AI Factory Austria AI:AT

Beyond Generative AI

Machine Learning Fundamentals and Applications

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Expert AI Knowledge Transfer @ AI Factory Austria AI:AT

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AI in **manufacturing** (through digital twins)

- IT Consultant and Trainer
- Business Informatics Researcher (441 citations) [1]

AI for **general public**

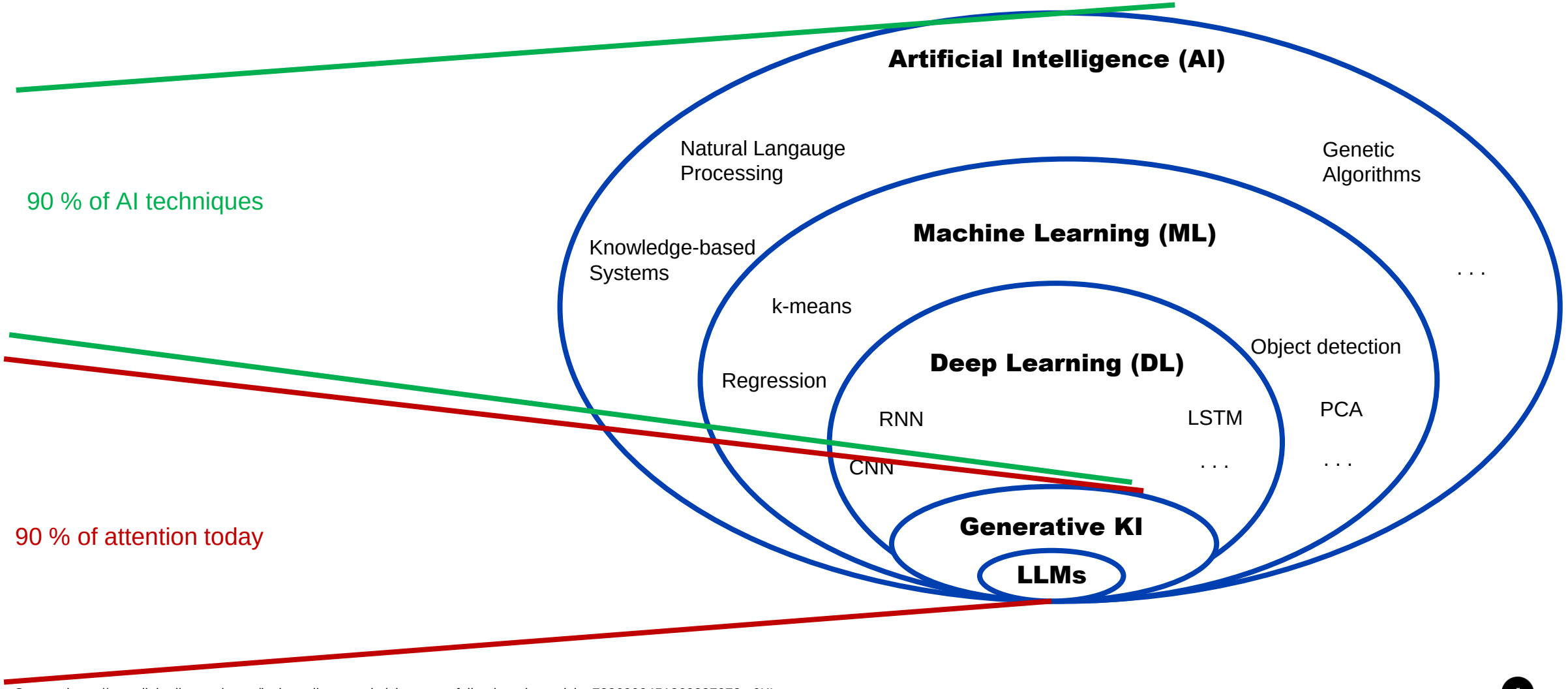
- University lectures AI for law/business administration
- VHS courses AI for general public [2]
- Certified AI Manager trainings [3]

[1] https://scholar.google.com/citations?user=TGGaQ_0AAAAJ

[2] https://vhskurs.linz.at/index.php?kathaupt=18&suchesetzen=false&kfs_dozentid=139372

