

6 Deep Dive

Deep Dive

43

Med. Regression Beispiel

ANN Applikation, Training, Transparency

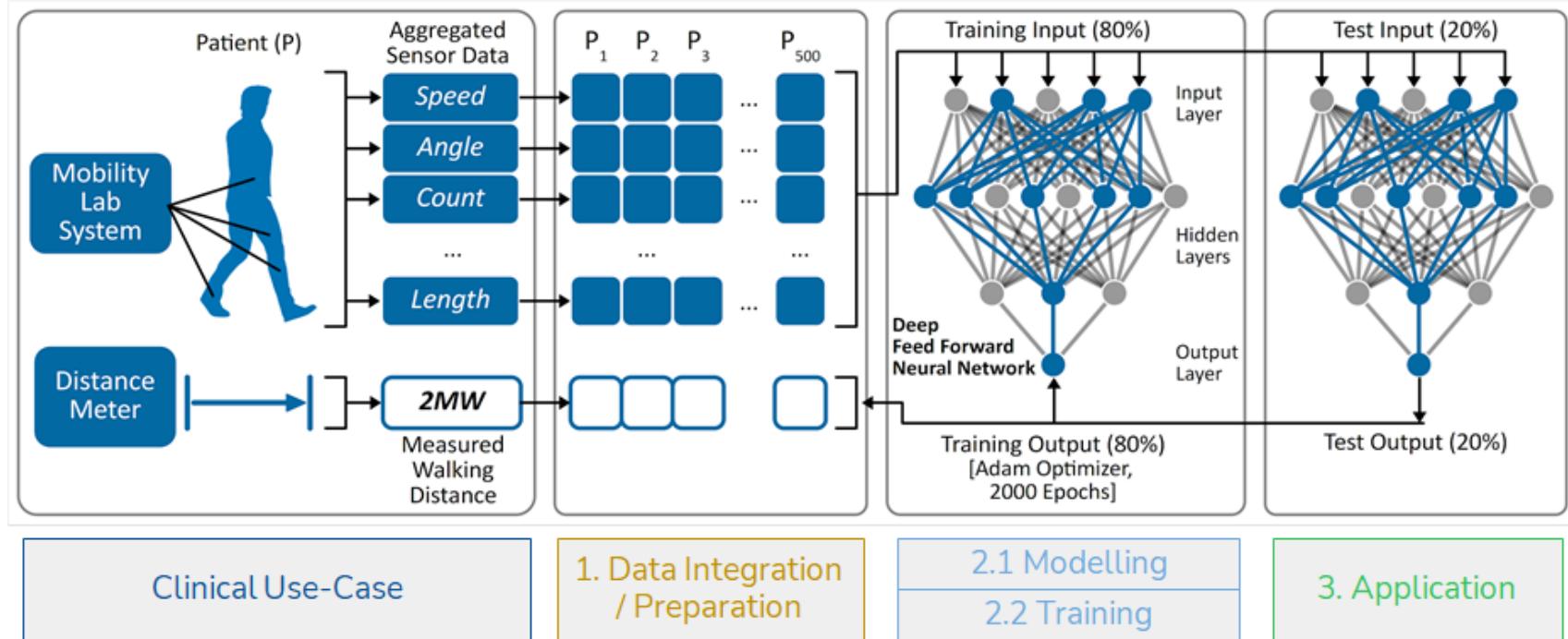
Neural Networks & Types

Data Transformation

Deep Dive

Regression Beispiel

44



Deep Dive

ANN Application

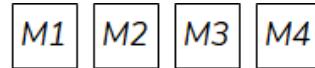
45

Wie funktioniert ein künstliches neuronales Netz? (ANN, DNN)

