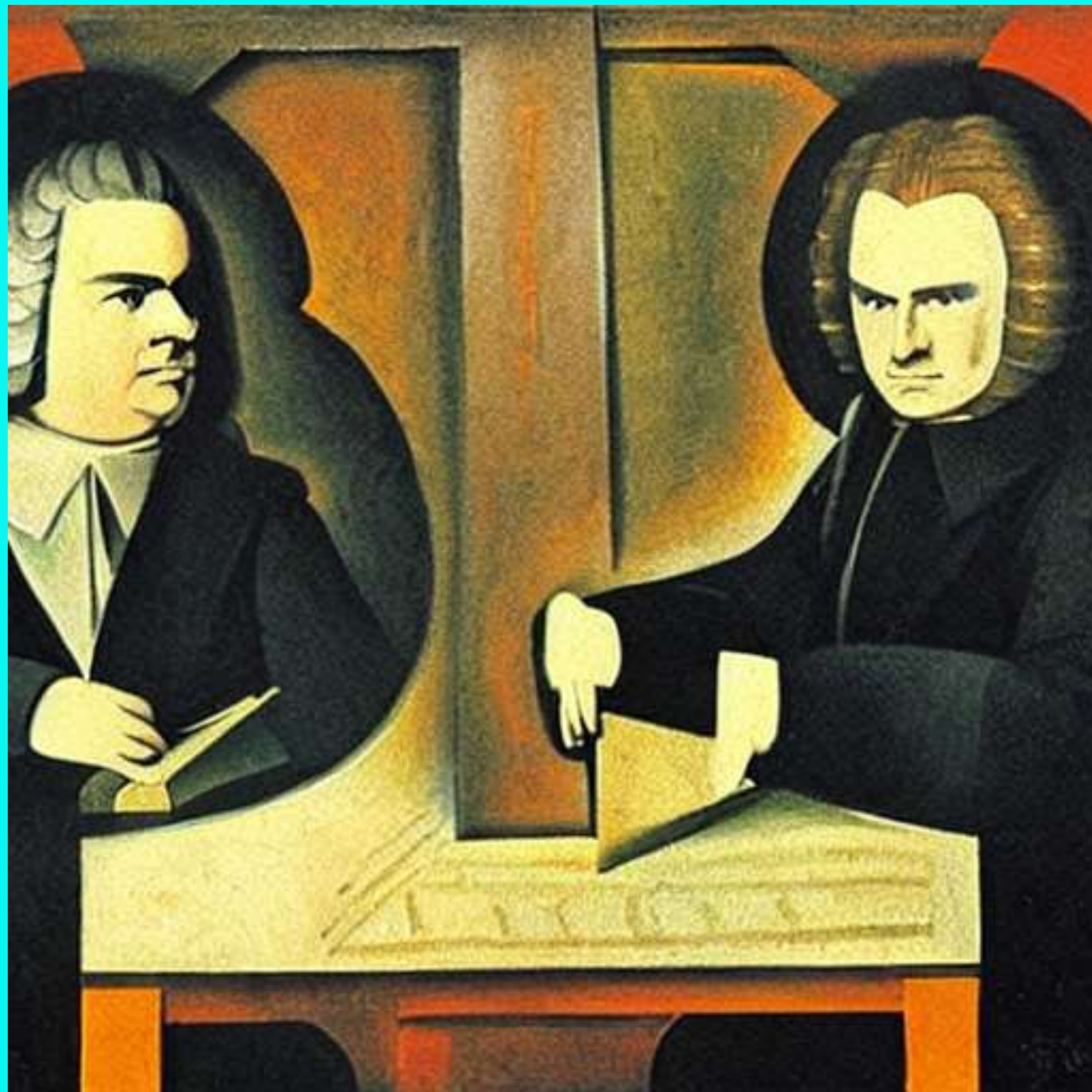


BAYES+ BACH

AN RNN POWERED AFFAIR

BRAINHACK DONOSTIA 2024

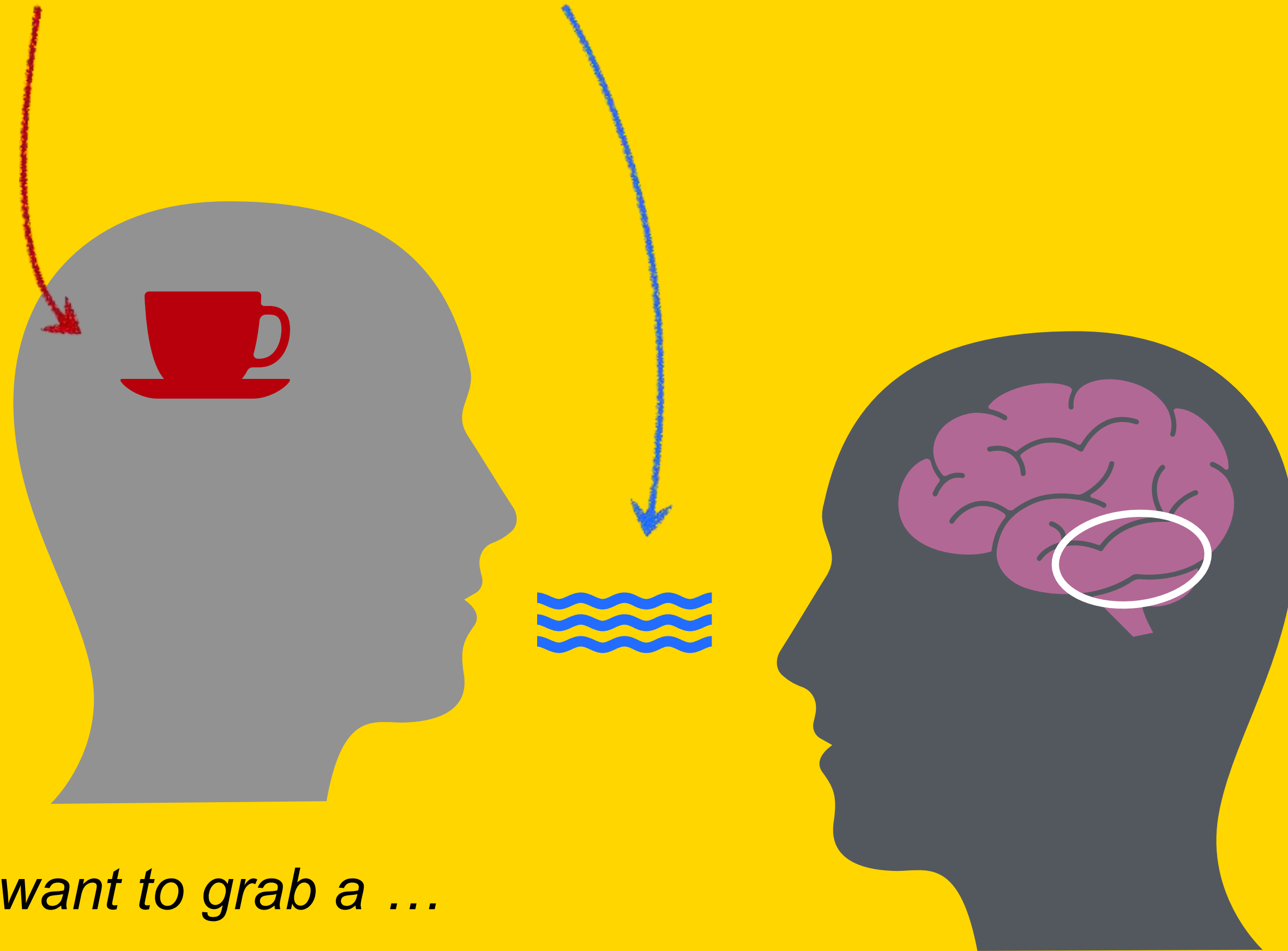