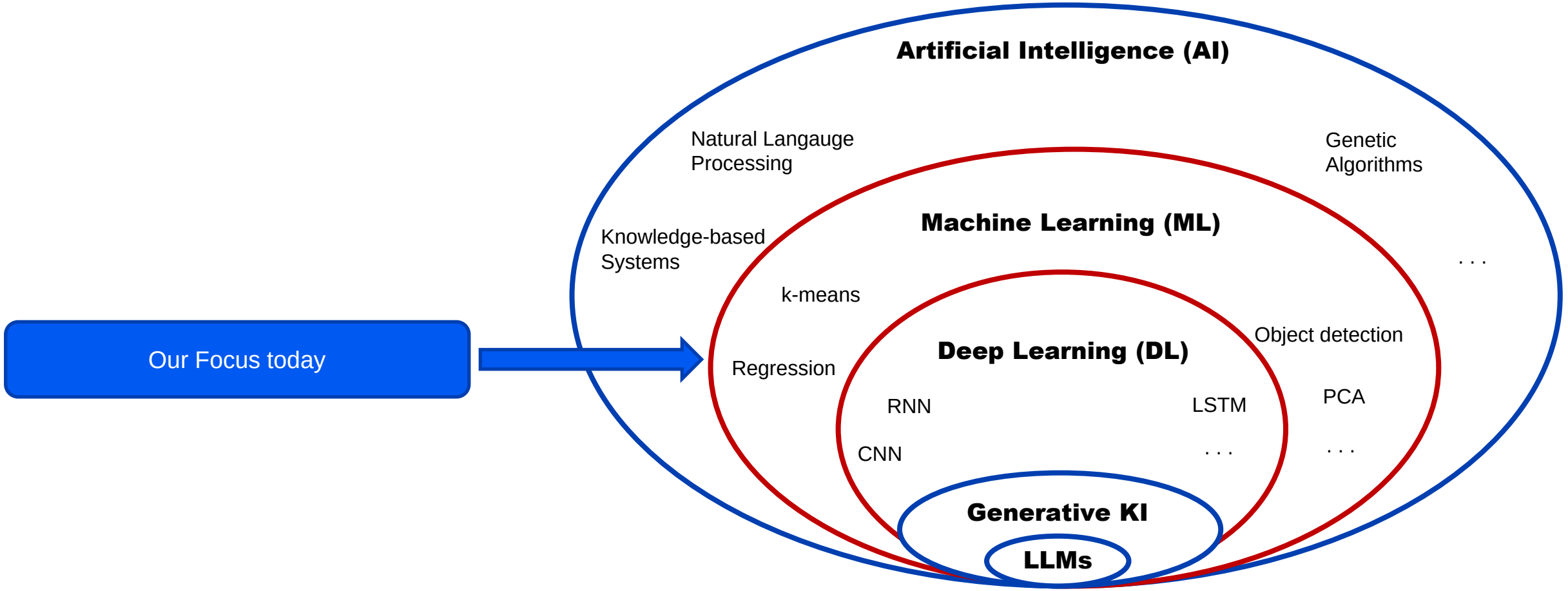
[3] https://tecnovy.com/de/tecnovy/certified-ai-manager

„AI Tunnel View“



Source: https://www.linkedin.com/posts/jaylatta_llm-tunnel-vision-weve-fallen-into-the-activity-7386990451360387072-y6KI

„AI Tunnel View“



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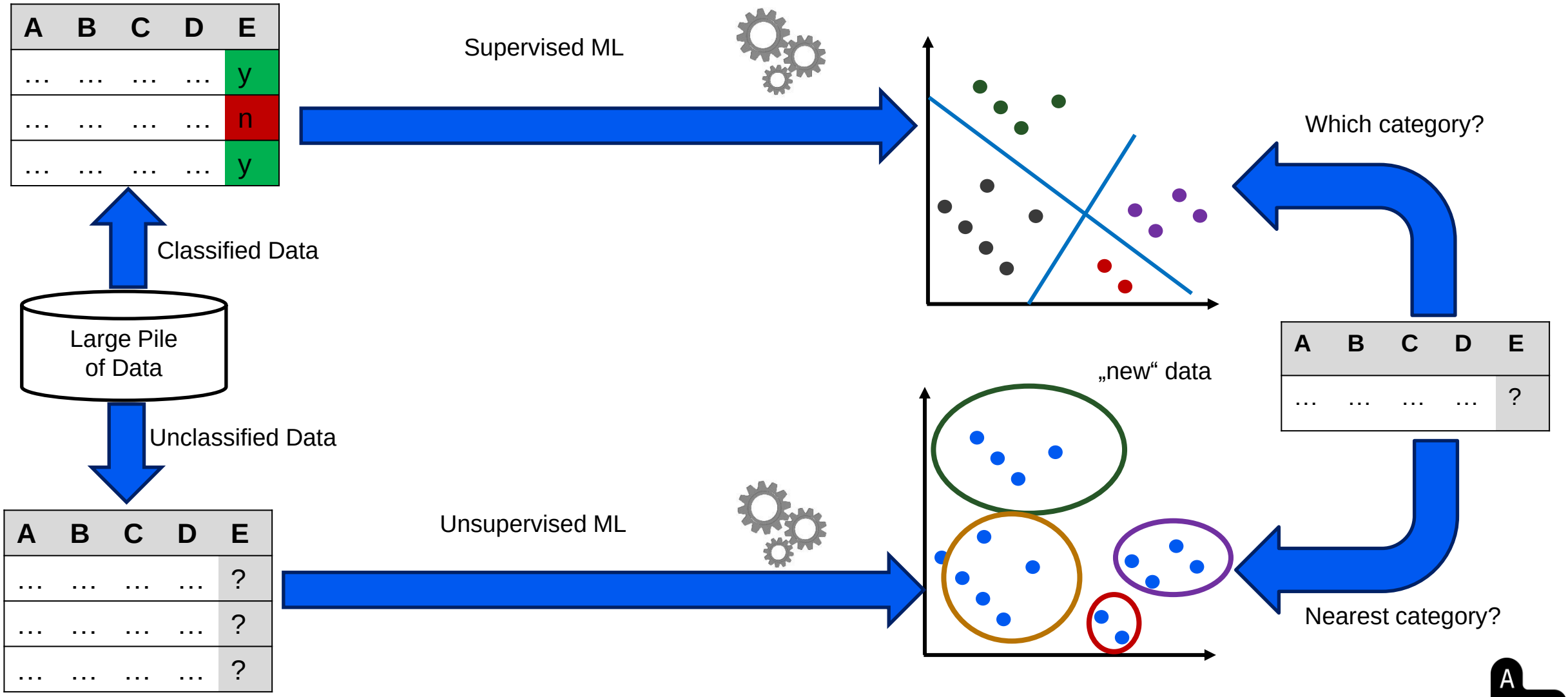
Machine Learning (ML)