Deep Dive

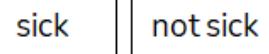
ANN Application

46



Input Data

- Purpose
 - predict sickness based on medical data

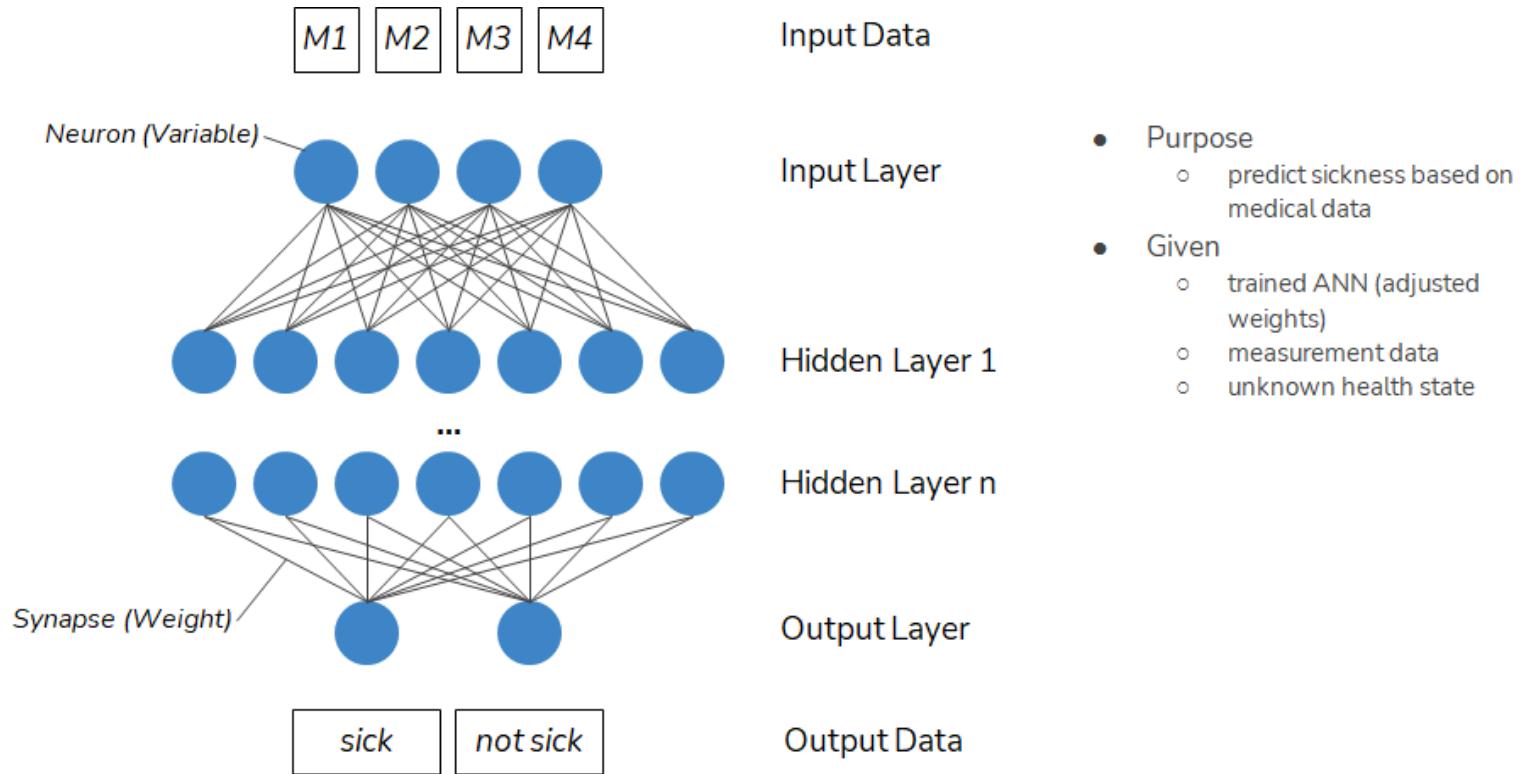


Output Data

Deep Dive

ANN Application

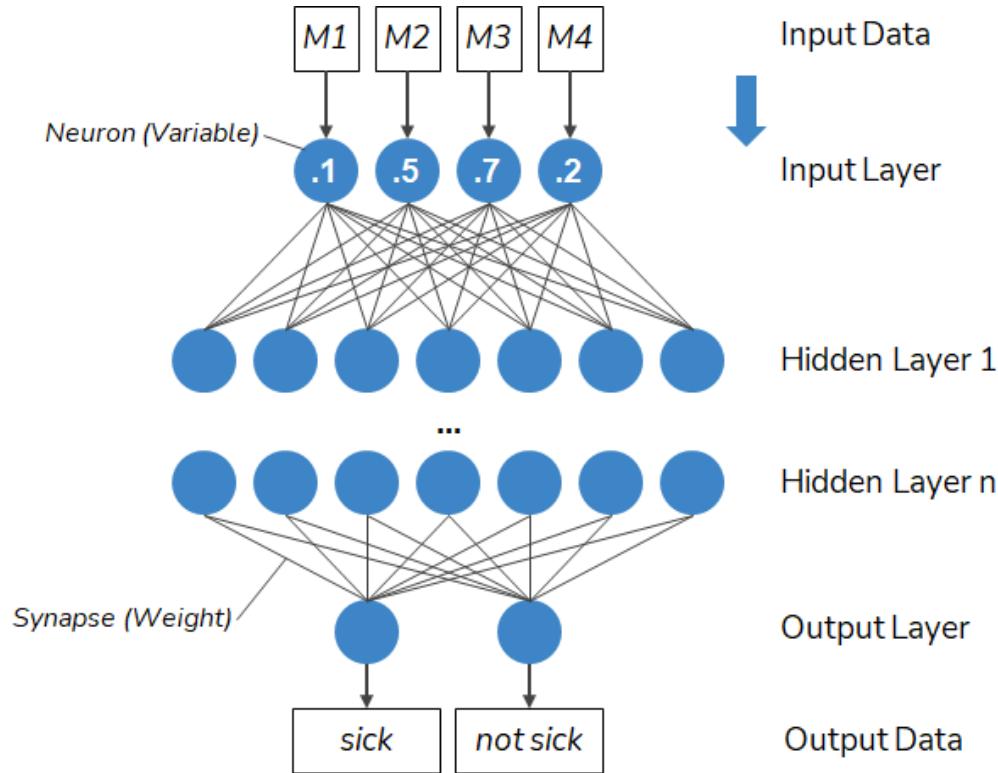
47



Deep Dive

ANN Application

48

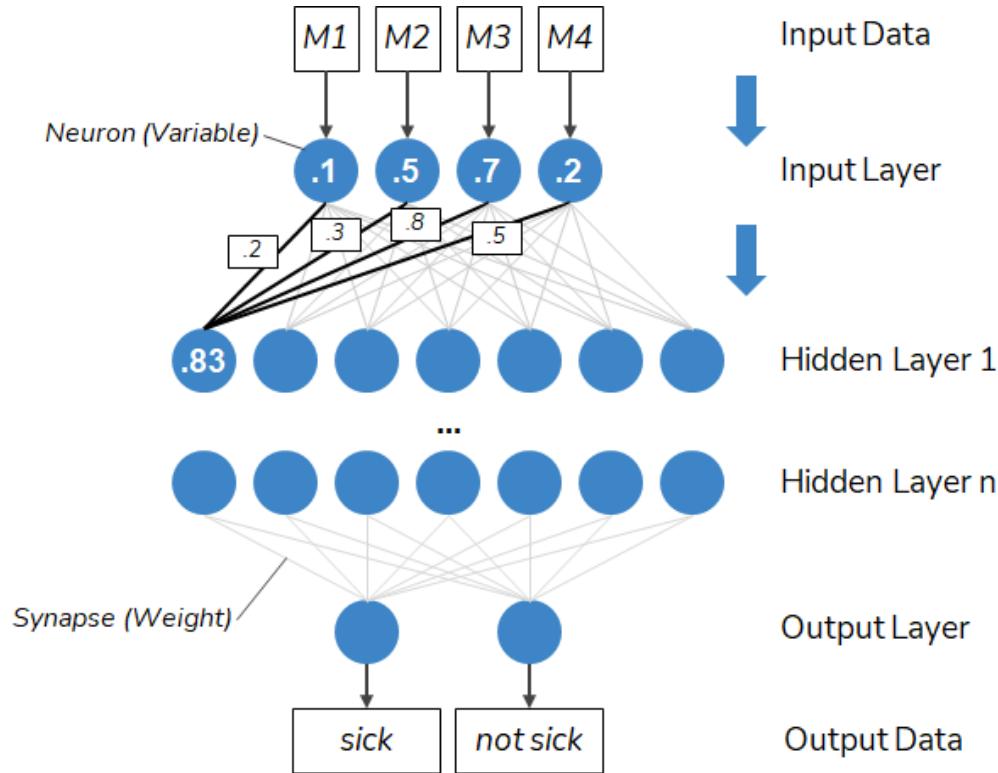


- Purpose
 - predict sickness based on medical data
- Given
 - trained ANN (adjusted weights)
 - measurement data
 - unknown health state
- ANN Functionality
 - feed in medical data directly in defined order / structure

Deep Dive

ANN Application

49

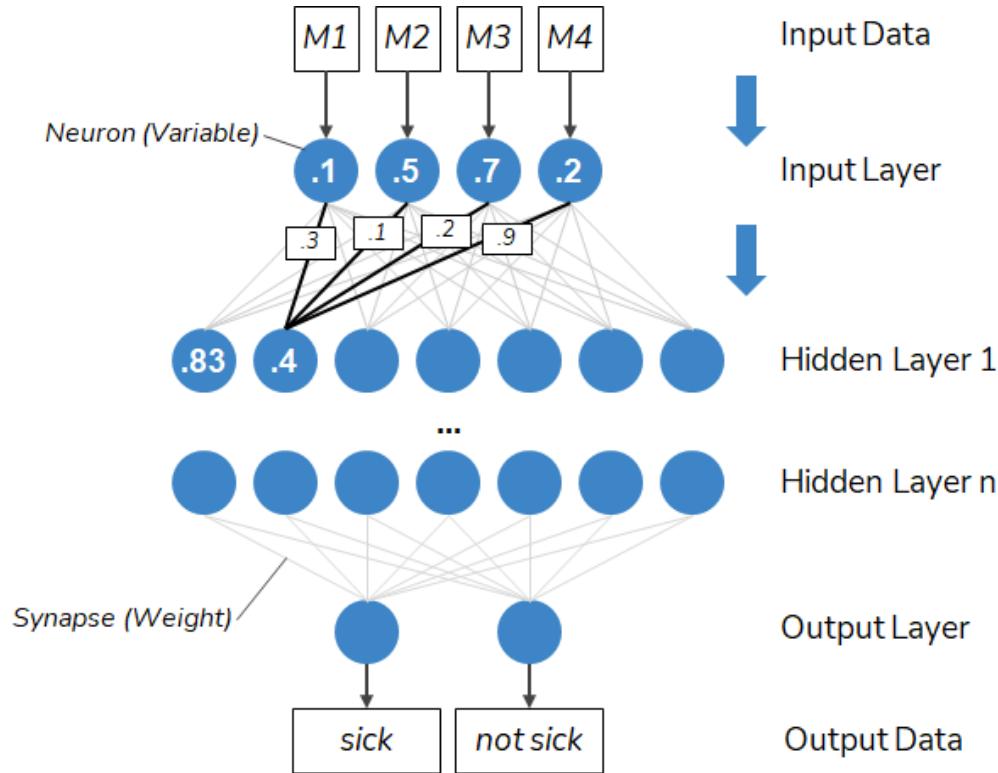


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 - calculate weighted sum iteratively