github.com/qtabs/BayesPlusBach



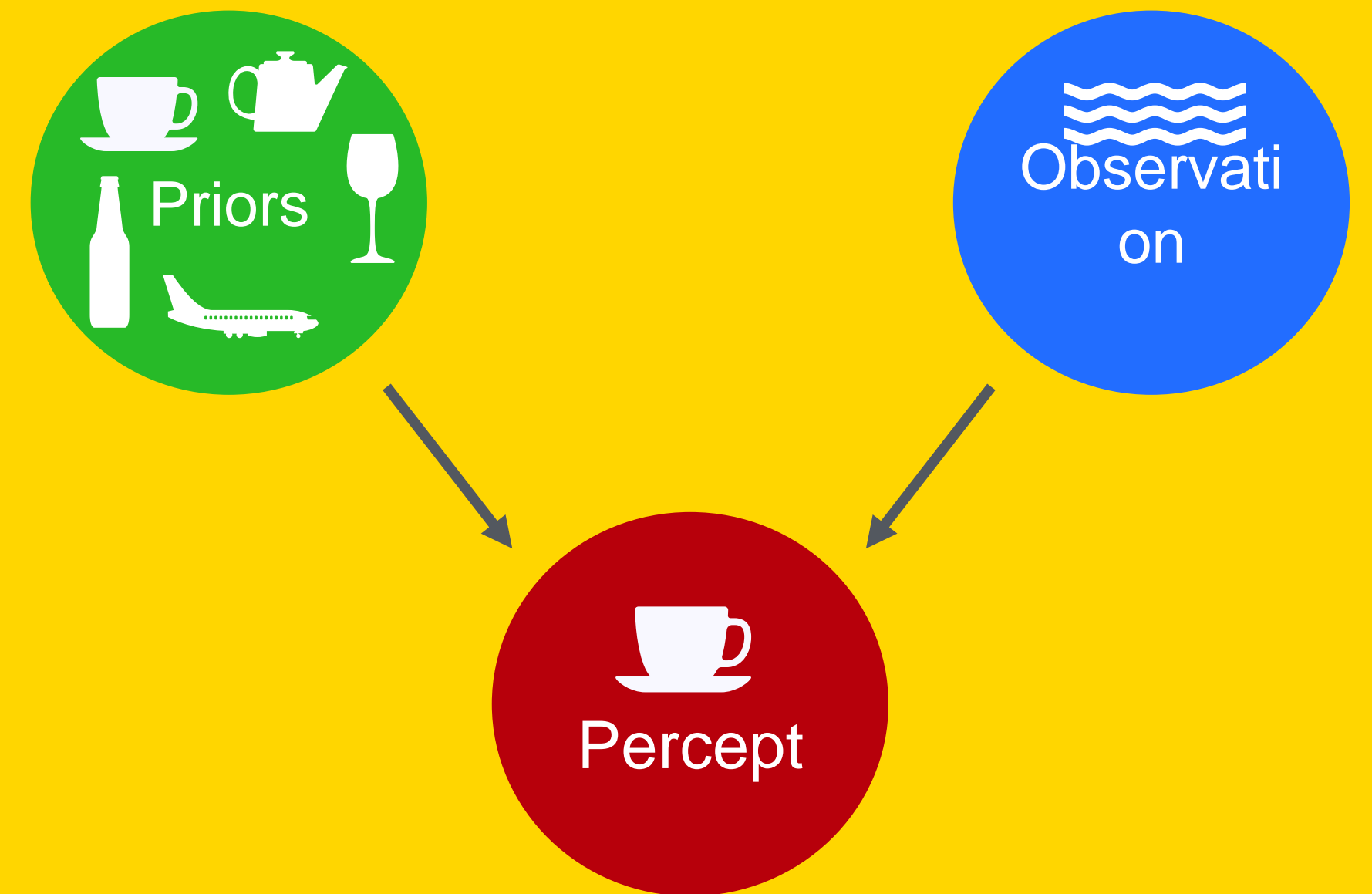
Perception is actually statistical inference

