MoSim – Modellierung und Simulation II

- Dozent: Jun.-Prof. Dr. Christian Mendl
- Zeit und Ort:
  - Di. 11:10 – 12:40 Uhr (3. DS), WIL C204
  - Do. 11:10 – 12:40 Uhr (3. DS), WIL C129 und PC-Pool
- Inhalt: Machine Learning, Artificial Neural Networks (ANNs)
- Prüfungszulassung: mindestens Hälfte der erreichbaren Hausaufgabenpunkte (Bearbeitung in Gruppen bis zu 3 Personen erlaubt)
- Verwendete Programmiersprache: Python
- Webpage zur Vorlesung:
  https://tu-dresden.de/mn/math/wir/mendl/studium/courses/mosim_2018_sose

Machine Learning-Klassifizierung

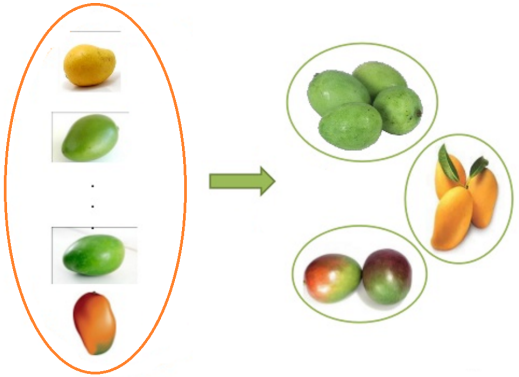
Machine Learning

Supervised

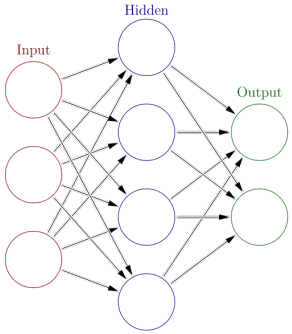
"Dog"

"Cat"

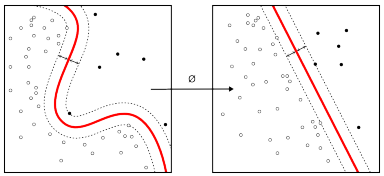
Unsupervised



Künstliche Neuronale Netze



Support Vector Machines, Kernel Methods



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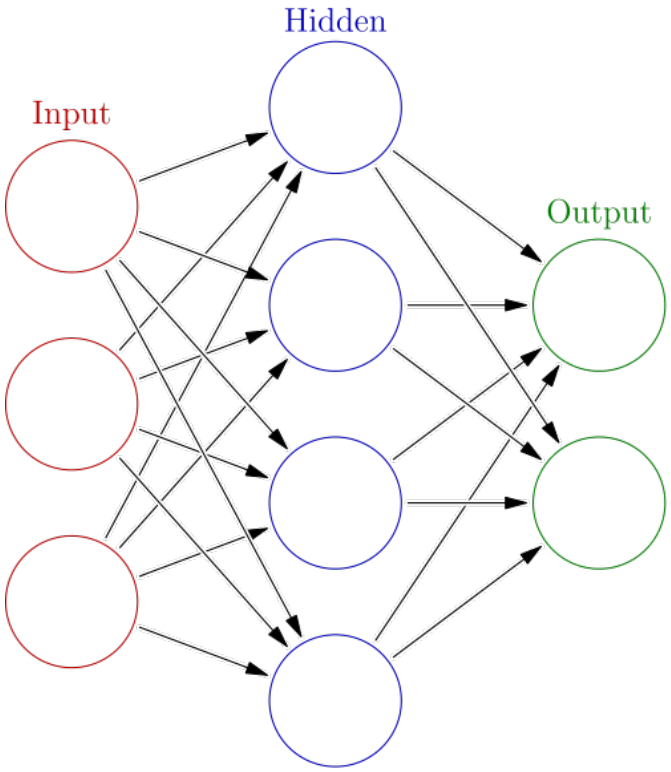
Artificial Neural Networks (ANNs)