Deep Dive

ANN Application

50

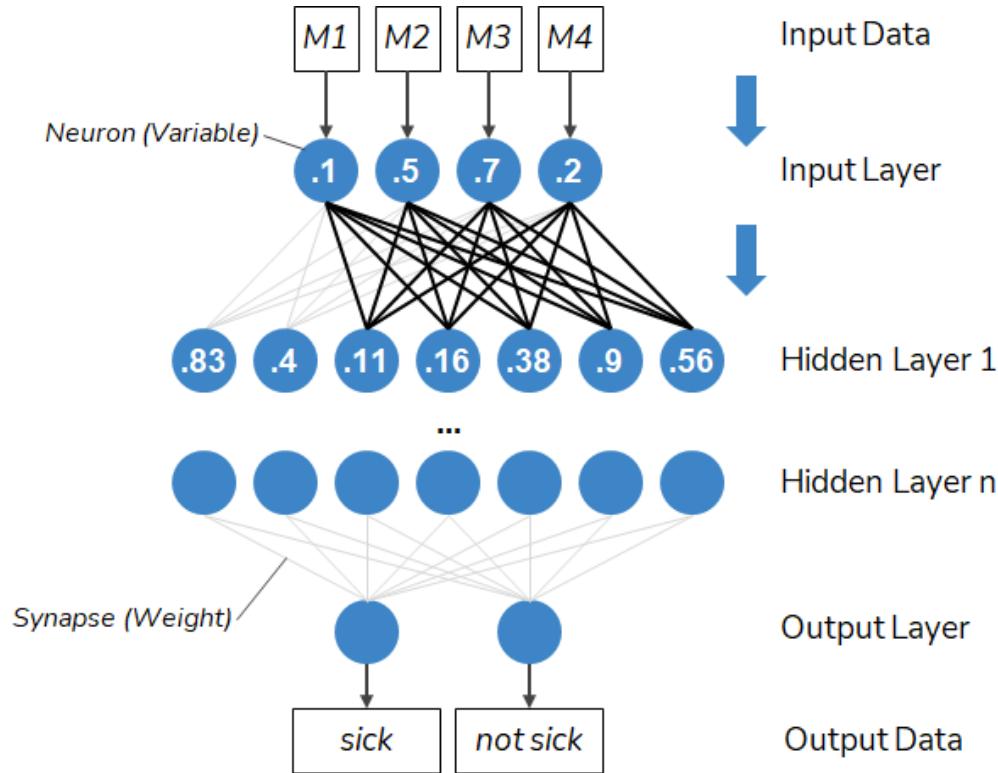


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Deep Dive

ANN Application

51

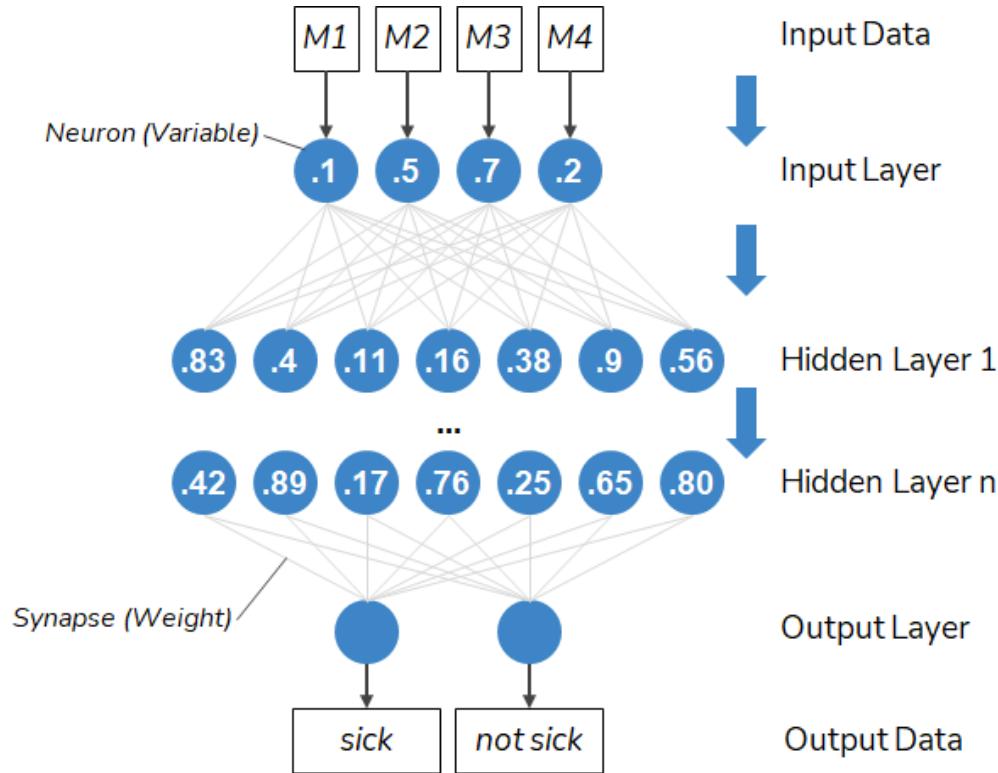


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Deep Dive

ANN Application

52

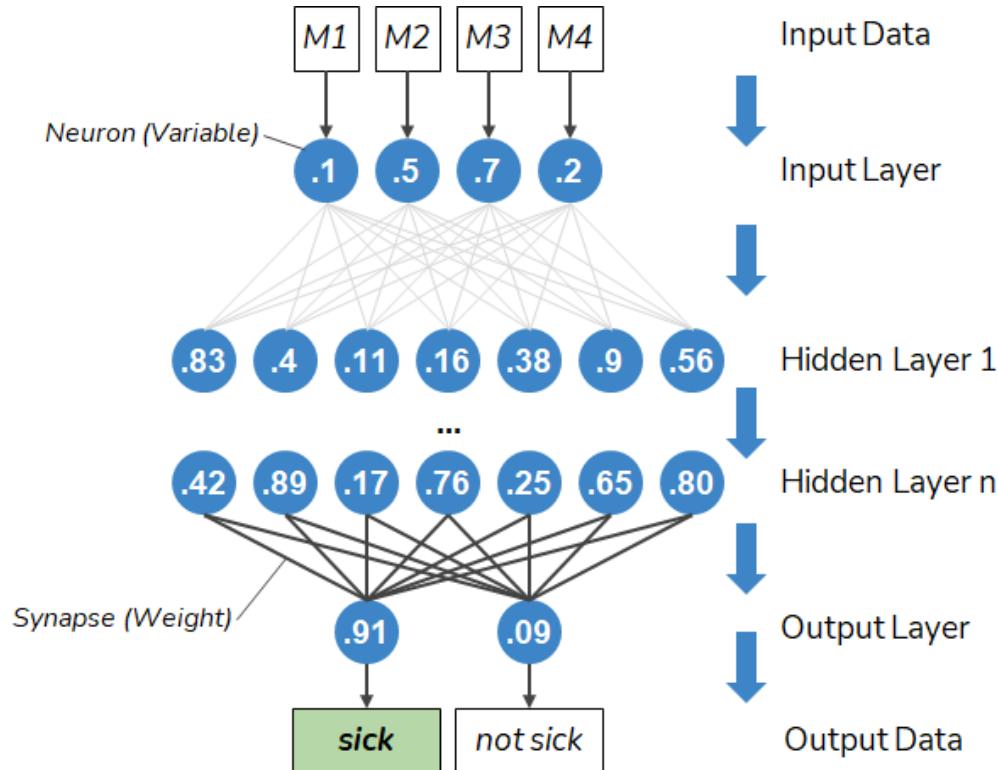


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Deep Dive

ANN Application

53



- Purpose
 - predict sickness based on medical data
- Given
 - trained ANN (adjusted weights)
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- ANN Functionality
 - feed in medical data directly in defined order / structure
 - calculate weighted sum iteratively
 - interpret output neuron as prediction probabilities

Deep Dive

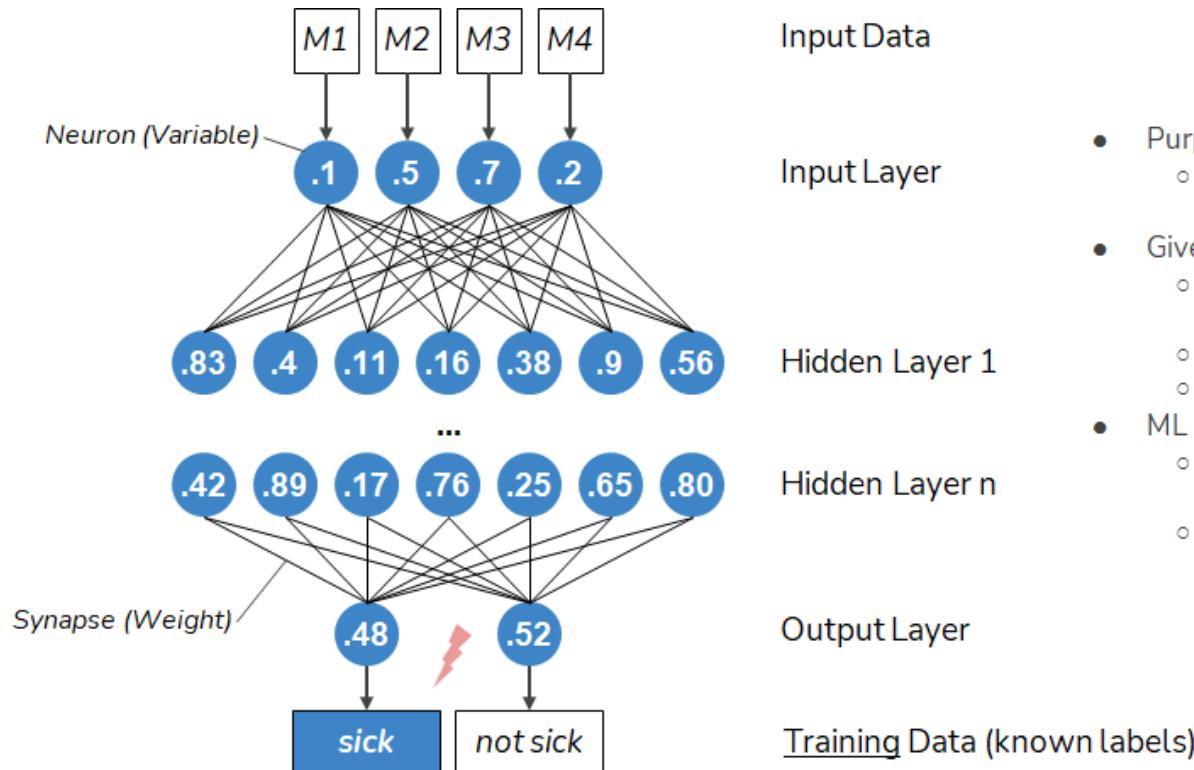
ANN Training

54

Wie kommt man zu einem trainierten künstlichen neuronalen Netz?

