

# FORMEL 1 PREDICTION

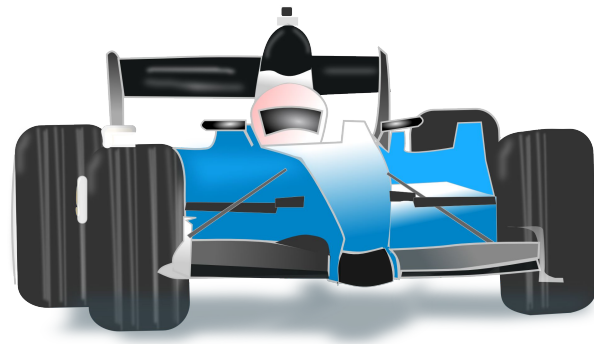
**Julian Greil, Florian Köhler, Hannah Weber, Manuel  
Zeh**

# GLIEDERUNG

- Einführung
- Wirtschaftlicher Vorteil des Projektes
- Datenaufbereitung & Feature Engineering
- Lineare Regression & Deep neural network
- Hyperparameteroptimierung & Cross-Validation
- Fragen - Anregungen - Kritik
- Quellen

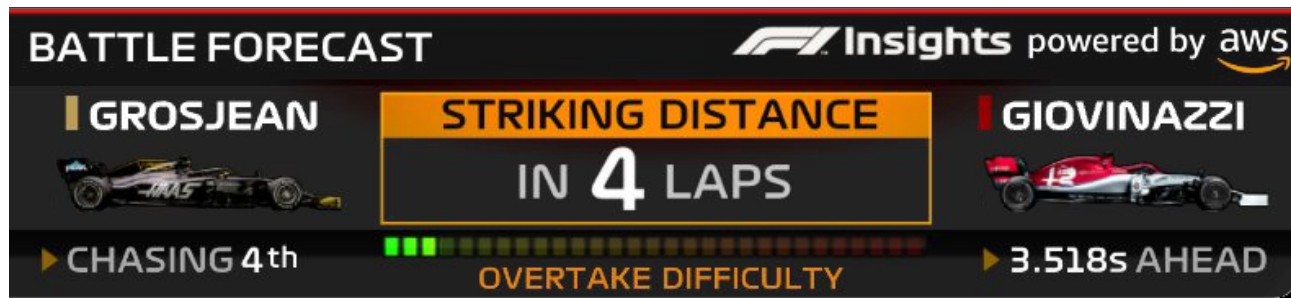
# EINFÜHRUNG

- Formel 1 Rennen ideal geeignet
- Abhängigkeit der Ergebnisse von Parametern
- Unglaublich umsatzstarke Sportart → Breites Spektrum
- Daten liegen stets detailliert vor



# WIRTSCHAFTLICHER VORTEIL

- Wettsport 
- TV-Grafiken und Overlays





50%

Entscheidender strategischer Zeitpunkt (Point of no return)

# DATENAUFBEREITUNG & FEATURE ENGINEERING

# HANDWERKSZEUG DATENTRANSFORMATION



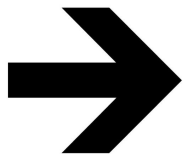
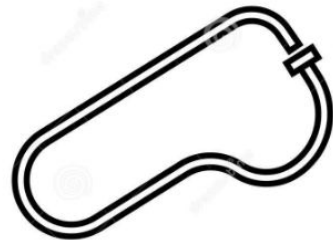
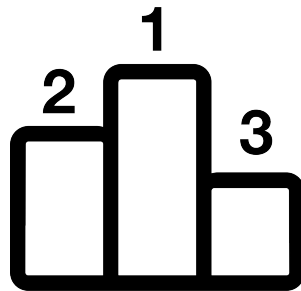
matplotlib



kaggle

FEATURES

***RACE ID***



***FORM***





# LINEARE REGRESSION & DEEP NEURAL NETWORK

# LINEARE REGRESSION

- sklearn Package
- L1 und L2 Regularisierung
- und doch:



