

Artificial Intelligence and Deep Learning for Autonomous Driving

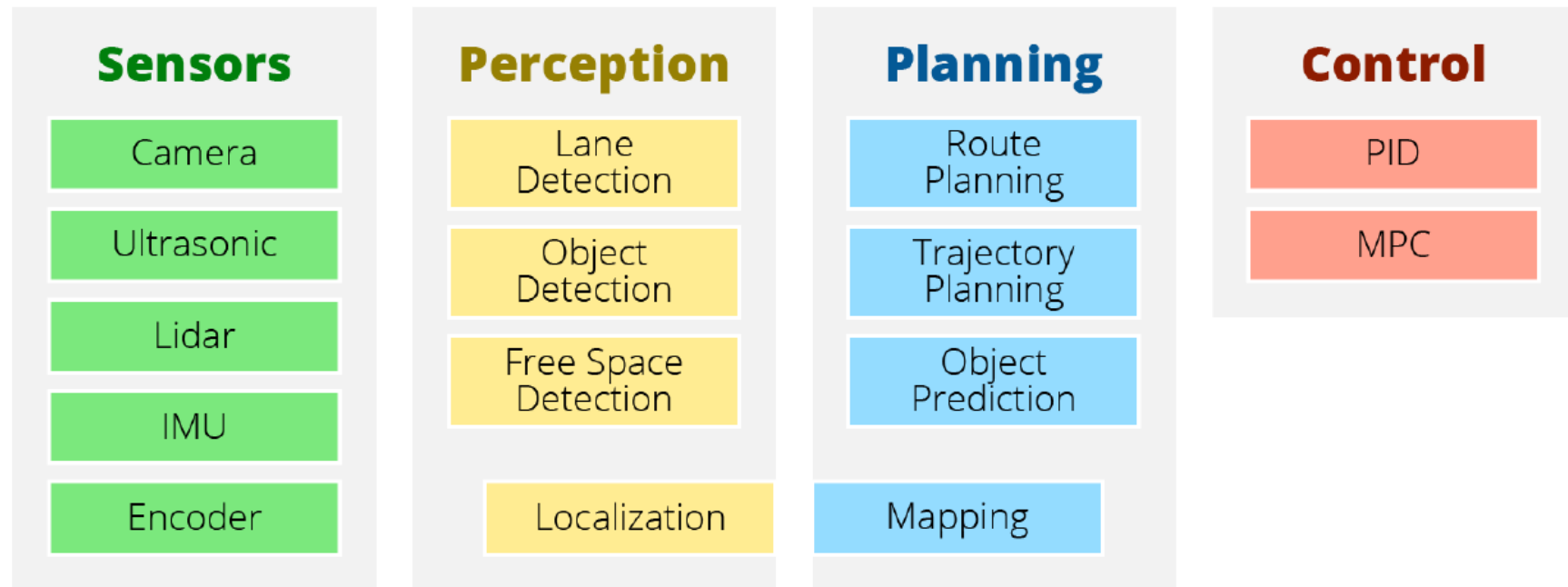


GTC Europe

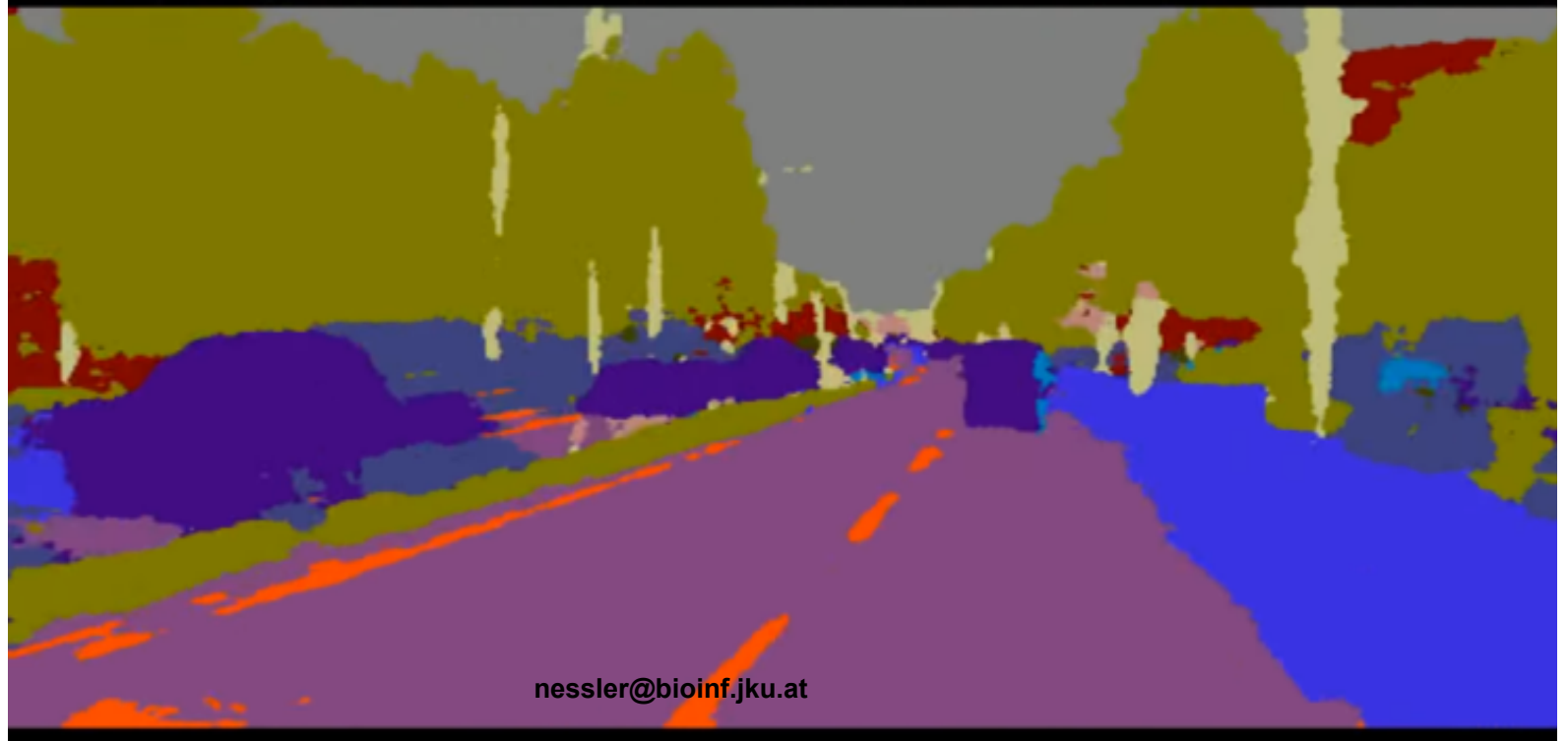
Bernhard Nessler
München, 2018-10-10



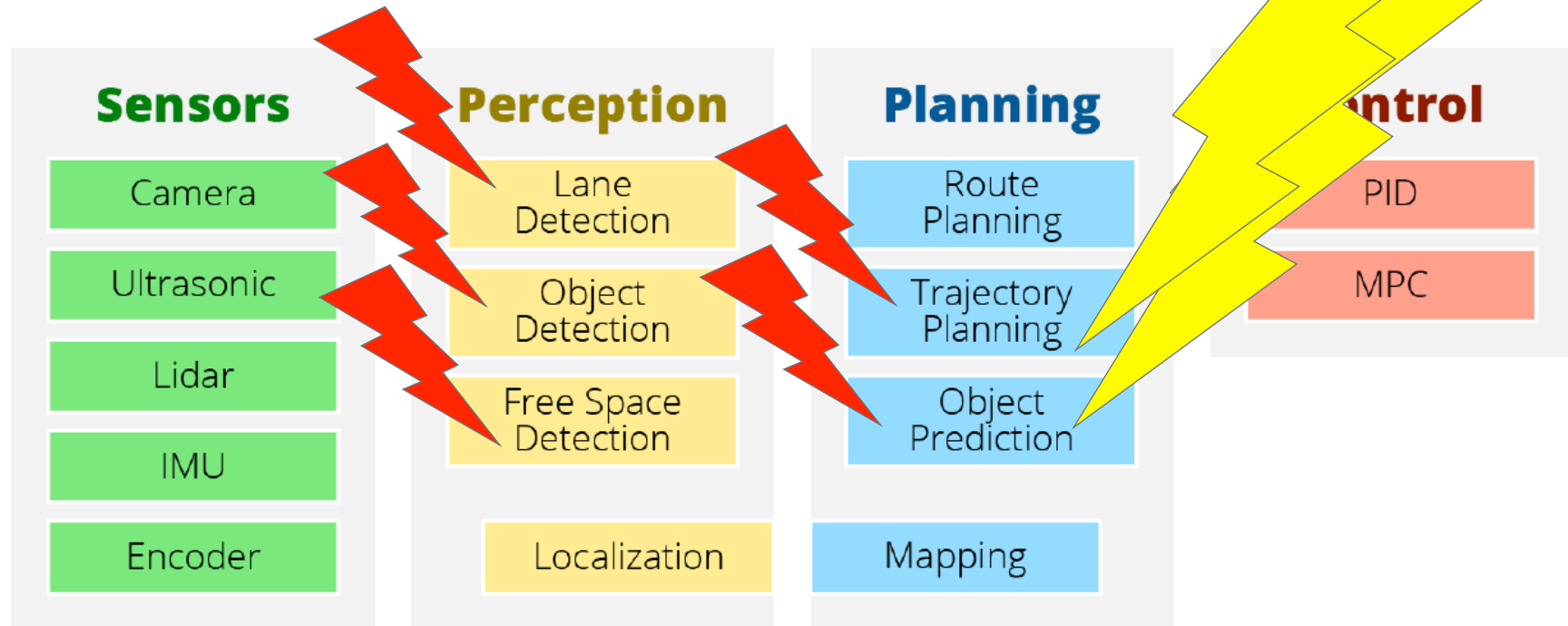
TRADITIONAL ROBOTIC PIPELINE FOR AUTONOMOUS DRIVING



- Detect all objects and own position, recognize target path, optimize detailed path plan, execute. Perfect engineering work!
- We are all done! (on a sunny day, with no humans on the road)
- Okay even by night or light rain! (but with no humans on the road)



WHAT IS WRONG?



- Technical problems: detection and model-building of real world
 - Complexity of perfect solution is immense, but possible
- Social interaction problems: Currently crowded traffic is a game between human opponents. It is a mutual agreement to give way, too.
- Pedestrian do not arbitrarily cross because they fear to be hit.















SOLUTIONS

■ Reduce the problem:

- ☐ Strictly separate automated driving from human traffic (no pedestrian, no bicycles, no motor-bikes, no other human driver)
- ☐ Technically possible, does not solve our problem in the cities.

■ Play the game !

