What I am doing here...

(Besides playing foosball)

Research question(s)

KM3NeT’s actual classification scheme is track – shower (binary → N bins).

Can we improve that in any way? Is there a way to be sure? What is the information that we (will) have from our detectors?

What is machine learning?

- **An old idea (1960’s) brought up again recently thanks to current parallel computation techniques (GPU).**
- **Fairly satistically simple:**
  - Loss ~ - Likelihood.
  - Find (global) minima in parameter space.
  - Start in random state → Move to favorable solution (gradient descent) → Converge

Oh, so it’s just Tminuit in an expensive computer!

What machine learning about?

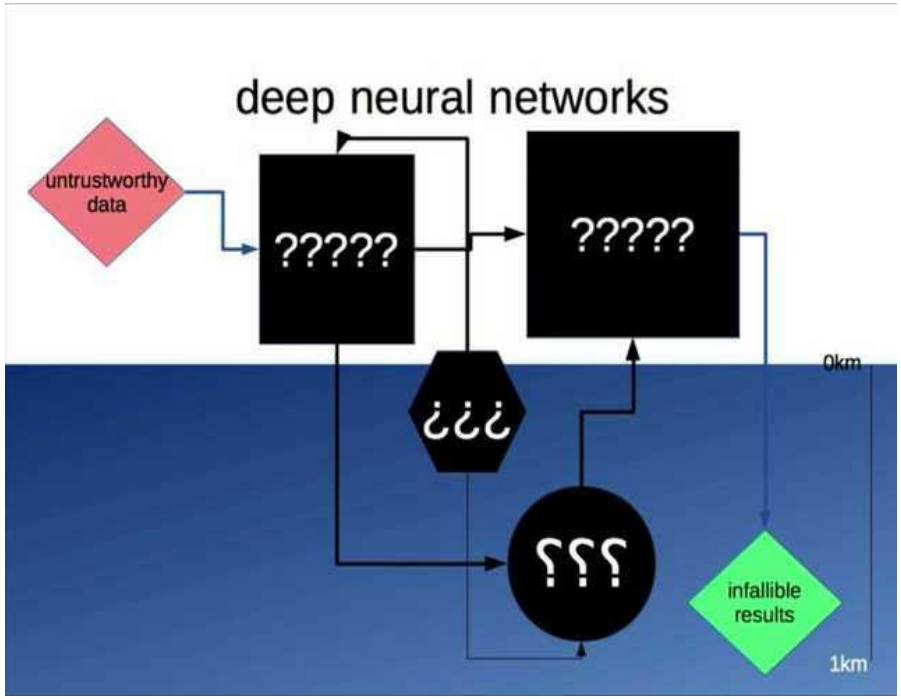
Computing a complex problem, like fitting, depends on a good description (parametrization), which tends to be both difficult AND efficient.

See: The analog watch example.

This is not what machine learning is about.

It’s a bit different than that.

But what?



What is machine learning about?

