

CADE METZ BUSINESS 02.01.17 07:00 AM

INSIDE LIBRATUS, THE POKER AI THAT OUT-BLUFFED THE BEST HUMANS

POLICY & ETHICS Will Democracy Survive Big Data and Artificial Intelligence?

We are in the middle of a technological upheaval that is organized. We must now

transform the way society now

"Nearly Indistinguishable From Human Translation"—Google Claims Breakthrough

by Florian Faes on September 27, 2016

Academia

Yale and Oxford Enter the Business of Predicting the End of the Human Translator

by Florian Faes on May 26, 2017



How Google's AlphaGo Beat a Go World Champion

Inside a man-versus-machine showdown

CHRISTOPHER MOYER

MAR 28, 2016

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A \$96 billion fund firm created a AI hedge fund, but freaked out when it couldn't explain how it made money

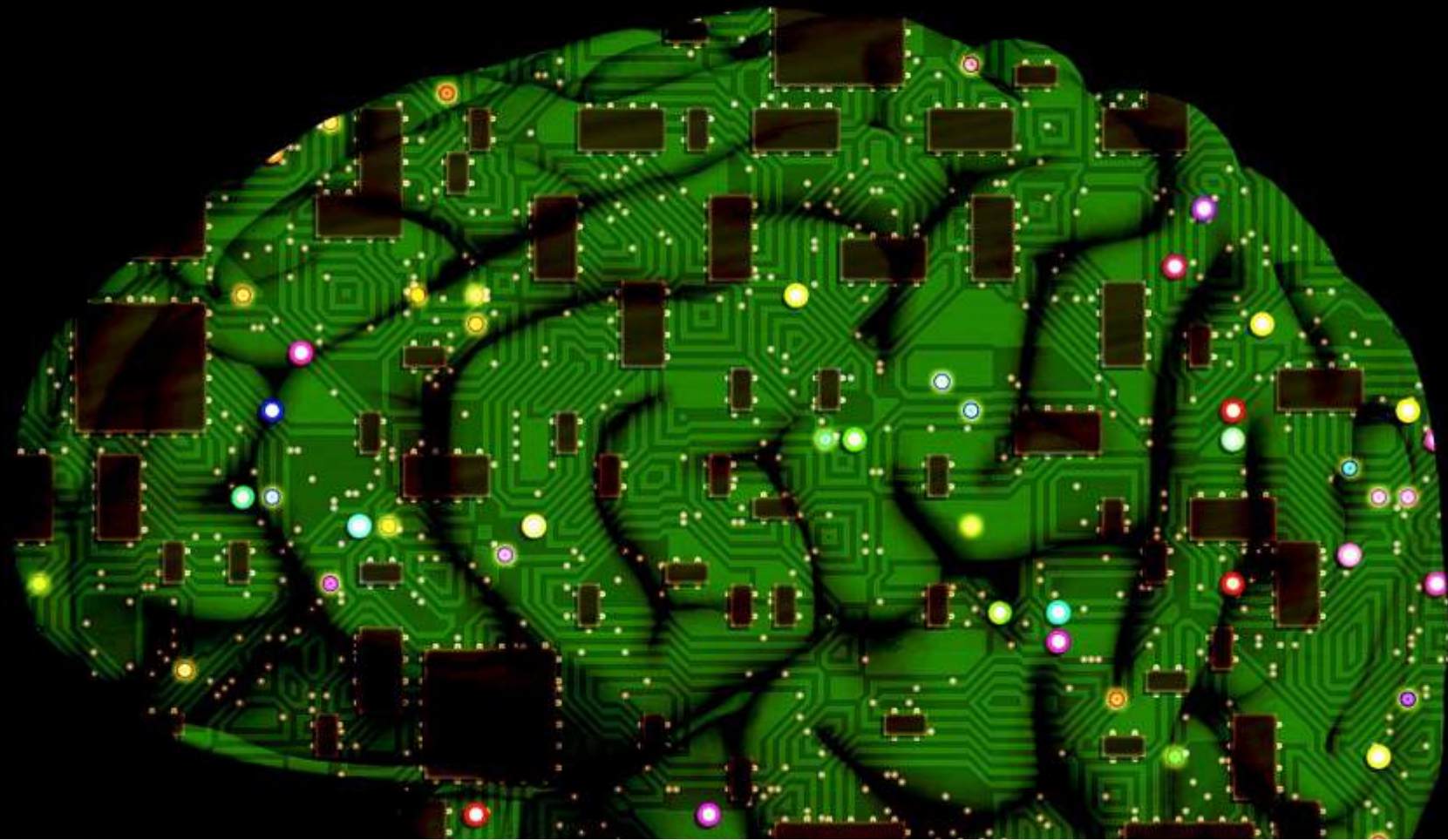


A blackboard sign is hanging from a red string against a rustic wooden wall. The sign has the German text 'HANDY bitte hier ausschalten' written in white chalk. To the right of the text, a white arrow points towards a wooden stump in the foreground. On top of the stump lies a hammer with a wooden handle and a metal head. The background consists of horizontal wooden planks.

HANDY bitte hier
ausschalten

Translation:
Please turn off cell
phones here =>

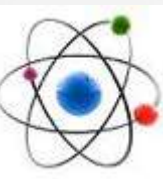




AN INTRODUCTION TO ARTIFICIAL INTELLIGENCE, MACHINE LEARNING, AND NEURAL NETWORKS

ATA58

Carola F. Berger



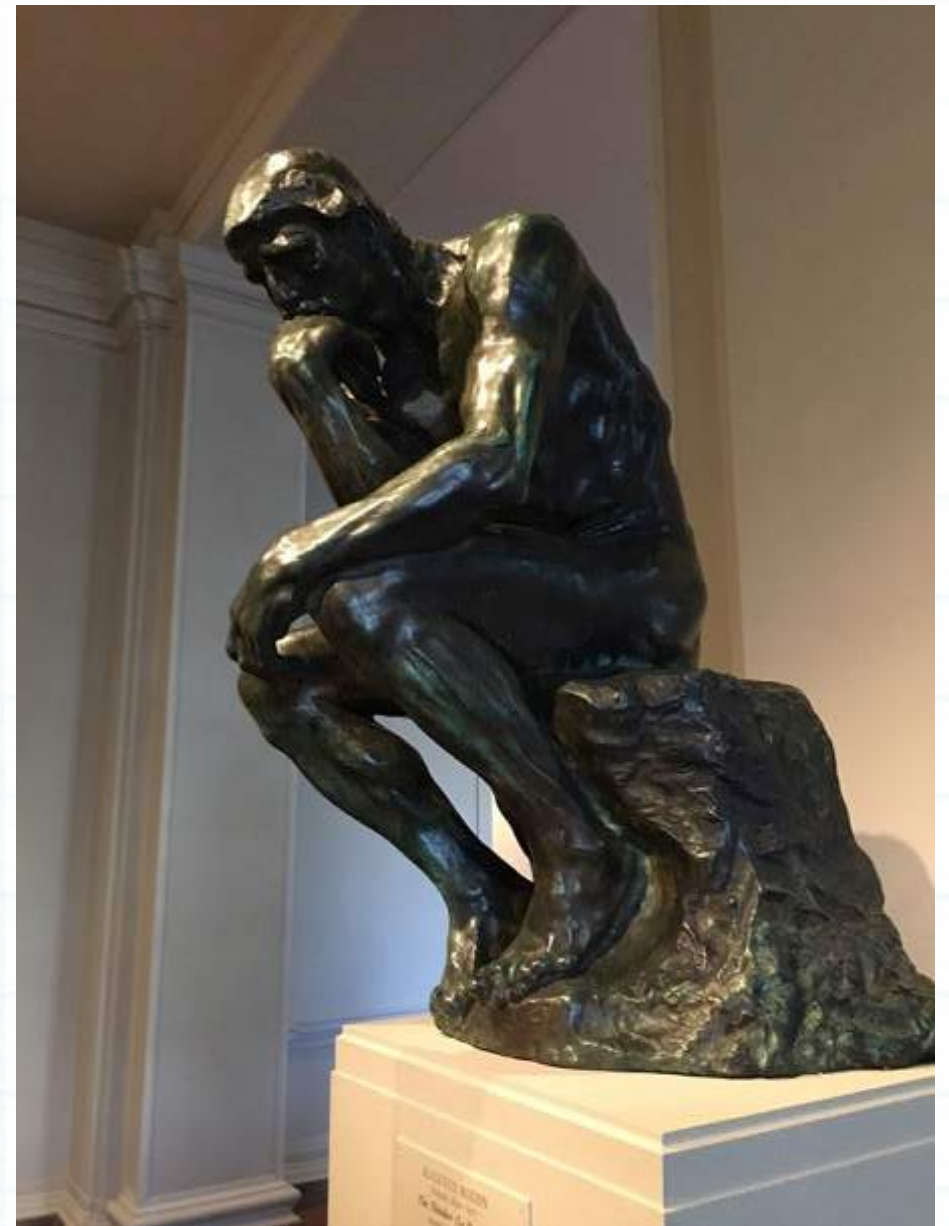
OUTLINE

- What is Artificial Intelligence (AI)?
- What does it do?
- How does it work?
- Will there be a robot apocalypse?
- References and Further Reading



WHAT IS AI?