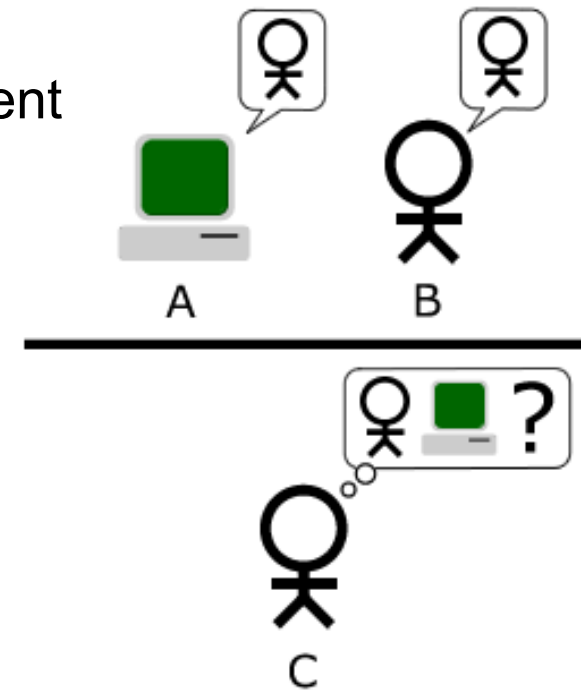
- ☐ The goal is not to get hurt and *hurt others only, if it is their fault*.
 - ☐ And if it is their fault *we have to hurt them* (at least with a certain chance), otherwise we are not taken seriously.
(Remember: It is a game!)
 - ☐ Alternatively, avoid the accident, but let the others pay a fine.
(total surveillance, automated cars regulate the traffic)
- Play a complex social game with humans ! **That is A.I. !**



WHAT IS A.I.?

WHAT IS A.I. ?

- the capability of a machine to imitate intelligent human behavior (Merriam Webster)
- „I know it, when I see it“
- Turing Test:
 - 1 human (C) has to tell apart an A.I. chatbot (A) from a human chatter (B) while talking to both simultaneously
- 1966: Eliza, Joseph Weizenbaum
- 2011: Cleverbot, Rollo Carpenter (unilateral Turing test)
 - Cleverbot got 59,3%, humans achieved 63 %