Deep Dive

ANN Training

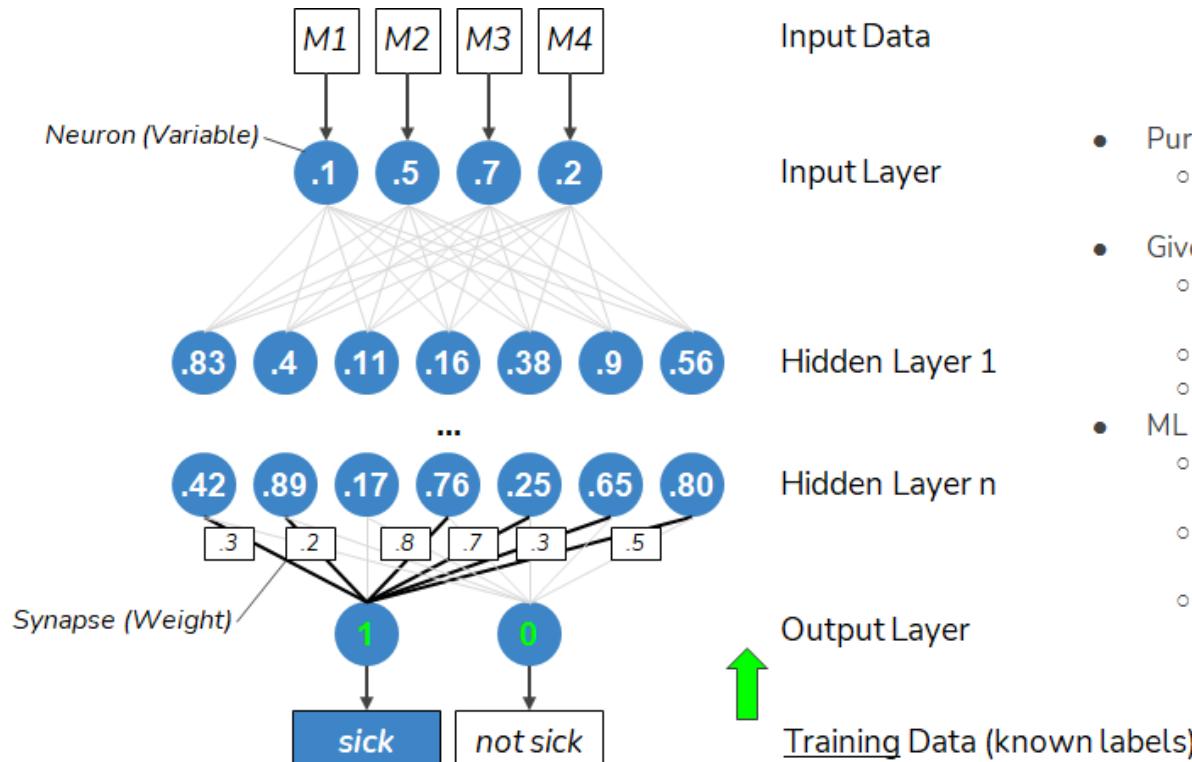


- Purpose
 - train a fresh ANN to imitate the desired behavior
- Given
 - untrained ANN (random weights)
 - measurement data
 - known health state
- ML Functionality
 - feed in medical data directly in defined order / structure
 - calculate weighted sum iteratively

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ANN Training

56

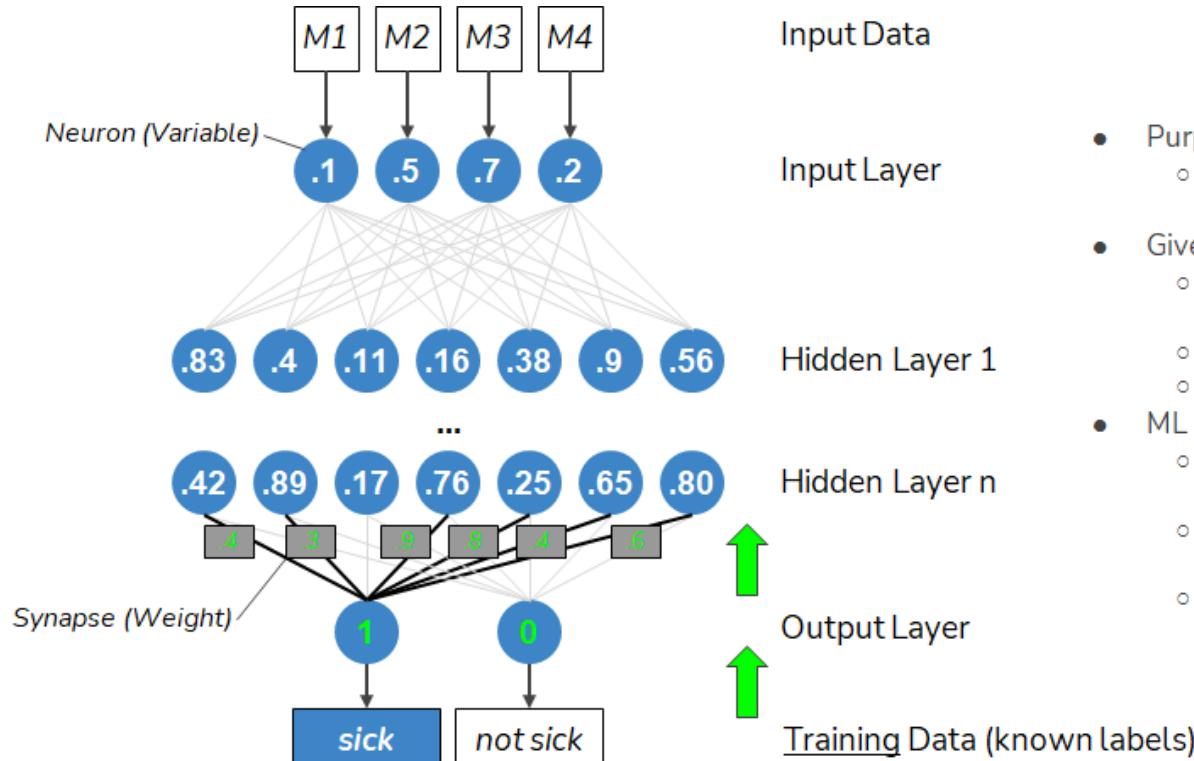


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- Given
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- ML Functionality
 - feed in medical data directly in defined order / structure
 - calculate weighted sum iteratively
 - adjust the synapse weights backwardly & step-wisely

