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# Decision Support Systems in nursing & allied healthcare. Building an AI-based Learning Health System by use op Natural Language Processing Tools. Dag van de Fysiotherapeut 21 MEI 2...

Presentation · May 2022

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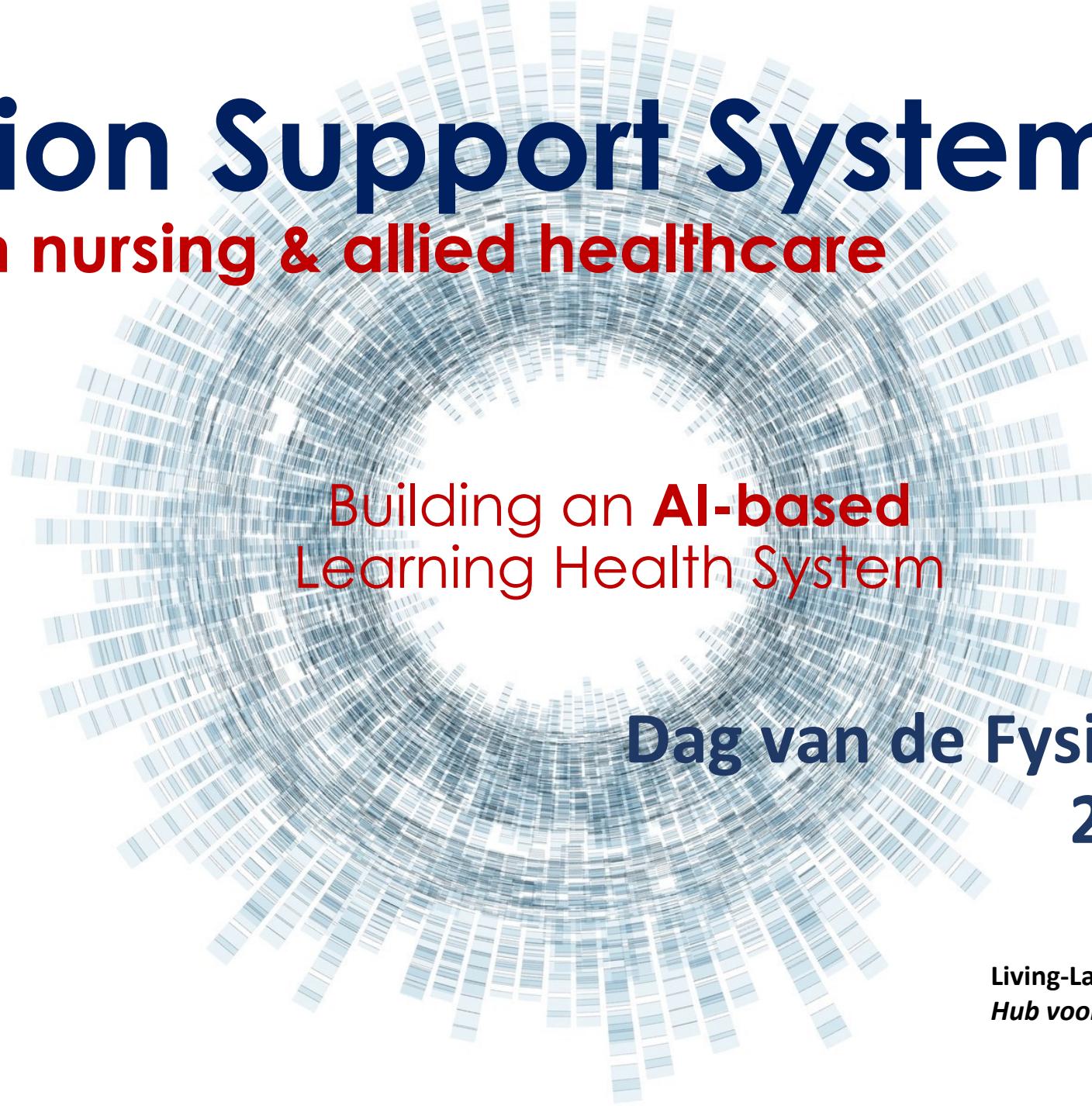
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# Decision Support Systems

in nursing & allied healthcare



Building an **AI-based**  
Learning Health System

**Dag van de Fysiotherapeut**  
**21 MEI 2022**



Living-Lab: AiRA,  
Hub voor AI: Responsible & Applied  
[Rob van der Willigen](#)

**“The inescapable resurgence of {AI}  
on the world wide web {WWW}  
— along with the arrival of Internet-of-Things {IoT} —  
has expanded the scope of the  
digital world into the realm of cybernetics”**

Cybernetics studies communication & control of information in living beings +  
the machines built by humans

=====> Feedback & Reinforcement <=====

**The cybernetic foundation of {AI} explains its insatiable hunger for Big data, with the promise to solve societal challenges ranging from:**