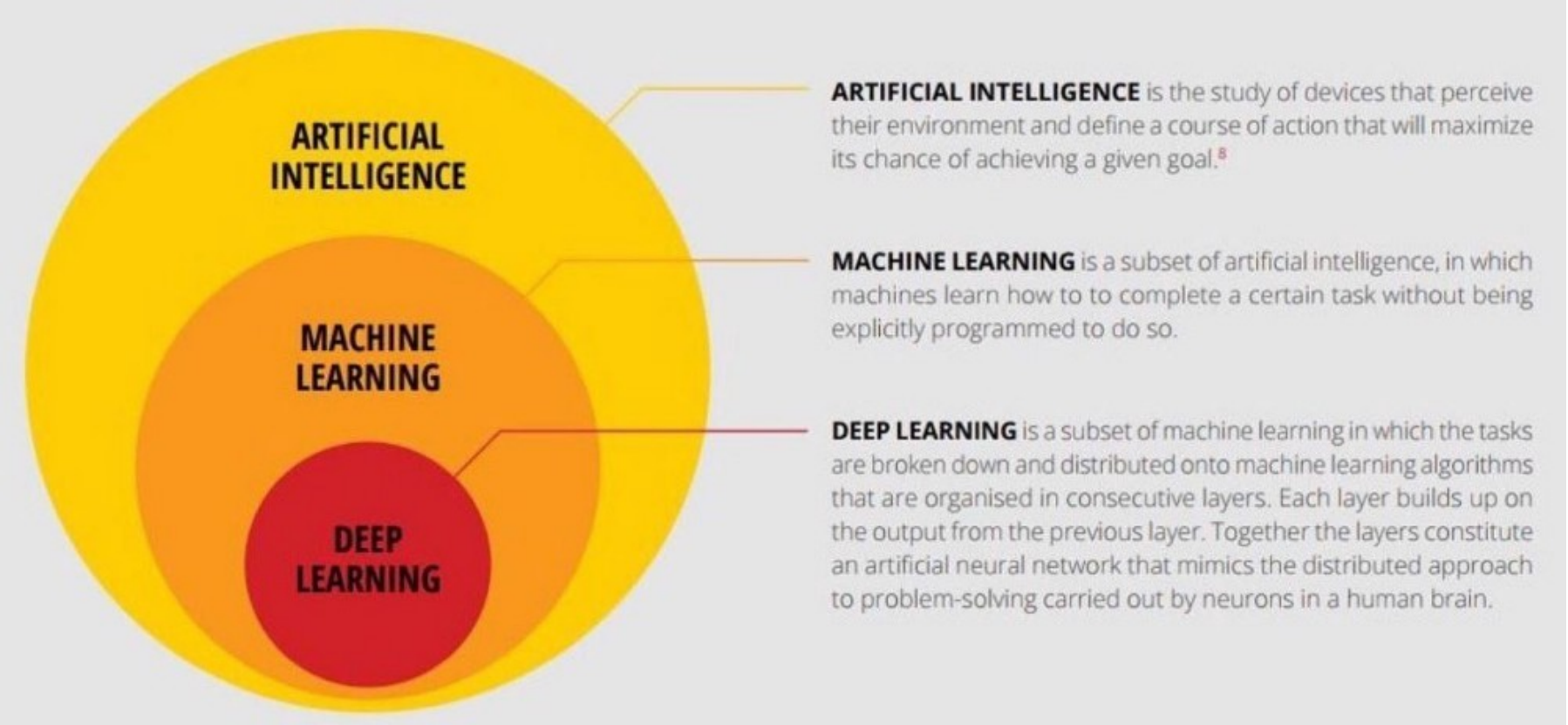
Every and all Machine Learning algorithms are based on “features”:

- **H1 = The data available to the algorithm has somehow features coded within.**
- **H0 = Our data is randomly distributed in all features.**

The algorithm task is to beat random guessing.

Relevant note!

Deep learning is ML where the features are also part of the learning.



Why machine learning?

Machine Learning techniques come handy in two special cases:

- **Search for “ unknown” features → Classification.**
- **“Solve” abstract, not parametrizable problems → Reconstruction.**