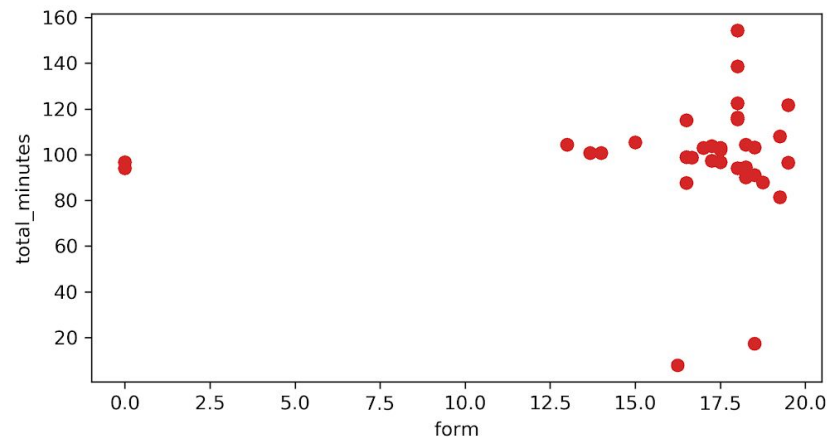
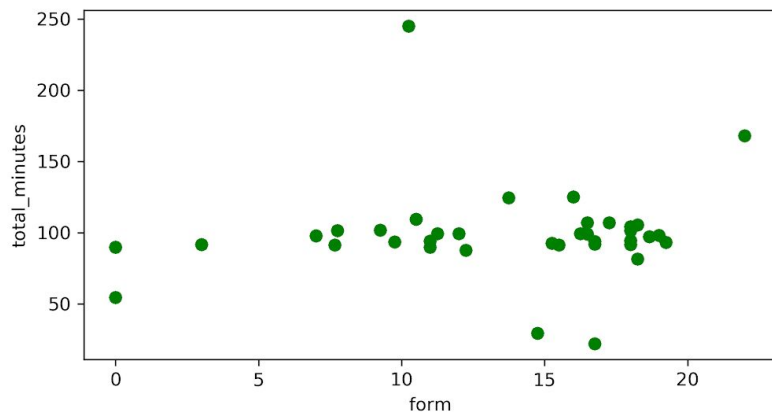
KEINE GUTEN  
VORHERSAGEN



	podium_position	predicted_position	total_minutes	prediction
0	1.0	10	97.198100	97.229309
1	2.0	9	97.339050	97.032593
2	3.0	12	97.629450	97.802734
3	4.0	5	97.794500	96.295105
4	5.0	8	98.041067	96.836853
5	6.0	6	98.070050	96.371033
6	7.0	7	98.464167	96.391602
7	8.0	14	98.483467	97.857605
8	9.0	17	98.882883	98.281189
9	10.0	16	99.024054	98.265137
10	11.0	18	99.250182	98.379944
11	12.0	20	99.262235	99.359497
12	13.0	13	99.327623	97.819763
13	14.0	19	99.723708	99.229187
14	15.0	11	99.915614	97.731873
15	16.0	15	100.398901	98.009460
16	17.0	22	100.455684	101.520386
17	18.0	21	101.592679	101.395386
18	19.0	23	102.098956	103.990479
19	20.0	24	102.652432	104.142517
20	24.0	1	2.905517	-7.103516
21	24.0	2	35.301750	47.488150
22	24.0	3	34.033017	51.241089
23	24.0	4	89.407783	78.216858