latent variable

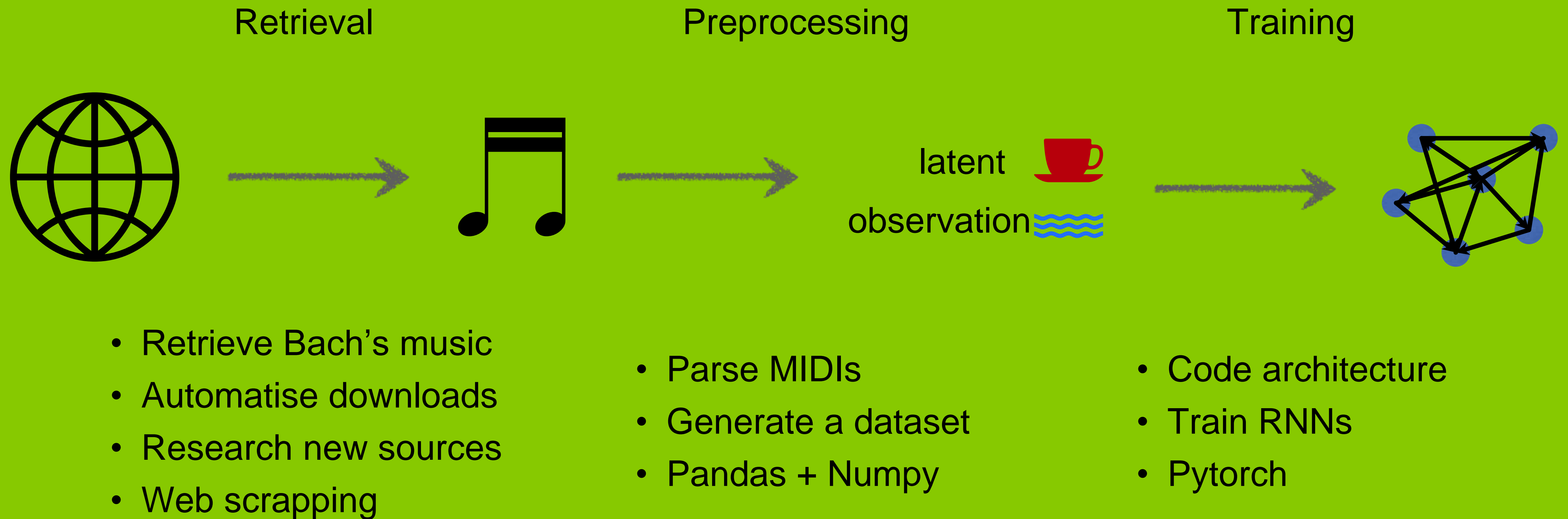
observation



Do you want to grab a ...



Three teams to make Bayes love Bach again



Minimally-working deadlines (that were royally ignored)

Monday

Tuesday

Wednesday

Retrieval

- Webs selected
- First MIDI files available

Preprocessing

- Format/spaces selected
- First samples available

Training

- RNN architecture coded
- Hyperparameter sets chosen
- First random RNN available

Benchmarking

- Heuristic models selected

Testing

- Testing strategies selected

Retrieval

- MIDI dataset completed

Preprocessing

- All training samples available

Training

- Training pipeline coded

Benchmarking

- Benchmarking models coded

Testing

- Linear architecture coded

Actual deadlines that were met

Monday

Retrieval

- Valiantly volunteers to work alone on this task
- Coded a web-scraper

Preprocessing

- Format/spaces (sort of) selected
- Realize how little they know about numpy, data, programming and life in general

Training

- Read about RNN
- Decide what program to work on

Benchmarking

- Joined other teams to help them with their work

Testing

- Graciously shared their knowledge to other less-fortunate groups

Tuesday

Retrieval

- MIDI dataset completed (songs uploaded to the github repo)

Preprocessing

- Code to generate random data completed

Training

- 3 architectures coded
- Trained on random data
- Chose hyperparameters

Benchmarking

- Still helping other teams
- Decided on heuristic models

Testing

- Linear architecture coded

Wednesday

Retrieval

- MIDI dataset completed

Preprocessing

- All training samples available

Training

- Training pipeline coded

Benchmarking

- Benchmarking models coded

Testing

- Linear architecture coded

Data retrieval

aka Symphony Hunter



Data Preprocessing

From music to numbers

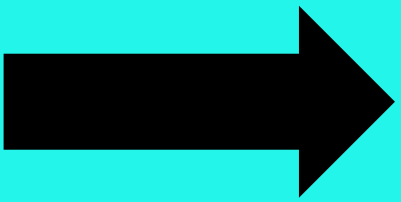


Prelude and Fugue No.3 in C sharp major
from Book I of the *Well Tempered Clavier* (BWV 848)
Johann Sebastian Bach (1685 - 1750)

Vivace

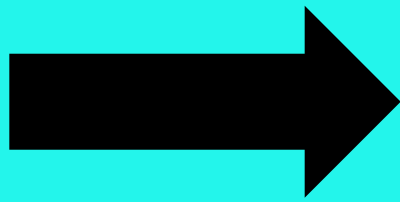
Piano

Pno.



[[54],
[54, 57],
[83, 46,
59],
[31, 43],
[32]]