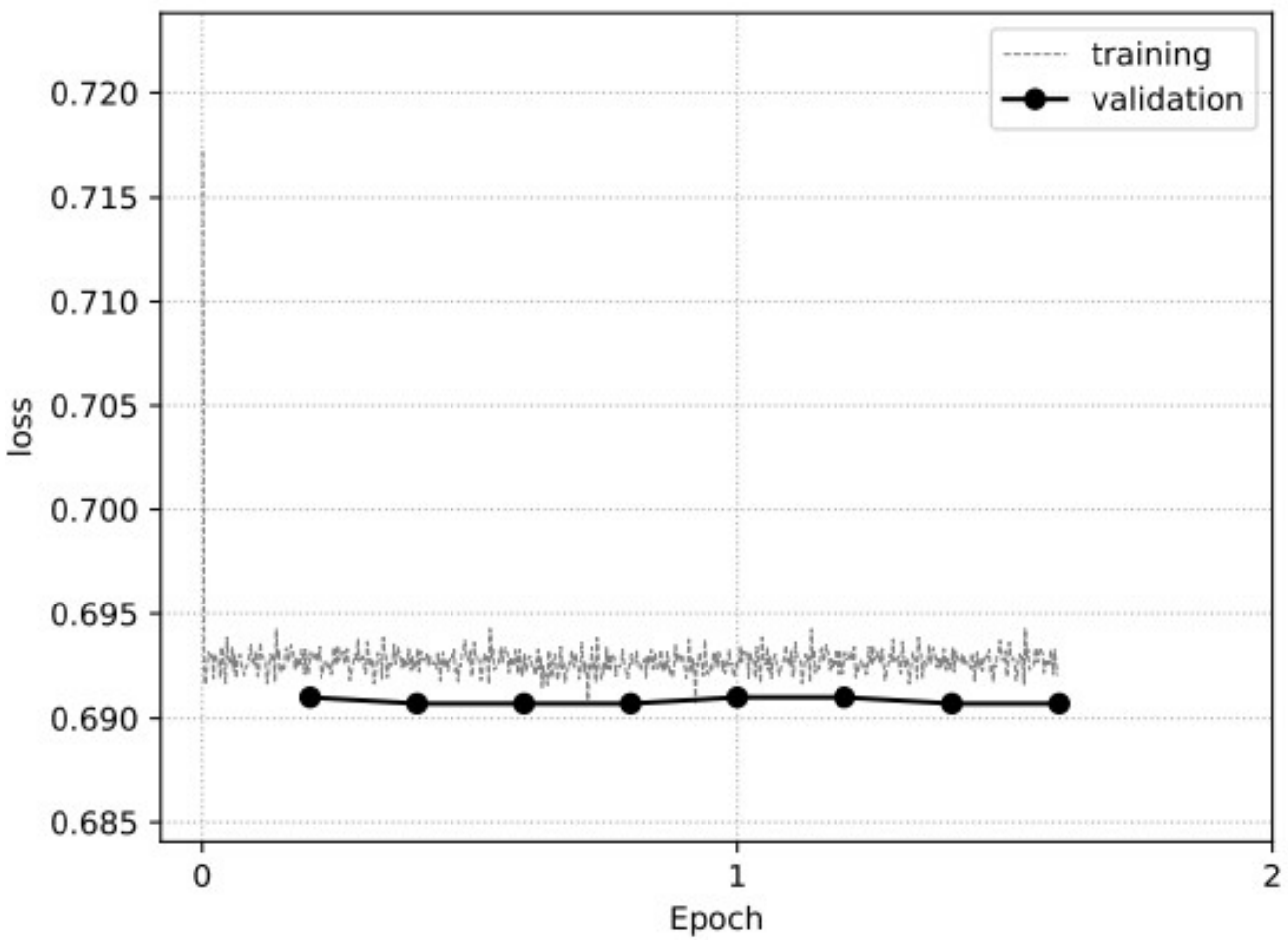
Enough storytelling!

My work

- **Post-trigger classification DL for ORCA (and maybe ARCA).**
- **Feature: Information about the flavour interaction (Outgoing lepton signal?).**
- **First iteration: elec-CC vs elec-NC, 3 – 100 GeV.**
- **Toolset: OrcaNet (Mosser, Erlangen)**

