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AI and AR:
(Re-)engineering a brain

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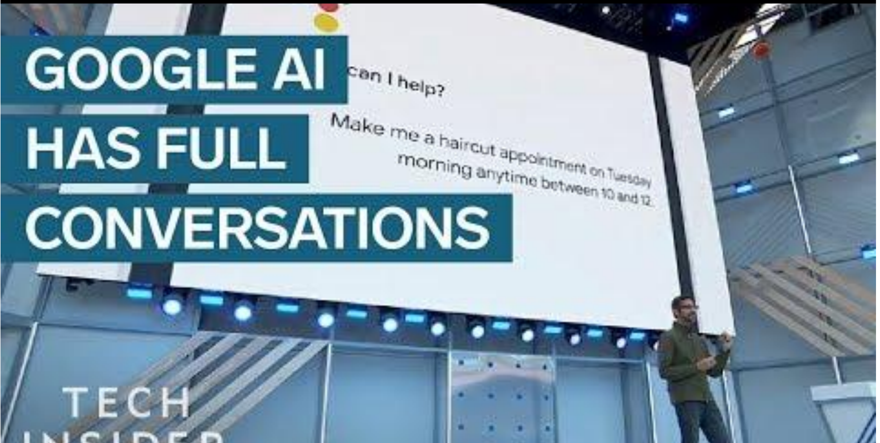
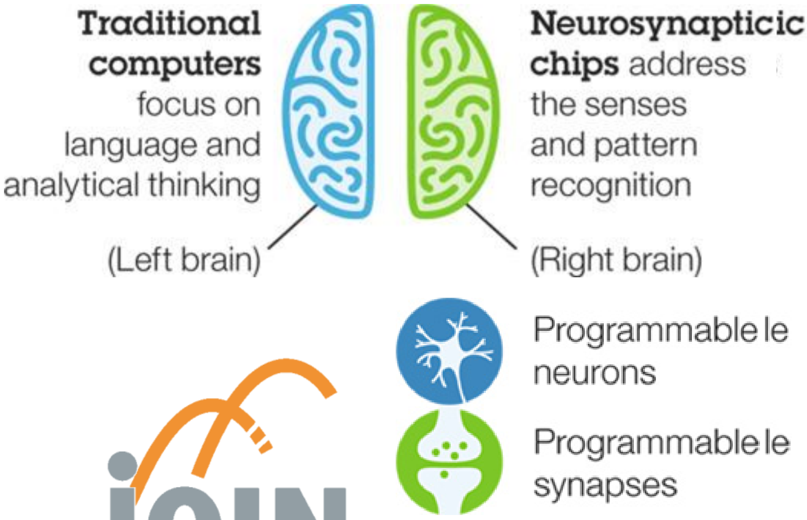
Welcome

Why are we here?


GOOGLE AI
HAS FULL
CONVERSATIONS
can I help?
Make me a haircut appointment on Tuesday morning anytime between 10 and 12.
TECH
INSIDER

```
conv1 p1 n1 conv2 p2 n2 conv3 conv4 conv5 p5 fc6 fc7 fc8 prob
fwd conv5_151 | Back: deconv (from conv5_151, disp raw) | Boost: 0/1
```



Traditional computers focus on language and analytical thinking

(Left brain)

Neurosynapticic chips address the senses and pattern recognition

(Right brain)

Programmable le neurons

Programmable le synapses

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Content

Content

1. Terminology: What is AI and AR?
2. Training: What data to use?
3. What tools to use?
4. What hardware to use?
5. What's going on with AR?
6. What about the future?
7. Discussions
8. nVidia AI and Tobii AR trial/demo

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Terminology

What is AI, AR and AGR?

