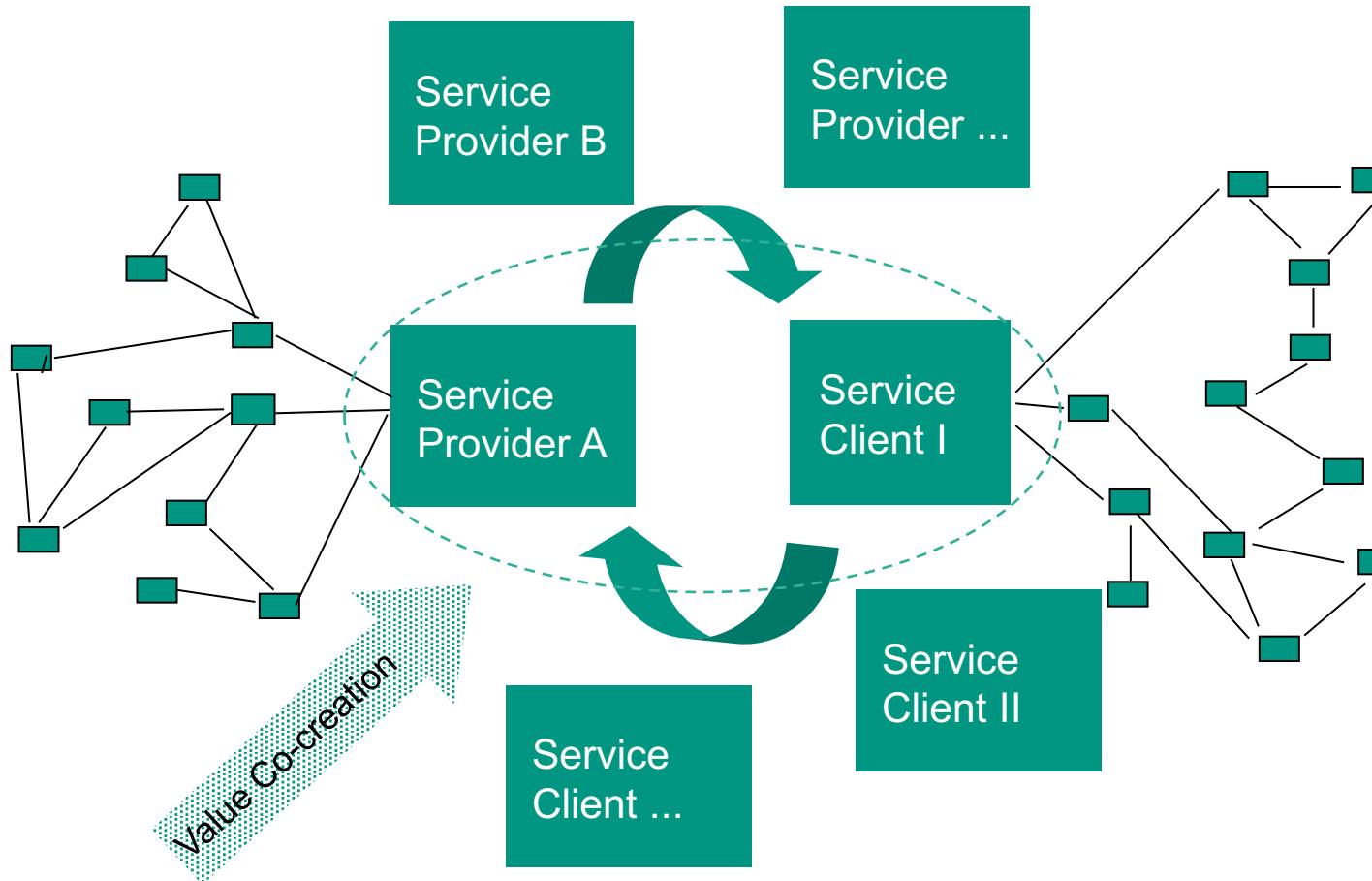
So... was Mark Zuckerberg right?



- 1 Organizational
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Service Systems

What are (Service) Systems?