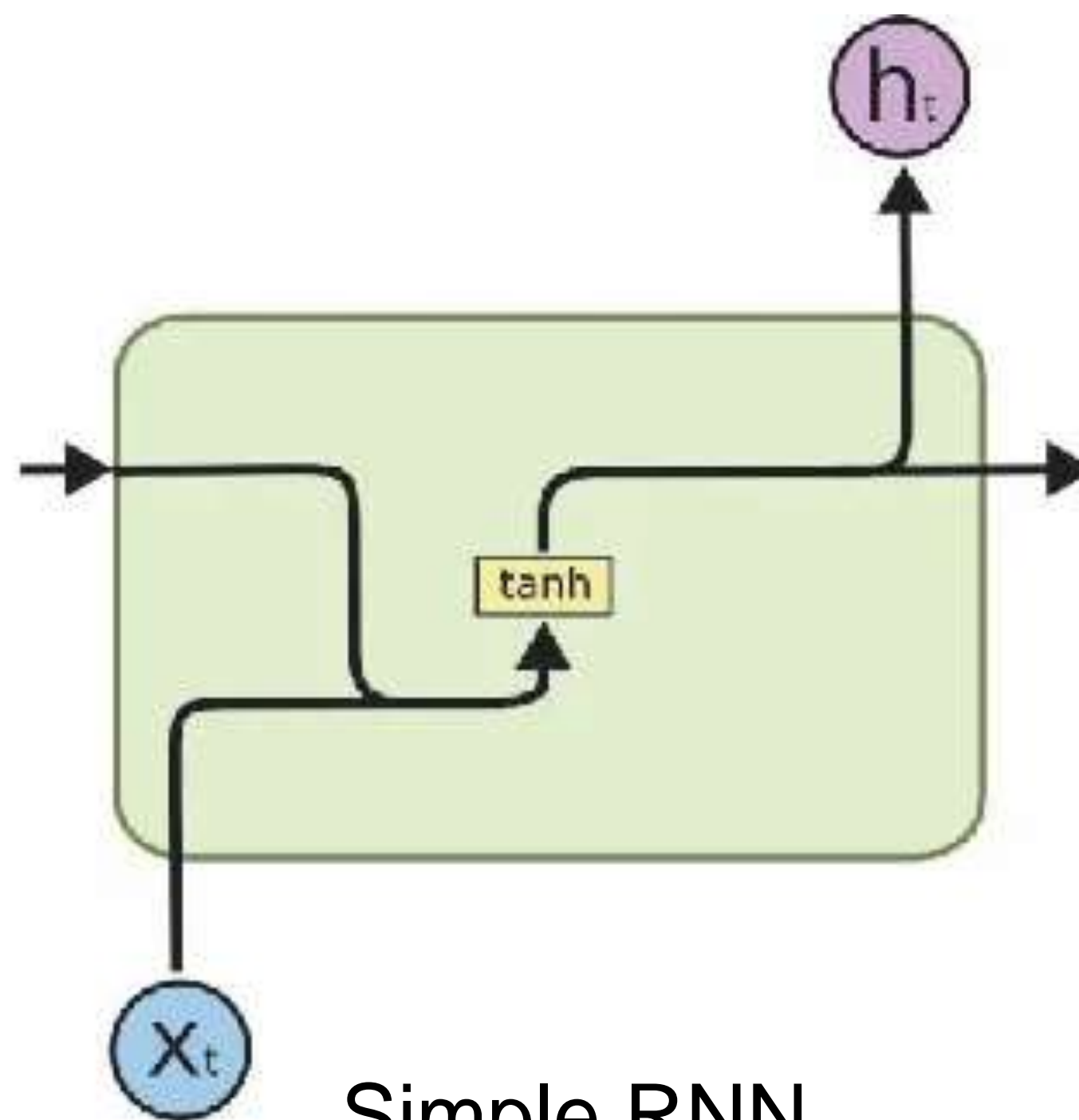
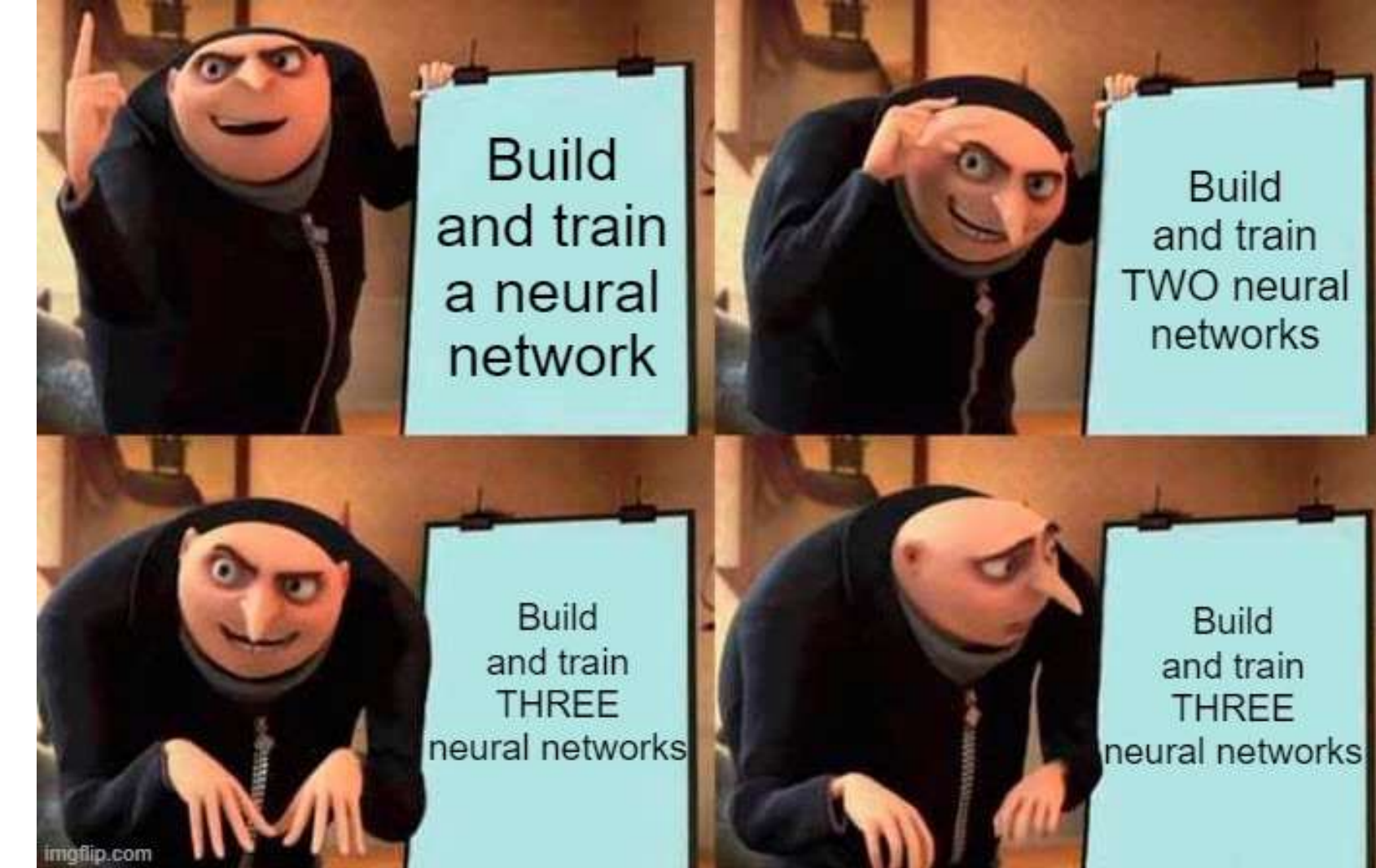
108 possible
notes