**Health - Climate Change - Safety up to Cyber Physical Systems {CPSs}: Robotics & Driverless Cars**

**Today it seems we only  
receive ambiguous promises  
and paradoxical stories**

**{AI} has revealed itself to us  
as a double-edged sword:**

**Dangerous yet Supportive  
All-Consuming yet Liberating**

# {The Secrets Behind AI}



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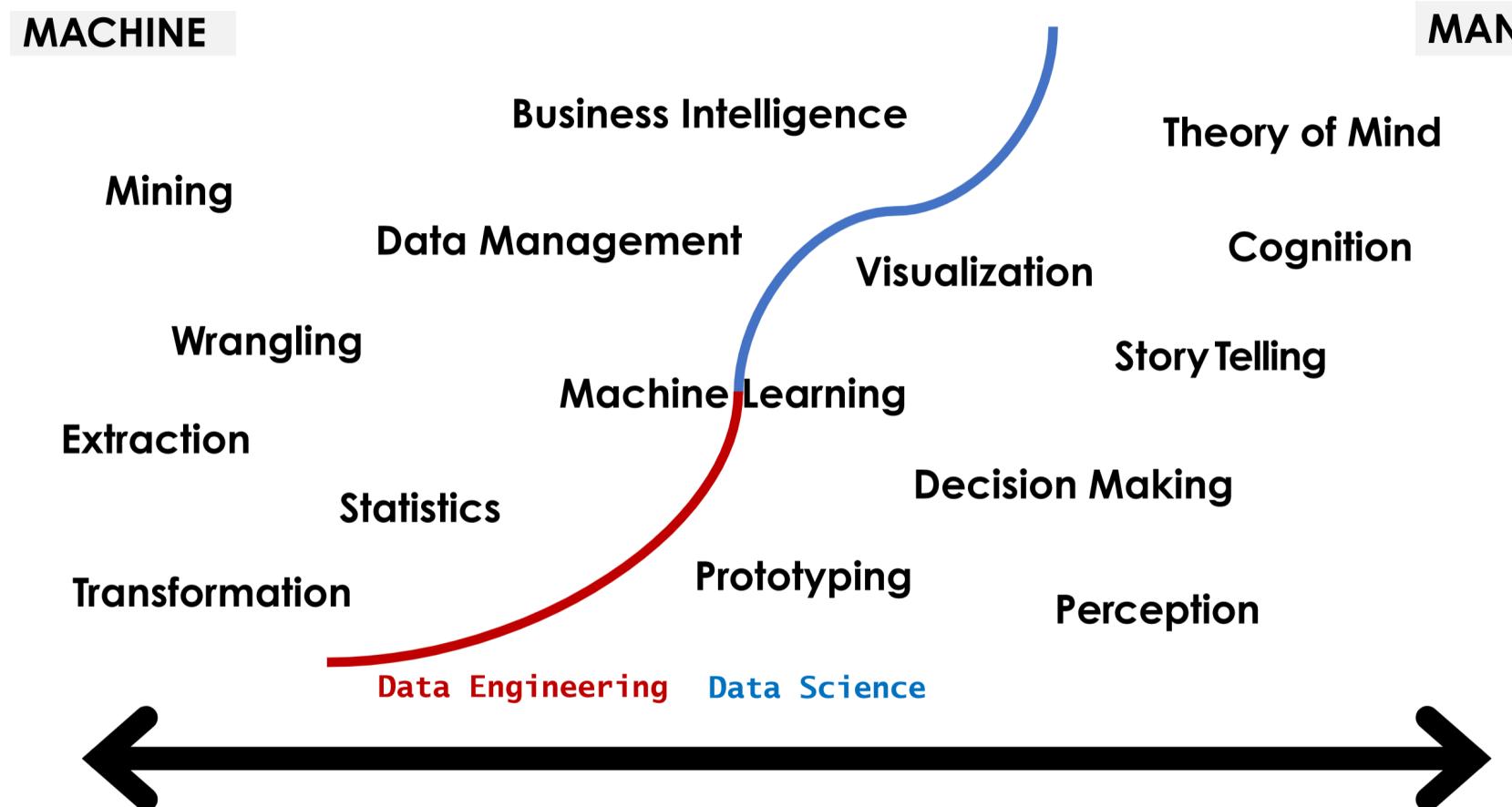
## The Secrets Behind AI

We look at the impact of emerging technology in Kenya, Nairobi - and analyse the effect of what artificial intelligence will have on the world around us.