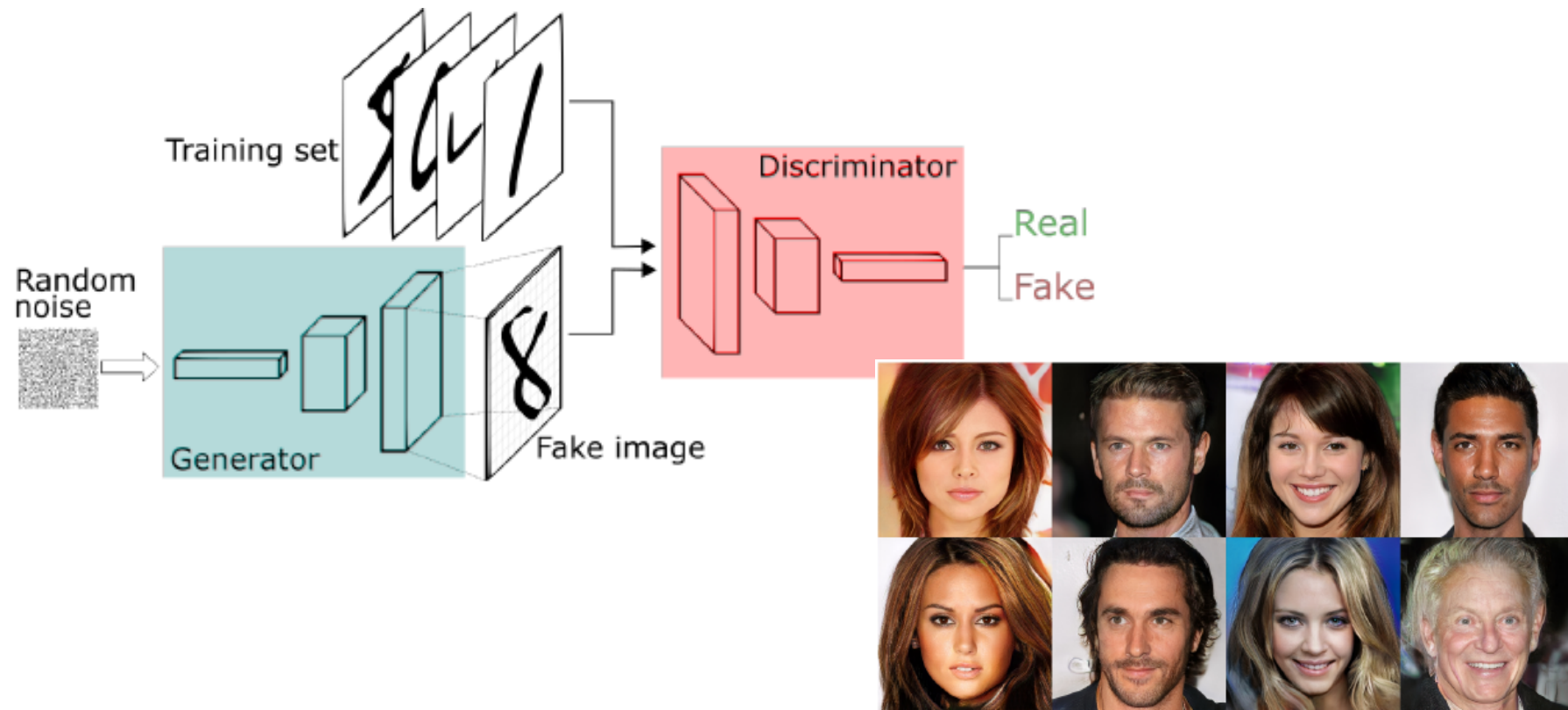


CONCLUSION

- Level 5 Selfdriving is an AI Task.
- We need competitive (Deep) Learning approaches for selfdriving
 - Generative Adversarial Nets
 - Drive like humans, Turing Test
 - Reinforcement Learning (RUDDER)
 - Drive better than all others
