LEGO® Deep Learning

FACt, BNAIC/Benelearn 2021
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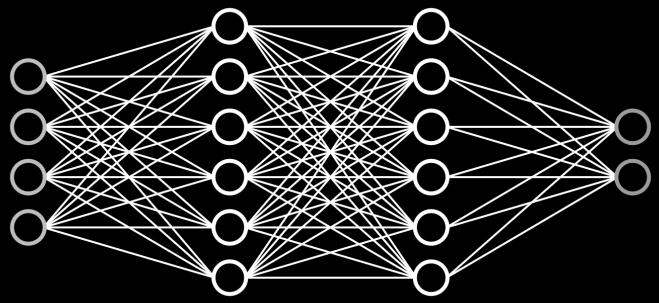
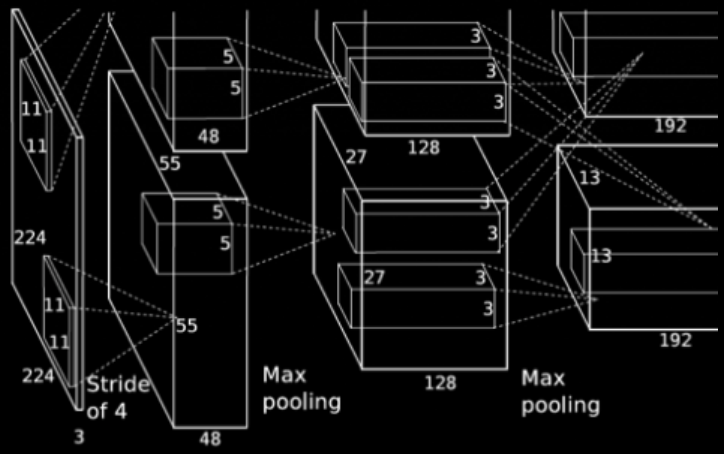
LIÈGE université

1960-2012:

The pre-deep learning era.

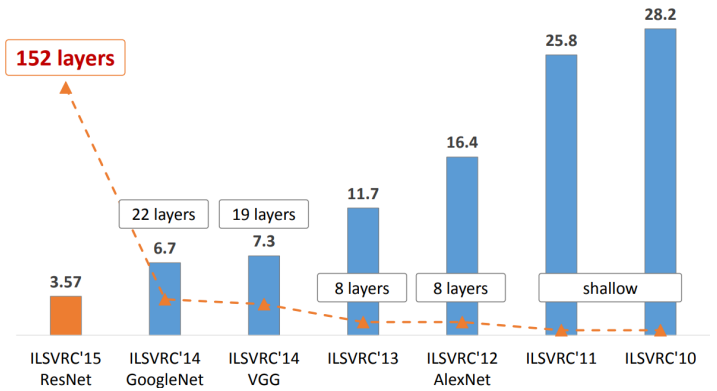


2012: AlexNet



2012-Present:

The deep learning revolution.