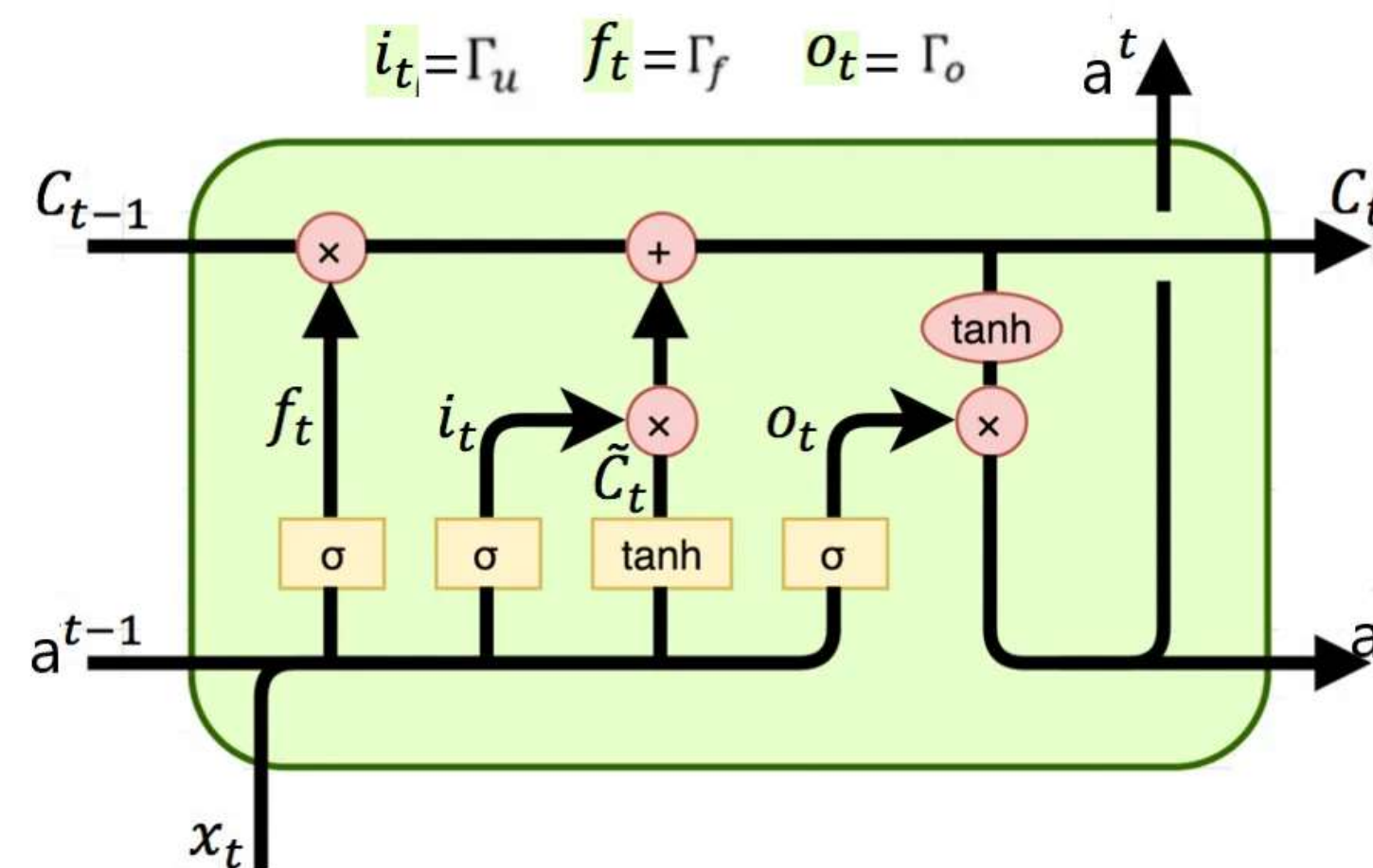
[1,	[0,	[1,
0,	0,	0,
0,	0,	0,
0,	0,	0,
0,	0,	0,
0,	0,	0,
0,	0,	0,
0,	1,	1,
0,	0,	0,
0,	0,	0,
0,	0,	0,
0]	0]	0]

Training: RNN Architectures

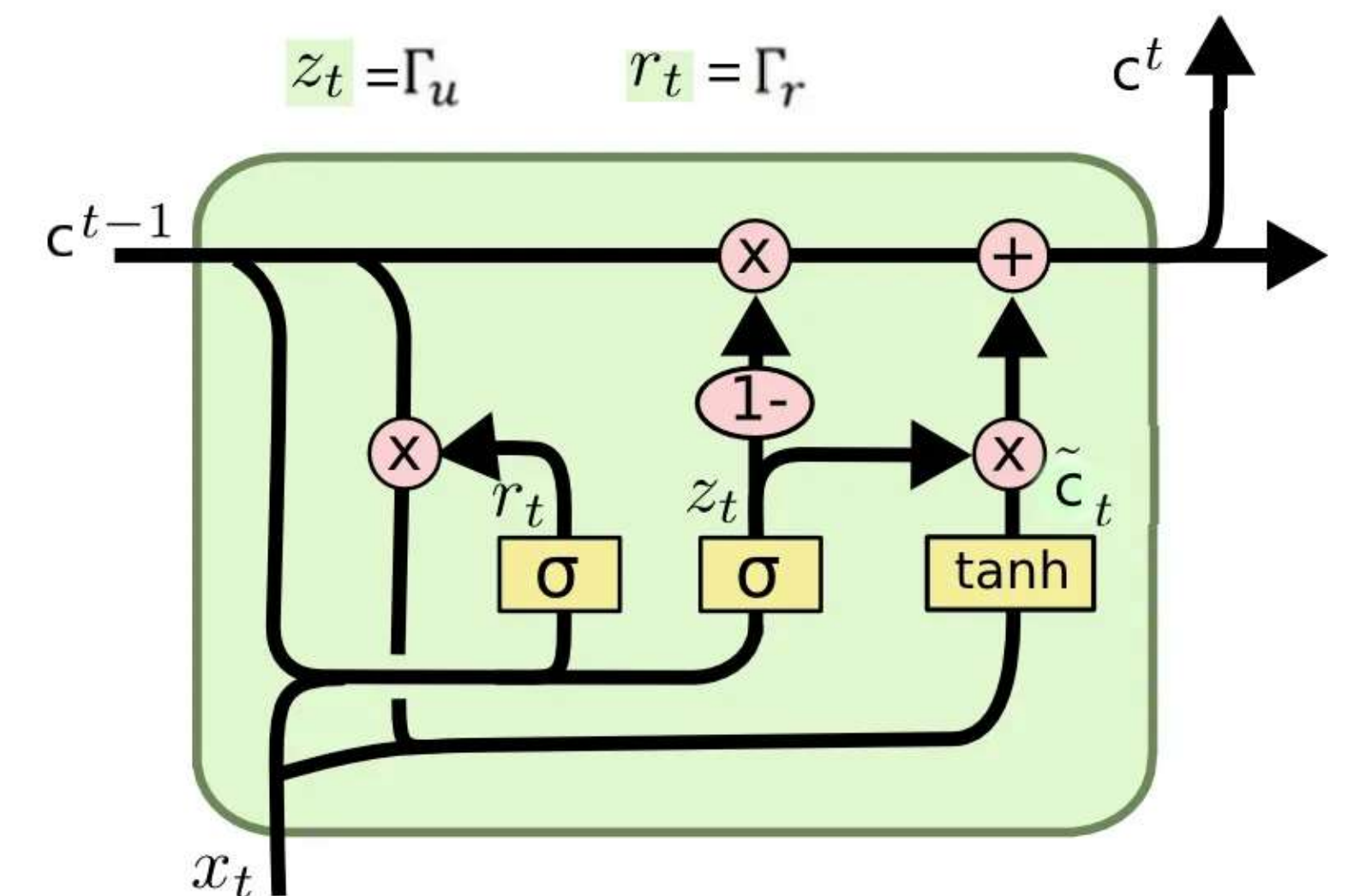
Not one, not two, but three RNNs!!!