- We need to set egoistic goals within the limit of the law but with respect to how humans interpret the laws.
- There will be many solutions. Human will decide which style of driving they buy.
- As long as humans participate in the traffic there will be accidents.

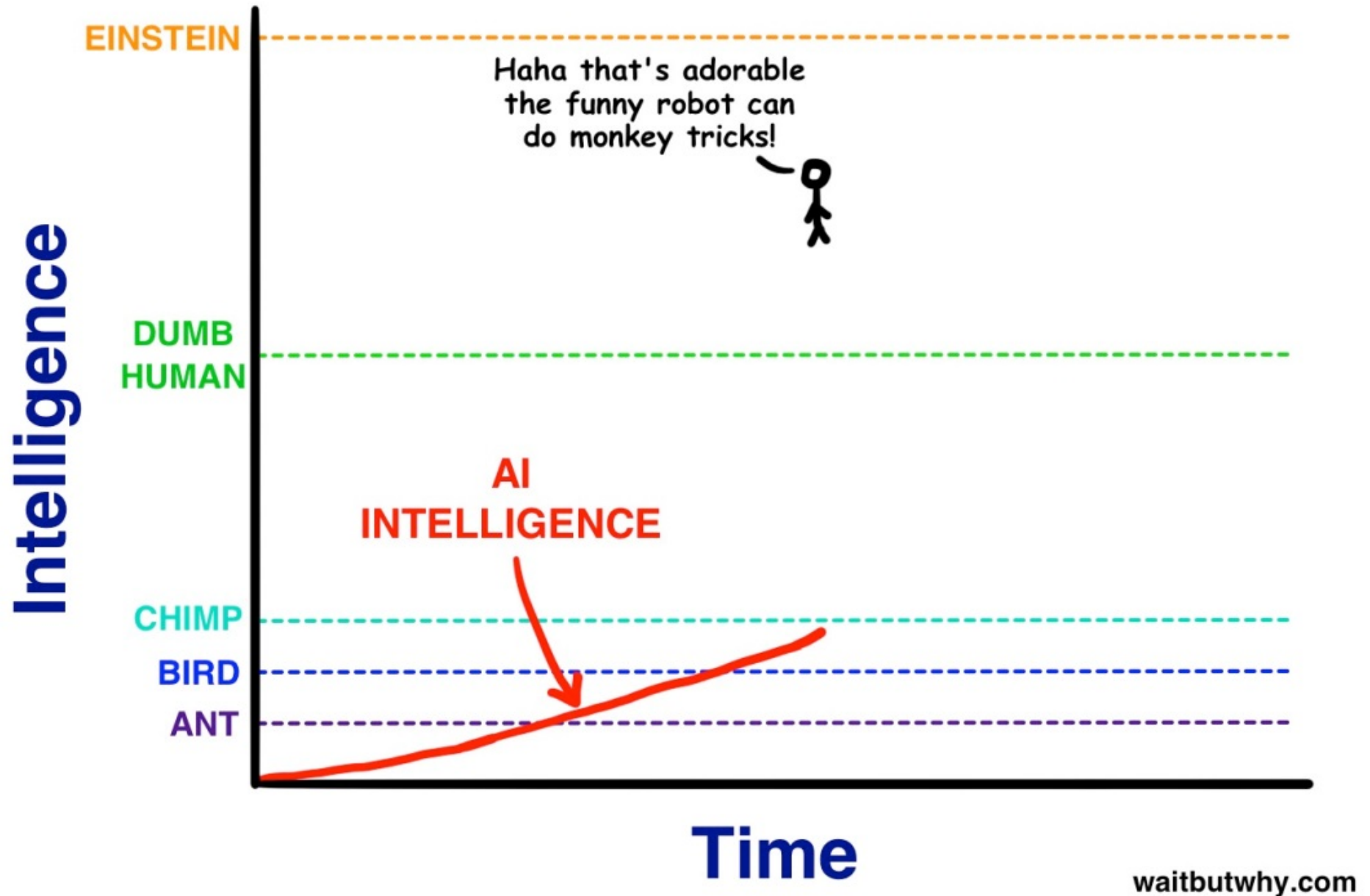
QUESTIONS?