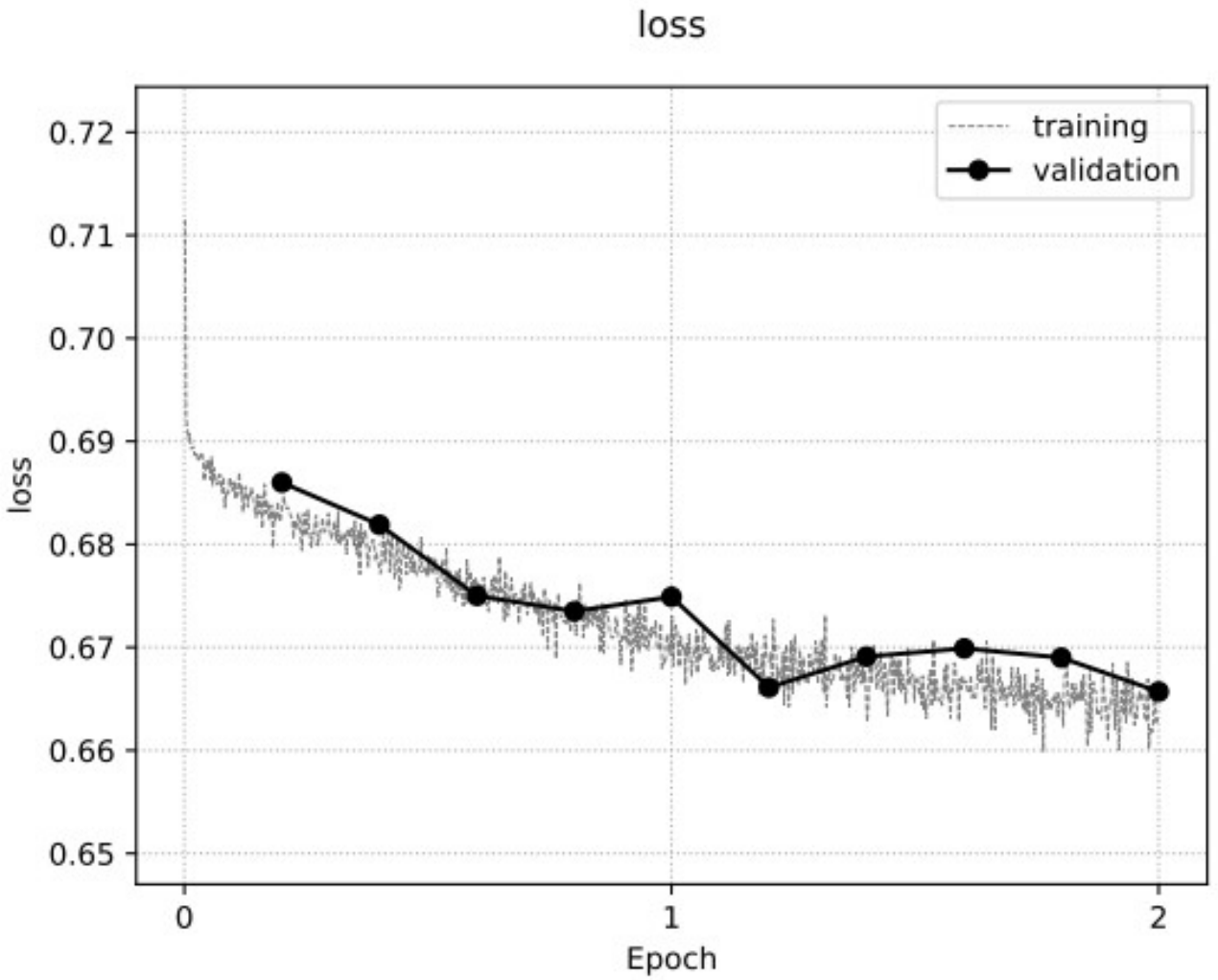
  + Stoomboot GPU Nodes.
- **Dataset ~ 7 million events in 5 files.**