Show more

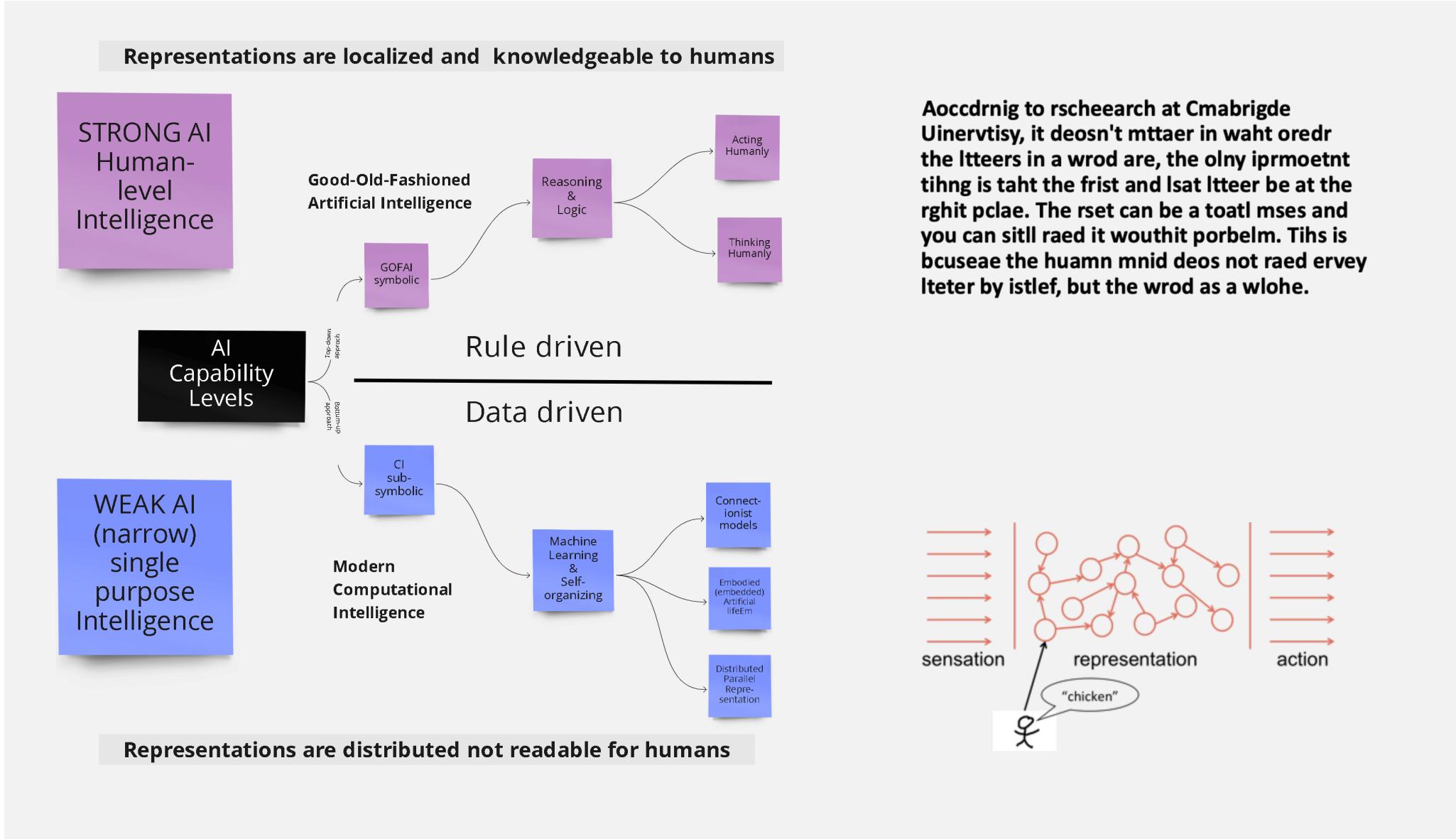
30 minutes

# {AI integrates two Scientific Disciplines}

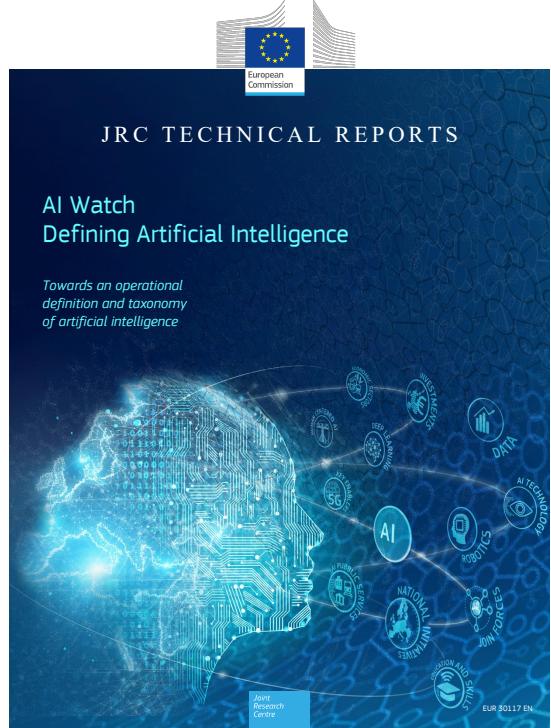


Inspired by Daniel Keim, "Visual Analytics: Definition, Process, and Challenges"

# {The taxonomy of AI is complex}



# {The taxonomy of AI is complex}



<https://publications.jrc.ec.europa.eu/repository/handle/JRC118163>

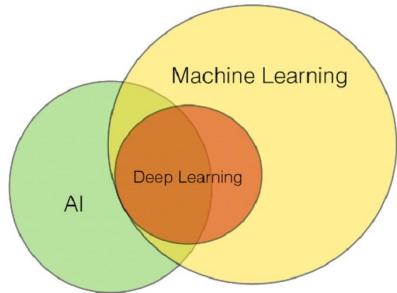
AI taxonomy		
	AI domain	AI subdomain
Core	<b>Reasoning</b>	Knowledge representation
		Automated reasoning
		Common sense reasoning
	<b>Planning</b>	Planning and Scheduling
		Searching
		Optimisation
	<b>Learning</b>	Machine learning
	<b>Communication</b>	Natural language processing
Transversal	<b>Perception</b>	Computer vision
		Audio processing
		Multi-agent systems
	<b>Integration and Interaction</b>	Robotics and Automation
		Connected and Automated vehicles
		AI Services
	<b>Ethics and Philosophy</b>	AI Ethics
		Philosophy of AI

<http://dx.doi.org/10.2760/382730%20>

# {AI=ML=DL}

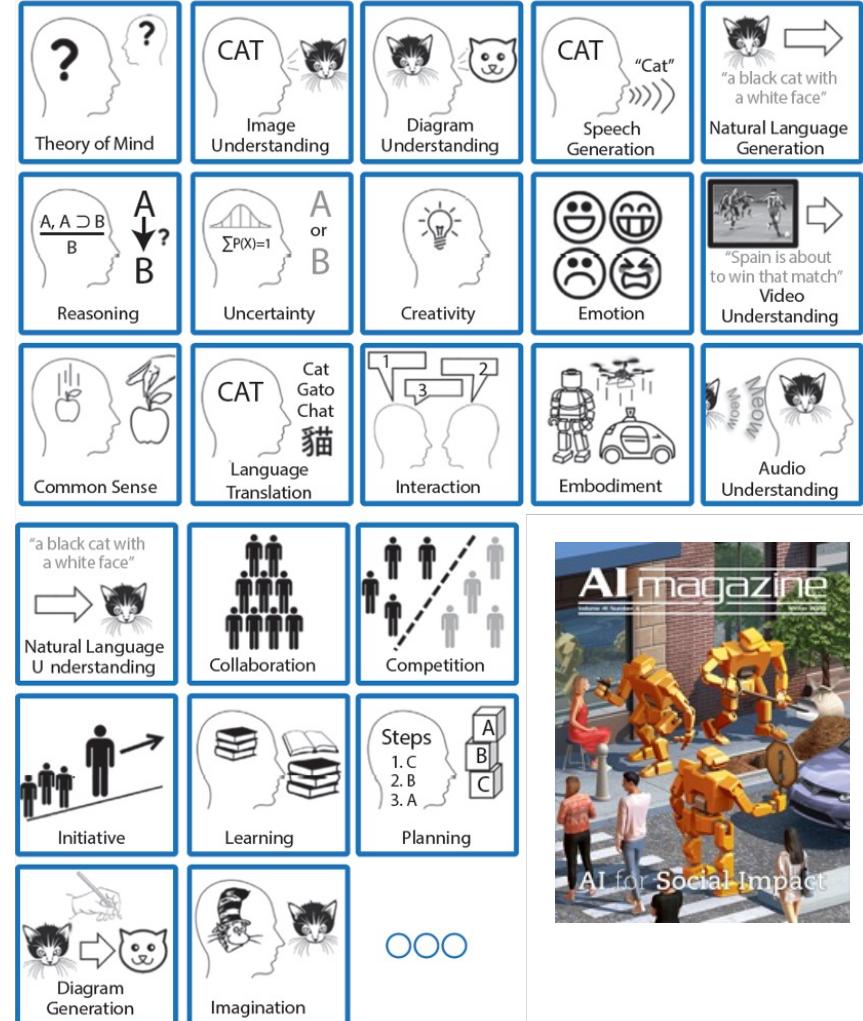
AI enabled through {DL} must be understood as any form of Machine Learning {ML} technology mimicking & automatizing tasks which otherwise require

*human perception,  
cognition and/or  
motor skills*



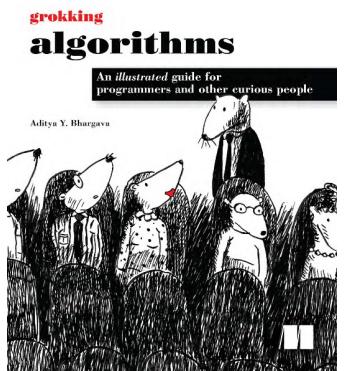
<https://robfvdw.medium.com/the-world-wide-web-ai-safari-b2e4f7f90647>