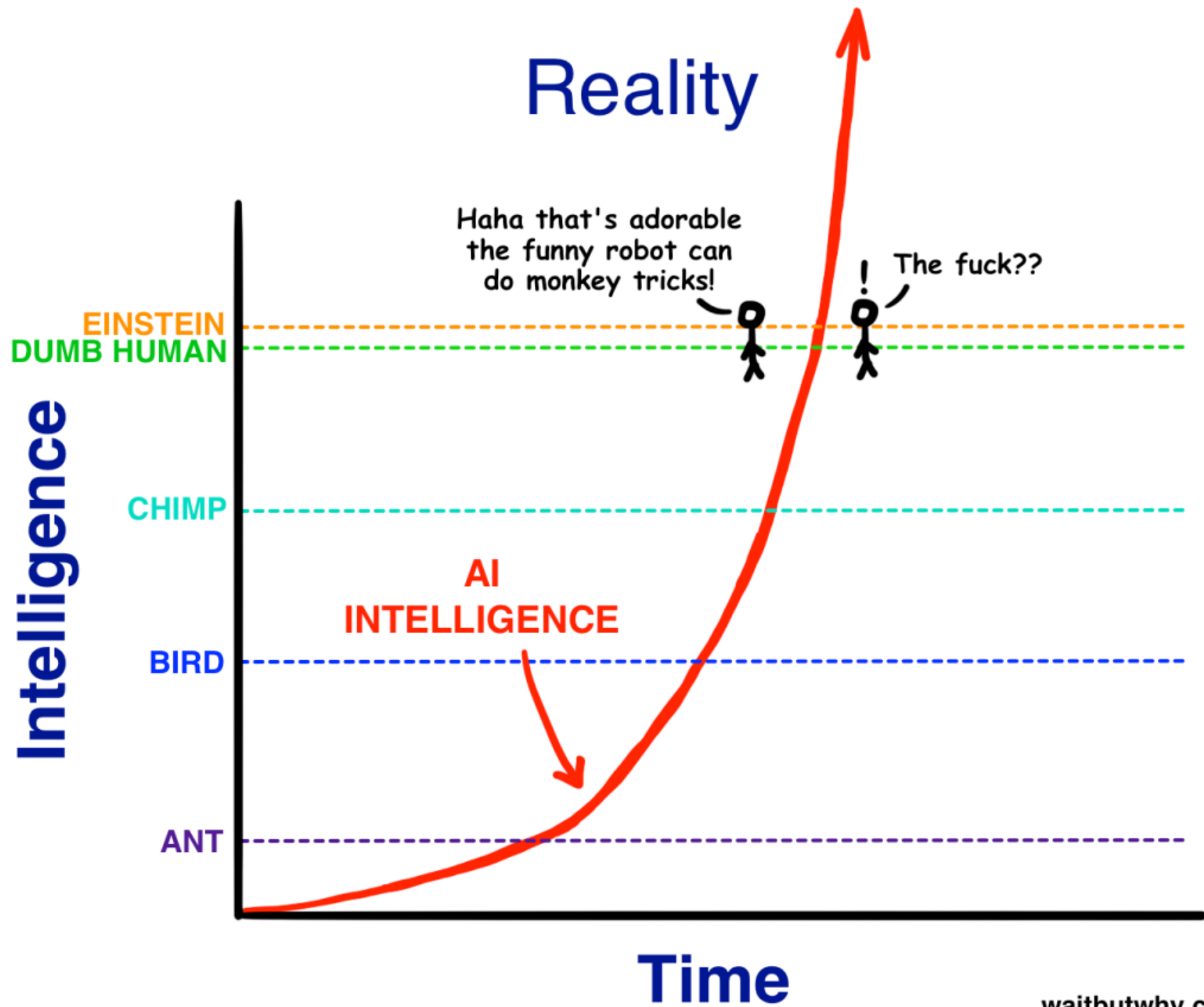
AI IMPROVES ITSELF: GENERATIVE ADVERSARIAL NETWORKS (GAN)