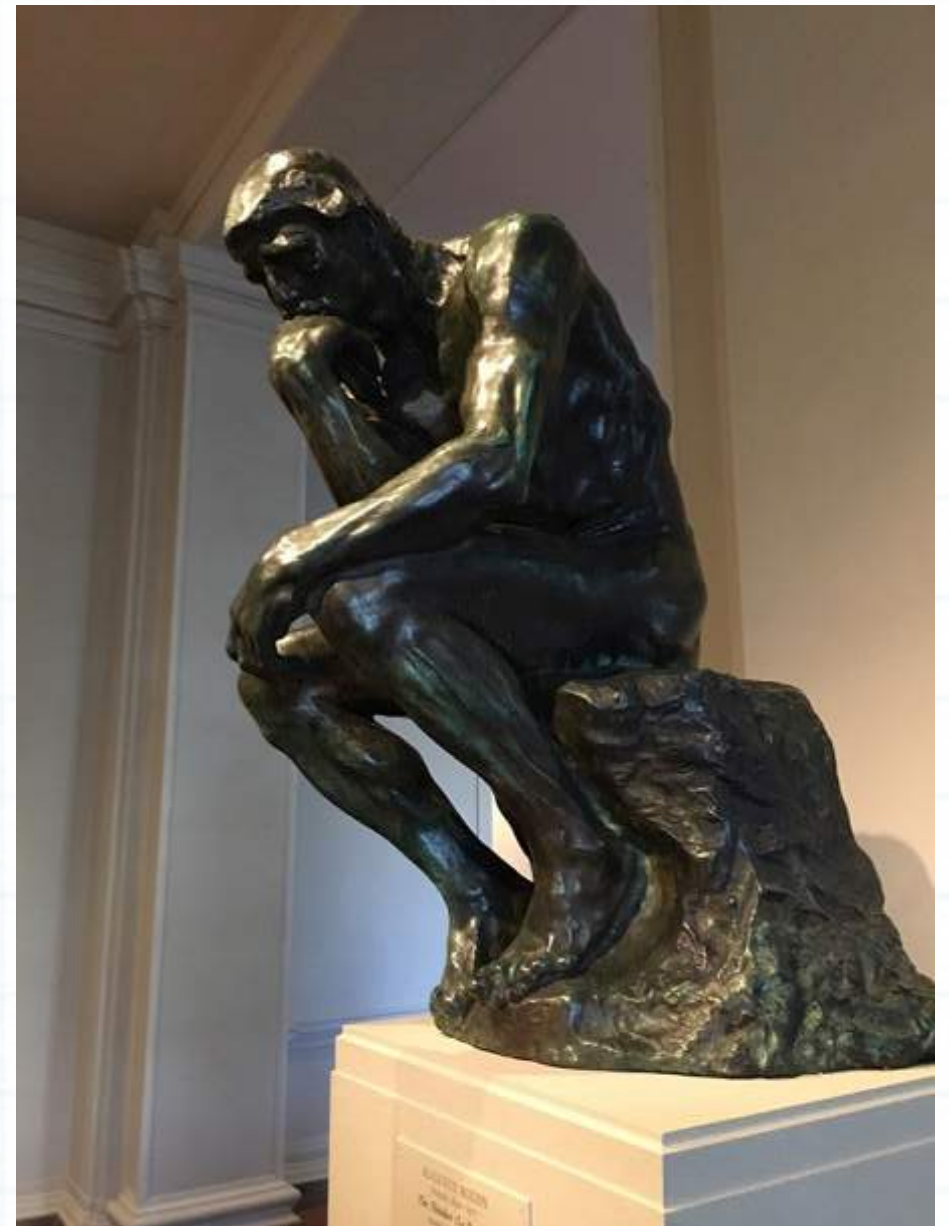
→ What is “intelligence”?



WHAT IS AI?

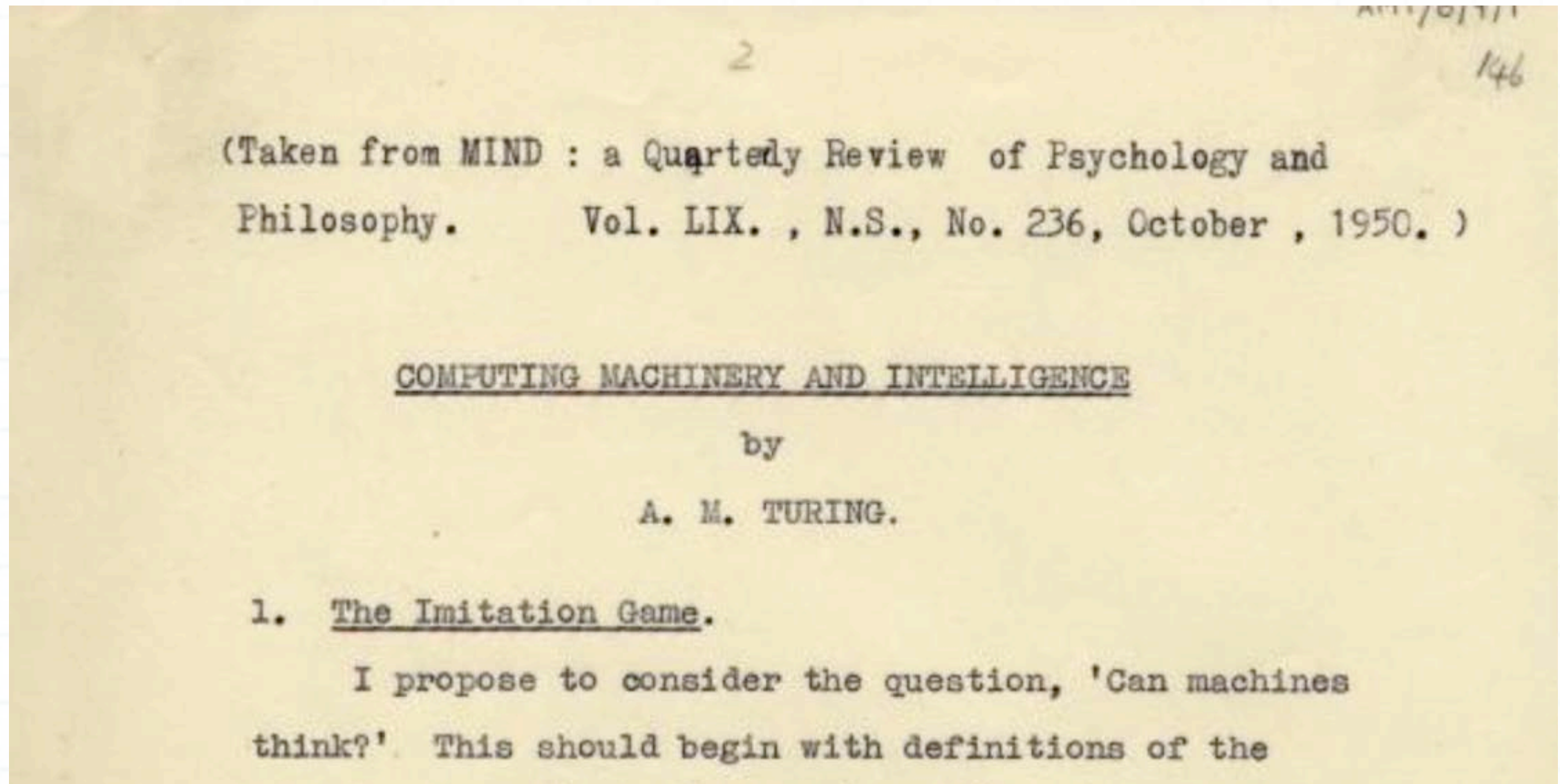
→ What is “intelligence”?

Merriam-Webster:
“the ability to learn or
understand or to deal
with new or trying
situations”



WHAT IS AI?

→ What is "intelligence"?



turingarchive.org



WHAT IS AI?

→ What is “intelligence”?

**MIT
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Review**

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Intelligent Machines

AI's Language Problem

Machines that truly understand language would be incredibly useful. But we don't know how to build them.

by Will Knight August 9, 2016



WHAT IS AI?

→ What is “machine learning”?



WHAT IS AI?

→ What is “machine learning”?