Simple RNN



LSTM



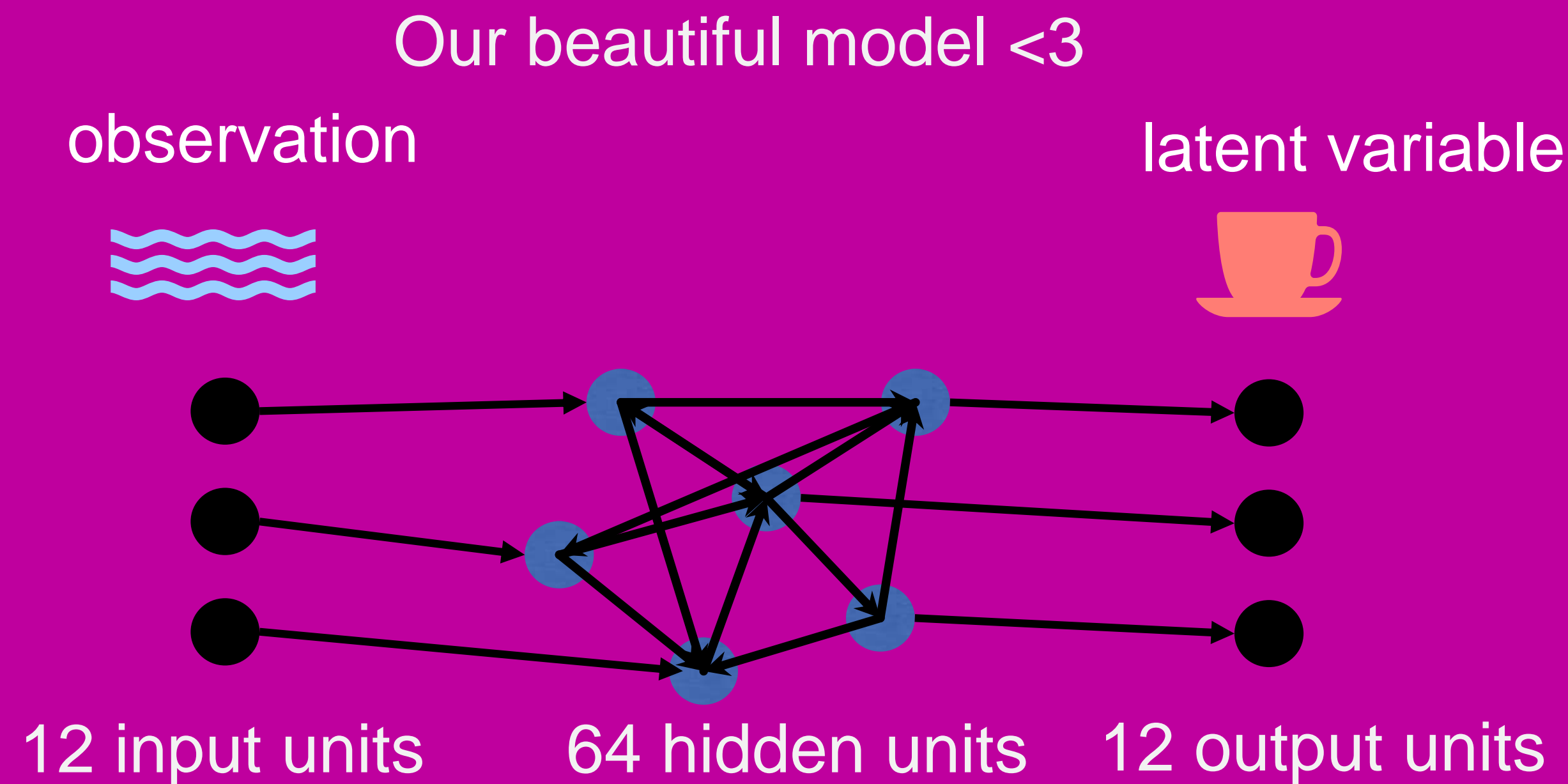
GRU

Loss decrease



Training: Hyperparameters

Deciding how smart the model is gonna be



Benchmarking - Inference

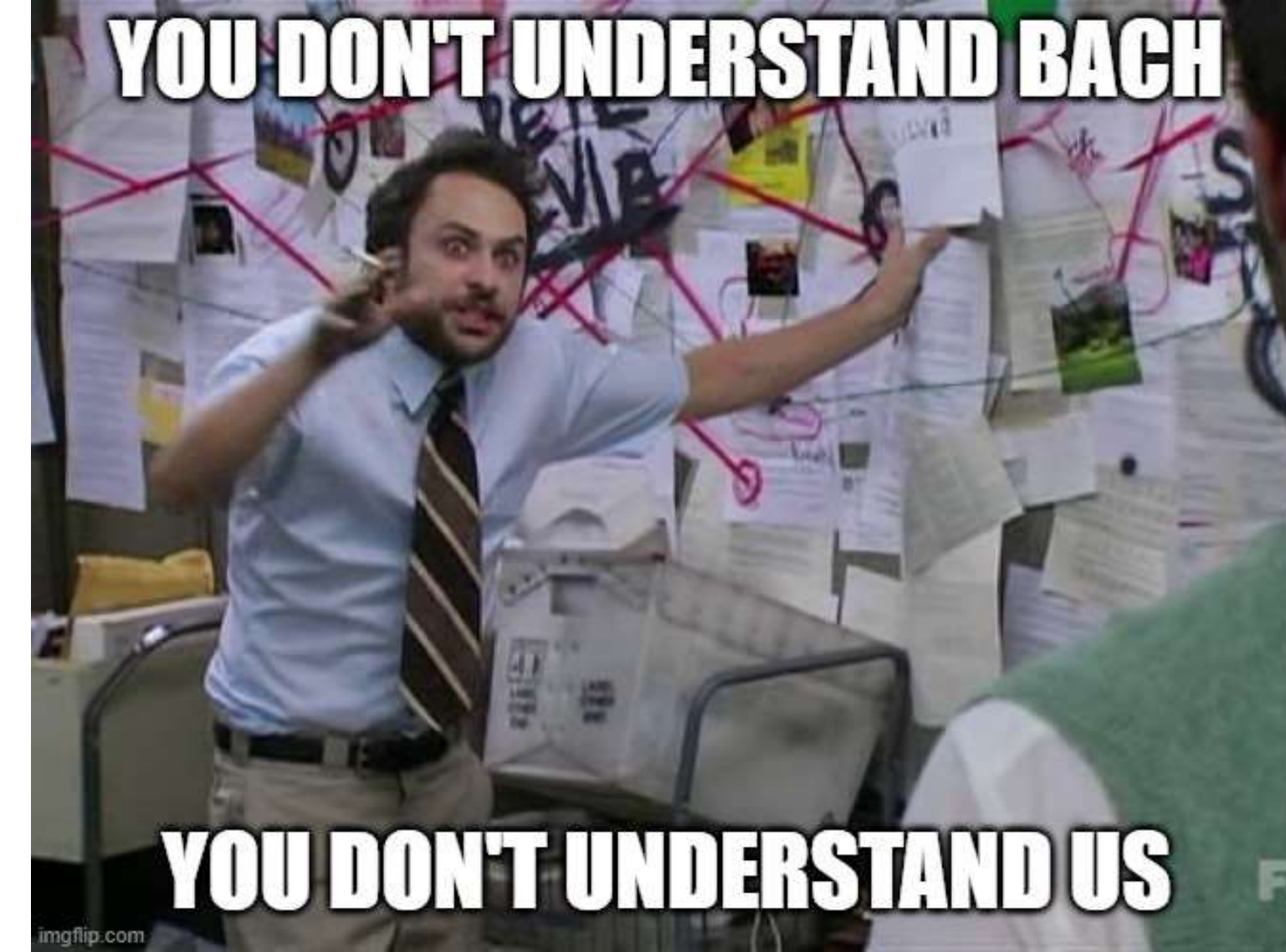
Deciding what is smart and what is not
(and visualizing it)

average

Forward NN

Our model

Perfect score



Benchmarking - Prediction

Deciding what is smart and what is not
(and visualizing it)



average

Forward NN

Our model

Prediction optimized
model

Testing

Seeing whether the model is actually smart or not
(with real data)