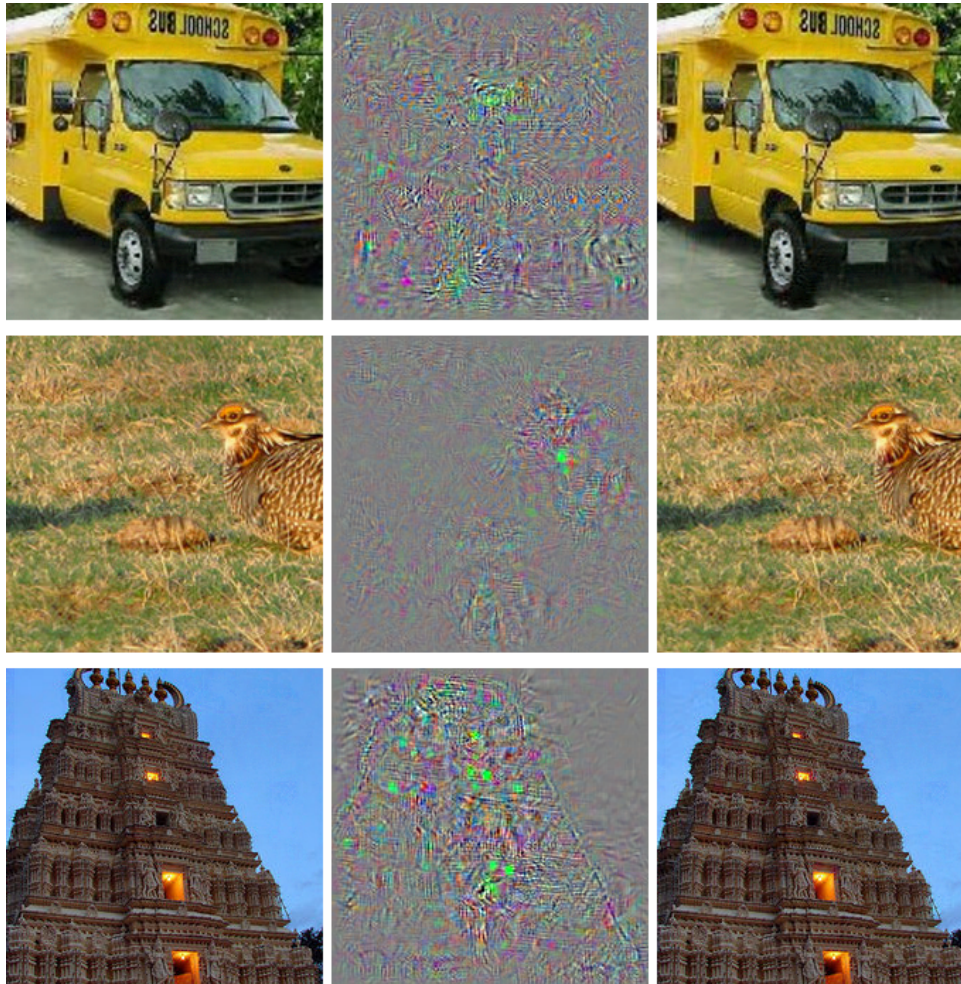
$$\min_G \max_D V(D, G) = \mathbb{E}_{\mathbf{x} \sim p_{\text{data}}(\mathbf{x})} [\log D(\mathbf{x})] + \mathbb{E}_{\mathbf{z} \sim p_{\mathbf{z}}(\mathbf{z})} [\log(1 - D(G(\mathbf{z})))]$$