https://www.flickr.com/photos/healthblog

$\sim 10^{11}$ Nervenzellen,

~ 7000 Synapsen pro Nervenzelle

$\overset{?}{\Longleftrightarrow}$



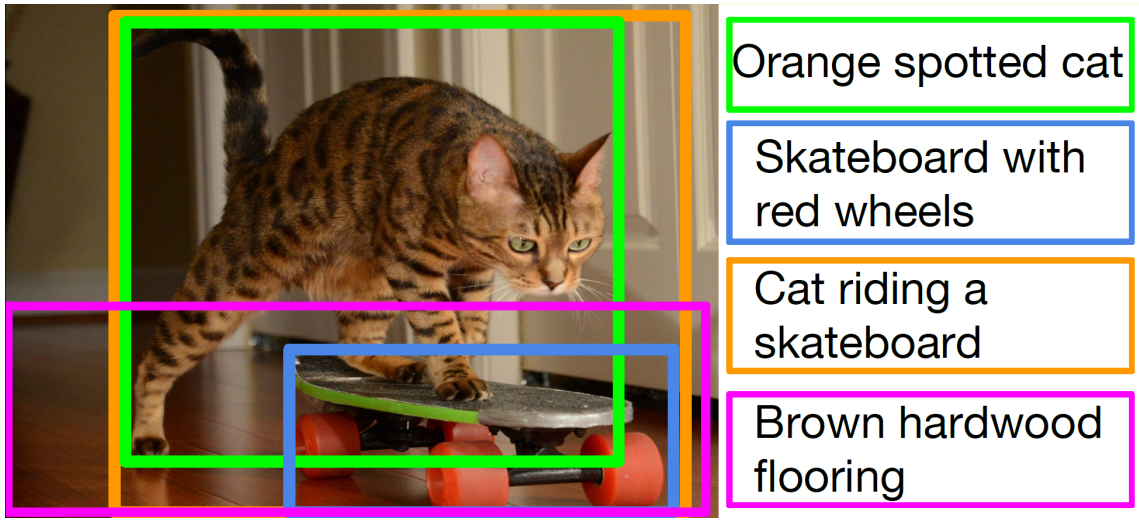
https://commons.wikimedia.org/wiki/File:Colored_neural_network.svg

Vergleich menschliches Gehirn $\leftrightarrow$ Computer

	Menschliches Gehirn	Computer (Laptop)
Energieverbrauch	20 Watt	20 – 50 Watt
# "Recheneinheiten"	$\sim 10^{11}$ Nervenzellen	10^9 – 10^{10} Transistoren
Konnektivität	$\sim$ 7000 Synapsen pro Nervenzelle	einige wenige pro Transistor
Taktfrequenz	$\sim$ 100 Hz	$2 - 4 \cdot 10^9$ Hz
Taktzyklus	asynchron	synchron (gesamter Chip)
Topologie	2D und 3D	im Wesentlichen 2D
Operationsmodus	stochastisch	deterministisch