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ANN Training

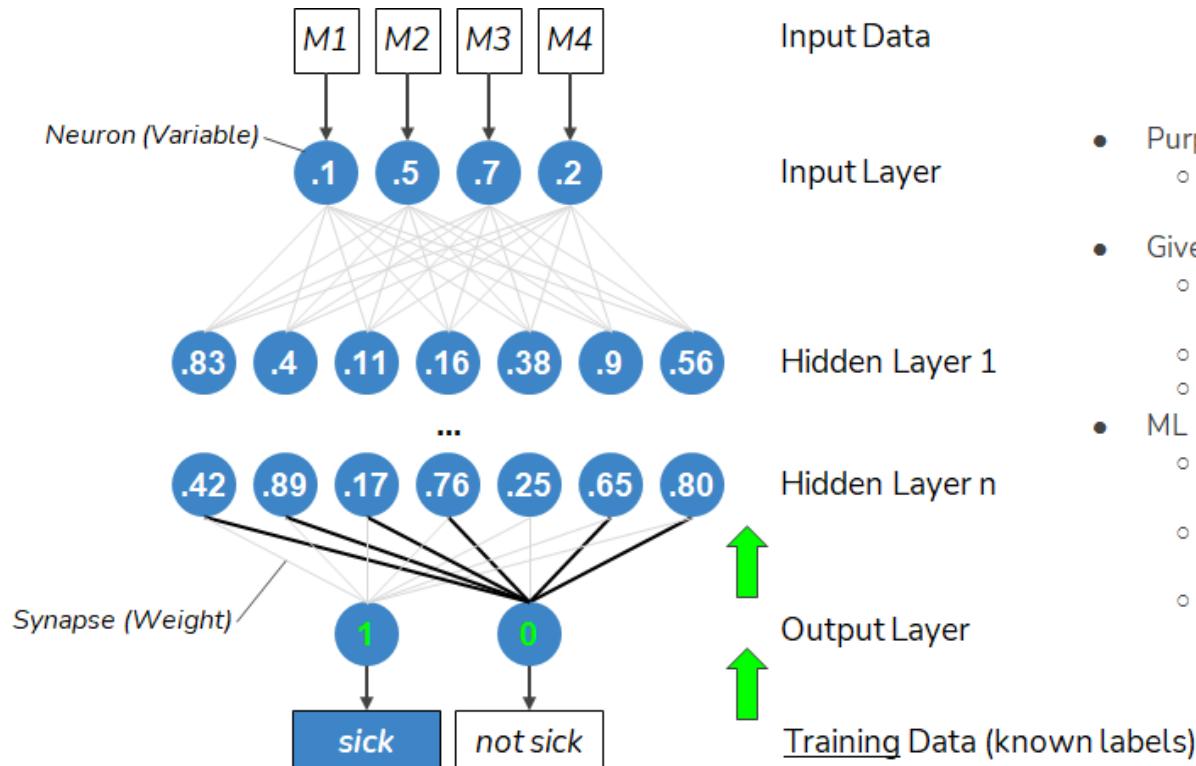
57



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Deep Dive

ANN Training

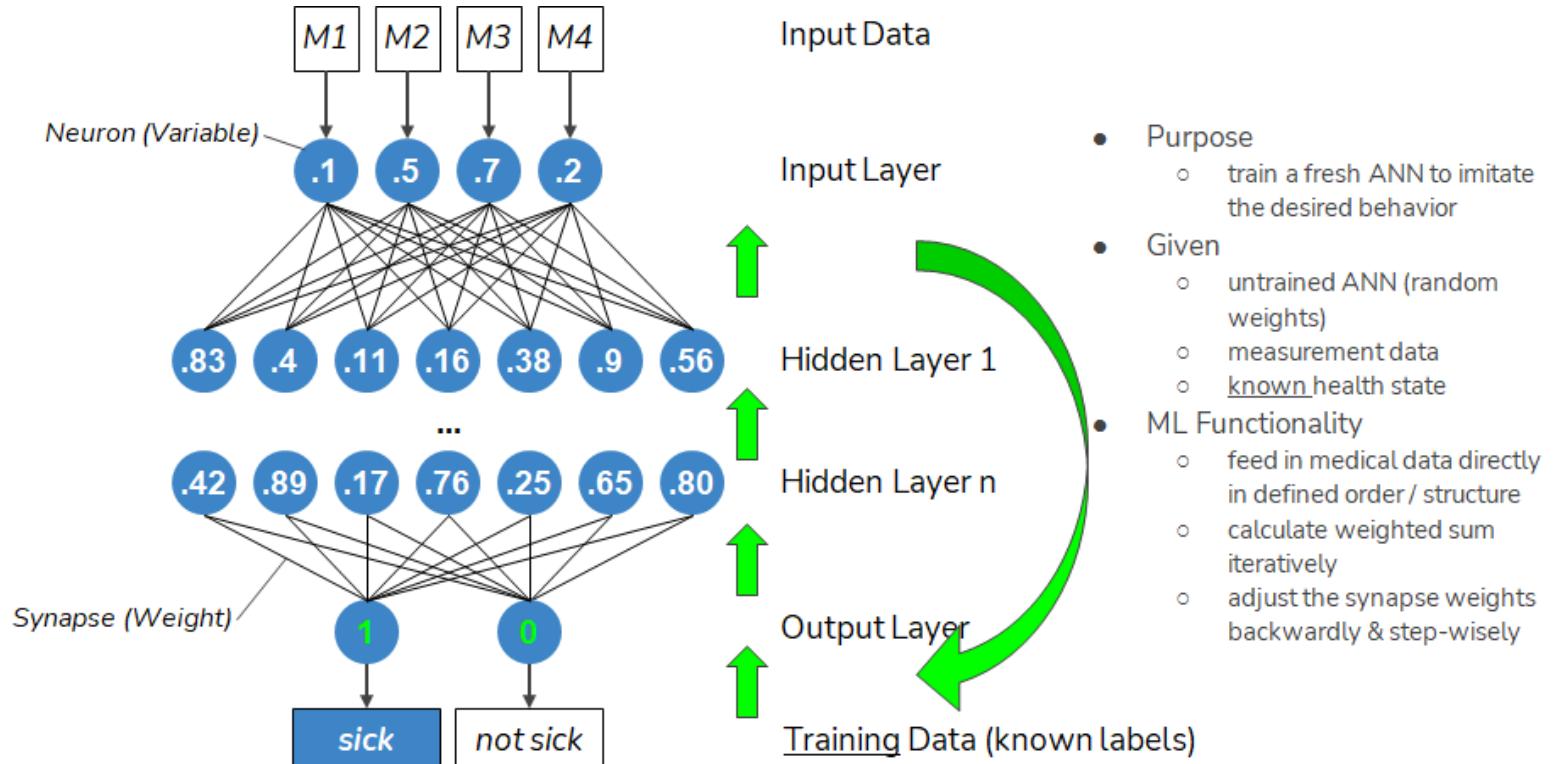


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Deep Dive

ANN Training

59



Deep Dive

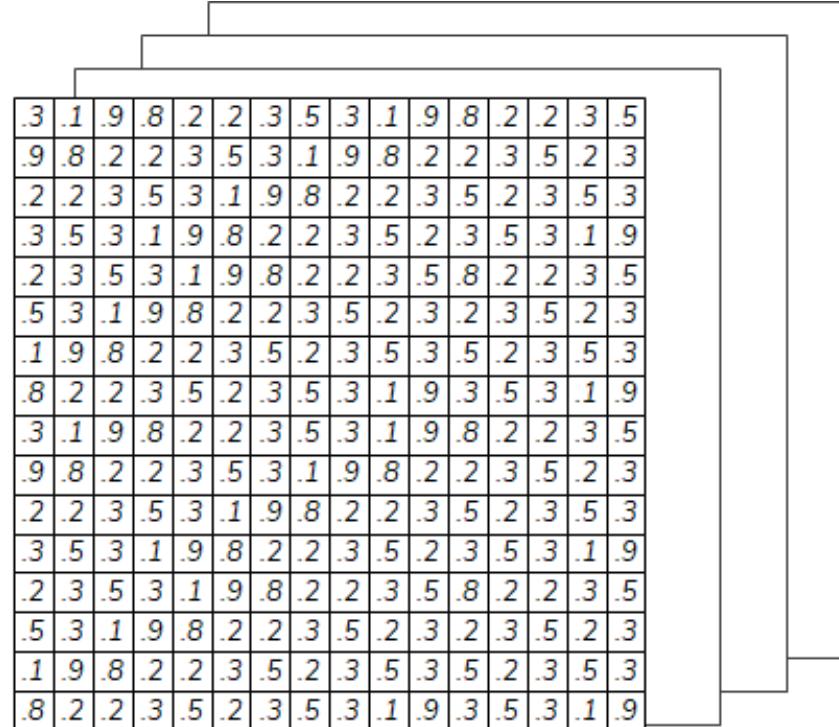
ANN Transparency

60

Wie versteht man, was künstliches neuronales Netz tut?