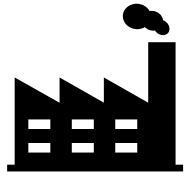


Comparison of Machine Learning Paradigms

	Supervised Learning	**Unsupervised Learning**	**Reinforcement Learning**
Input	Classified data	Unclassified data	Reward function + possible actions
Output	Classification of new Data	Classes/Groups	List of Actions to optimize reward function
Feedback required	Before learning process	None	After each learning step

Machine Learning in the Wild

Example Manufacturing



Created by vighnesh anvekar
from the Noun Project

Challenge: Mistakes are expensive, but more and more common (lack of qualified personnel)

Solution: Automated mounting check

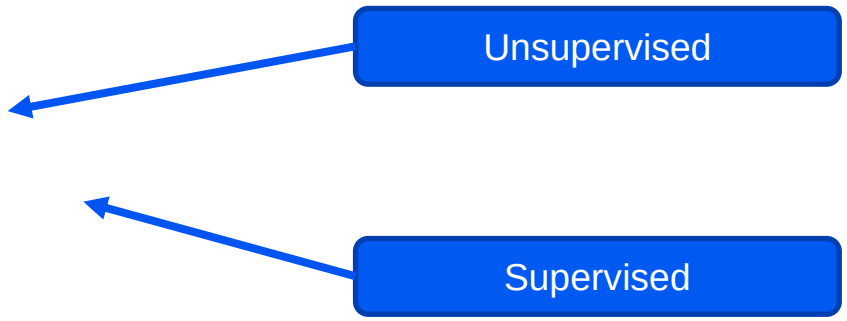
Machine Learning Aspect:

- Detection of mistakes via camera feed

Solution: Predictive Maintenance

Machine Learning Aspects:

- Detection of anomalies in live data
- Prediction of best reaction to anomaly



Example Healthcare

Challenge: Lack of doctors

Solution: Recommendation of diagnoses

Machine Learning Aspect:

- Most likely diagnosis based on symptoms

Supervised

Solution: Individualized Health Recommendations

Machine Learning Aspects:

- Prediction of diseases from health data
- Recommendations based on data from similar users

Supervised

Unsupervised/Reinforcement

Example Tourism

Created by Tithy
from Noun Project

Challenge: Food waste due to overproduction

Solution: Demand Prediction

Machine Learning Aspect:

- Prediction based on common parameters

Example Farming

Created by Cindy Van Heerden
from the Noun Project

Challenge: Animals on field during harvesting

Solution: Detection via cameras

Machine Learning Aspect:

- Automated detection (classification) from camera feed/images ← Supervised

Tourism

Created by Tithy from Noun Project

Challenge: Food waste due to overproduction

Value: protection of resources

Value: more efficient use of personnel

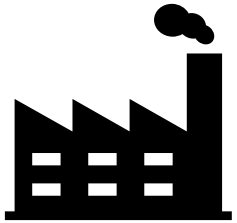
Healthcare

Challenge: Lack of doctors

Value: increased health of overall population

Value: more time for patients/more patients treated

Manufacturing



Created by vighnesh anvekar from the Noun Project

Challenge: More and more mistakes during production

Value: more efficient use of machines

Value: less accidents/ increased longetivity of machines

Farming

Created by Cindy Van Heerden from the Noun Project

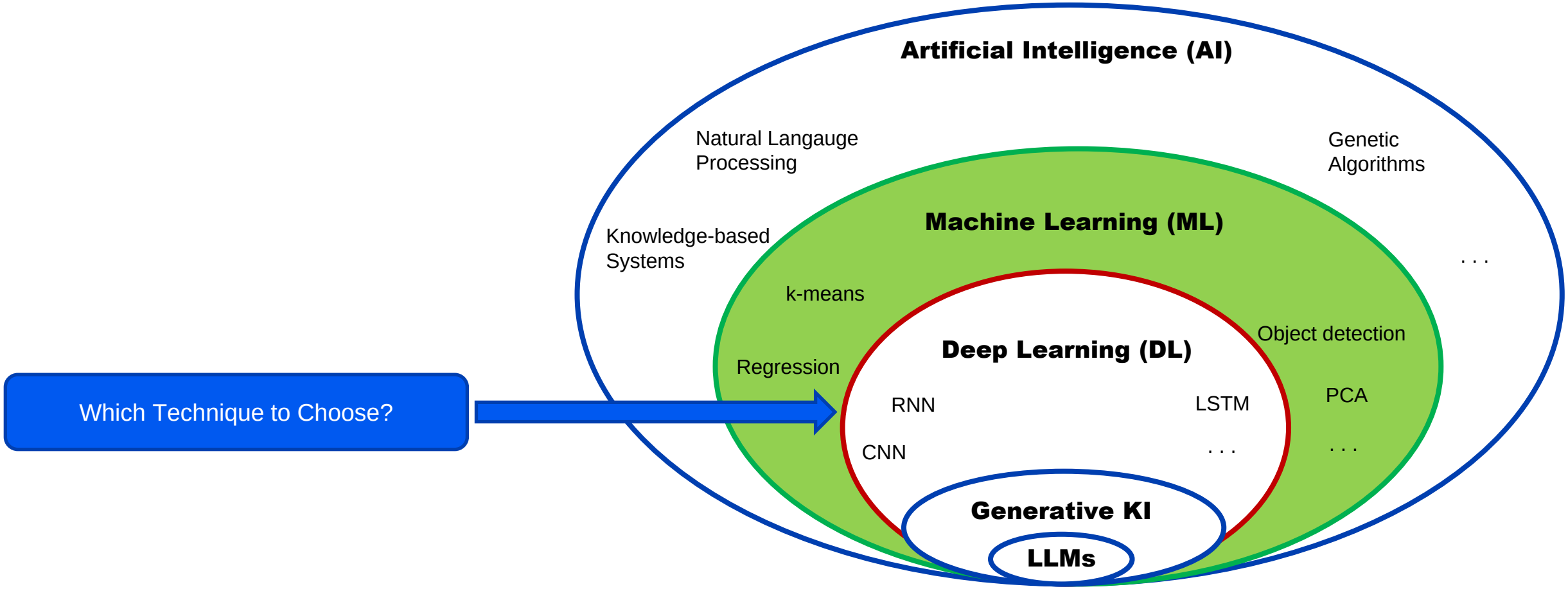
Challenge: Animals on field during harvesting