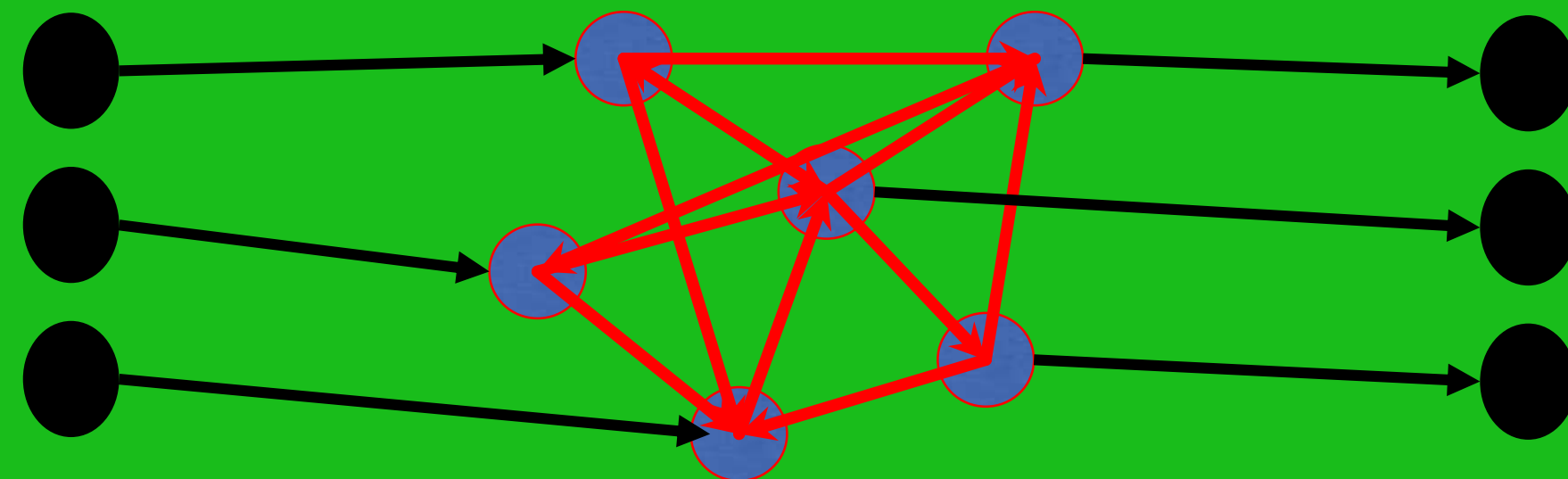
Dissecting our beautiful model

<3

observation



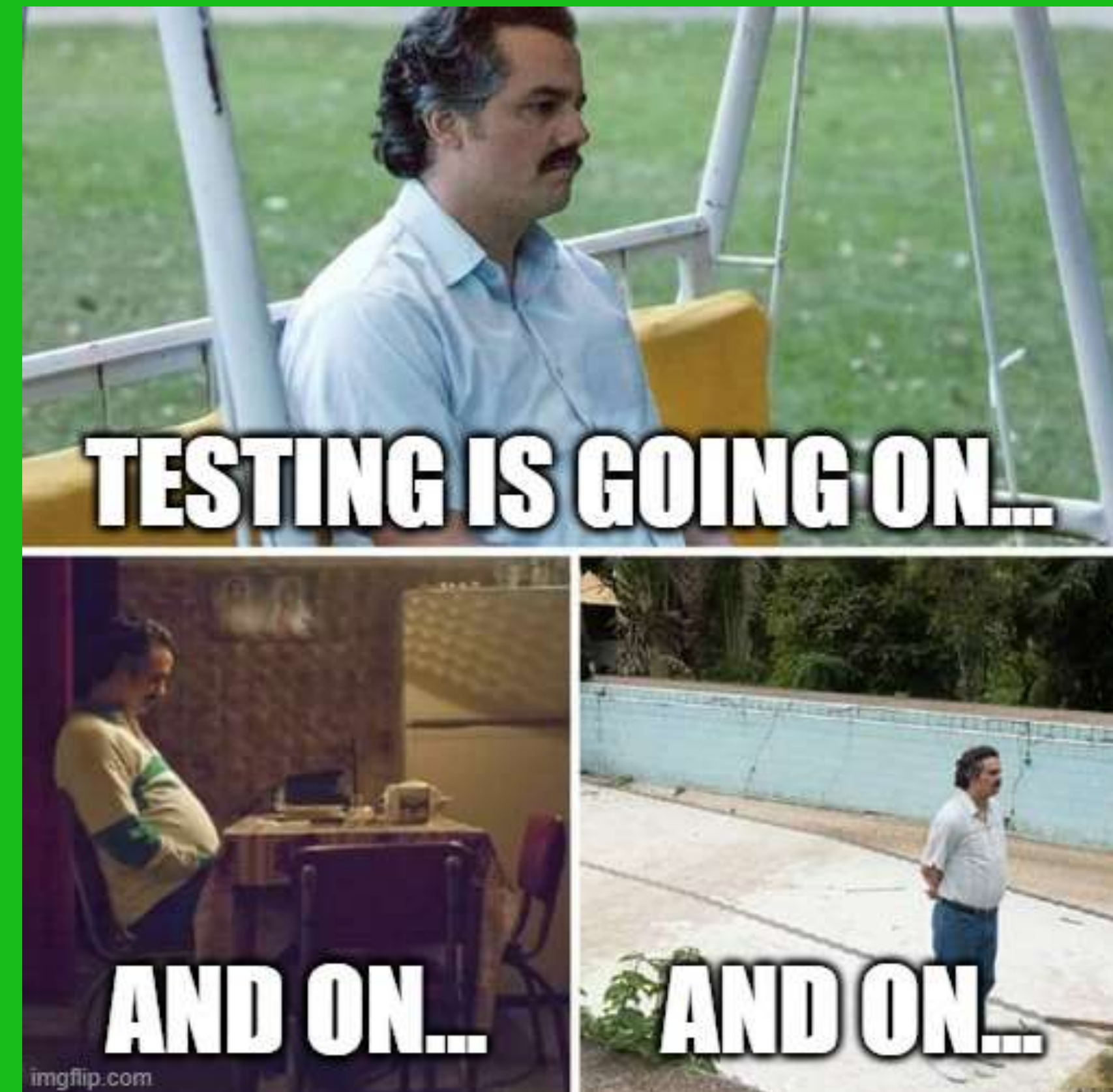
latent variable



12 input units