Deep Dive

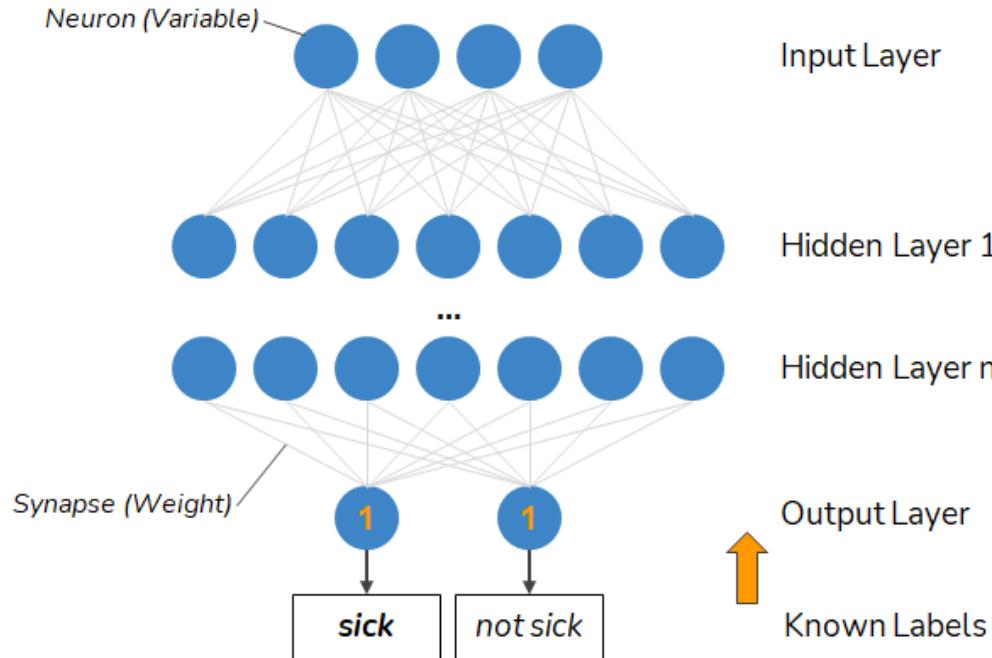
ANN Transparency



Deep Dive

ANN Transparency

62

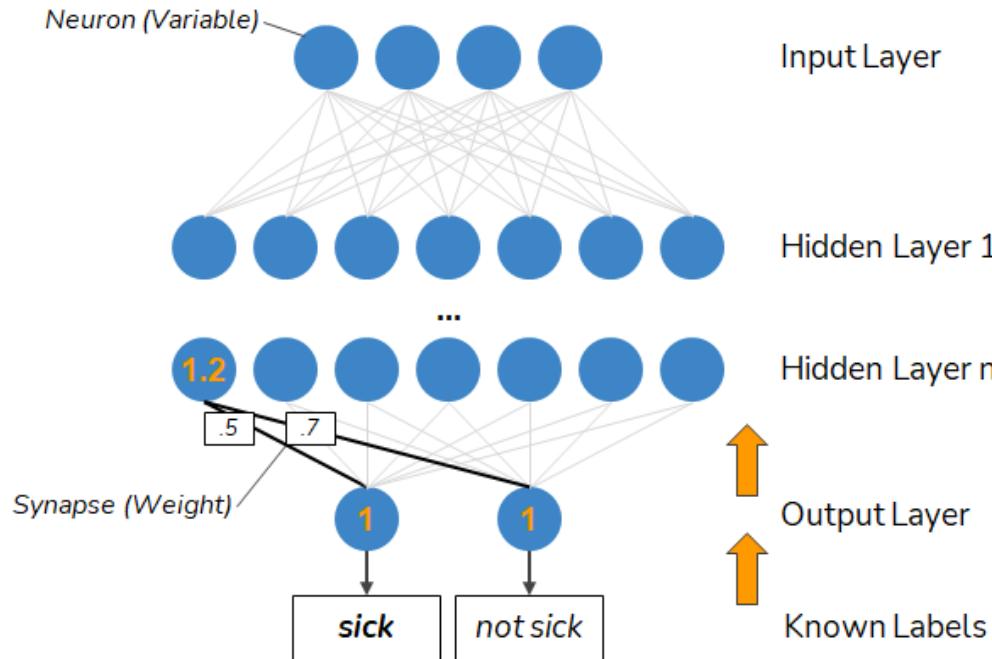


- Purpose
 - gain access to the implicit knowledge within the ANN
- Given
 - trained + validated ANN (weight matrices)
- Traceback Functionality
 - define the output

Deep Dive

ANN Transparency

63

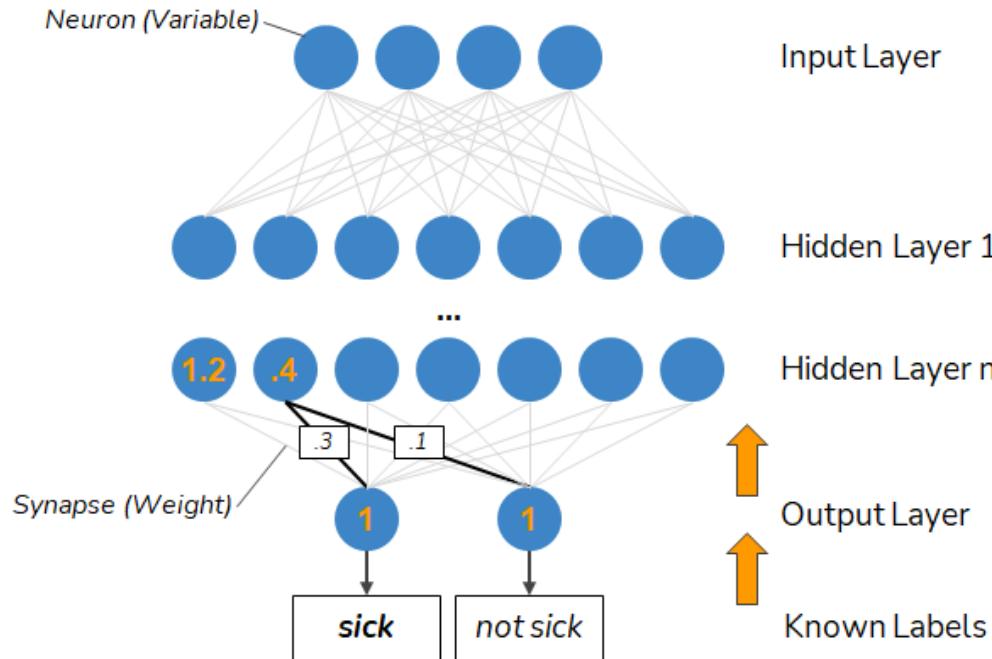


- Purpose
 - gain access to the implicit knowledge within the ANN
- Given
 - trained + validated ANN (weight matrices)
- Traceback Functionality
 - define the output
 - access the synapse weights
 - calculate "importance" of each neuron backwardly