Value: saving lives

Value: increased efficiency of harvesting/ increased longetivity of machines

Let‘s get Technical!

„AI Tunnel View“



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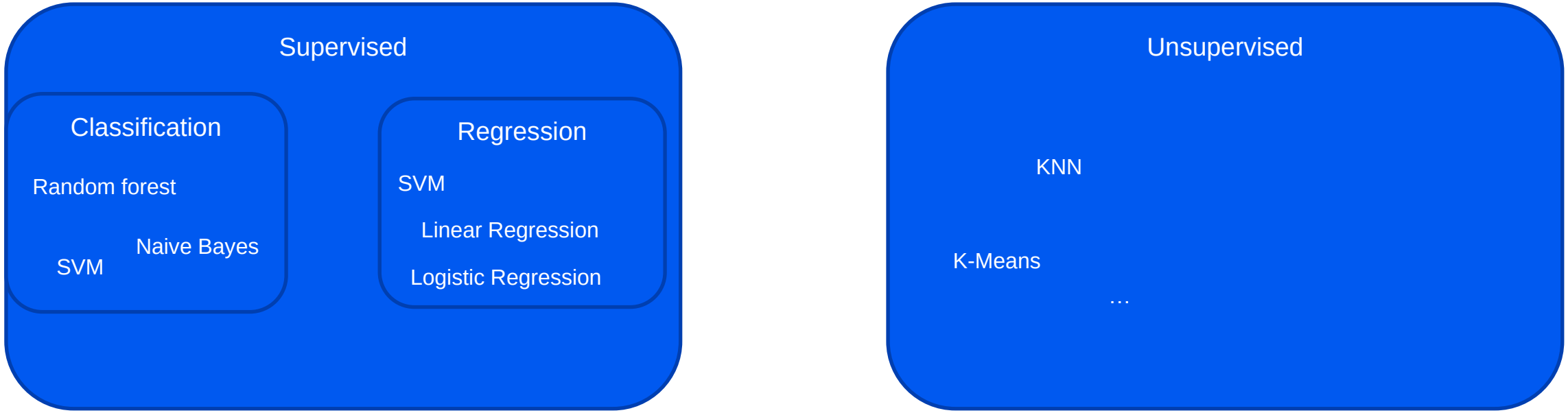
Which Technique to Choose?



What are Artificial Neural Networks?

Simulation of the brains‘ working mode

Allows **„biological“** processing of informaiton

Also a **technical concept for problem solving**

- Pattern recognition
- Prediction
- Planning
- …

Neural Networks in Biology

Brain comprises ~10 Billion Neurons
Each Neuron is connected with 10.000 other Neurons

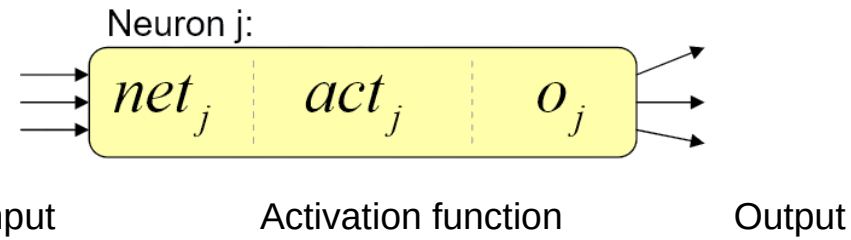
All inputs are processed in parallel by Neuron

Learning = change in connections between neurons (=Synapses)