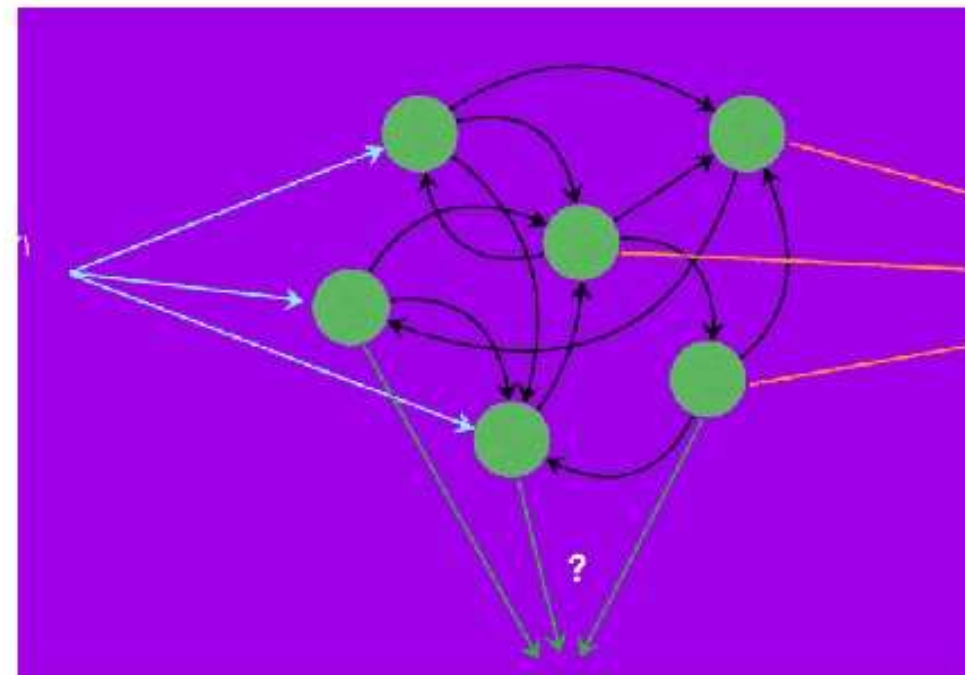
Weights of 64
hidden units

12 output units



Conclusion

A challenging but rewarding journey



**DAY 1 AT
BRAINHACK**



**DAY 3 AT
BRAINHACK**