Service System comprises
“**service providers and service clients working together to coproduce value in complex value chains or networks**” [1]

■ Entities
/ Link

Spohrer et al. [1]

Service Systems Examples



customer's resources
(car)

Value Co-Creation

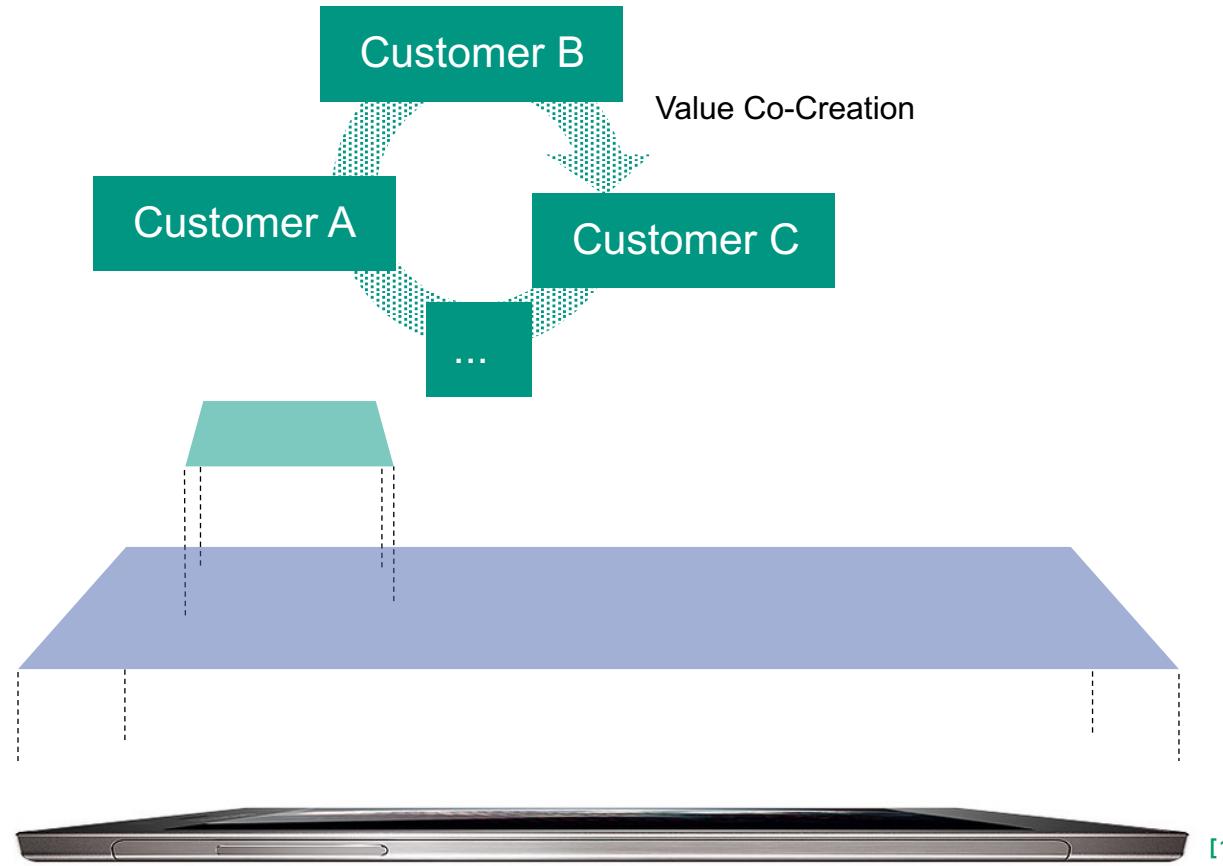


provider's resources
(car wash, staff, commodities)



Maglio, P.P., Vargo, S.L., Caswell, N. et al. Inf Syst E-Bus Manage (2009) 7: 395. <https://doi.org/10.1007/s10257-008-0105-1> [1]
<https://freerangestock.com/photos/94025/person-washing-car-with-sponge.html> [2]