Training data

History of input **X** and wanted output **Y**

AI = Artificial Intelligence

Model the unseen **x-y** from the seen **X-Y**

Radial basis: $\mathbf{y} = f(\mathbf{x} - \mathbf{X})\ \mathbf{Y} / \mathrm{sum}(f(\mathbf{x} - \mathbf{X}))$

Deep learning: $\mathbf{y} = f(\mathbf{K1}\ f(\mathbf{K2}\ f(\mathbf{K3}\ \mathbf{x} + \mathbf{m3}) + \mathbf{m2}) + \mathbf{m1})$

Recurrent: $\mathbf{y} = f(\mathbf{C}\ \mathbf{y} + \mathbf{K}\ \mathbf{x} + \mathbf{m})$

Spiky: $\mathbf{y} = f(\mathbf{C}\ \mathbf{y} + \mathbf{K}\ d\mathbf{x}/dt + \mathbf{m})$

AR = Augmented Reality

Sharpen **x** now by adding ${}_{\mathrm{inv}}f(\mathrm{strongest}(\mathbf{y}))$

AGR = Artificial General Intelligence

Model the unseen x-y-ai-ar (possible futures)
from the seen X-Y-AI-AR (past experiences)

Terminology

What makes an AI work?

f(**x** - **X**) etc is typically a gaussian function

$\mathbf{y} = \exp(-k\,(\mathbf{x} - \mathbf{X})^2)\,\mathbf{Y} / \mathrm{sum}(\exp(-k\,(\mathbf{x} - \mathbf{X})^2))$

$|\mathbf{x} - \mathbf{X}| \sim 0 \rightarrow \mathbf{y} =$ average **Y**

"Confident"

$|\mathbf{x} - \mathbf{X}| \gg 1/k \rightarrow \mathbf{y} =$ nearest **Y**

"Uncertain"

f(**K x** + **m**) etc is typically a sigmoid function:

$\mathbf{K}\,\mathbf{x} + \mathbf{m} \ll -1 \rightarrow \mathbf{y} = \mathbf{0}$

"Uninterested"

$\mathbf{K}\,\mathbf{x} + \mathbf{m} \sim -1 \rightarrow \mathbf{y} \sim \exp(\mathbf{K}\,\mathbf{x} + \mathbf{m})$ "Interested"

$\mathbf{K}\,\mathbf{x} + \mathbf{m} \sim 0 \rightarrow \mathbf{y} \sim \mathbf{K}\,\mathbf{x} + \mathbf{m}$ "Curious"

$\mathbf{K}\,\mathbf{x} + \mathbf{m} \sim +1 \rightarrow \mathbf{y} \sim \log(\mathbf{K}\,\mathbf{x} + \mathbf{m})$ "Alert"

Training

What was the problem?

Training (of **K** and **m** etc) was very difficult due many AI options, nonlinear algebra, and large **X**, **Y**, **K** and **m** etc.

- With new deep learning tools it is easy - but even more compute intense.

These computations were very time-consuming due to lack of parallelism.

- With modern gaming GPUs it way much faster - but still a bottle-neck.

The amount of training data needed for robust AI is very large, and such data did not exist.

- Google now has trained AIs for free/ads and for pay-per-use!
- nVIDIA now support virtual 3D playgrounds in their AI tools

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Tools

Where to start?

Basic:

- Your kids gaming PCs
- pytorch.org

Professional:

- www.defaultlogic.com/learn?s=List_of_datasets_for_machine_learning_research
- nVidia Jetson AI module
- Intel-based CAE or gaming workstation
- nVidia GPU with at least CUDA 7.5 support
- Ubuntu 16 or 18 on an NVMe flash drive
- Commercial AI software and services listed at https://www.g2crowd.com/categories/artificial-intelligence
- When stuck or created something: Awesome - contact me!

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Thank you for participating!

What about the future?

Human intelligence makes optimal use of the brain at every stage of learning. To do this with AI: Keep pruning (removing zeros) and adding new layers (adding randomness on top) in an endless training loop. Fill the GPU with the new layers after every pruning step - this makes most use of the HW all the time. There is no tool yet for this - time to innovate!

Discussions

Questions

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Demo

My AI & AR setup

Demo, trial, hands-on

Feedback

Recommended read:

https://distill.pub/2018/building-blocks/

(Click around - this article is interactive in every detail!)

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