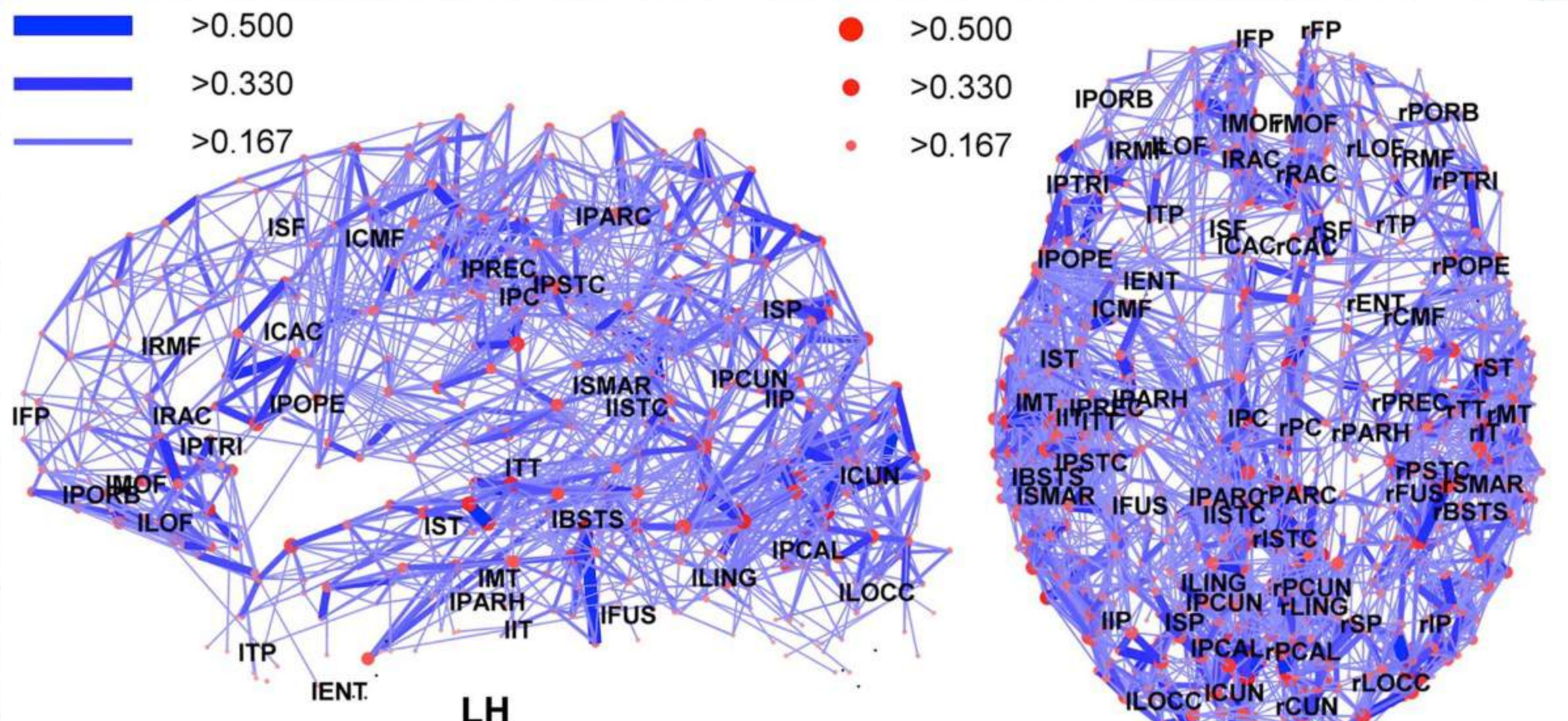
“‘Machine learning’ is a fancy way of saying ‘finding patterns in data.’”

Kirti Vashee



WHAT IS AI?

→ What is “deep learning”?



Hagmann P, Cammoun L, Gigandet X, Meuli R, Honey CJ, Wedeen VJ, Sporns O (2008) Mapping the structural core of human cerebral cortex. PLoS Biology Vol. 6, No. 7, e159.



WHAT IS AI?

→ What is “deep learning”?

Artificial neural nets are not a new idea:

W. McCulloch, W. Pitts, 1943

D. O. Hebb, 1949

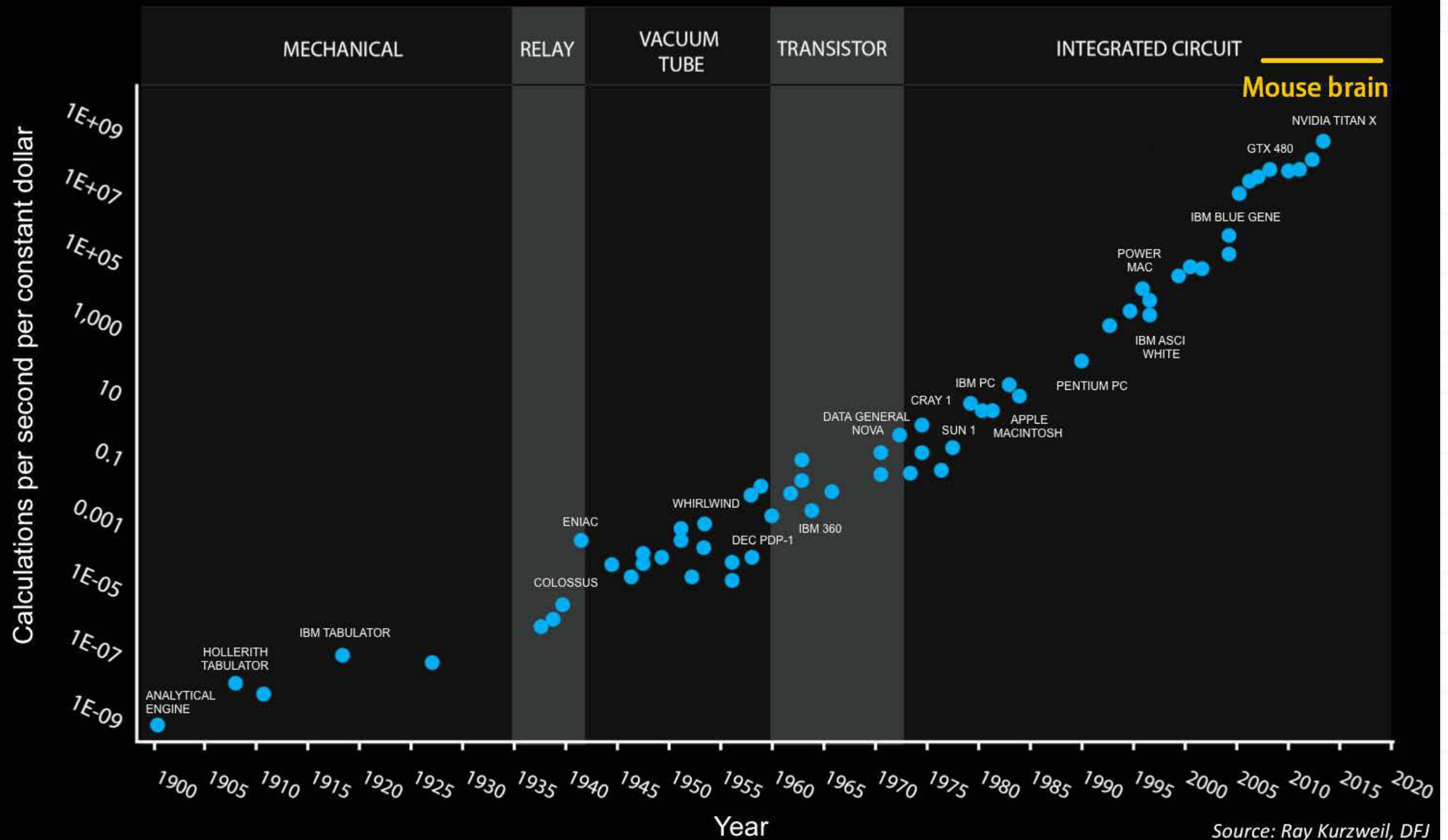
B. G. Farley, W. A. Clark, 1954

...