# PROBLEM: LINEARITÄT

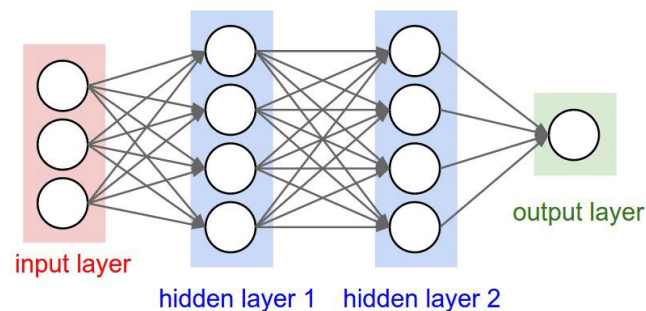
Zusammenhang Form und insgesamt gefahrener Minuten



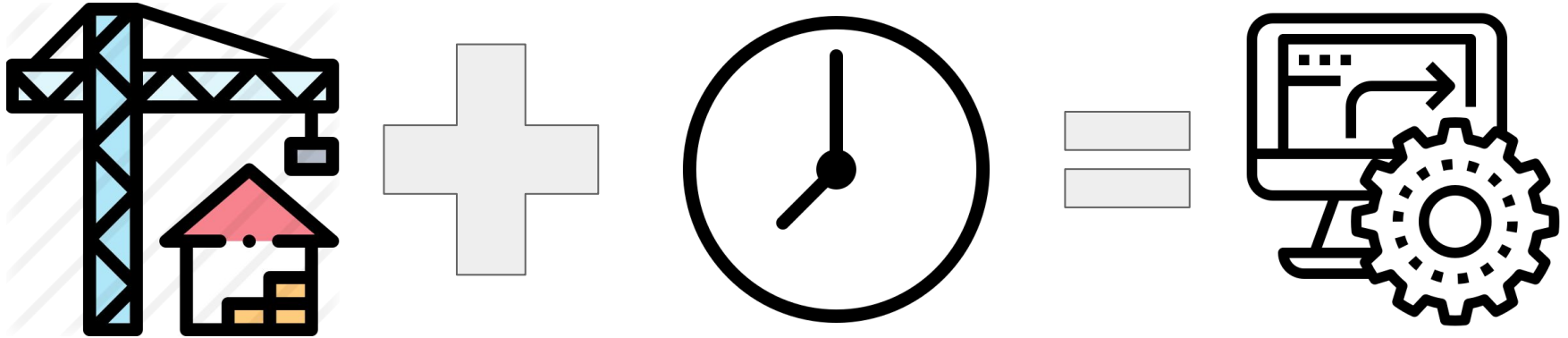
# DEEP NEURAL NETWORK



 PyTorch

The PyTorch logo, consisting of a red circular icon with a flame-like shape inside, followed by the word "PyTorch" in a black, sans-serif font.