<https://doi.org/10.1609/aimag.v37i1.2643>



# {Algorithm}

**Step by step process or recipe  
describing  
how to solve a problem and/or  
complete a task,  
which will always give  
identical end results**



# {Modeling =Labeling}

**Classification**



**CAT**

No spatial extent

**Semantic Segmentation**



**GRASS, CAT,  
TREE, SKY**

No objects, just pixels

**Object Detection**



**DOG, DOG, CAT**

Multiple Object

**Instance Segmentation**



**DOG, DOG, CAT**

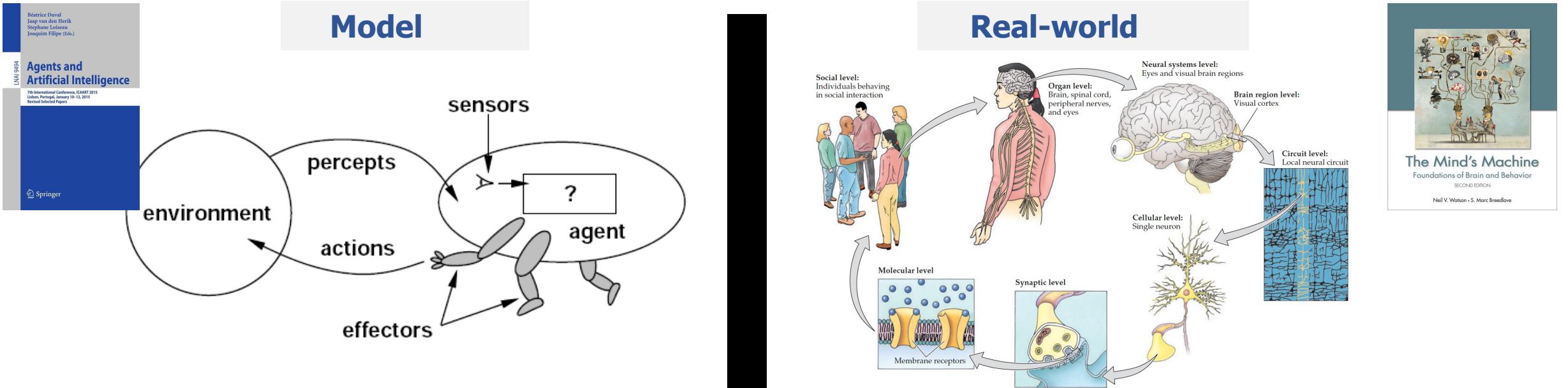
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# {AI favors Agent-Based Models}

## Agents

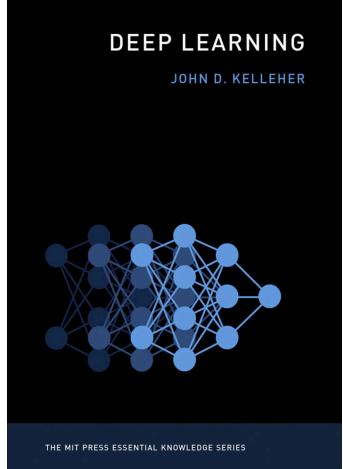
are abstractions of the real world **{models}** that can **perceive** their environment through sensors (input) and **act** upon that environment through effectors (output), combined with learning capabilities.

As a result, agent behaviour is desirable from an AI-viewpoint



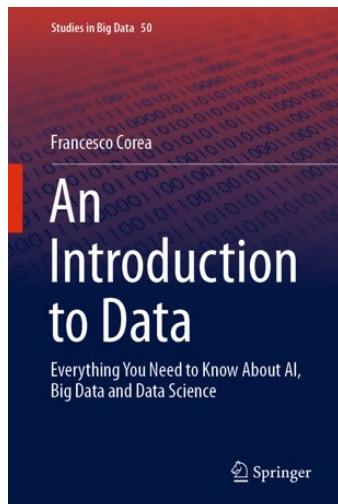
Animal research is an essential part of life sciences research, including biological psychology

# {State-of-the-Art AI: DL + DNNs}



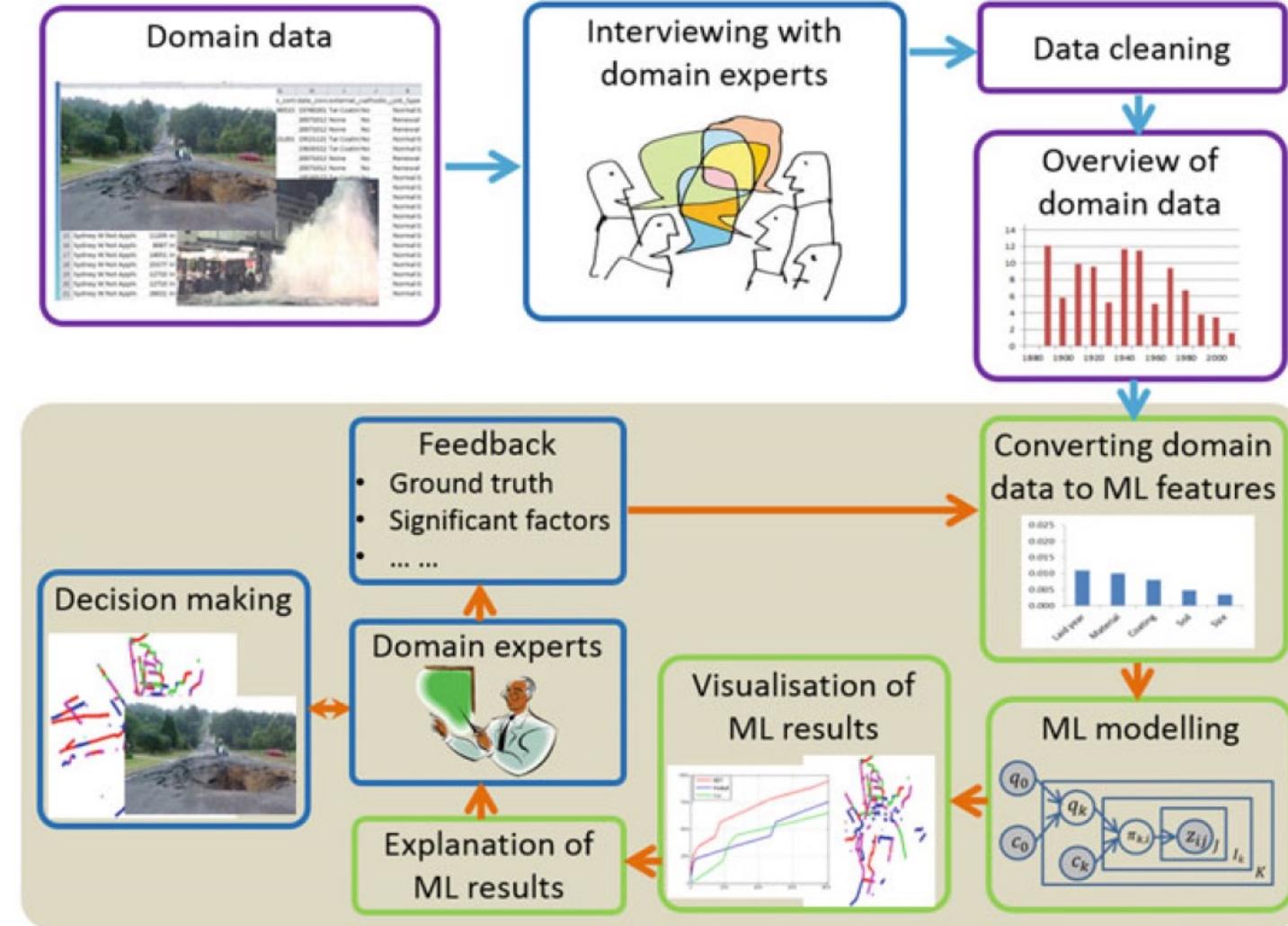
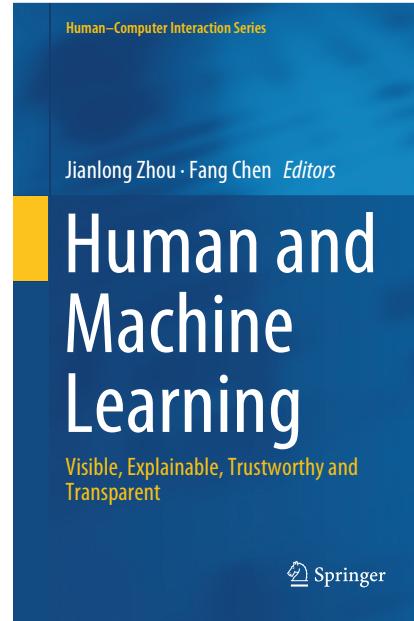
Deep learning **{DL}** must be understood as a major Machine Learning **{ML}** subdomain:

Crafting Deep Neural Networks **{DNNs}** that can attain human-level performances on challenging cognitive tasks.



**{DNNs}** can **Recognize Speech or Human Poses & Faces; Translate Text in real time at High Levels of Performance.**

# {AI & Decision Support Systems}



# {Human-in-the-Loop}

$$\mathbf{AI} = \mathbf{ML} + \mathbf{TD} + \mathbf{HITL}$$

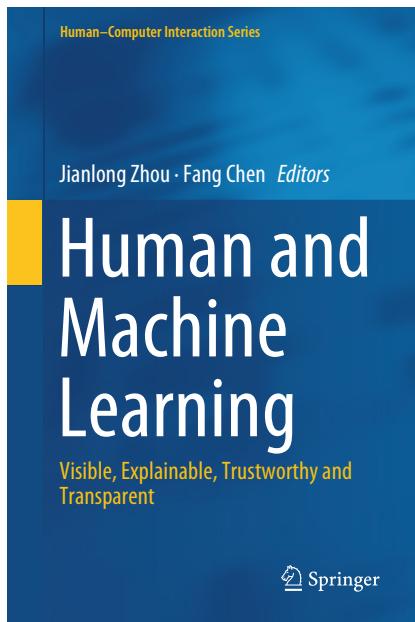


**Artificial Intelligence:**  
in contrast to natural intelligence, it is *the ability of computer systems to perform tasks or actions that would normally require a human*

**Machine Learning:**  
*the ability of computer systems to use algorithms and statistical models to perform tasks without explicit instruction, through patterns and inferences*

**Training Data:**  
*the data used to train a machine learning algorithm to perform a task in supervised machine learning*

**Human in the Loop:**  
*the involvement of a human in training a machine learning algorithm*



**Decision Support {DS}  
by use of**

**Natural Language  
Processing {NLP}**

# {NLP & Decision Support Systems}

## A Survey on Recent Named Entity Recognition and Relationship Extraction Techniques on Clinical Texts

Priyankar Bose <sup>1,\*</sup>, Sriram Srinivasan <sup>2,3</sup>, William C. Sleeman IV <sup>1,2,3</sup>, Jatinder Palta <sup>2,3</sup>, Rishabh Kapoor <sup>2,3</sup> and Preetam Ghosh <sup>1,2,3</sup>

<sup>1</sup> Department of Computer Science, Virginia Commonwealth University, Richmond, VA 23284, USA;

<sup>2</sup> Department of Radiation Oncology, Virginia Commonwealth University, Richmond, VA 23284, USA;

<sup>3</sup> National Radiation Oncology Program, Department of Veteran Affairs, Richmond, VA 23245, USA

\* Correspondence: bose@vcu.edu

**Abstract:** Significant growth in Electronic Health Records (EHR) over the last decade has provided an abundance of clinical text that is mostly unstructured and untapped. This huge amount of clinical text data has motivated the development of new information extraction and text mining techniques. Named Entity Recognition (NER) and Relationship Extraction (RE) are key components of information extraction tasks in the clinical domain. In this paper, we highlight the present status of clinical NER and RE techniques in detail by discussing the existing proposed NLP models for the two tasks and their performances and discuss the current challenges. Our comprehensive survey on clinical NER and RE encompass current challenges, state-of-the-art practices, and future directions in information extraction from clinical text. This is the first attempt to discuss both of these interrelated topics together in the clinical context. We identified many research articles published based on different approaches and looked at applications of these tasks. We also discuss the evaluation metrics that are used in the literature to measure the effectiveness of these two NLP methods and future research directions.