Service Systems Examples



Application Provider, e.g.,
TikTok

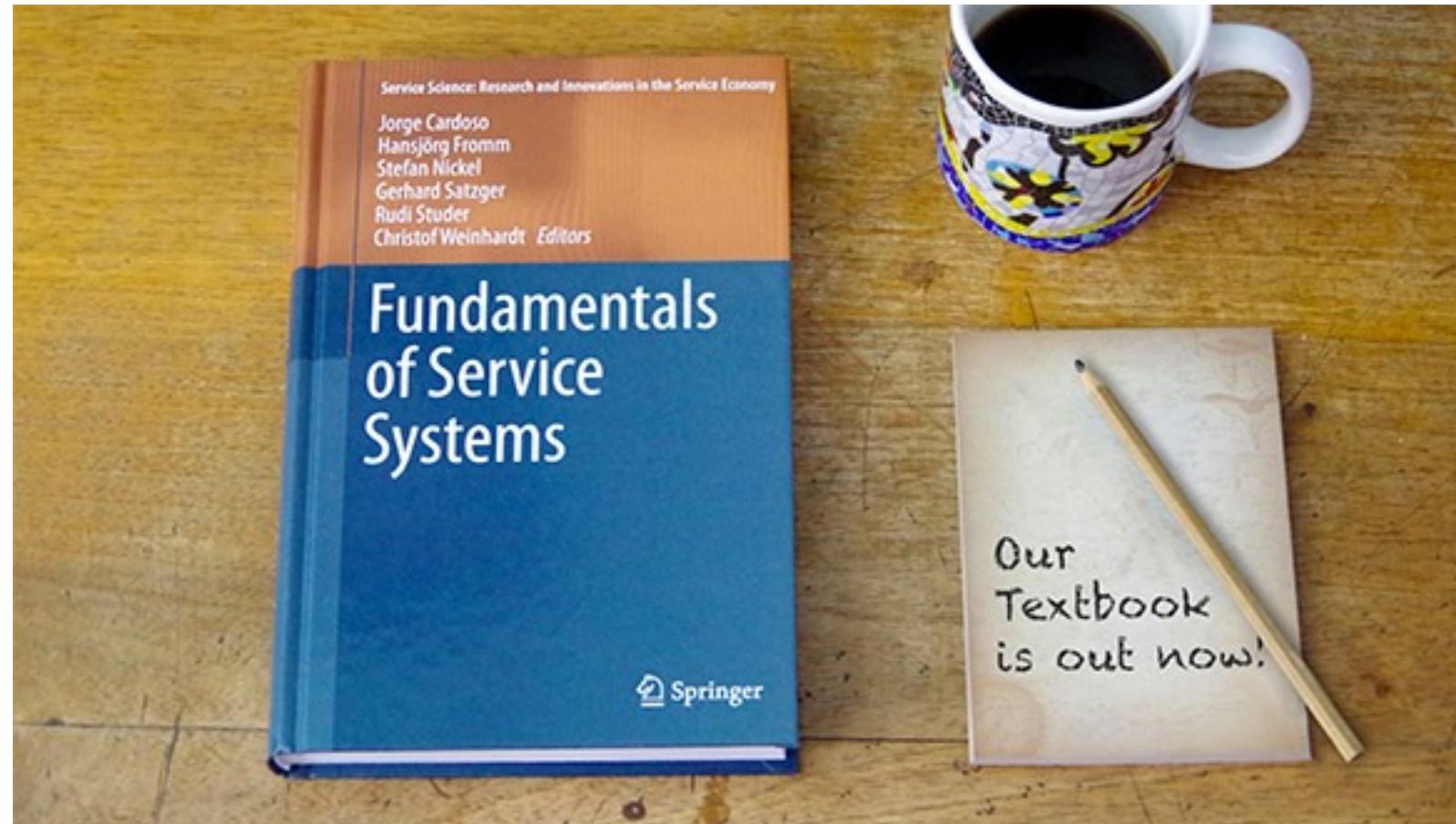
Operation System Provider,
e.g., Google

Smartphone Provider,
e.g., Samsung

<https://www.flickr.com/photos/blltz/9369660668/> [1]

Service Systems

The first textbook of Service Systems is available

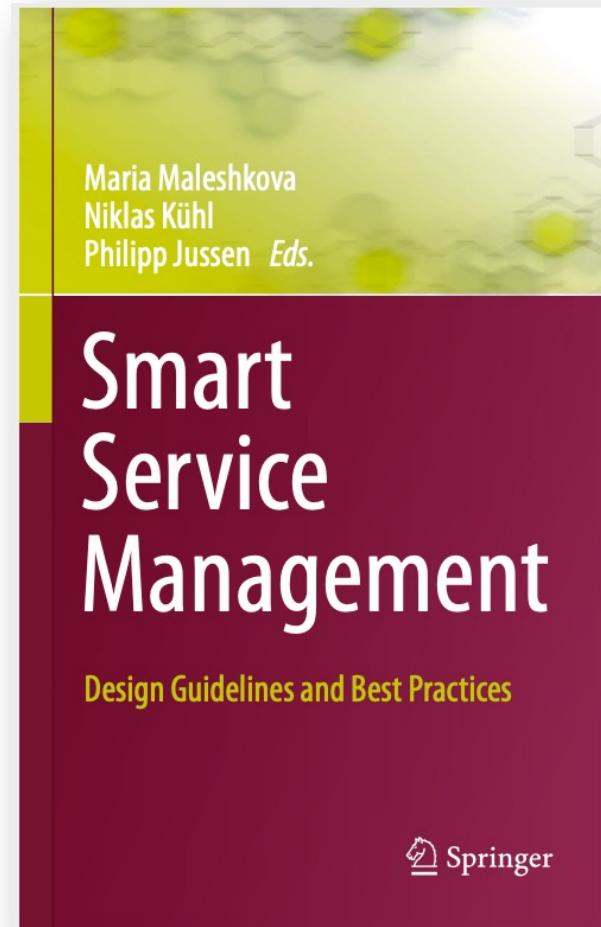


[1,2]
]