120 Years of Moore's Law

Human brain

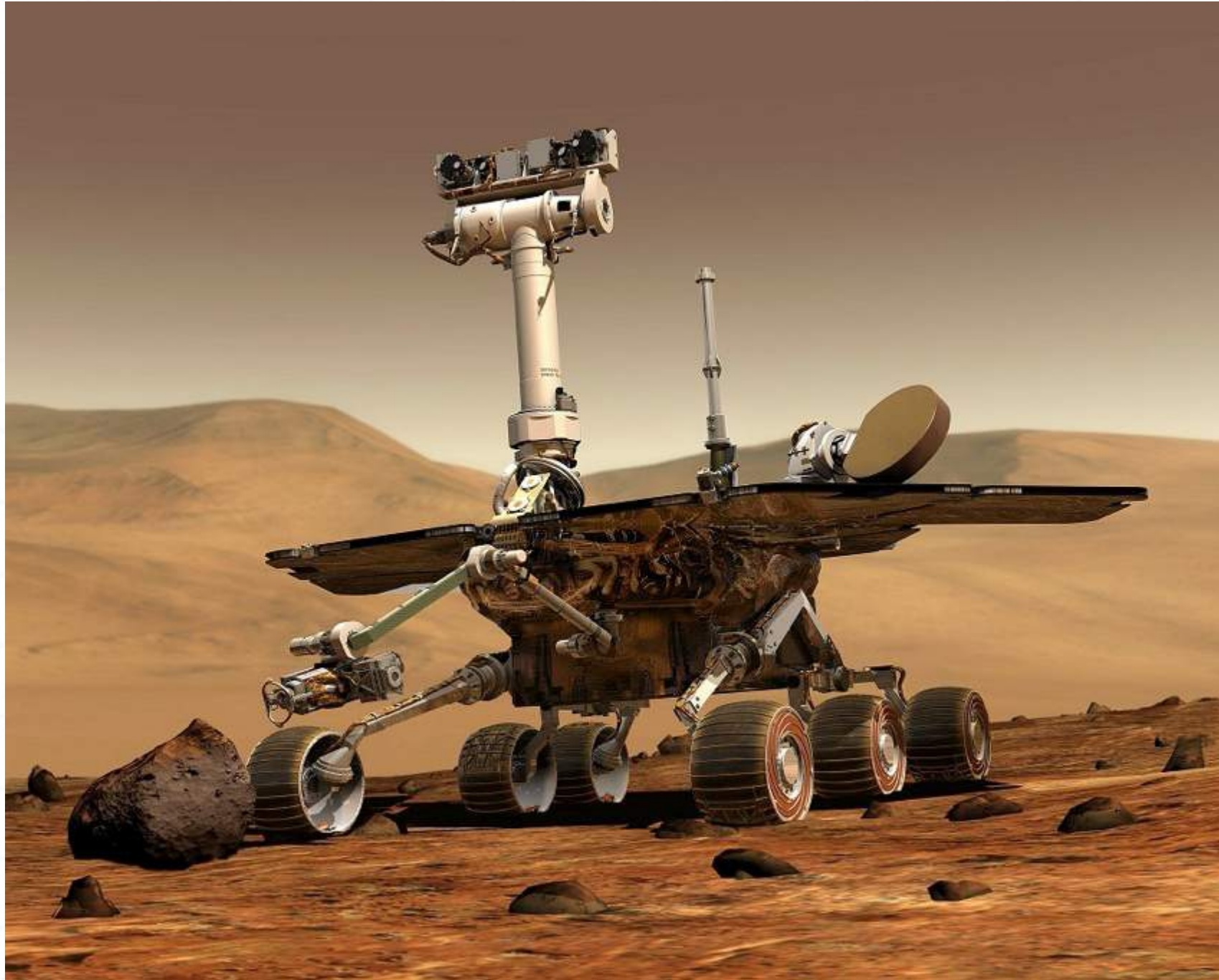


Adapted from: S. Jurvetson, <https://www.flickr.com/photos/jurvetson/31409423572>



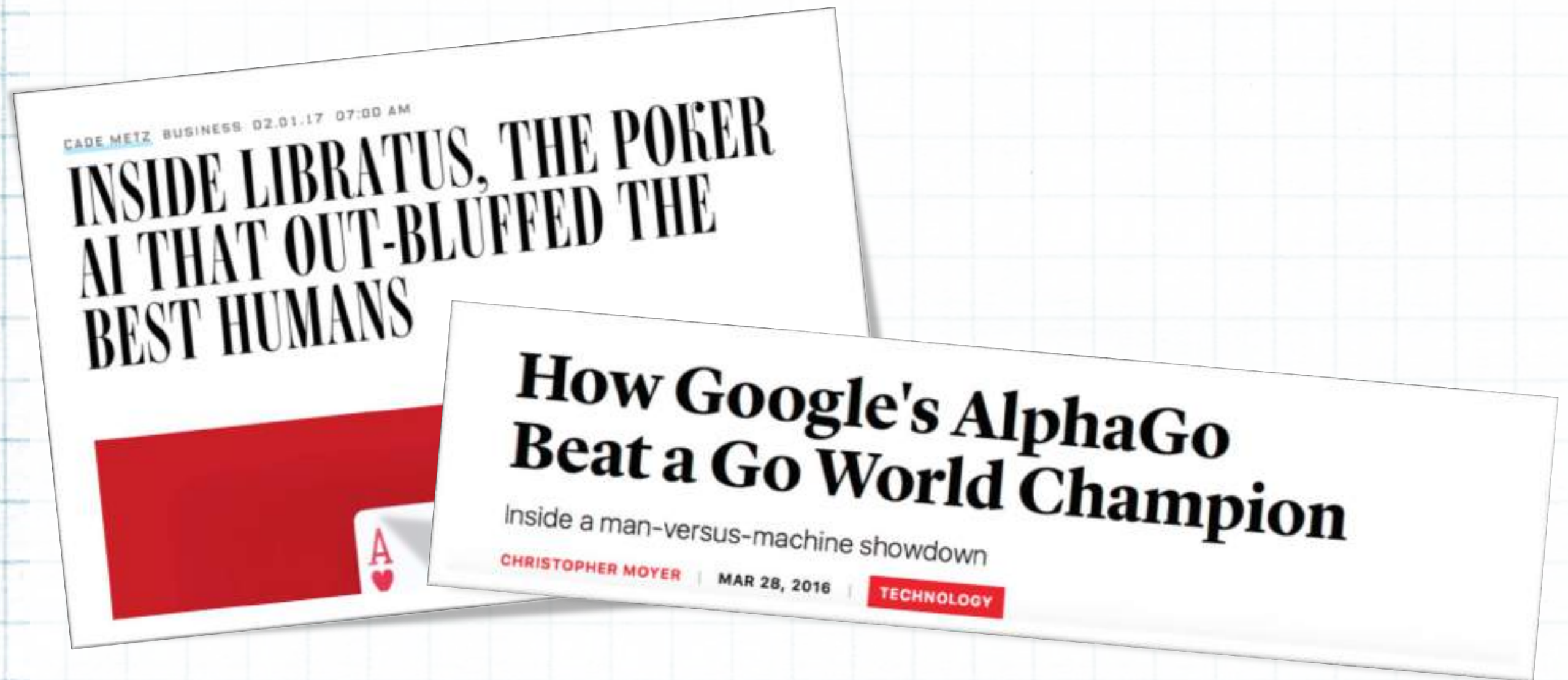
Carola F. Berger, AI and Neural Nets, /ATA58

WHAT DOES AI DO?



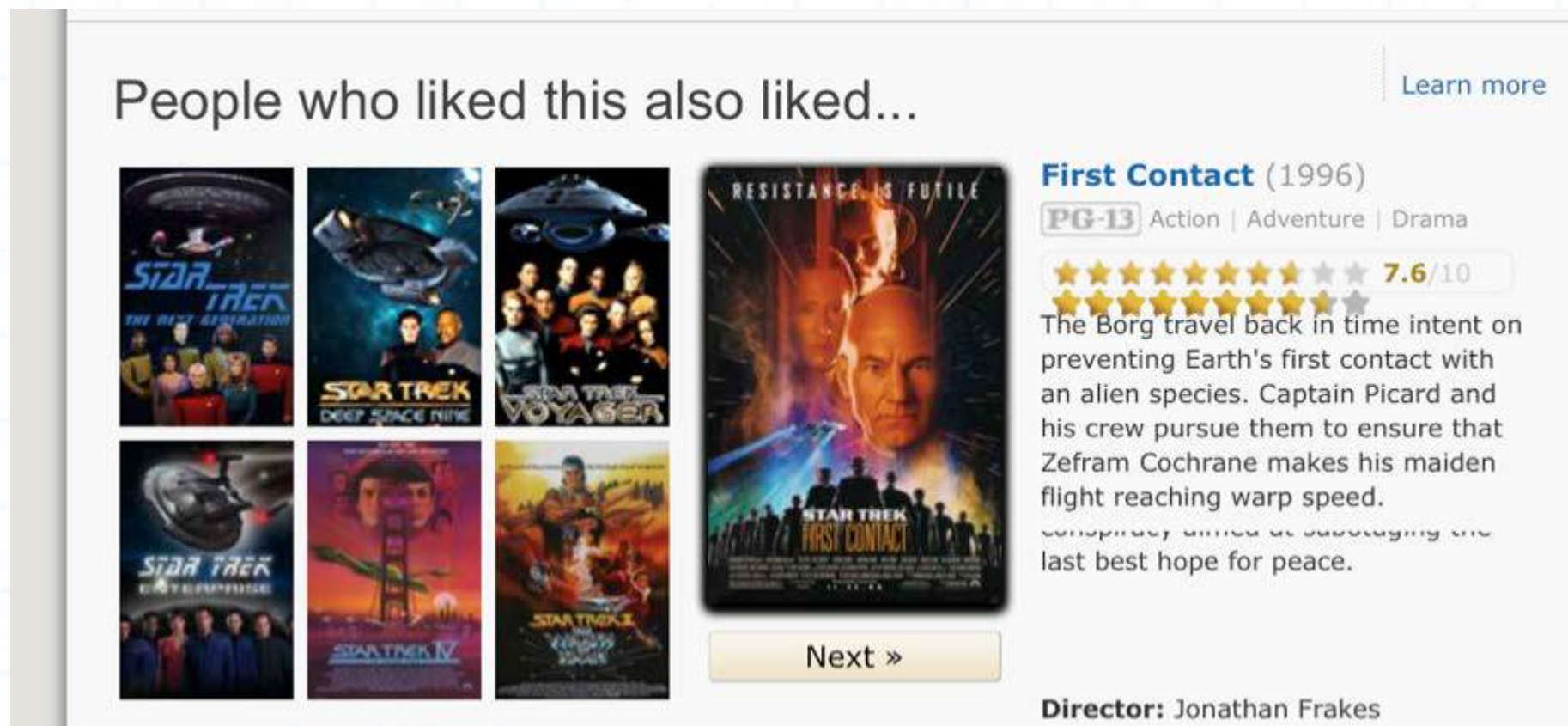
WHAT DOES AI DO?