The deep learning toolbox

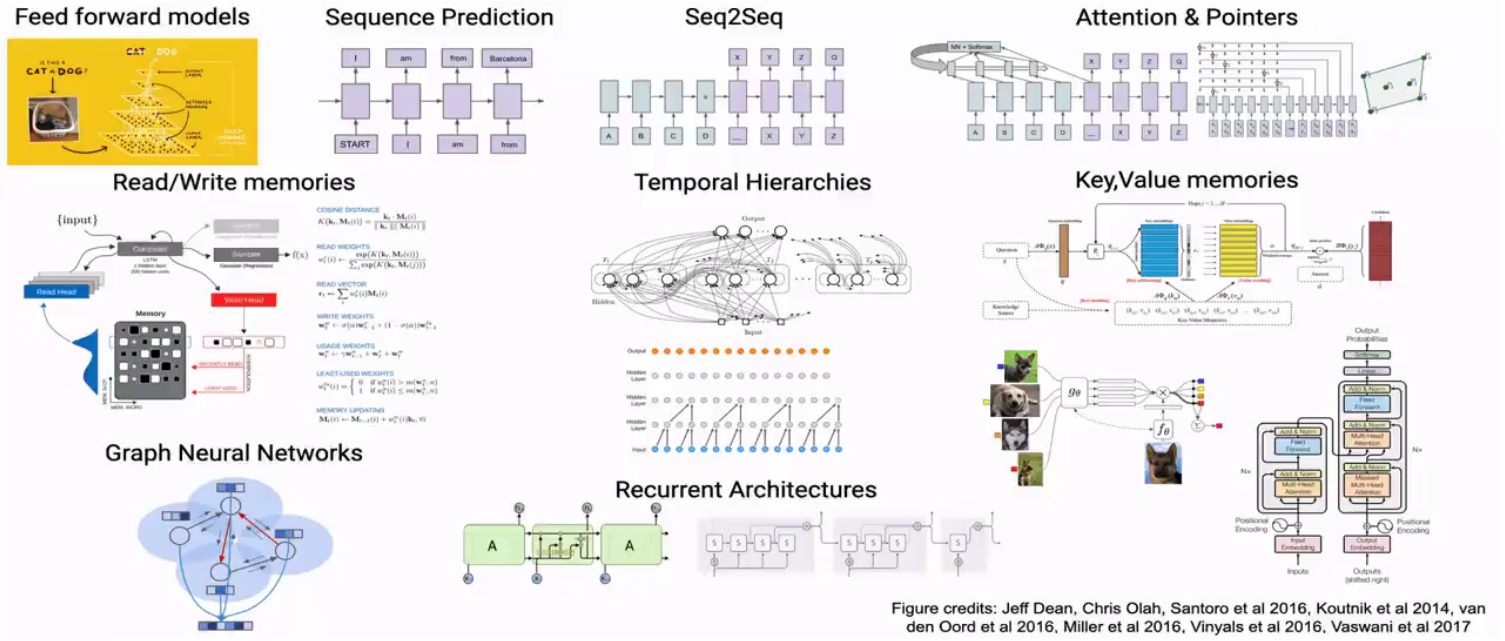


Figure credits: Jeff Dean, Chris Olah, Santoro et al 2016, Koutnik et al 2014, van den Oord et al 2016, Miller et al 2016, Vinyals et al 2016, Vaswani et al 2017

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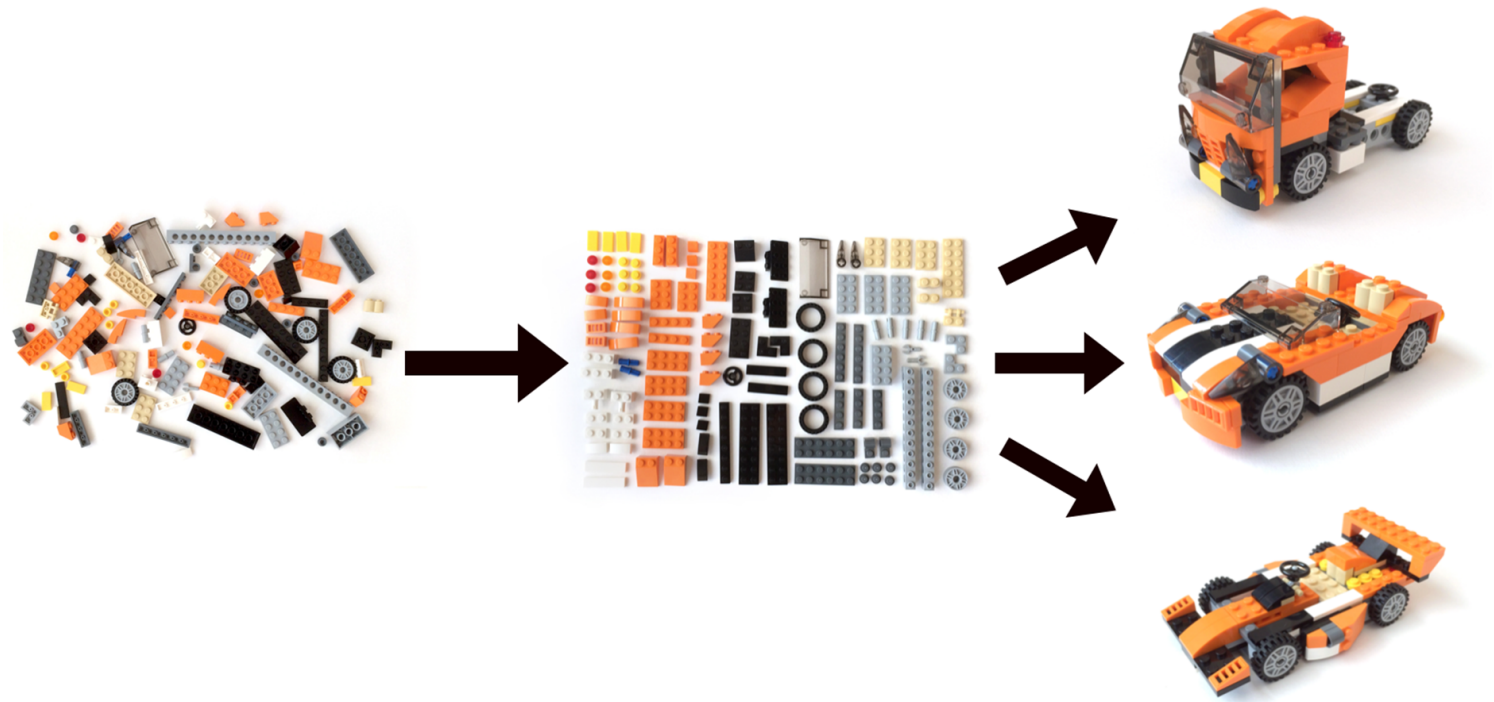
Credits: Oriol Vinyals, 2020.