Neurons in Informatics

Perceptron as „computer representation“ of a neuron

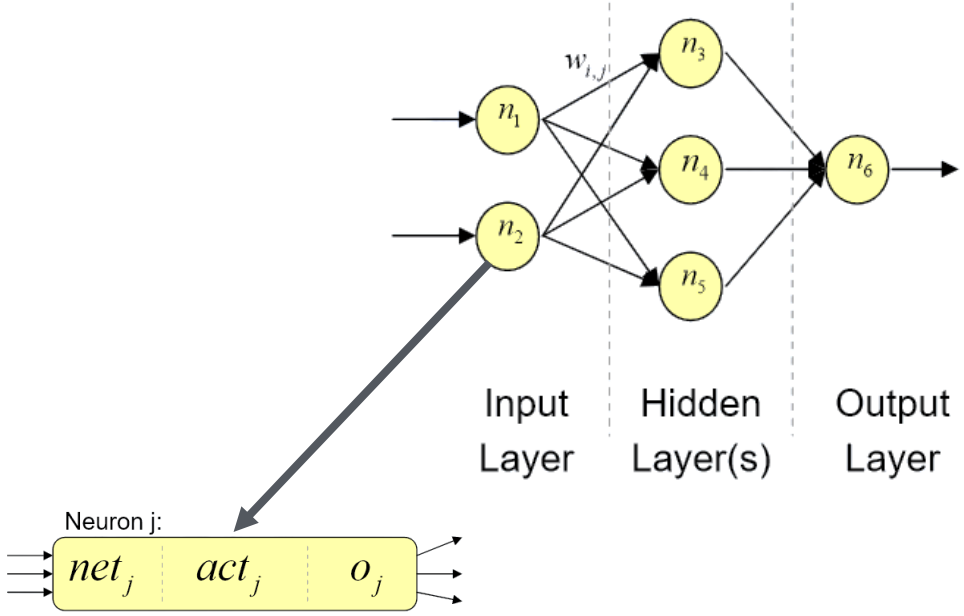
- Input: Set of numerical values
- Activation function to calculate output by applying weiths on inputs
- Output: Activation (0/1)



Artificial Neural Networks

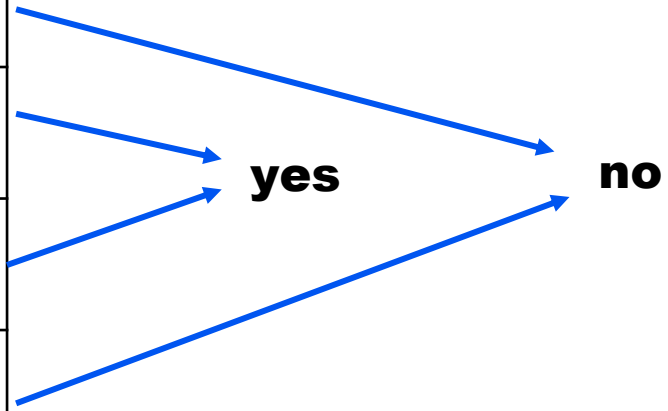
Simple Neural Network

- Directed, weighed graph
- Layers of Perceptrons
- Each weighed edge connects two Perceptrons from different layers