**Keywords:** electronic health records; clinical text; natural language processing; named entity recognition; relationship extraction; machine learning

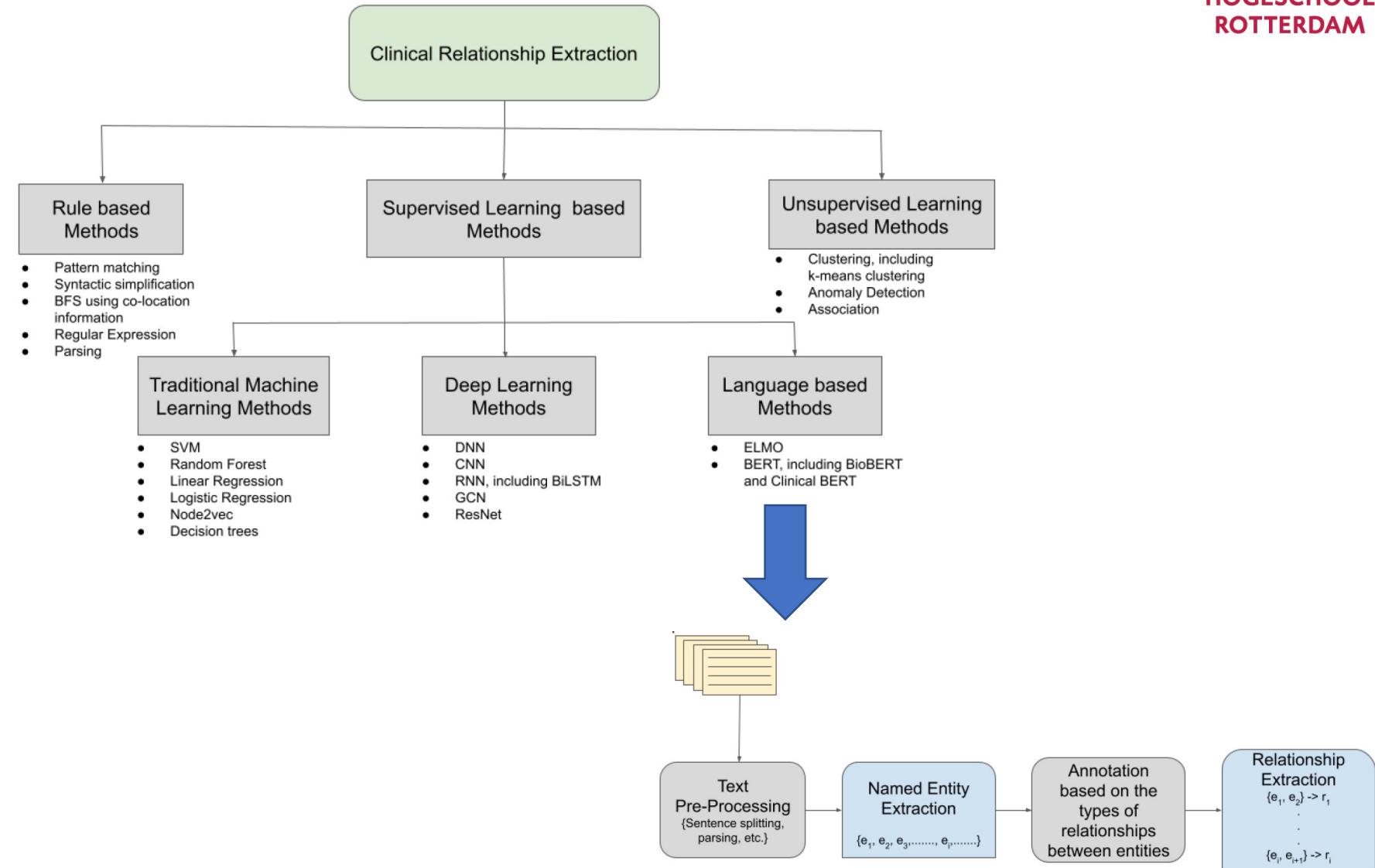
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*Appl. Sci.* **2021**, *11*, 8319. <https://doi.org/10.3390/app1188319>

<https://www.mdpi.com/journal/applsci>



# {Speech-to-Text}

Probeer Speech to Text uit met deze demo-app, ontwikkeld op basis van onze JavaScript-SDK



Taal

Dutch (Netherlands)

Automatische interpunctie

Spreken

Bestand uploaden

Uw spraakgegevens worden niet opgeslagen

[Ontdek hoe u Speech to Text in uw apps en producten gebruikt >](#)

[Verken meer aspecten van uw Speech to Text-uitvoer met het programma zonder code in Speech Studio >](#)

Kies de knop Spreken aan de linkerkant en begin met spreken. De spraakservice retourneert herkenningsresultaten terwijl u spreekt. Als u verschillende talen spreekt, kunt u elke taal uitproberen die door de spraakservice wordt ondersteund. U kunt ook bestanden uploaden om de spraakservice voor uw specifieke gebruiksscenario's te testen. Raadpleeg onze documentatie en ontdek hoe u de spraak-naar-tekstfunctie in uw oplossingen inbouwt.

<https://azure.microsoft.com/nl-nl/services/cognitive-services/speech-to-text/#features>

# {Named Entity Recognition}



displaCy Named Entity Visualizer

When Sebastian Thrun started working on self-driving cars at Google in 2007, few people outside of the company took him seriously. "I can tell you very senior CEOs of major American car companies would shake my hand and turn away because I wasn't worth talking to," said Thrun, now the co-founder and CEO of online higher education startup Udacity, in an interview with Recode earlier this week.

Model ?

English - en\_core\_web\_sm (v3.1.0)

Entity labels (select all)

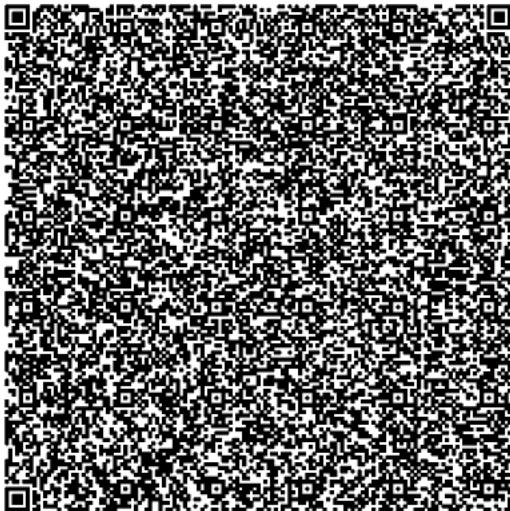
PERSON    NORP    ORG    GPE    LOC  
 PRODUCT    EVENT    WORK OF ART    LANGUAGE  
 DATE    TIME    PERCENT    MONEY  
 QUANTITY    ORDINAL    CARDINAL

When Sebastian Thrun PERSON started working on self-driving cars at Google ORG in 2007 DATE, few people outside of the company took him seriously. "I can tell you very senior CEOs of major American NORP car companies would shake my hand and turn away because I wasn't worth talking to," said Thrun GPE, now the co-founder and CEO of online higher education startup Udacity, in an interview with Recode earlier this week DATE.