Anwendungen: Bilderkennung und -klassifizierung

http://neuralnetworksanddeeplearning.com/chap1.html



A. Karpathy PhD thesis (2016)

Anwendungen: Artistic Style Transfer

https://deepart.io

Anwendungen: Spracherkennung und -übersetzung

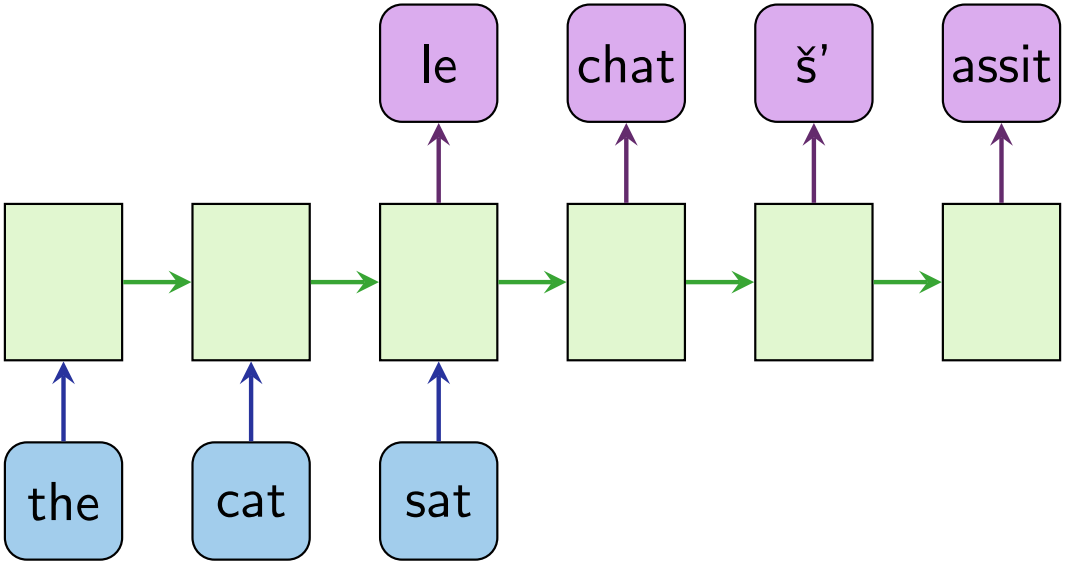


Abbildung: Recurrent Neural Network (RNN) Schema

Insbesondere Long short-term memory (LSTM) Netzwerke

Anwendungen: Objekterkennung, Self-Driving Cars

https://waymo.com

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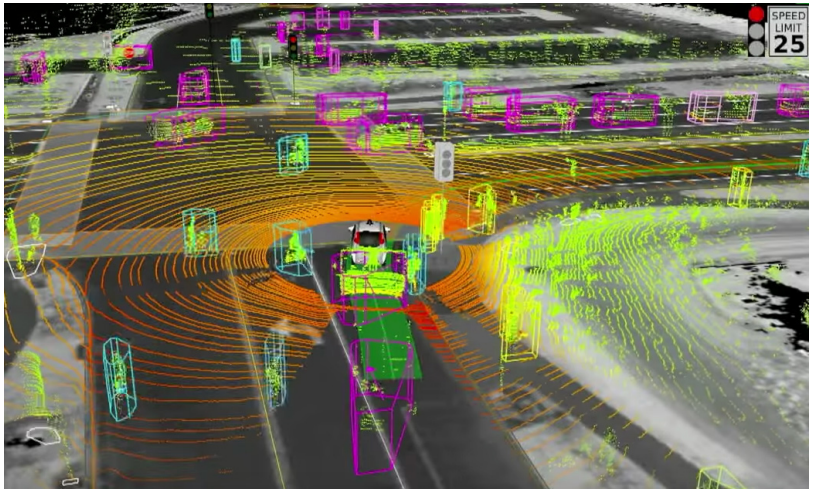

https://x.company/waymo

Anwendungen: Objekterkennung, Self-Driving Cars

https://waymo.com

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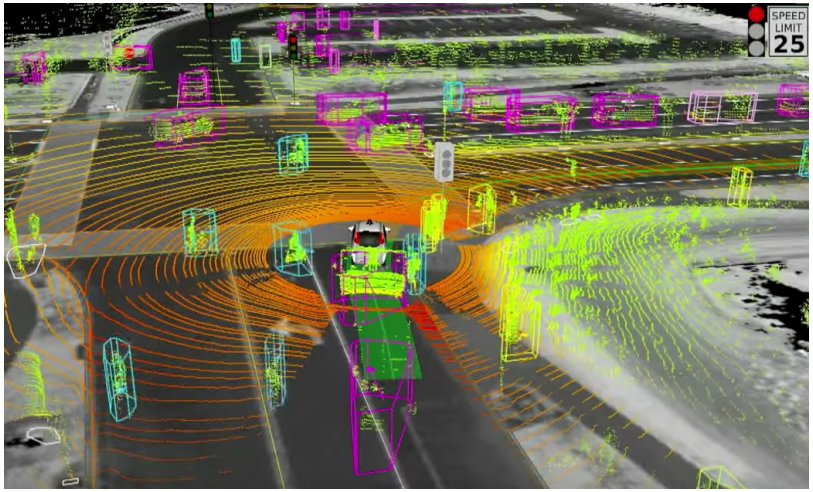

https://x.company/waymo

https://twitter.com/dweekly/status/664936697621254145