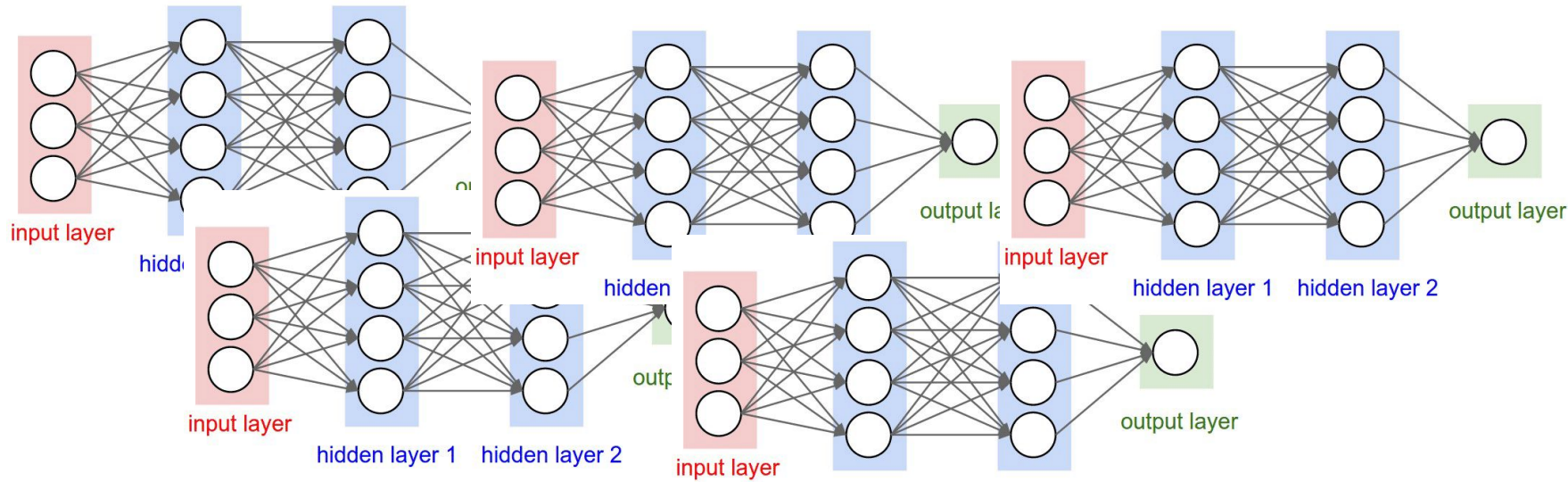
# CHALLENGE DES NEURONALEN NETZWERKES



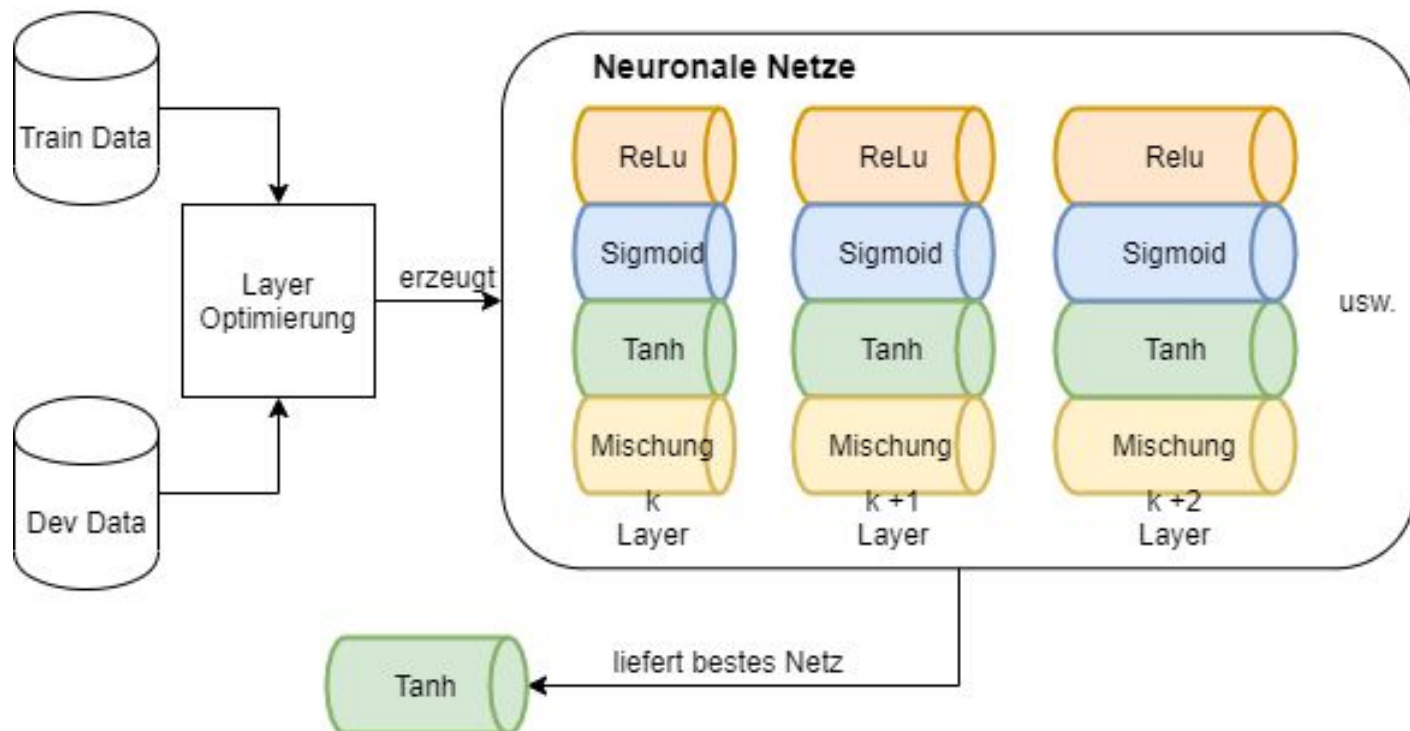
# HYPERPARAMETER OPTIMIERUNG & CROSS VALIDATION

# HYPERPARAMETEROPTIMIERUNG

- Idee: Erzeugen von 