A little less than a decade later DATE, dozens of self-driving startups have cropped up while automakers around the world clamor, wallet in hand, to secure their place in the fast-moving world of fully automated transportation.

<https://explosion.ai/demos/displacy-ent/>

# {Named Entity Recognition}



displaCy Named Entity Visualizer

Doctor: Hello! What can I do for you?  
Patient: Good Morning Doctor. I don't feel good.  
Doctor: Come and sit here.  
Doctor: Open your mouth.  
Doctor: Since how long are you not feeling well?  
Patient: Since yesterday

Entity labels (select all)

Model ?

English - en\_core\_web\_sm (v3.1.0)

Doctor: Hello! What can I do for you?  
Patient: Good Morning Doctor. I don't feel good.  
Doctor: Come and sit here.  
Doctor: Open your mouth.  
Doctor: Since how long are you not feeling well?  
Patient: Since **yesterday** **DATE**.  
Doctor: No problem. Did you have motions **yesterday** **DATE**?  
Patient: No Doctor. Not so freely.  
Patient: Doctor I feel weak and do not feel like eating.  
Doctor: Ok. And what else?  
Patient: I feel like vomiting.  
Doctor: Do you drink a lot of water?  
Patient: No Doctor, I don't have water too much.  
Doctor: Did you take any medicine?  
Patient: Yes Doctor, I took a **Crocin** **ORG**. Doctor: who asked you to take it? Patient: No one Doctor. I took it myself.  
Doctor: why did you take it? Patient: Because I felt a headache. Doctor: Nothing to be worried at. Doctor: Do you need quick relief? Patient: No Doctor. It is enough you give me medicines for now.

# {Knowledge Dissemination & Curation}

High quality Dutch reviews on state-of-the-art AI



De (on)mogelijkheden van kunstmatige intelligentie in het onderwijs



In opdracht van:  
Ministerie van Onderwijs, Cultuur & Wetenschap

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2018.06.06

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Datum:  
Utrecht, 21 januari 2019

Auteurs:  
ir. Tommy van der Vorst  
ir. Nick Jelicic  
mr. Marc de Vries  
Julie Albers

# {Knowledge Dissemination & Curation}



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RESEARCH BRIEFS | DECEMBER 17, 2020

### Artificial Intelligence and the Future of Work

THOMAS MALONE, DANIELA RUS, ROBERT LAUBACHER

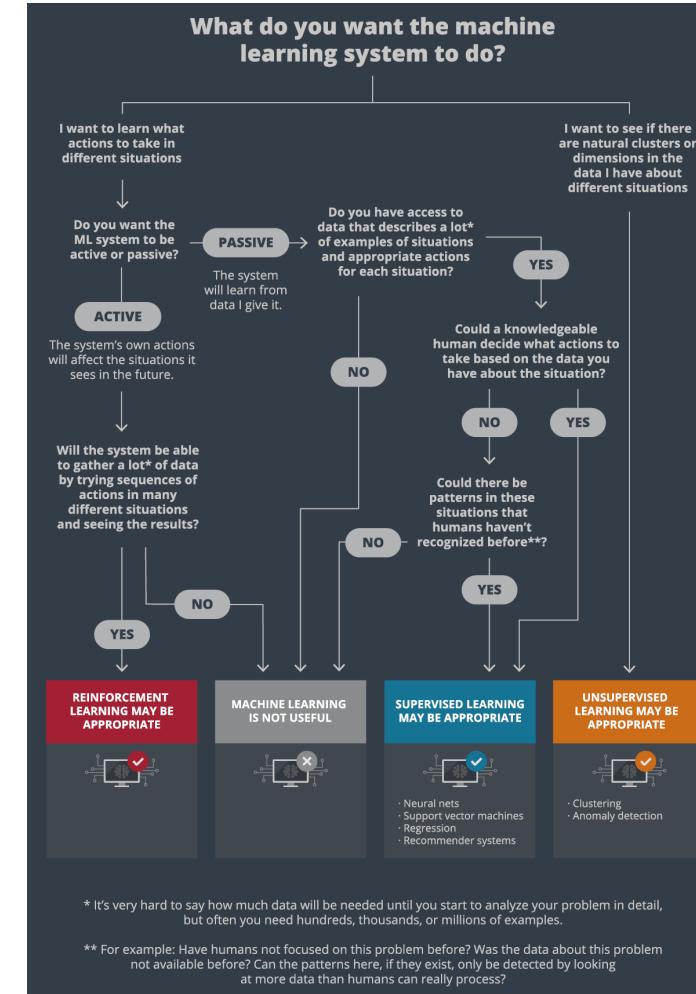
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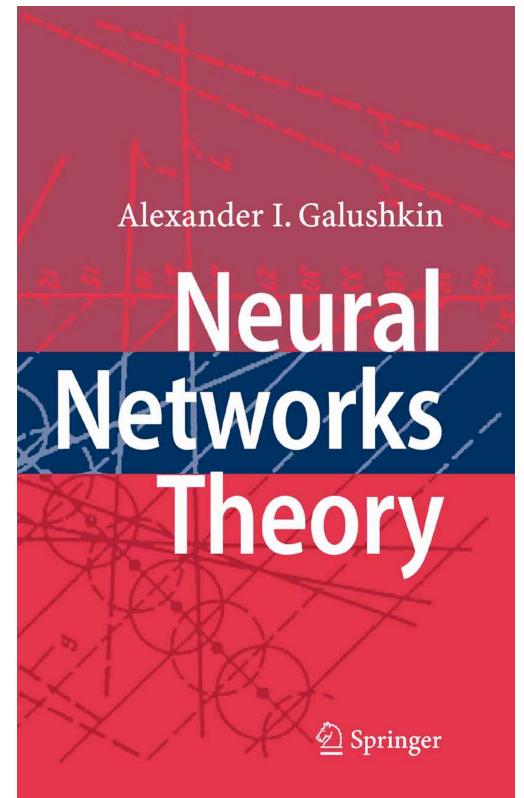
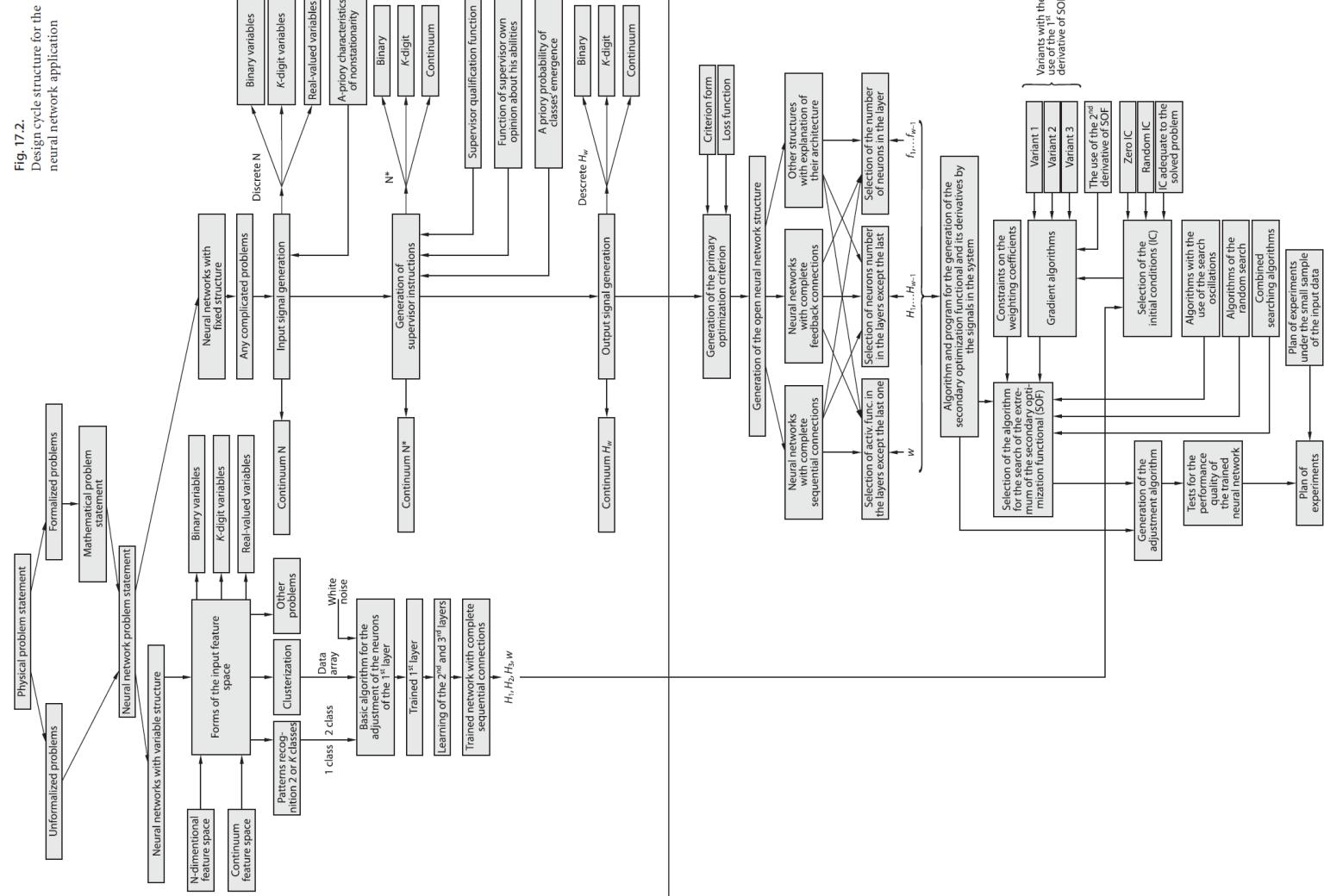
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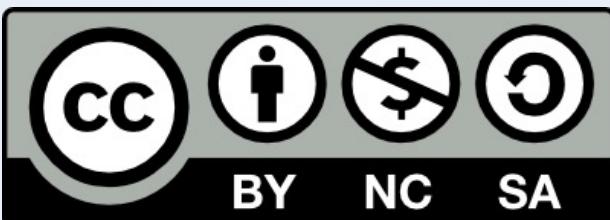