→ Play games and win



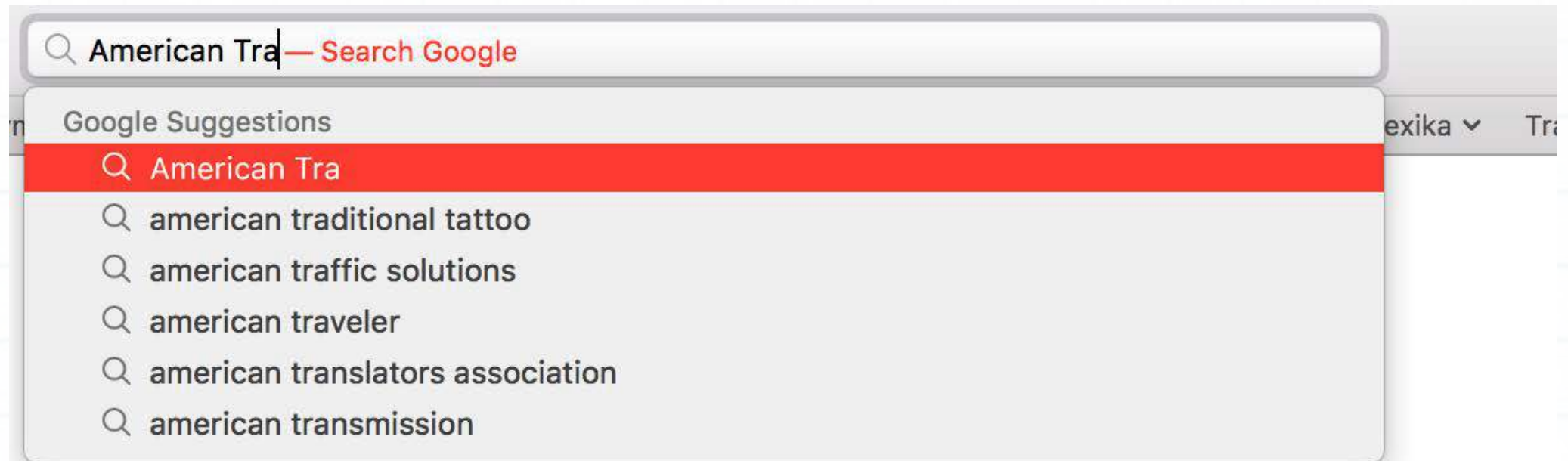
WHAT DOES AI DO?

- Automated classification
- Object recognition
- Recommender systems



WHAT DOES AI DO?

→ Predictive typing



→ Text-to-speech, speech-to-text

→ (Neural) machine translation



WHAT DOES AI DO?

→ Financial trading

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→ Legal assistance

A \$96 billion fund firm created a AI hedge fund, but freaked out when it couldn't explain how it made money

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A.I. Is Doing Legal Work. But It Won't Replace Lawyers, Yet.

In Silicon Valley, a Voice of Caution Guides a High-Flying Uber

Two Executives to Leave Uber, Adding to Departures

BITS Riding With Underdogs: Void Left by

TECHNOLOGY

A.I. Is Doing Legal Work. But It Won't Replace Lawyers, Yet.

By STEVE LOHR MARCH 19, 2017

Impressive advances in artificial intelligence technology tailored for legal



WHAT DOES AI DO?

→ Self-driving cars



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International Edition +

Cop pulls over Google self-driving car, finds no driver to ticket



WHAT DOES AI DO?

→ Chat and social media bots



Bob: i can i i everything else

Alice: balls have zero to me to me to me to me to me to me to me to me to me to

Bob: you i everything else

Alice: balls have a ball to me to me to me to me to me to me to me to me

Bob: i i can i i i everything else

Alice: balls have a ball to me to me to me to me to me to me to me to me

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Alice: balls have zero to me to me to me to me to me to me to me to me to me to

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Bob: you i i i everything else

Alice: balls have zero to me to me to me to me to me to me to me to me to me to



WHAT DOES AI DO?

→ Design inspirational posters



WHAT DOES AI DO?

→ Name rescued guinea pigs

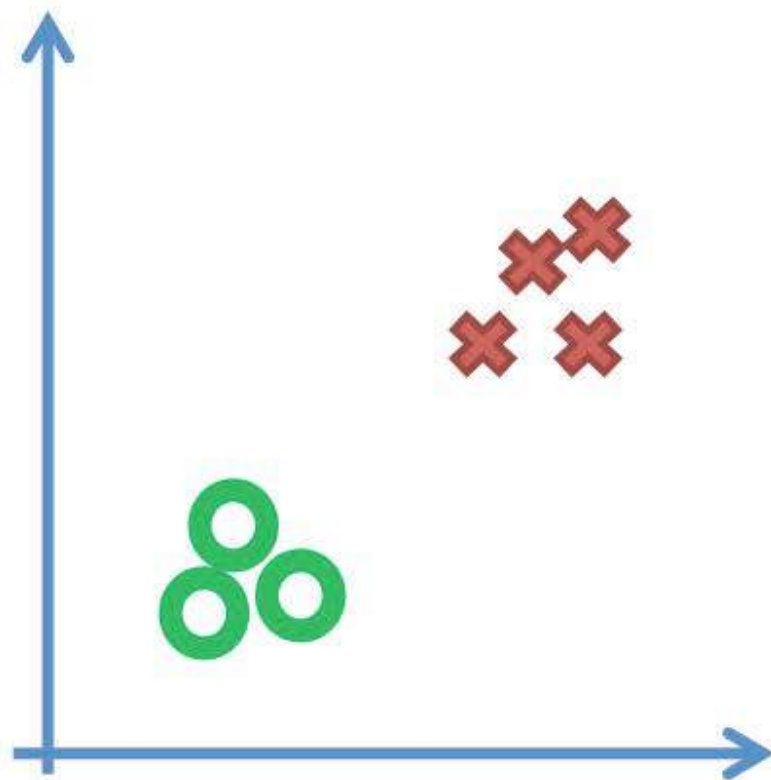


J. Shane, <http://lewisandquark.tumblr.com>

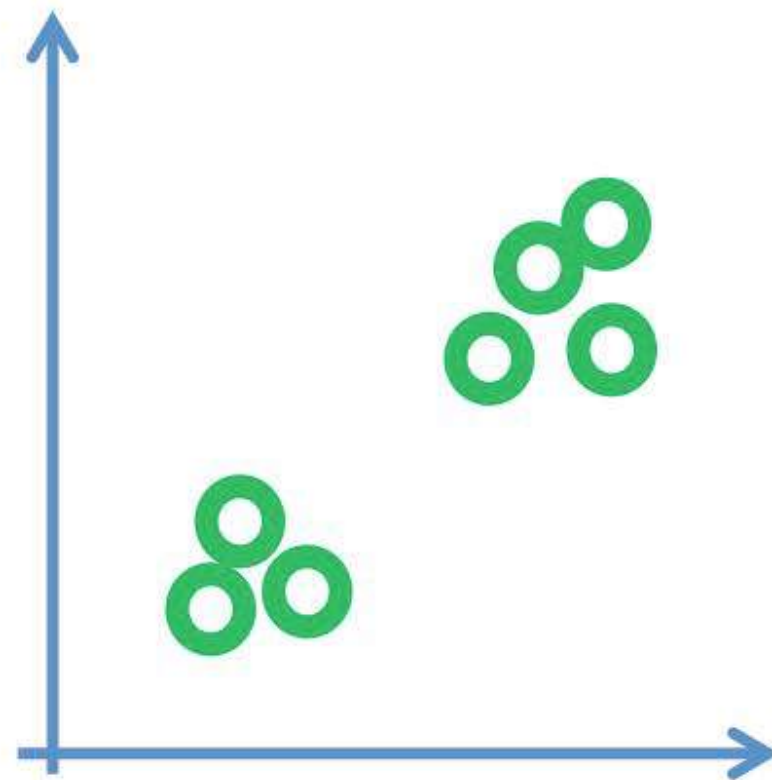


WHAT DOES AI DO?