First Results

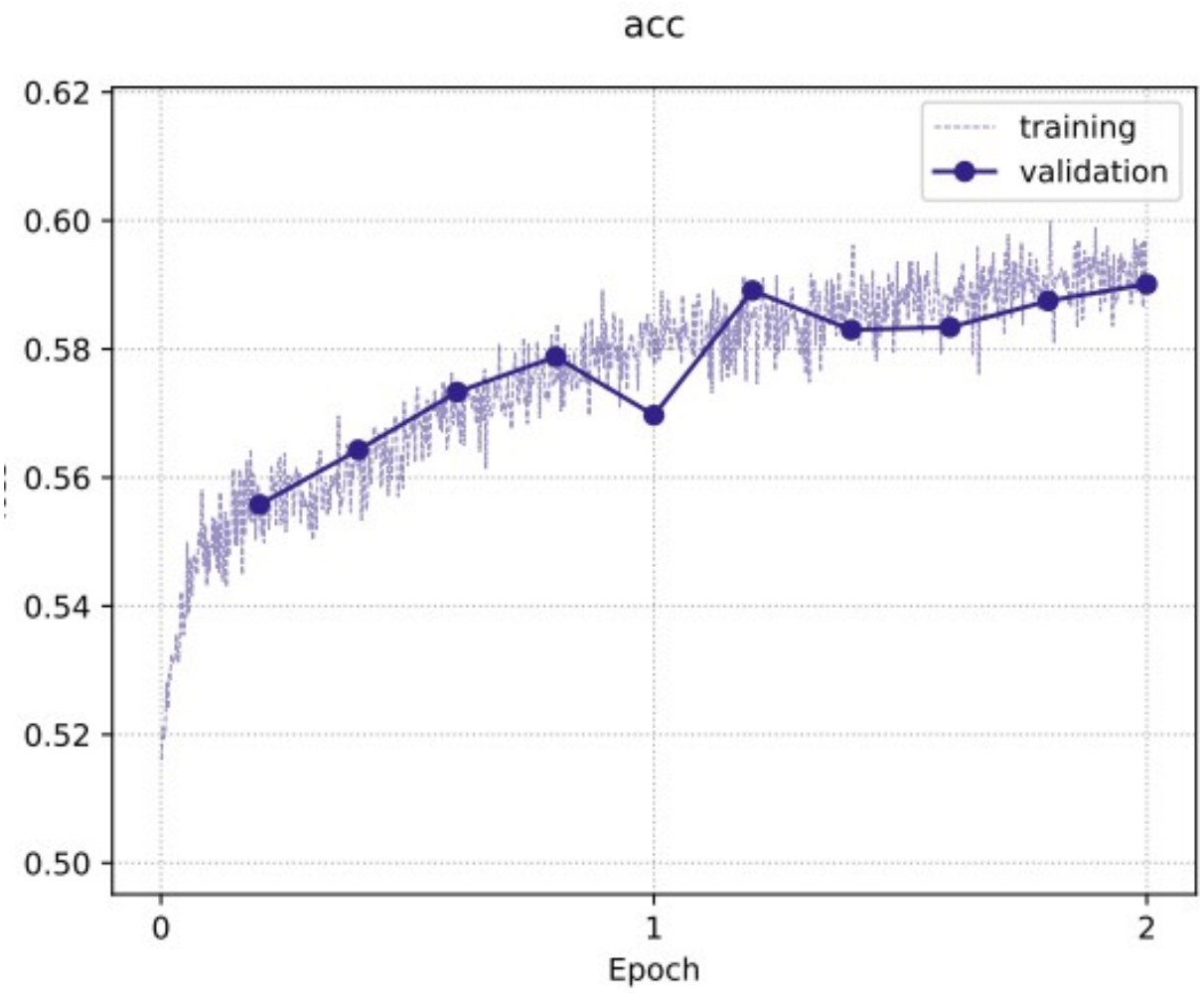


Random case:
Loss = 0.69

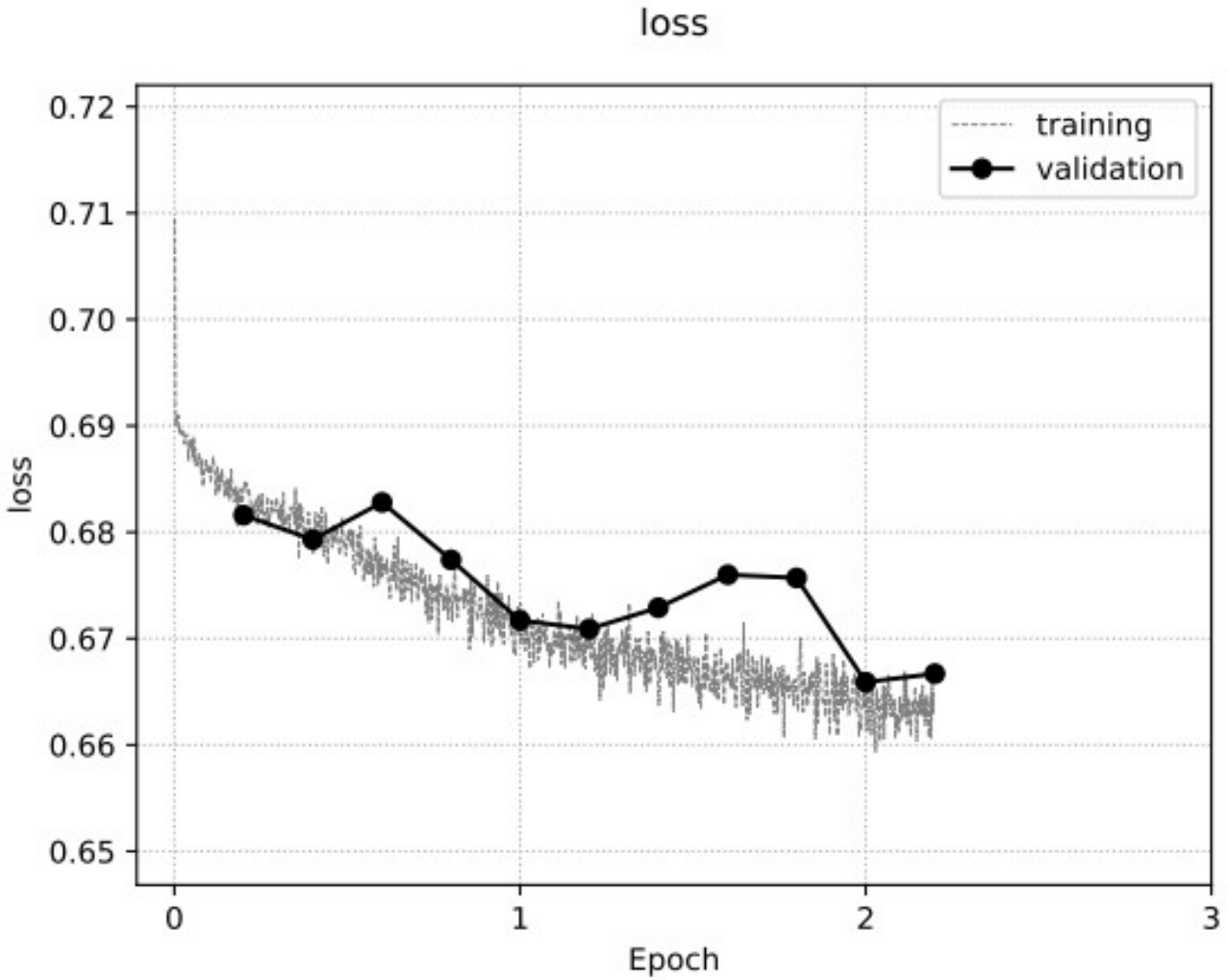
First Results



First Results



First Results



It’s alive!

Quick conclusions

- ***Barely* any improvement over the random case … which is expected for a first result.**
- **With a 60% accuracy for 52% of the data, there is still some doubts over the model.**
- **Sanity checks required (and on the way).**
- **Optimization and performance key.**

And that is it for today!

Joke time!