An architectural language



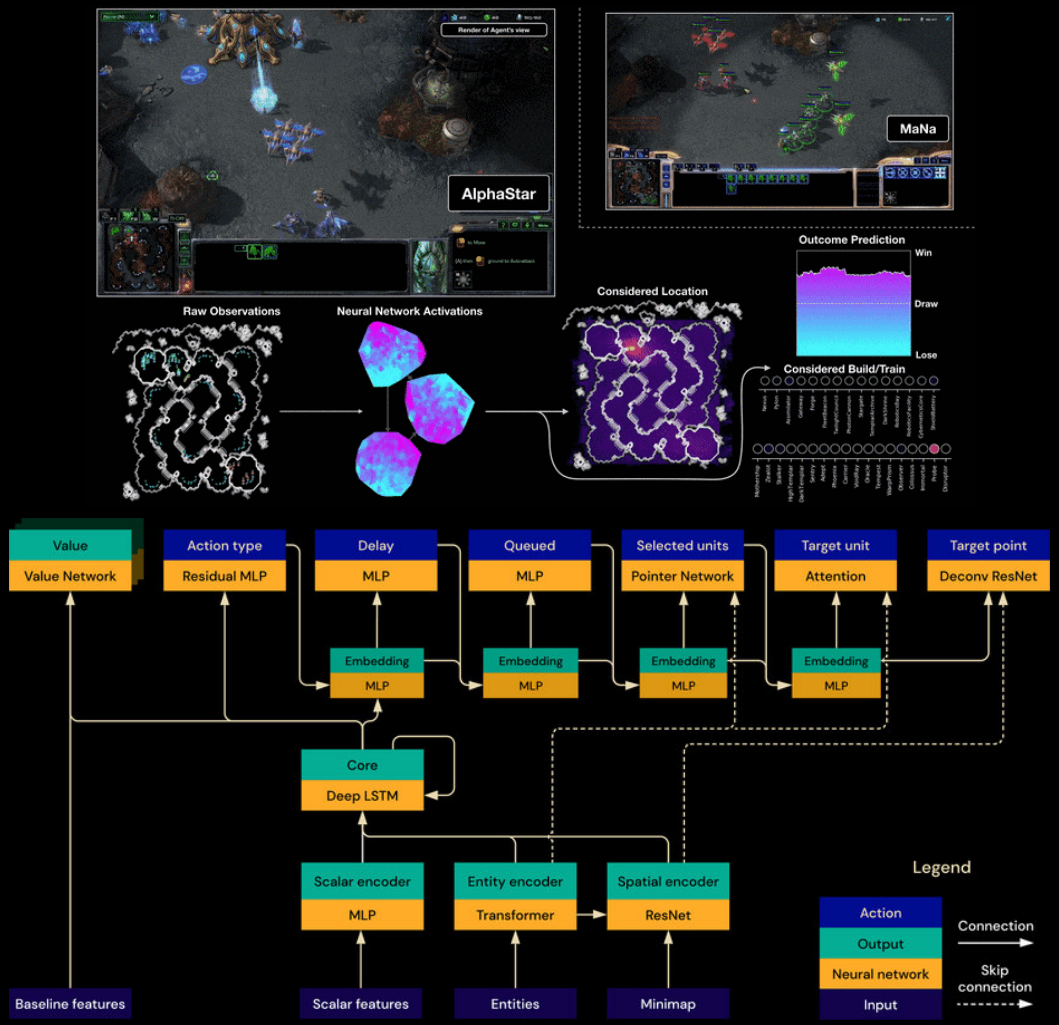
*People are now building a new kind of software by **assembling networks of parameterized functional blocks** and by **training them from examples using some form of gradient-based optimization**.*