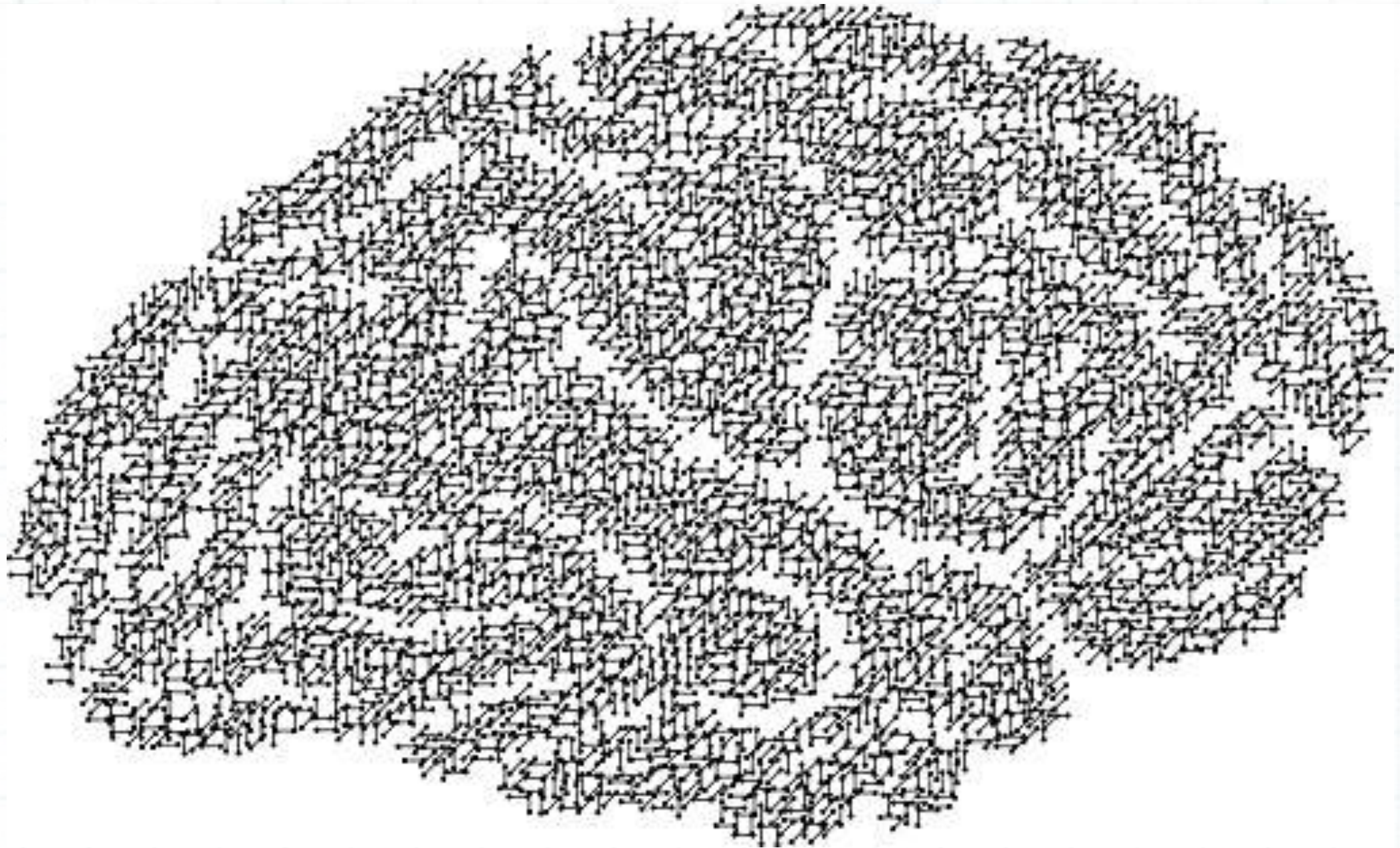
→ Supervised learning



Unsupervised learning

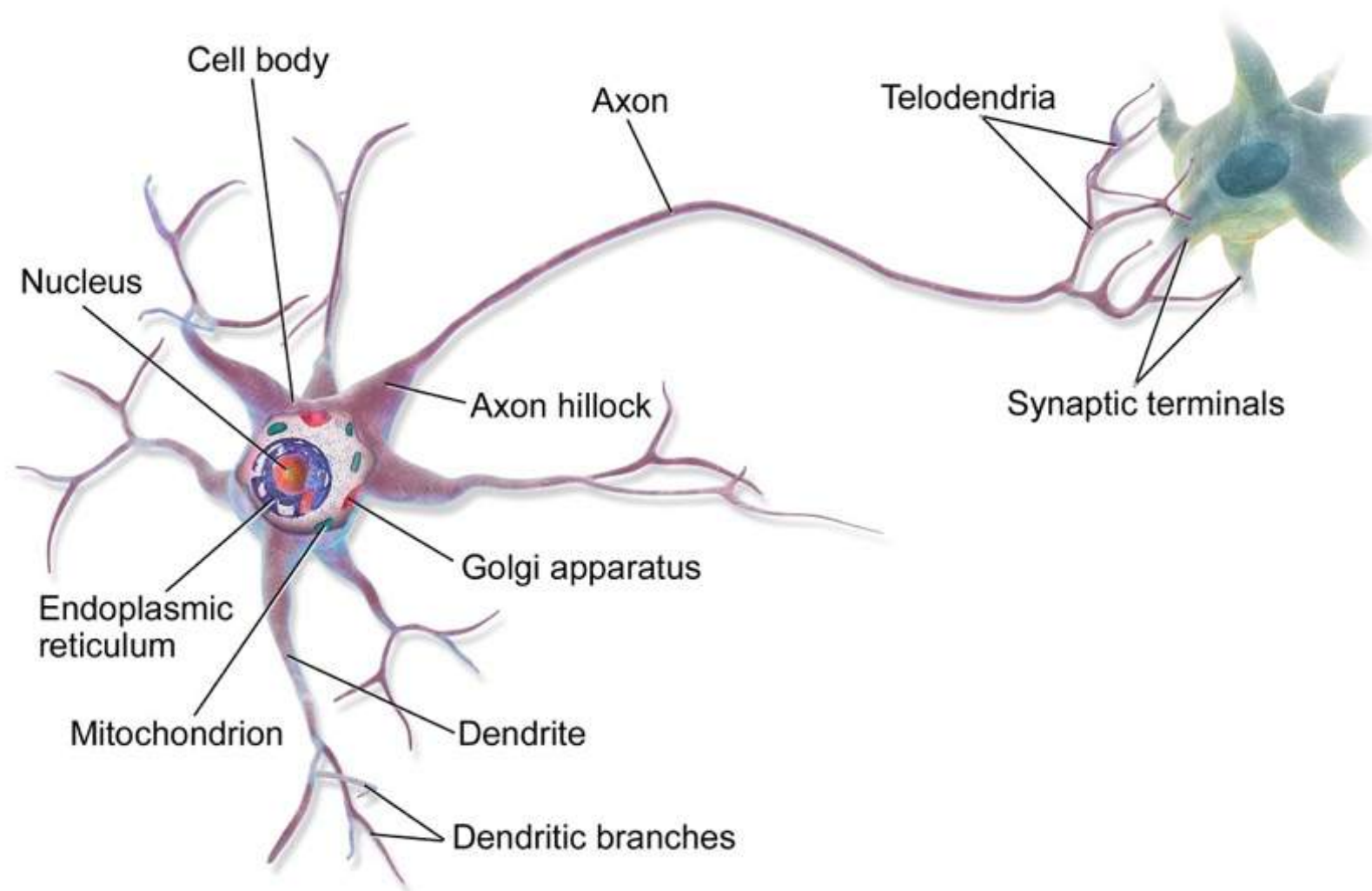


HOW DOES IT WORK?



HOW DOES IT WORK?

→ Neuron:

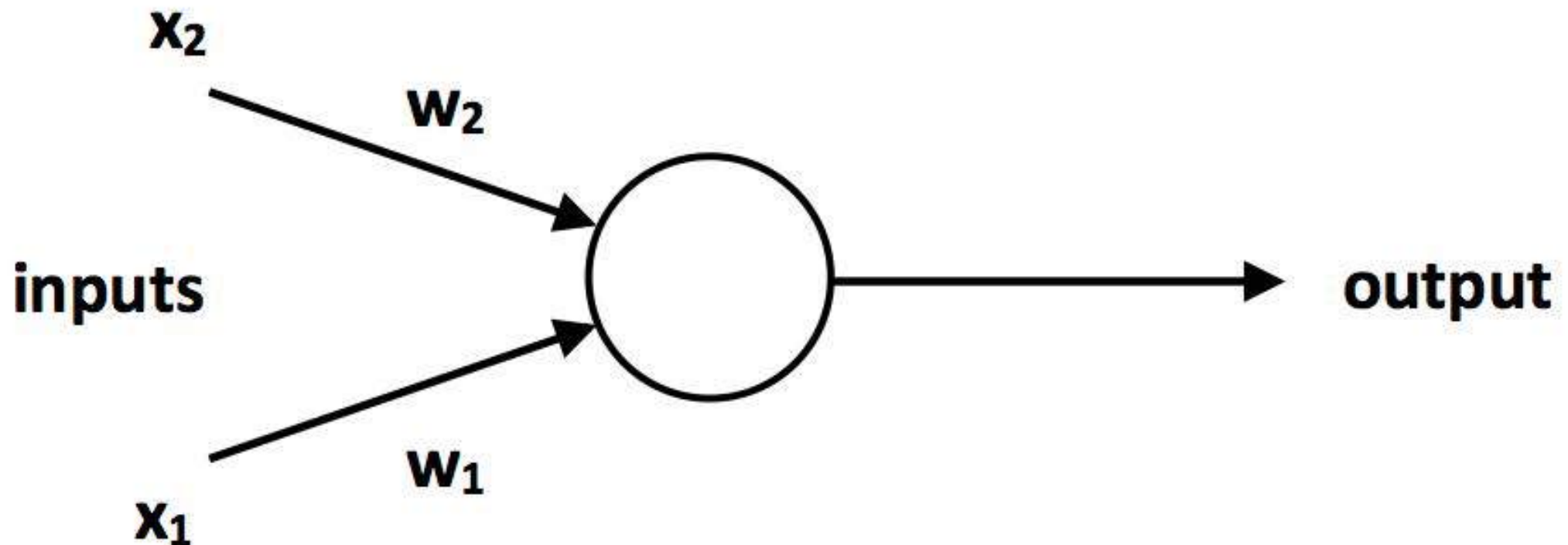


Bruce Blaus, https://commons.wikimedia.org/wiki/File:Blausen_0657_MultipolarNeuron.png