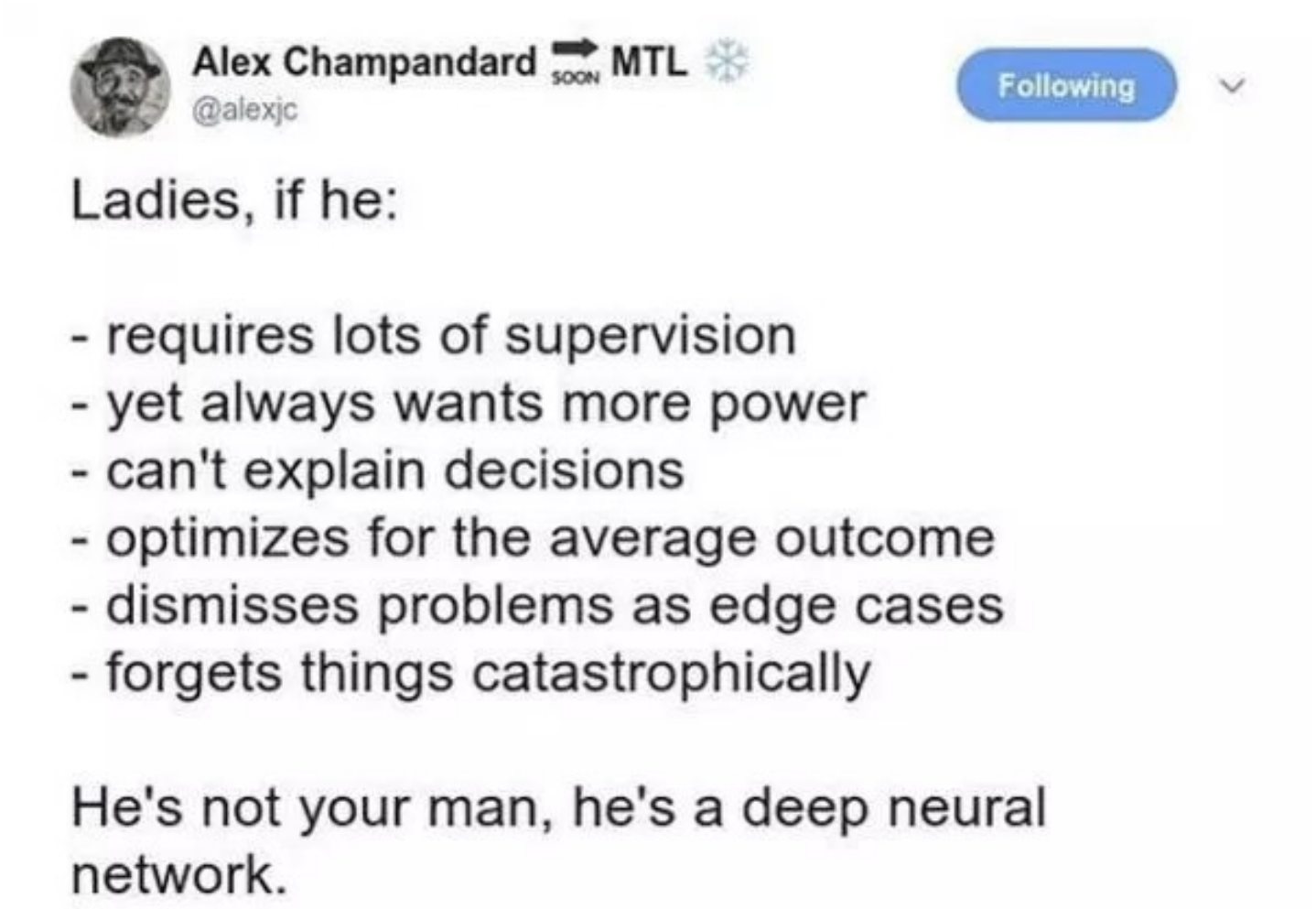
Steve Maine
@smaine

TIL that changing random stuff until your program works is "hacky" and "bad coding practice" but if you do it fast enough it's "#MachineLearning" and pays 4x your current salary

6:40 PM · 10 May 18

629 Retweets **1,692** Likes

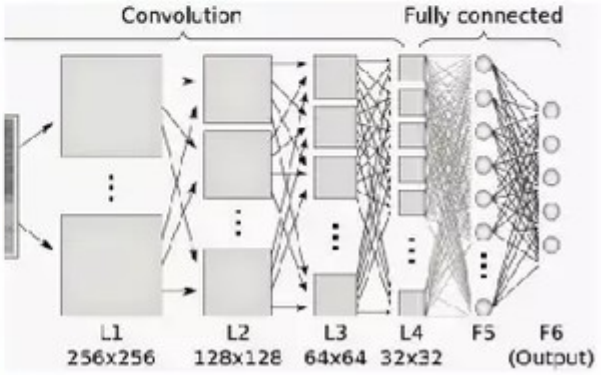
Joke time!


Alex Champandard SOON MTL
@alexjc
Following
Ladies, if he:
- requires lots of supervision
- yet always wants more power
- can't explain decisions
- optimizes for the average outcome
- dismisses problems as edge cases
- forgets things catastrophically
He's not your man, he's a deep neural network.

Joke time!

what people think he's referring to

what he's actually referring to



Joke time!

Interviewer: What's your biggest strength?

Me: I'm an expert in machine learning.

Inteviewer: What's 6 + 10?

Me: Zero.

Interviewer: Nowhere near, it's 16.

Me: It's 16.

Interviewer: Ok... What's 10 + 20?

Me: It's 16.