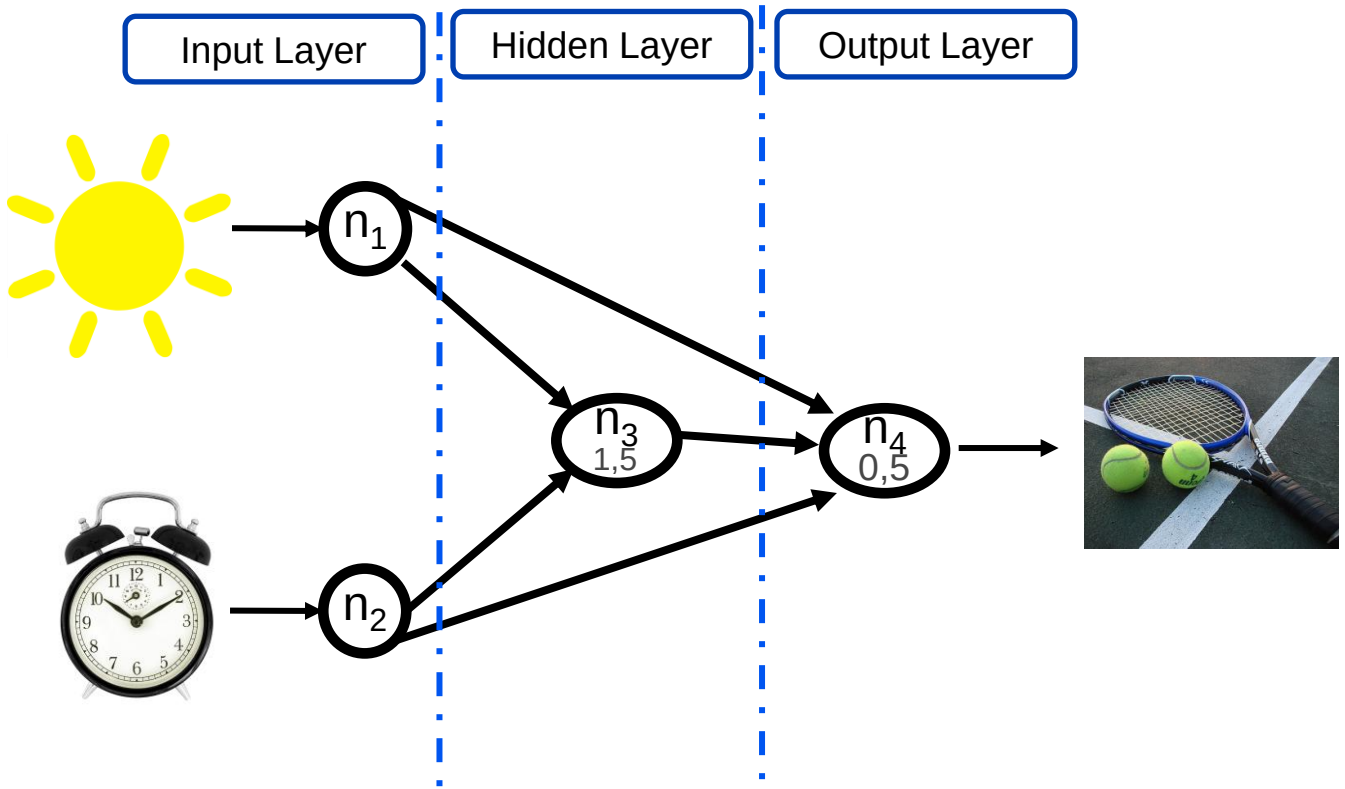


Example: Tennis

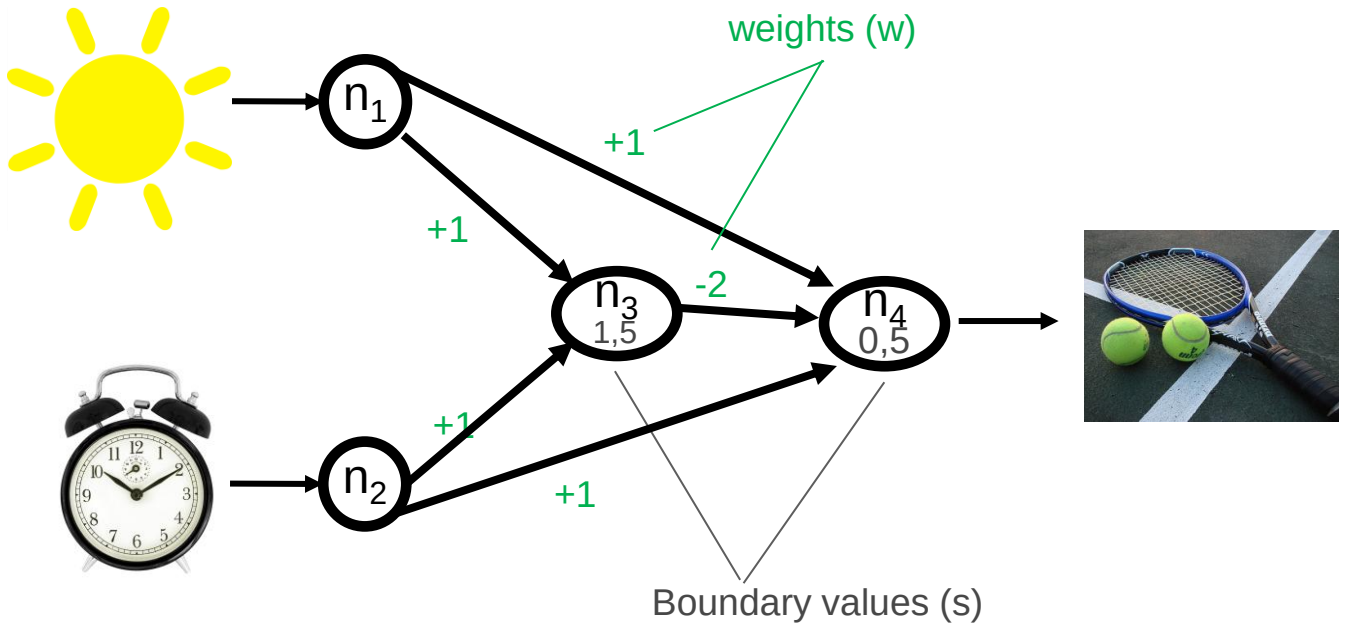
		
1	1	0
1	0	1
0	1	1
0	0	0



Example Neural Network



Example Neural Network



Input Function (for each Neuron):
- Sum of output * weight for each incoming neuron

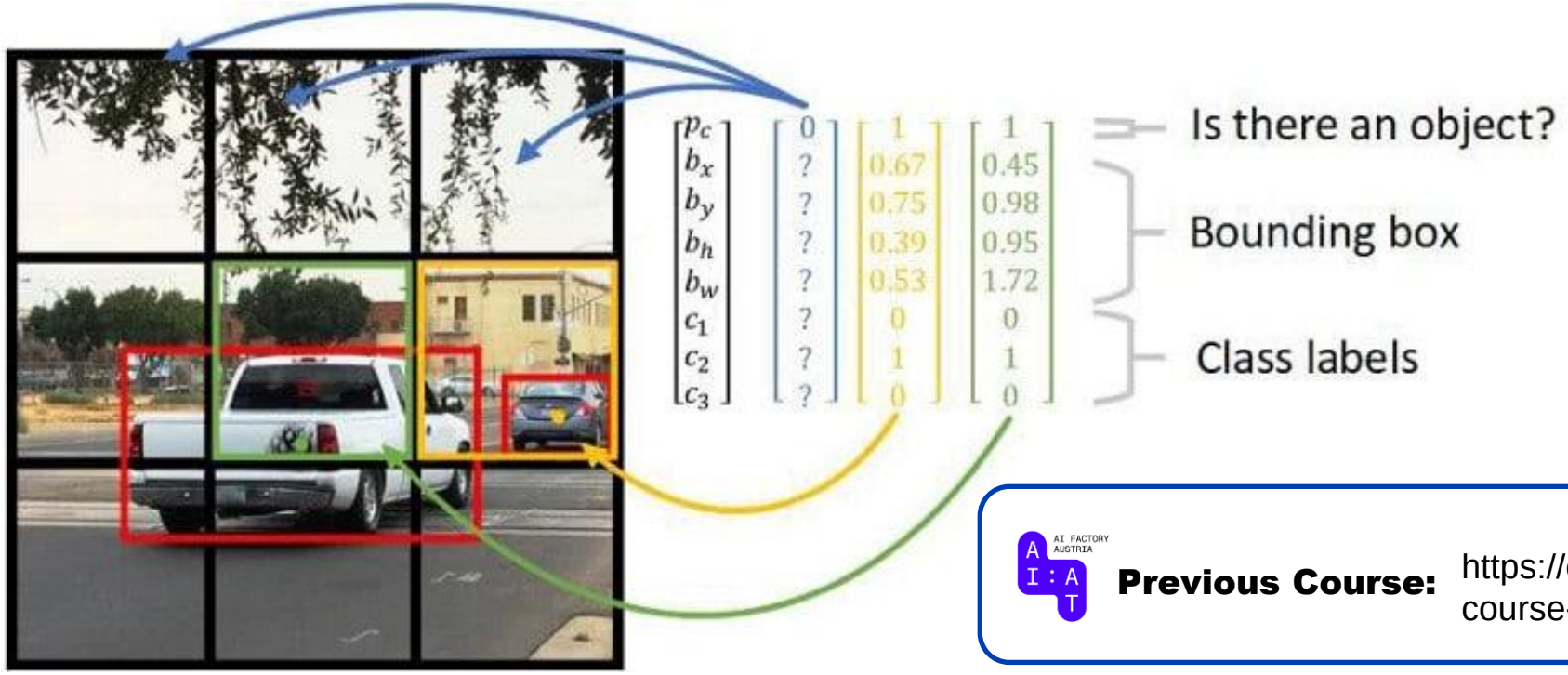
Activation Function (for each Neuron):
- 1, if Input ≥ boundary value
- 0 else