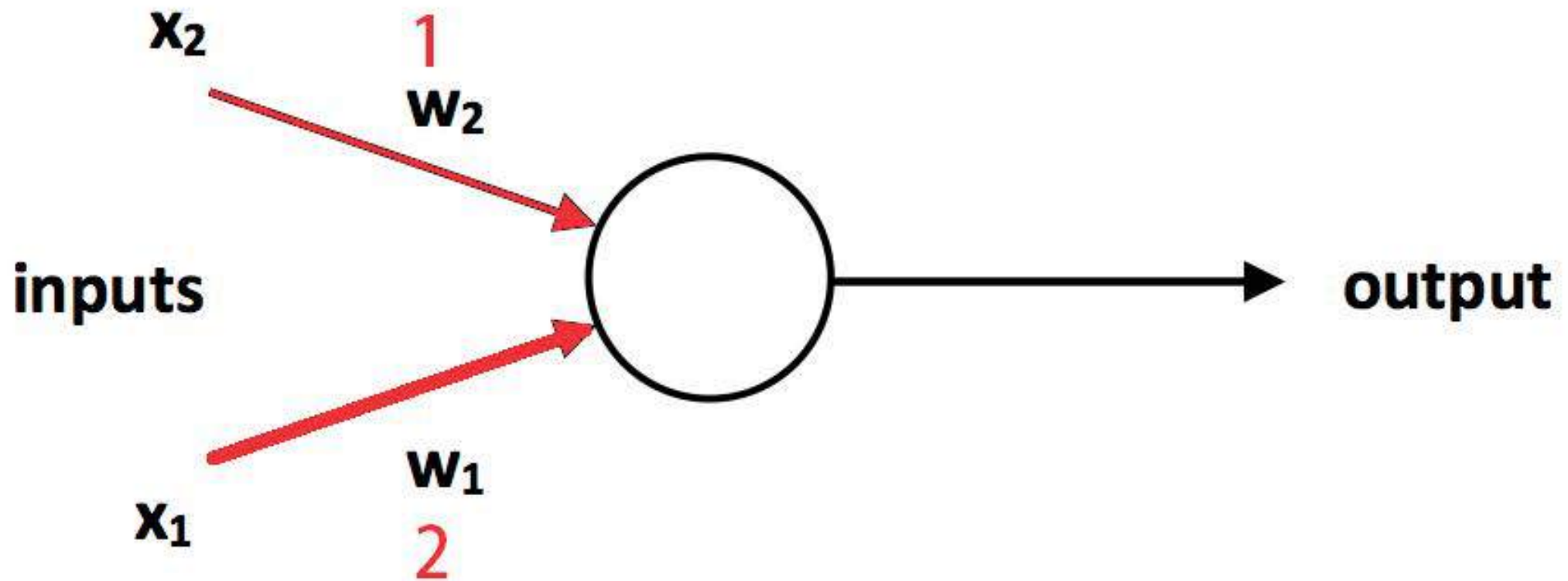
HOW DOES IT WORK?

→ Unit in artificial neural net:



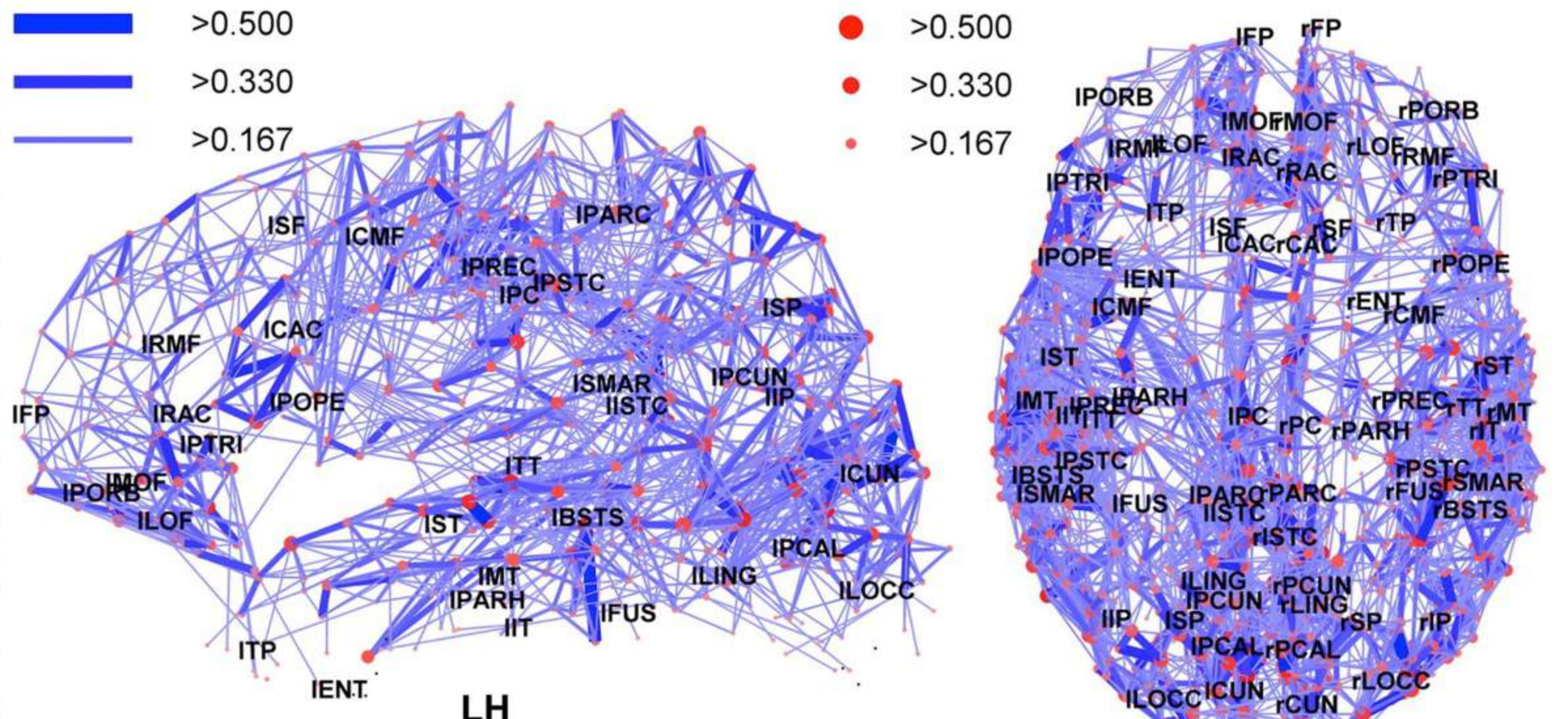
HOW DOES IT WORK?

→ Unit in artificial neural net:



HOW DOES IT WORK?

→ Neural network:

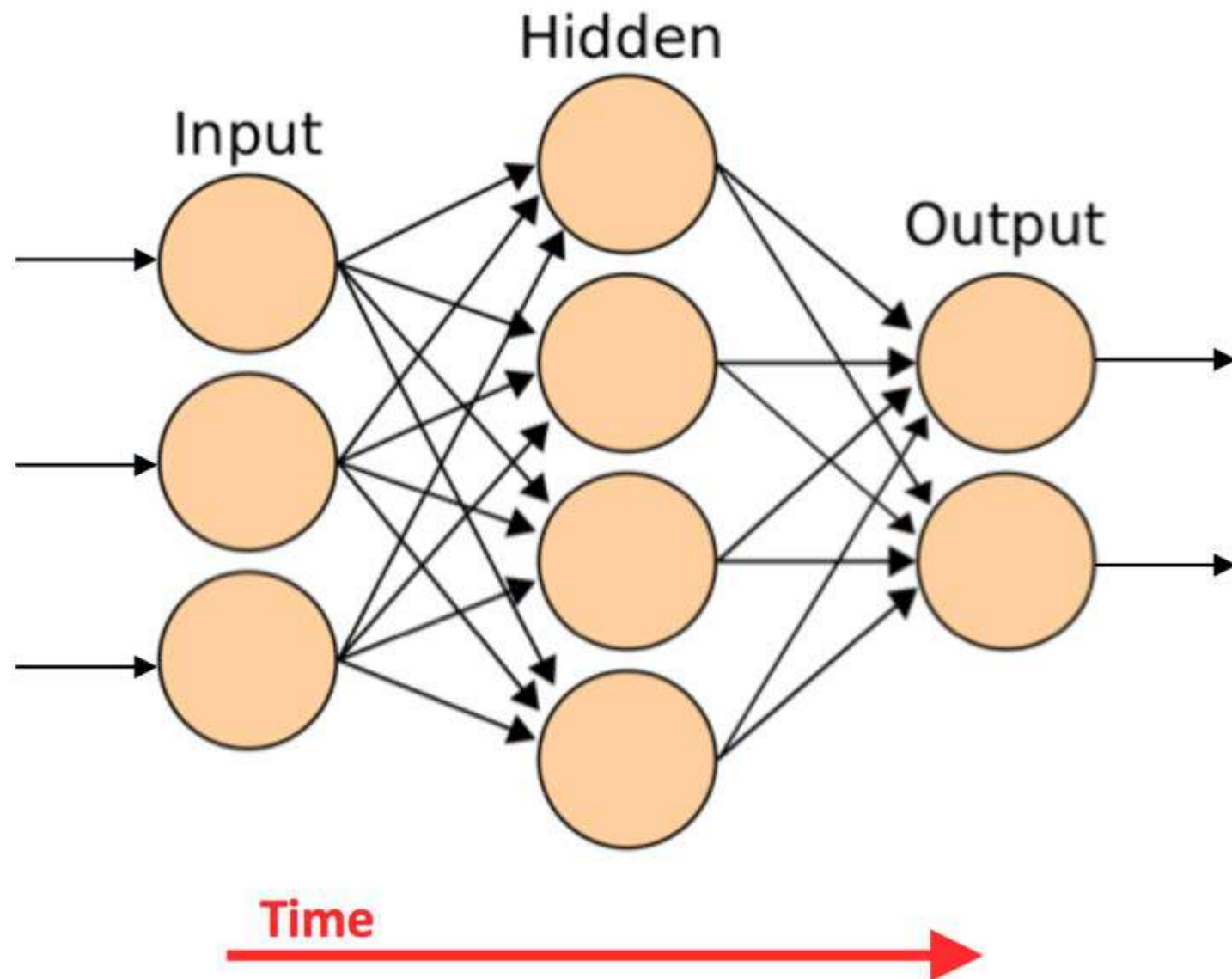


Hagmann P, Cammoun L, Gigandet X, Meuli R, Honey CJ, Wedeen VJ, Sporns O (2008) Mapping the structural core of human cerebral cortex. PLoS Biology Vol. 6, No. 7, e159.