600 Netzen, von denen die 30 besten ausgewählt werden
- Optimieren der Lernrate und Epochenanzahl der 30 Netze
- Limitierungen: max. 12h Ausführungszeit Google Colab



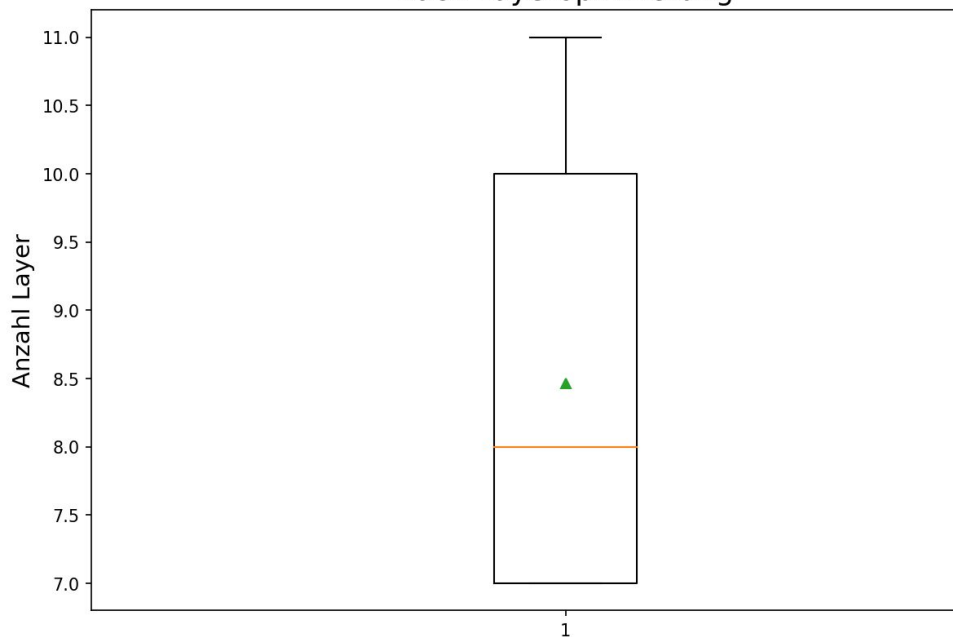
# VORGEHEN:



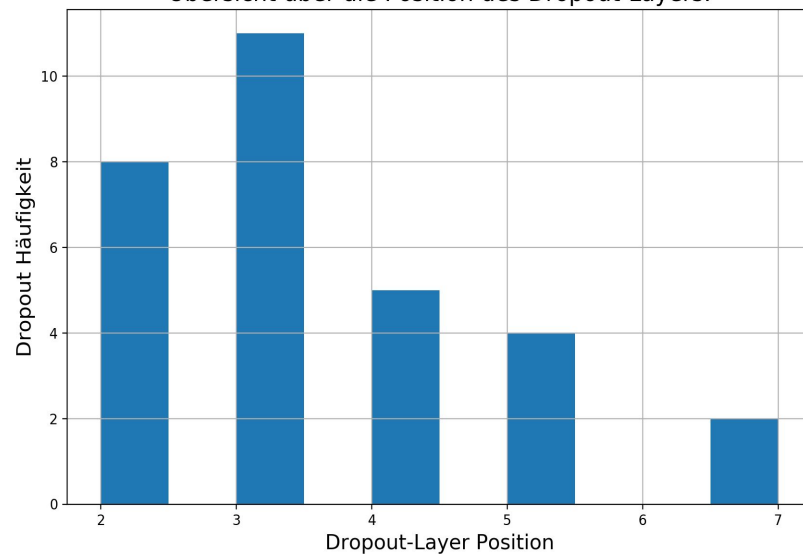


# ERGEBNIS

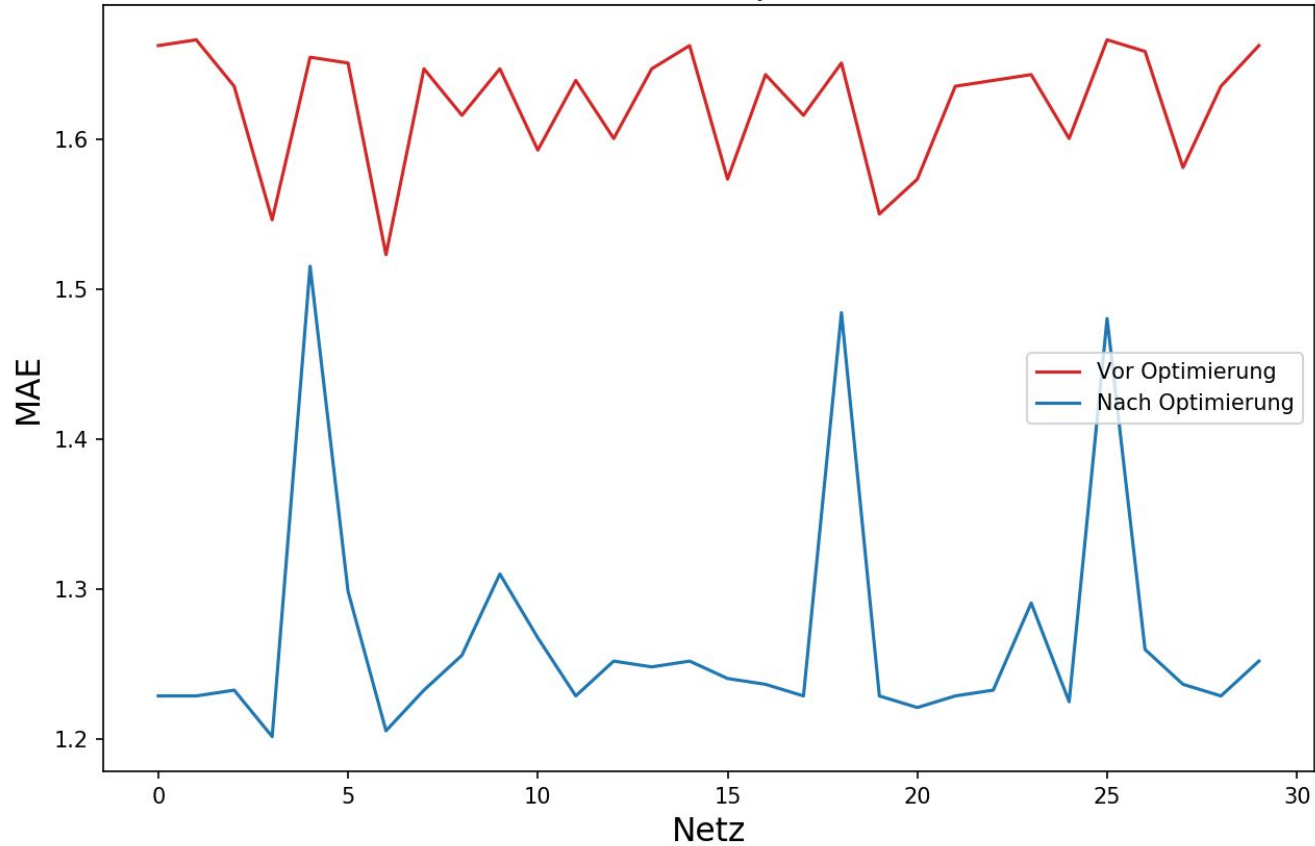
Übersicht der Anzahl Layer  
nach Layeroptimierung