Output N_1	Output N_2	Input N_3	Output N_3	Input N_4	Output N_4

Example: Tennis

		
1	1	0
1	0	1
0	1	1
0	0	0

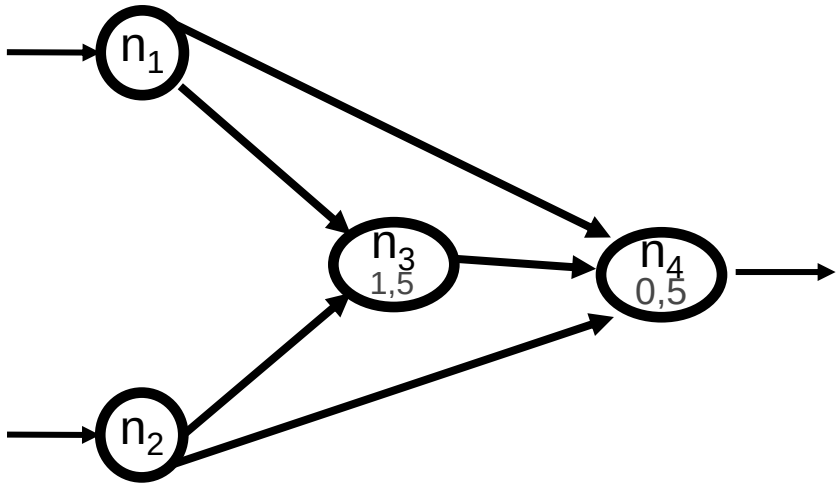
Real-World Example: Image Detection



Previous Course: https://events.asc.ac.at/event/252/page/663-course-material

Source: https://datasolut.com/einfuehrung-in-maschinelles-sehen/

Training a Neural Network



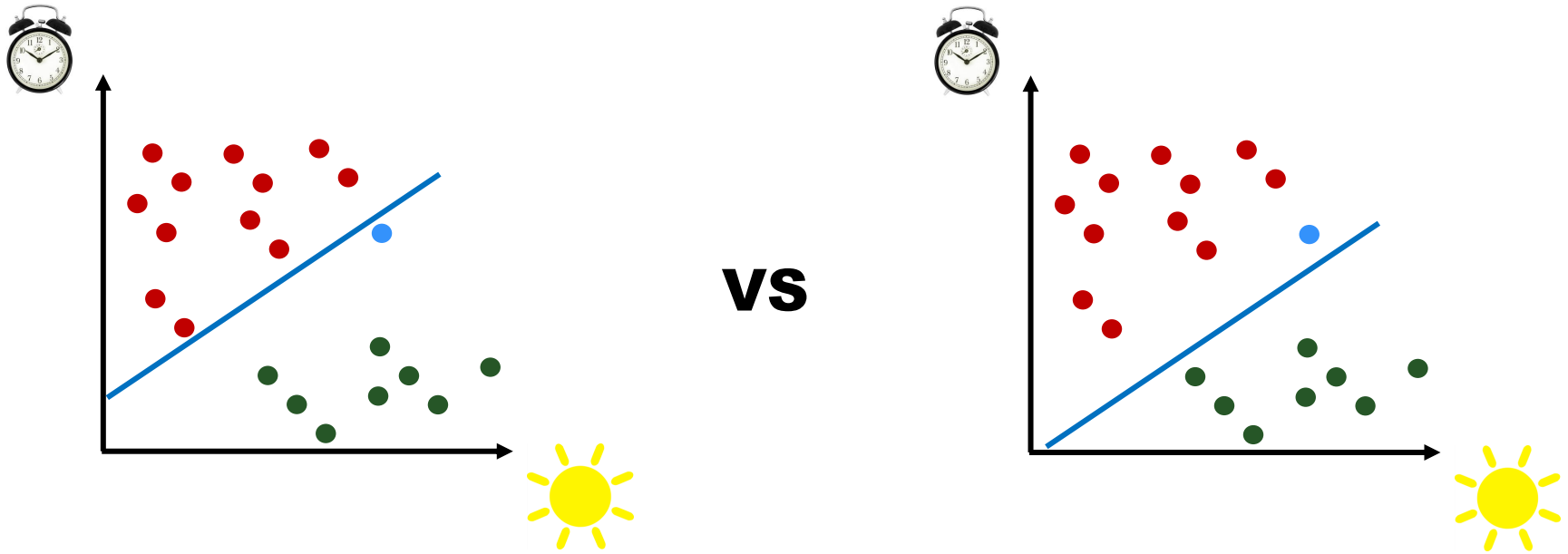
How to set **boundary values** and **weights?**