Deep Dive

ANN Transparency

64

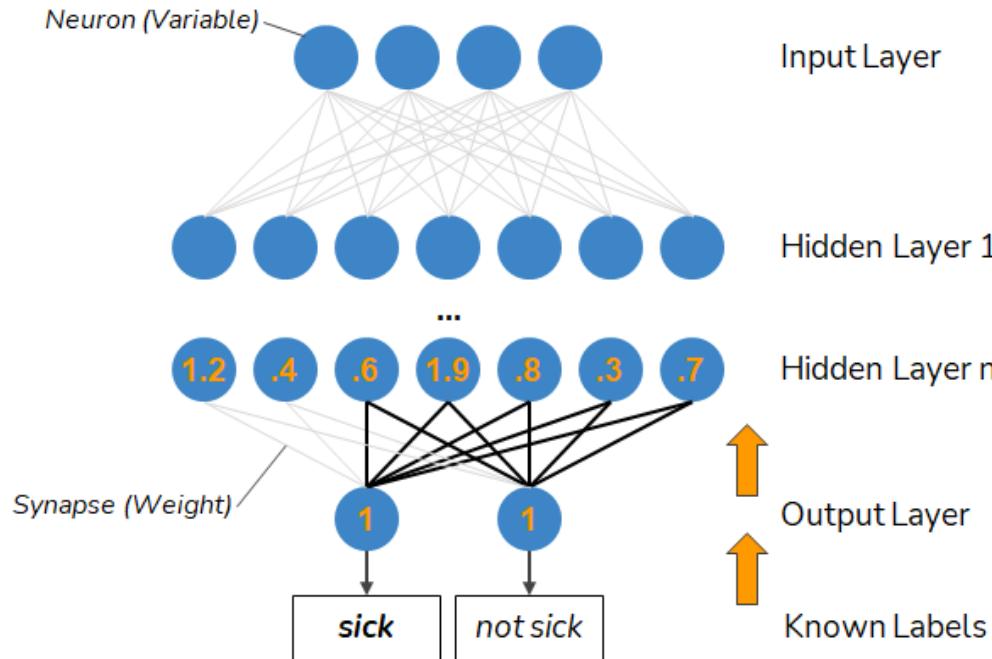


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Deep Dive

ANN Transparency

65

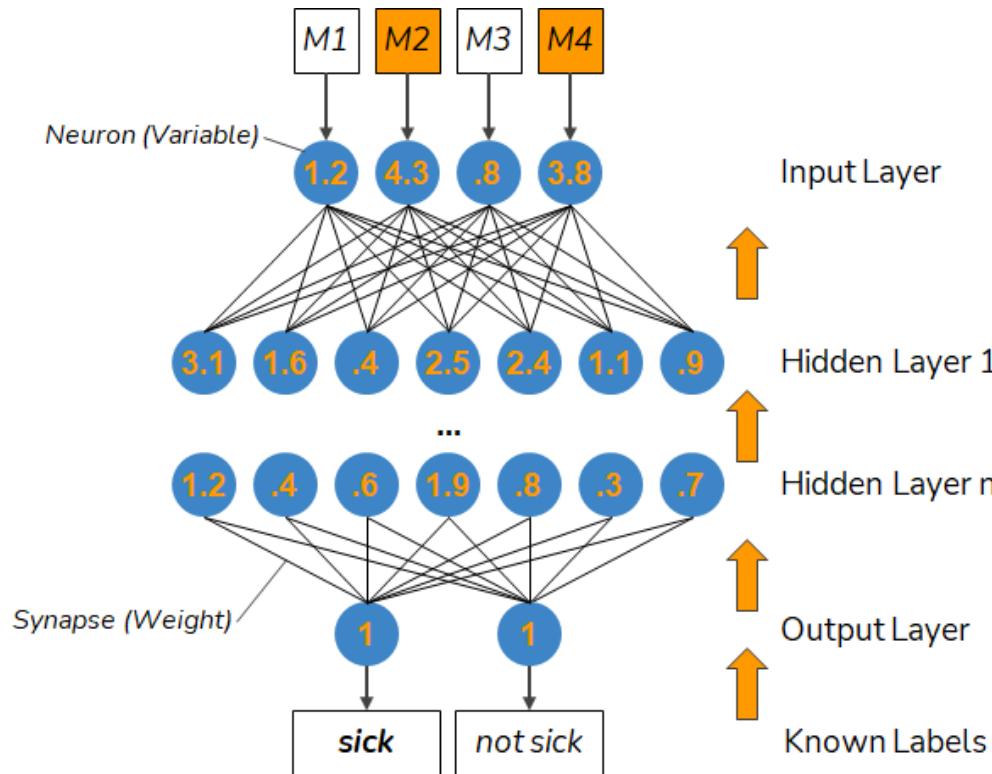


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Deep Dive

ANN Transparency

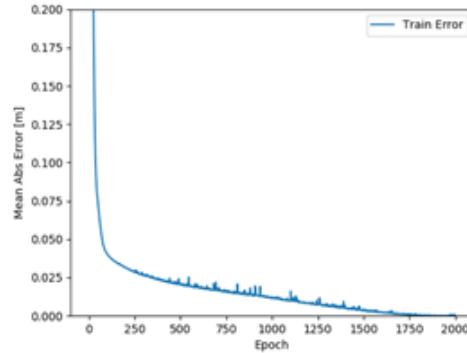
66



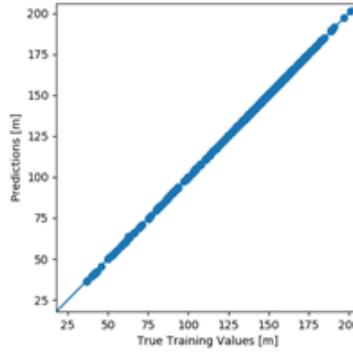
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Deep Dive

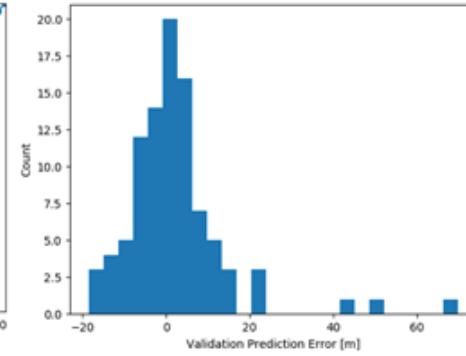
ANN Transparency



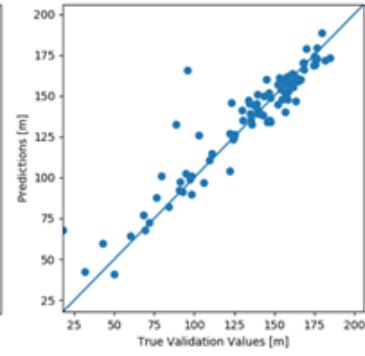
Minimized training error during training phase, objective of the Adam Algorithm



Scatter plot for fitting of training data after training



Histogram for distribution of prediction errors for unknown data



Scatter plot for prediction error of individual unknown data sets

	Gait - Lower Limb - Cadence L (steps/m in)	Gait - Lower Limb - Cadence R (steps/m in)	Gait - Lower Limb - Cadence L (steps/m in)	Gait - Lower Limb - Cadence R (steps/m in)	Gait - Lower Limb - Cadence L (%GCT)	Gait - Lower Limb - Cadence R (%GCT)	Gait - Lower Limb - Cadence R (%GCT)	Gait - Lower Limb - Cadence L (cm)	Gait - Lower Limb - Cadence g R (cm)	Gait - Lower Limb - Cadence g R (cm)	Gait - Lower Limb - Cadence L (s)	Gait - Lower Limb - Cadence L (s)	Gait - Lower Limb - Cadence L (s)	Gait - Lower Limb - Cadence R (s)	Gait - Lower Limb - Cadence R (s)	
Duration (s)	[mean]	[in]	[std]	[mean]	[in]	[std]	[mean]	[std]	[mean]	[std]	[mean]	[std]	[mean]	[std]	[mean]	[std]
Average	0,11	-0,07	0,53	0,07	-0,22	-0,04	-0,01	-0,06	-0,16	0,06	-0,35	0,06	0,11	0,11	-0,08	-0,02
SD	0,27	0,23	0,21	0,31	0,28	0,20	0,23	0,38	0,17	0,32	0,16	0,17	0,13	0,30	0,36	0,36

Deep Dive

ANN Transparency

68

Deep Dream

<https://deepprojectgenerator.com/>

<https://towardsdatascience.com/how-to-visualize-convolutional-features-in-40-lines-of-code-70b7d87b0030>



Martin Thoma - Eigenes Werk, CC0,

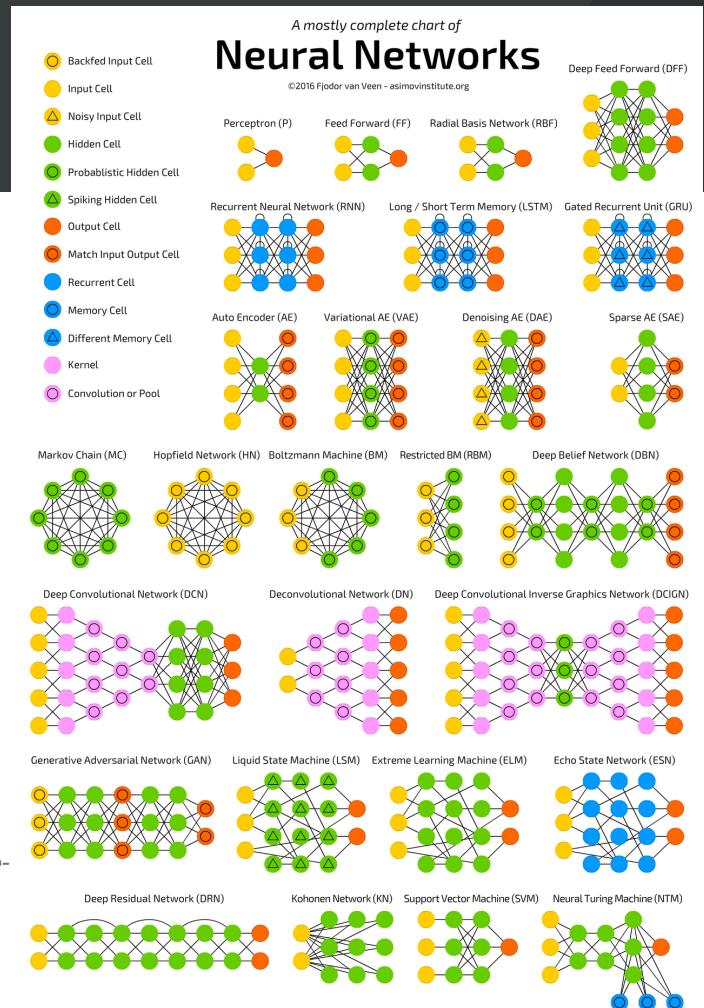
<https://commons.wikimedia.org/w/index.php?curid=46393647>