An increasingly large number of people are defining the networks procedurally in a data-dependent way (with loops and conditionals), allowing them to change dynamically as a function of the input data fed to them.

Yann LeCun, 2018.

LEGO® Creator Expert

AlphaStar (Vinyals et al, 2019)



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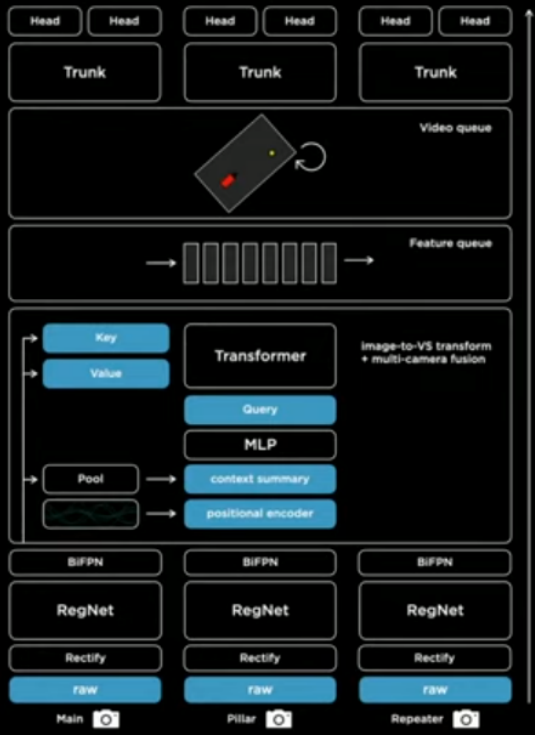
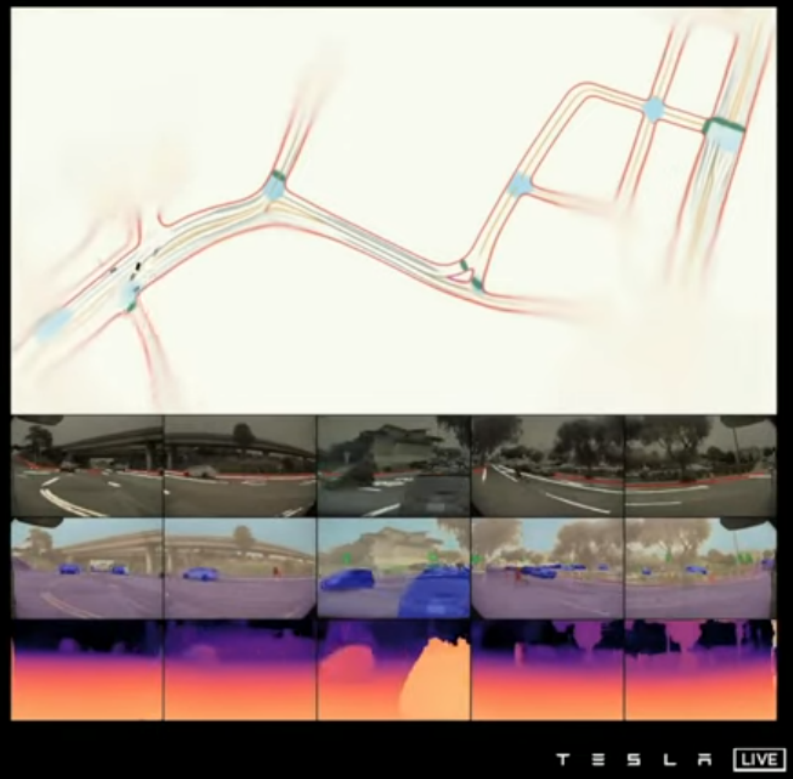
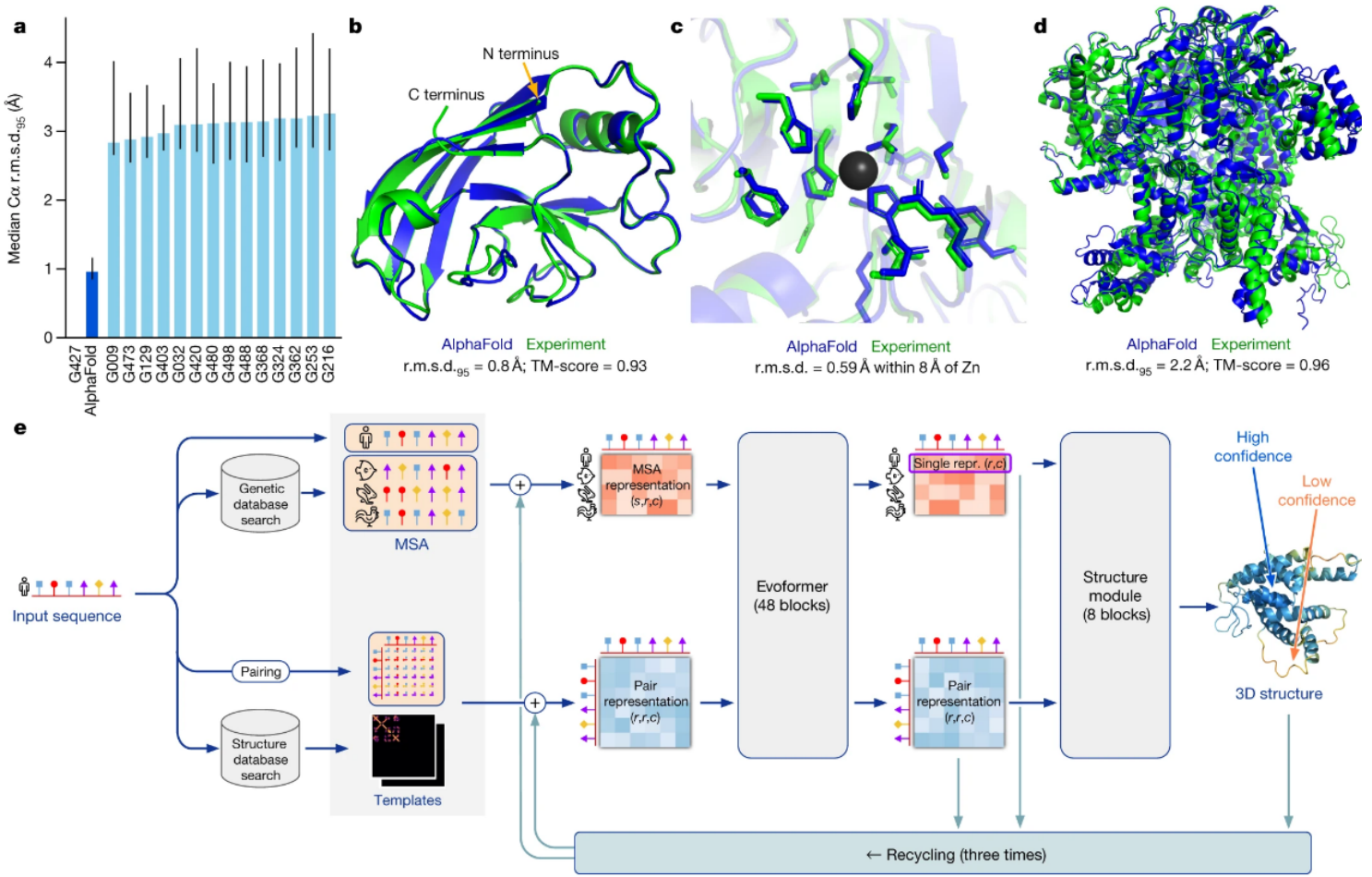
Credits: Vinyals et al, 2019.

Hydranet (Tesla, 2021)





AlphaFold (Jumper et al, 2021)



Conclusions

- Deep Learning is more than feedforward networks.
- It is a **methodology**:
  - assemble networks of parameterized functional blocks
  - train them from examples using some form of gradient-based optimisation.
- Bricks are simple, but their nested composition can be arbitrarily complicated.
- Think like an architect: make cathedrals!