Fundamentals of Service Systems. (2015). Deutschland: Springer International Publishing. [1]
<https://fundamentals-of-service-systems.ksri.kit.edu/> [2]

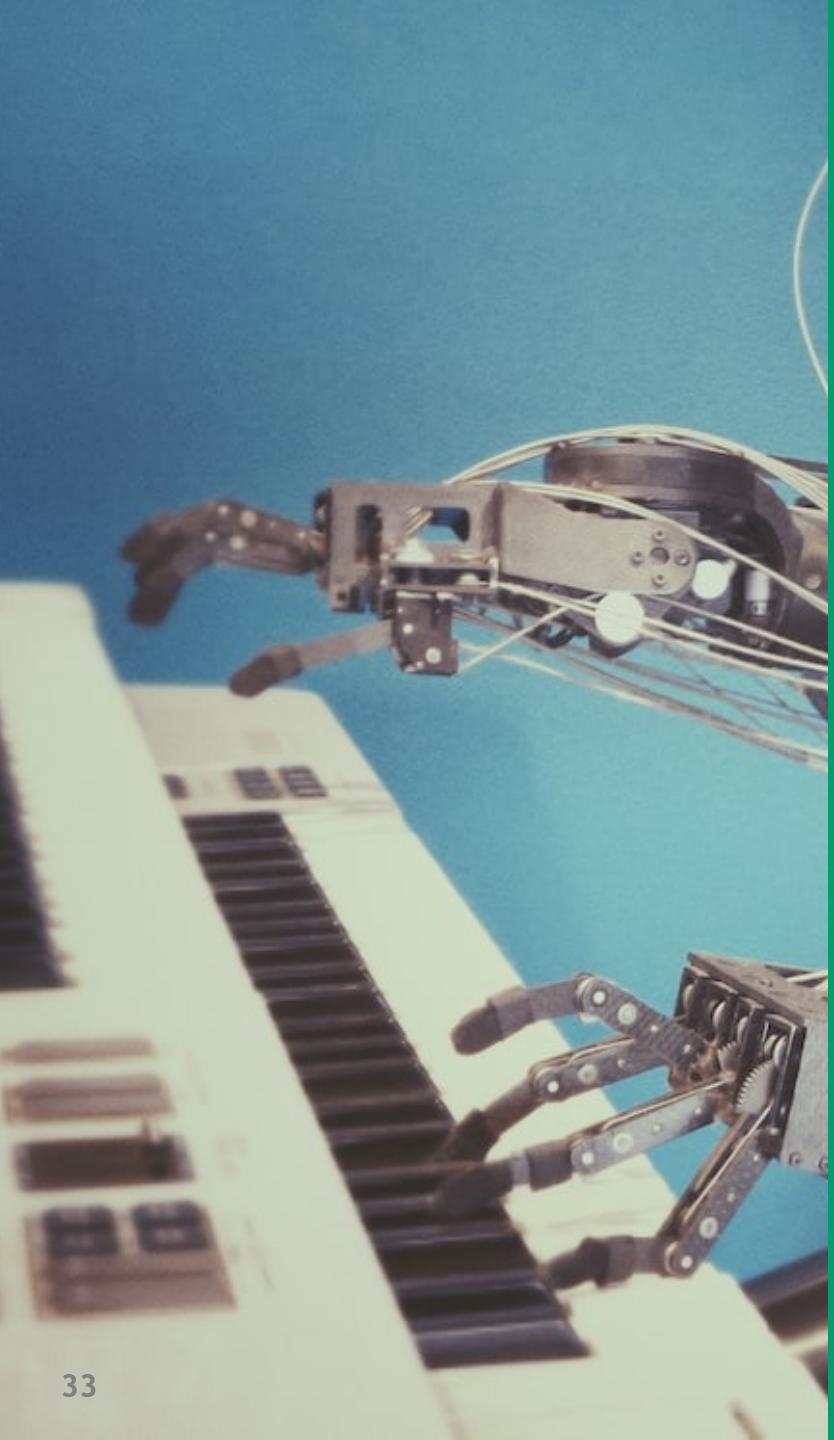
Service Systems

...as well as one on their management



[1]