Deep Dive

Network Types

unterschiedliche Neuronentypen
unterschiedliche
Verbindungsstrategien
verschiedene Anwendungsgebiete

<https://towardsdatascience.com/the-mostly-complete-chart-of-neural-networks-explained-3fb6f2367464>



Deep Dive

Network Types - Feed Forward

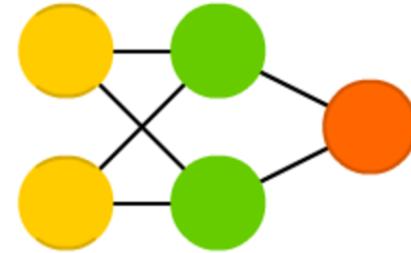
ältester Typ von ANN

voll vernetzt

einfacher Neuronentyp

Zweck: z.B. Regression

Feed Forward (FF)



<https://towardsdatascience.com/the-mostly-complete-chart-of-neural-networks-explained-3fb6f2367464>

Deep Dive

Network Types - Deep Feed Forward

wie FF, nur mit vielen versteckten Schichten

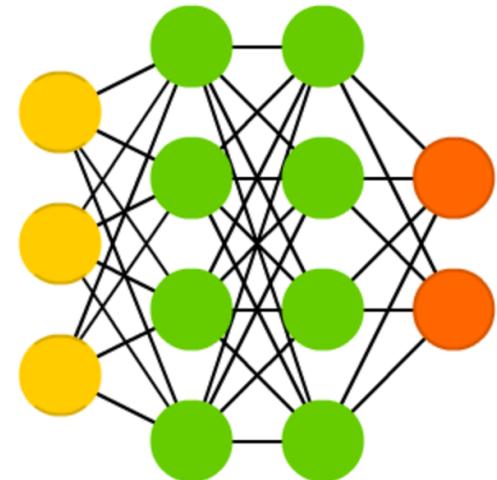
voll vernetzt

einfacher Neuronentyp

schwerer / aufwendig zu trainieren

Zweck: z.B. Regression, Klassifikation

Deep Feed Forward (DFF)



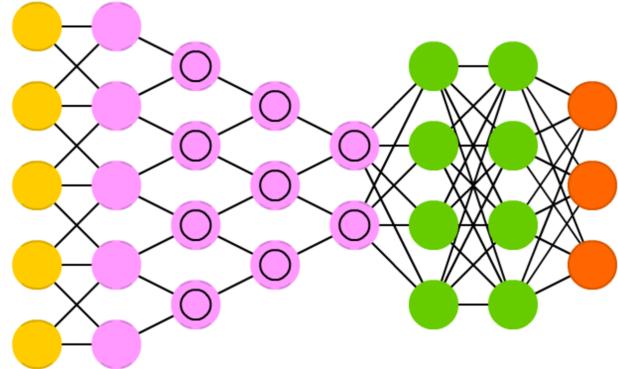
<https://towardsdatascience.com/the-mostly-complete-chart-of-neural-networks-explained-3fb6f2367464>

Deep Dive

Network Types - Convolutional Network

Fokus aus lokalen Features +
Abstraktion
teilvernetzt
unterschiedliche Neuronentyp
rel. einfach zu trainieren trainieren,
benötigt viele Daten
Zweck: Klassifikation, vor allem Bild &
Ton

Deep Convolutional Network (DCN)



<https://towardsdatascience.com/the-mostly-complete-chart-of-neural-networks-explained-3fb6f2367464>

Deep Dive

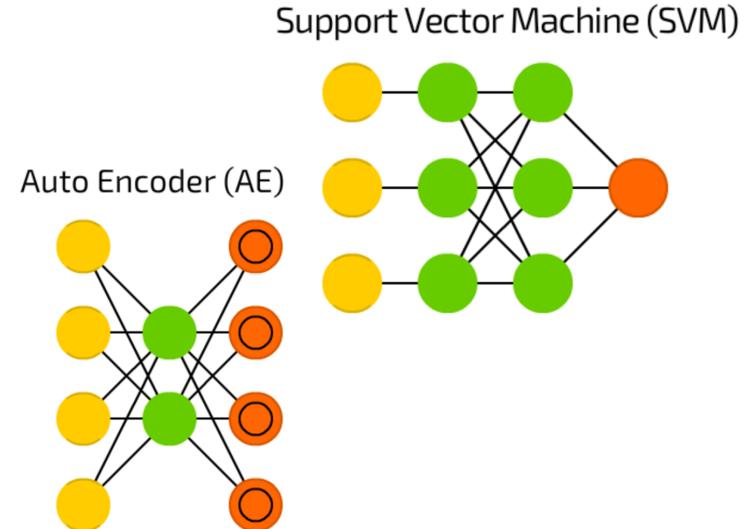
Network Types - SVM & AE

interne Representation ist interessant

voll vernetzt

Umsetzung bekannter Techniken als
ANN

Zweck: Kompression
(Transformation), Klassifikation



<https://towardsdatascience.com/the-mostly-complete-chart-of-neural-networks-explained-3fb6f2367464>

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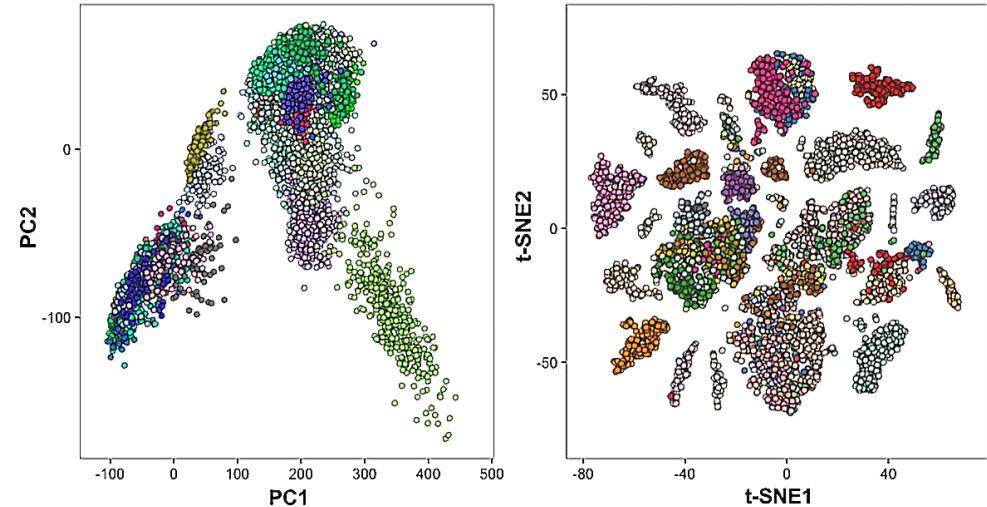
Data Transformation / Unifikation / Hyperoptimierung

Einheitliche Darstellung für ML-Verfahren und Vergleichbarkeit wichtig

Ziel:

- Feature Reduktion
- Redundanz entfernen
- Skalierung / Normierung
- Vergleichbarkeit von Features

Meta-Ansatz: Test und Adaption von vielen Verfahren



7 Key Take Aways

75

AI != ML != DL

keine Universallösungen - no one size fits all

Anwendungsfall (Frage + Daten) bestimmt

Technologie

Modell

Konfiguration

Vorgehen:

iterativ und parallel

Kooperation von ML- und Domänenexperten