Input Function (for each Neuron):
- Sum of output * weight for each incoming neuron

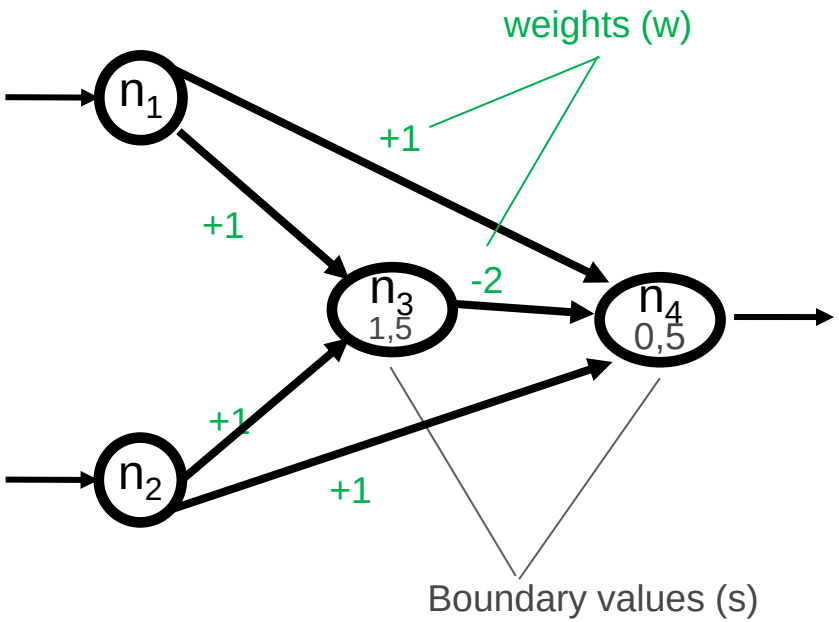
Activation Function (for each Neuron):
- 1, if Input ≥ threshold
- 0 else

Training in Machine Learning

Challenge: How to draw boundaries based on existing data?

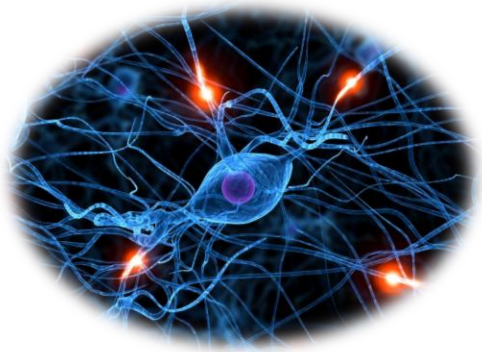


Training a Neural Network



How to set **boundary values** and **weights?**

Learning = change in connections between neurons (=Synapses)



How to do this in a Neural Network?

1. Use Base Values
2. Evaluate result on example data
3. Adapt values accordingly

Supervised

Reinforcement

Unsupervised

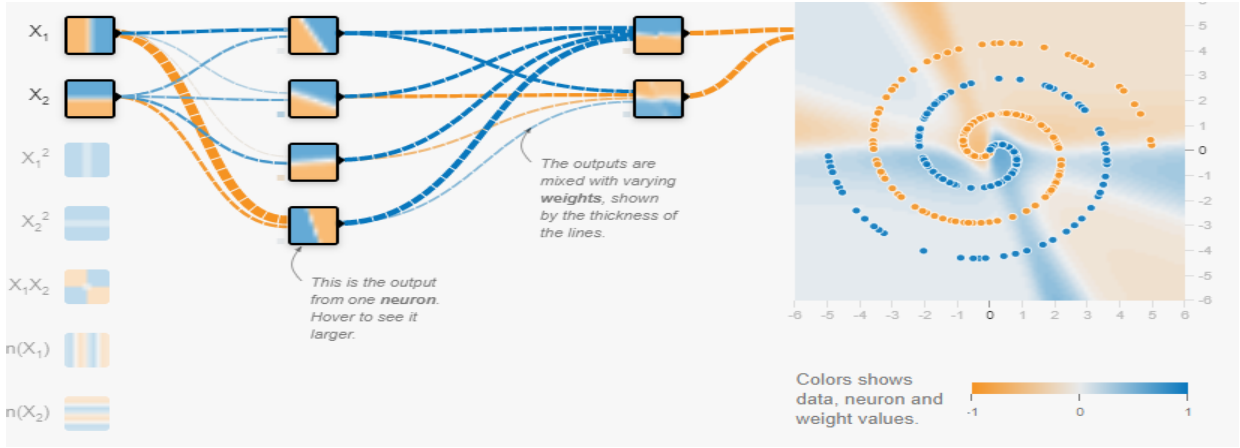
Challenges during Learning

Quality of prediction depends on quality of **learning outcome** in the **context of the given problem**

- No „one size fits all“ solution
- Always requires a lot of data

Learning efficiency depends on **quality of data**

Wanna try? http://playground.tensorflow.org



Looking for Hands-On Experience?

Course: https://ai-at.eu/training/introduction-to-deep-learning-4/

Contact

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under discussion with

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