Übersicht über die Position des Dropout-Layers:



## Verbesserung des MAE nach Optimierung der Lernrate und Epochenanzahl



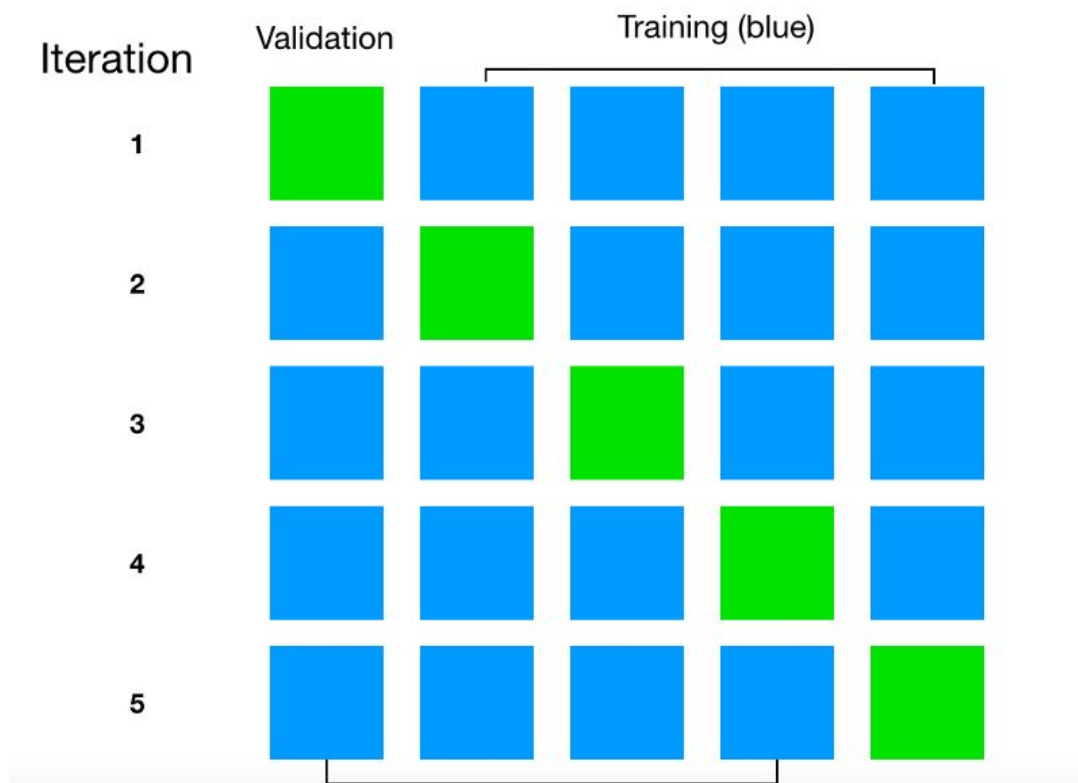
# NEUE AUSGANGSSITUATION

**30** optimierte Netze

**1** Datensatz

**1** Finales Netz

# CROSS VALIDATION



# FINALES NETZ

```
final_netz =  
  
{  
    'first': ['linear', 52, 111],  
    'tanh1': ['linear', 111, 184],  
    'tanh2': ['linear', 184, 187],  
    'tanh3': ['linear', 187, 200],  
    'tanh4': ['dropout', 200, 110],  
    'no_activation6': ['linear', 200,  
196],  
    'tanh6': ['linear', 196, 1],  
    'epochen': 10,  
    'lr': 0.0001,  
    'mae': 1.2286821705426356}
```