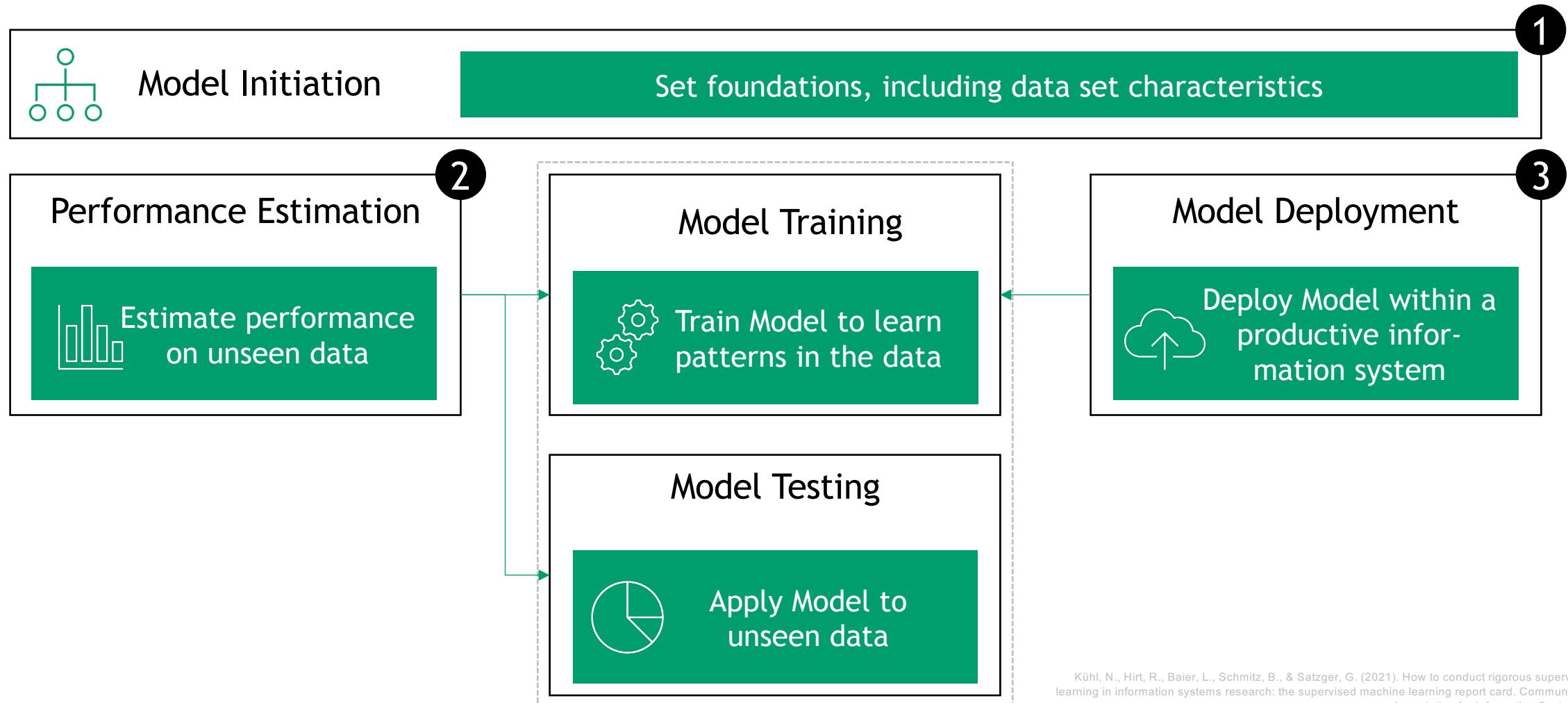
Smart Service Management: Design Guidelines and Best Practices. (2021). Deutschland: Springer International Publishing.[1]



- 1 Organizational
- 2 Artificial Intelligence & Machine Learning
- 3 Systems Thinking
- 4 The AI Lifecycle

The AI Lifecycle

Required steps for supervised machine learning



Kühl, N., Hirt, R., Baier, L., Schmitz, B., & Satzger, G. (2021). How to conduct rigorous supervised machine learning in information systems research: the supervised machine learning report card. Communications of the Association for Information Systems, 48(1), 46.

The AI Lifecycle

Required steps for supervised machine learning.