Our Distorted View of Intelligence



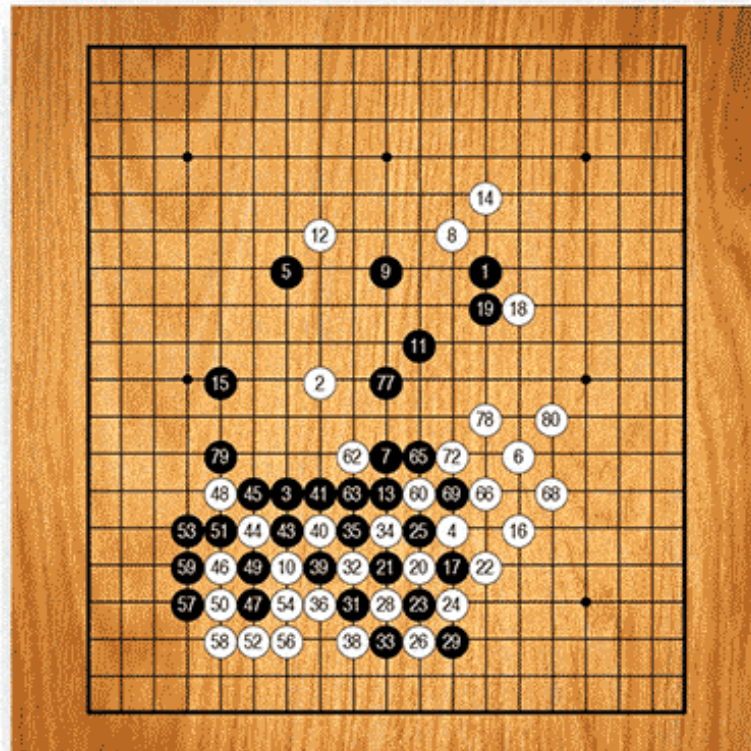


INTRIGUING PROPERTIES OF NEURAL NETWORKS



Szegedy, Christian, et al. "Intriguing properties of neural networks." arXiv preprint arXiv: 1312.6199 (2013).

ALPHA GO ZERO



27 at 17 30 at 20 37 at 21 42 at 34 55 at 44 61 at 39
64 at 40 67 at 39 70 at 40 71 at 25 73 at 21 74 at 60
75 at 39 76 at 34

Captured Stones

3 hours

AlphaGo Zero plays like a human beginner, forgoing long term strategy to focus on greedily capturing as many stones as possible.

ALPHA GO ZERO