Employ decision-three flowcharts to apply (D)NNs appropriately

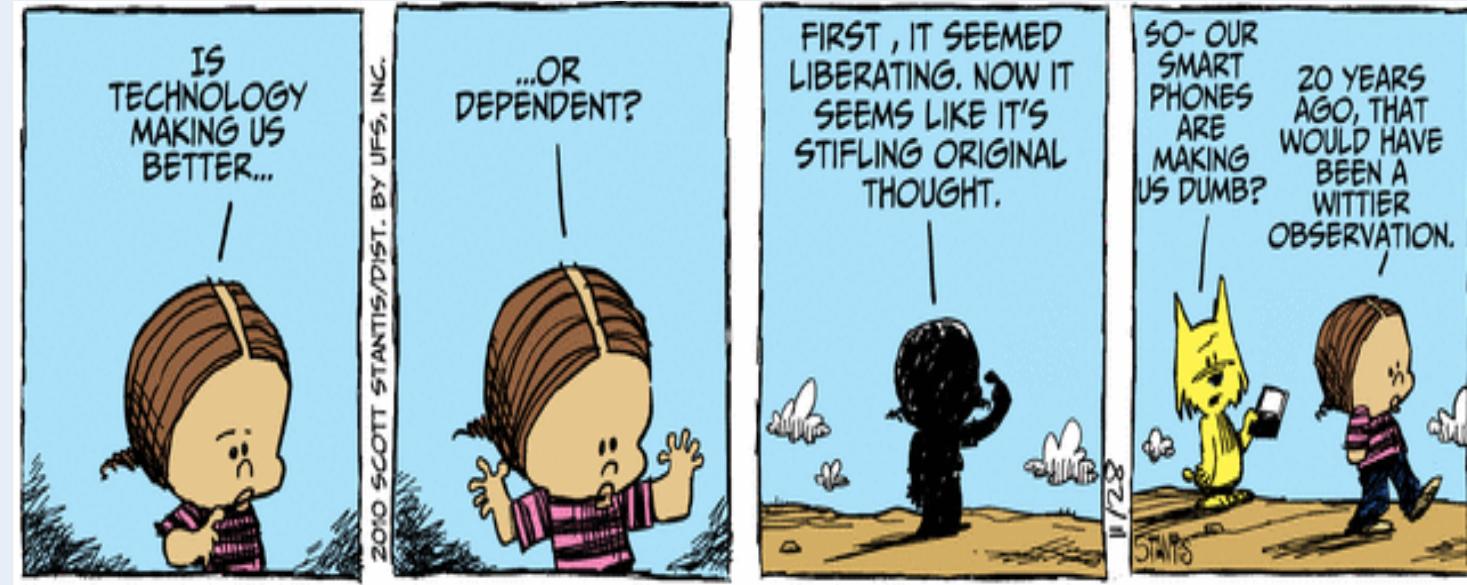


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