# AUSGANGSSITUATION ABU DHABI GRAND PRIX 2017

<u>Fahrer</u>	<u>Position nach 50%</u>
Valtteri Bottas	1
Lewis Hamilton	2
Sebastian Vettel	3
Daniel Ricciardo	4
Max Verstappen	5
Esteban Ocon	6
Carlos Sainz	7
Nico Hülkenberg	8
Sergio Pérez	9
Romain Grosjean	10

<u>Fahrer</u>	<u>Position nach 50%</u>
Fernando Alonso	11
Felipe Massa	12
Pascal Wehrlein	13
Pierre Gasly	14
Marcus Ericsson	15
Lance Stroll	16
Stoffel Vandoorne	17
Kevin Magnussen	18
Brandon Hartley	19

# ABU DHABI GRAND PRIX 2017

Target	Prediction	Pred_Name	Target_Name
1	1	Valtteri Bottas	Valtteri Bottas
2	2	Lewis Hamilton	Lewis Hamilton
3	3	Sebastian Vettel	Sebastian Vettel
4	4	Kimi Räikkönen	Kimi Räikkönen
5	5	Max Verstappen	Max Verstappen
6	8	Esteban Ocon	Nico Hülkenberg
7	7	Sergio Pérez	Sergio Pérez
8	6	Nico Hülkenberg	Esteban Ocon
9	9	Fernando Alonso	Fernando Alonso
10	10	Felipe Massa	Felipe Massa

# UNSER MODELL IM LIVE-EINSATZ



FRAGEN?  
ANREGUNGEN?  
KRITIK?

# QUELLEN QUICKSAVE

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<https://cdn2.iconfinder.com/data/icons/line-design-database-set-4/21/sql-badge-512.png>

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<https://upload.wikimedia.org/wikipedia/commons/thumb/c/c3/Python-logo-notext.svg/1024px-Python-logo-notext.svg.png>

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[https://png.pngtree.com/png-vector/20190215/ourlarge/pngtree-vector-driver-icon-png-image\\_515768.jpg](https://png.pngtree.com/png-vector/20190215/ourlarge/pngtree-vector-driver-icon-png-image_515768.jpg)

<https://banner2.cleanpng.com/20180511/yjw/kisspng-computer-icons-sport-pictogram-5af5f3cec673f2.7088924815260681748129.jpg>

<https://www.toi.no/getfile.php/1346642-1515072140/mmarkiv/Forside%202017/Kollisjon%20pictogram.JPG%20%28Stort%29.jpg>

<https://www.pngwing.com/de/search?q=rennwagen>

[https://lh3.googleusercontent.com/proxy/UhZxu1kR\\_3\\_DpydBYPQgk2DH0efFG5dxRsxs4O2nNxVTioGK2EcqBDi1T0itgU6Ezqr\\_SacRzEmTeEBHI-onCjEBclWG6k1CTg0n0my86MBI5rHv1tJw-Xwn-tu4nJ7tO4Kux1aT0MRBH3BYj\\_kHhrryD5i](https://lh3.googleusercontent.com/proxy/UhZxu1kR_3_DpydBYPQgk2DH0efFG5dxRsxs4O2nNxVTioGK2EcqBDi1T0itgU6Ezqr_SacRzEmTeEBHI-onCjEBclWG6k1CTg0n0my86MBI5rHv1tJw-Xwn-tu4nJ7tO4Kux1aT0MRBH3BYj_kHhrryD5i)

<https://w7.pngwing.com/pngs/122/831/png-transparent-race-track-computer-icons-track-field-running-track-miscellaneous-text-sport.png>

[https://www.iconfinder.com/icons/171465/cloud\\_rain\\_icon](https://www.iconfinder.com/icons/171465/cloud_rain_icon)

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<https://alexforrest.github.io/you-might-be-leaking-data-even-if-you-cross-validate.html>