HOW DOES IT WORK?

→ Neural network:

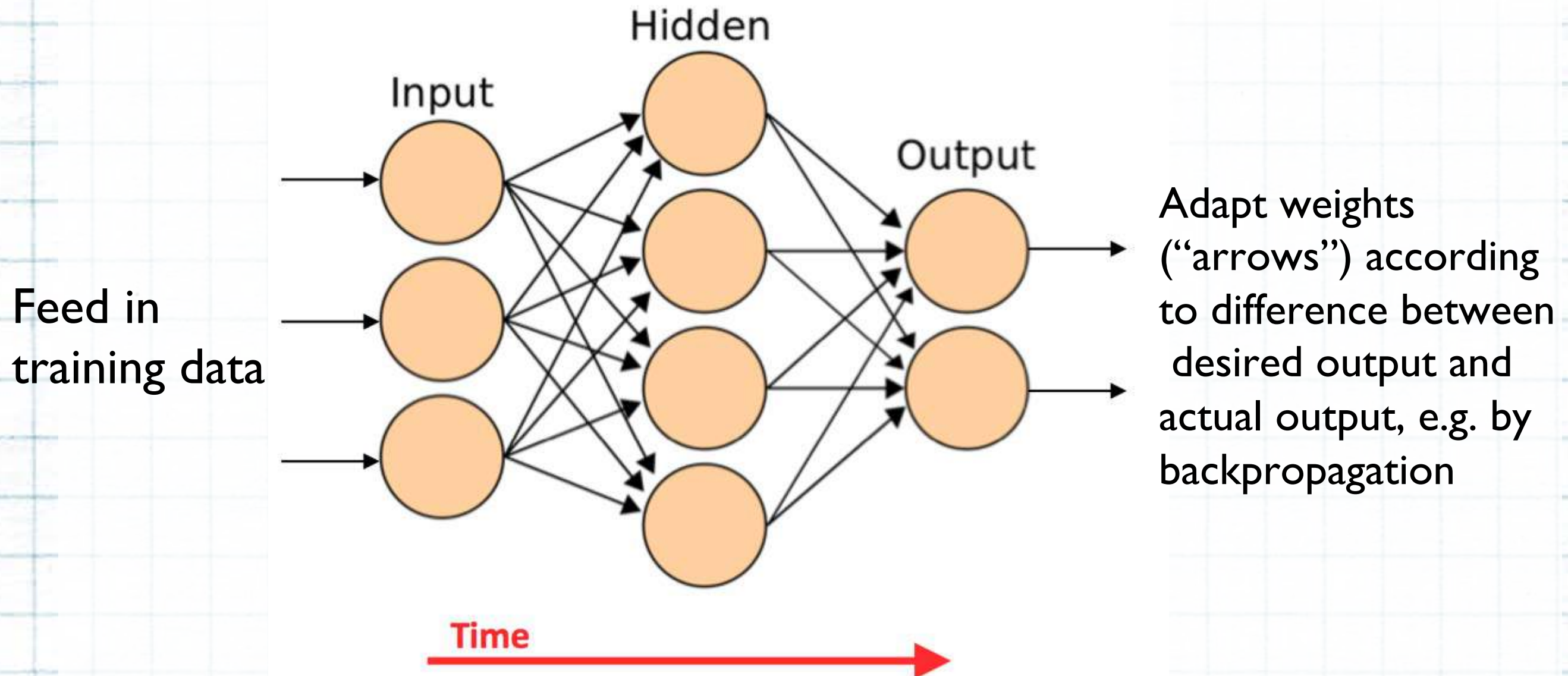


Adapted from: Cburnett, https://commons.wikimedia.org/wiki/File:Artificial_neural_network.svg



HOW DOES IT WORK?

→ Neural network – training:



Adapted from: Cburnett, https://commons.wikimedia.org/wiki/File:Artificial_neural_network.svg



AUTOPSY OF A NEURAL NET



AUTOPSY OF A NEURAL NET

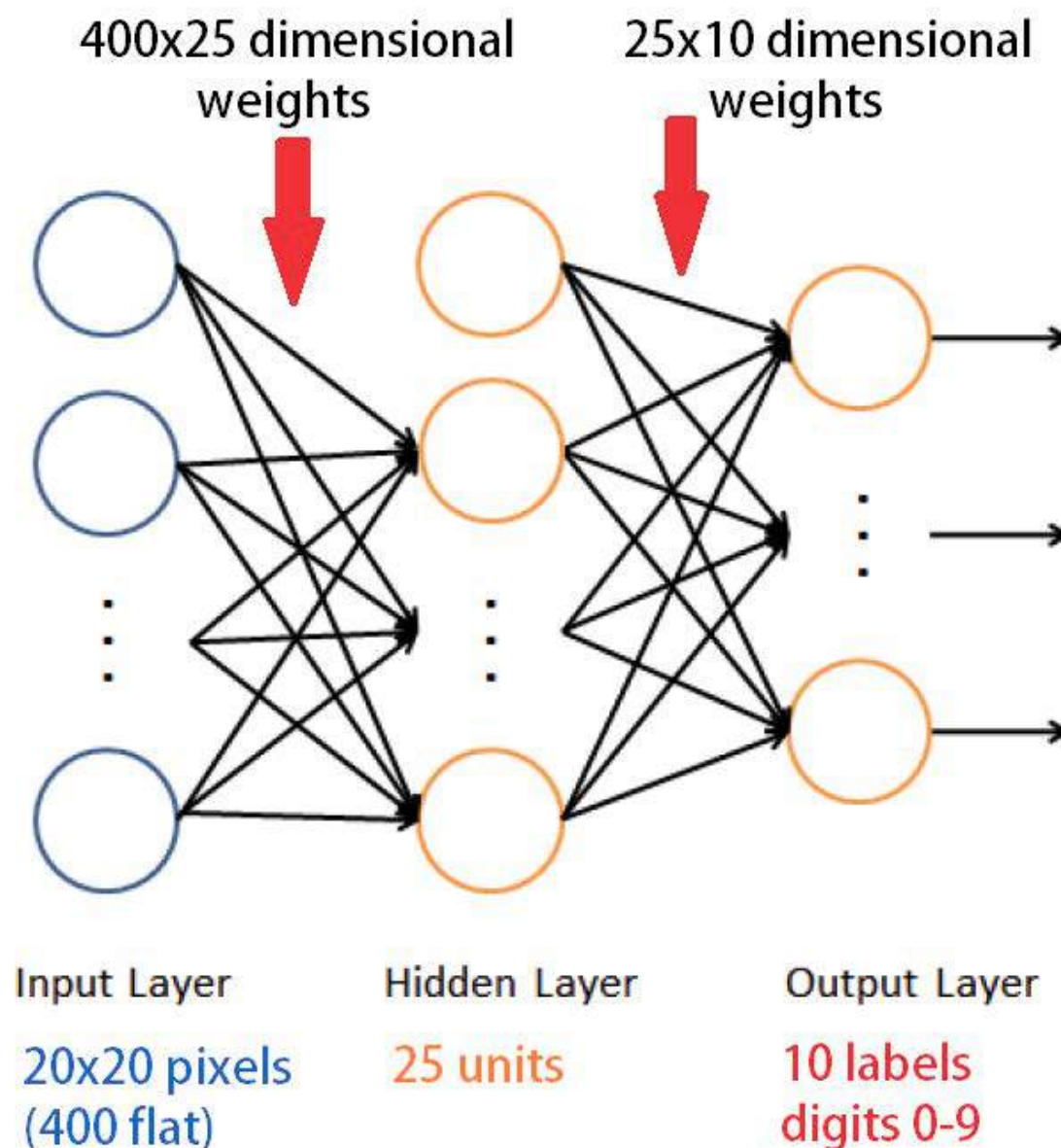
Neural net to recognize hand-written digits

8	9	3	1	4	5	9	0	3	3
5	3	7	6	7	5	8	8	5	3
8	9	8	5	7	2	0	9	8	4
4	6	6	6	0	3	9	6	8	9
8	1	8	3	5	9	3	3	2	7
8	5	1	3	9	8	2	0	8	7
9	8	8	1	5	6	5	9	4	9
6	5	0	0	2	7	4	8	3	1
4	5	2	2	2	1	2	4	8	1
4	6	9	2	2	7	6	0	8	5



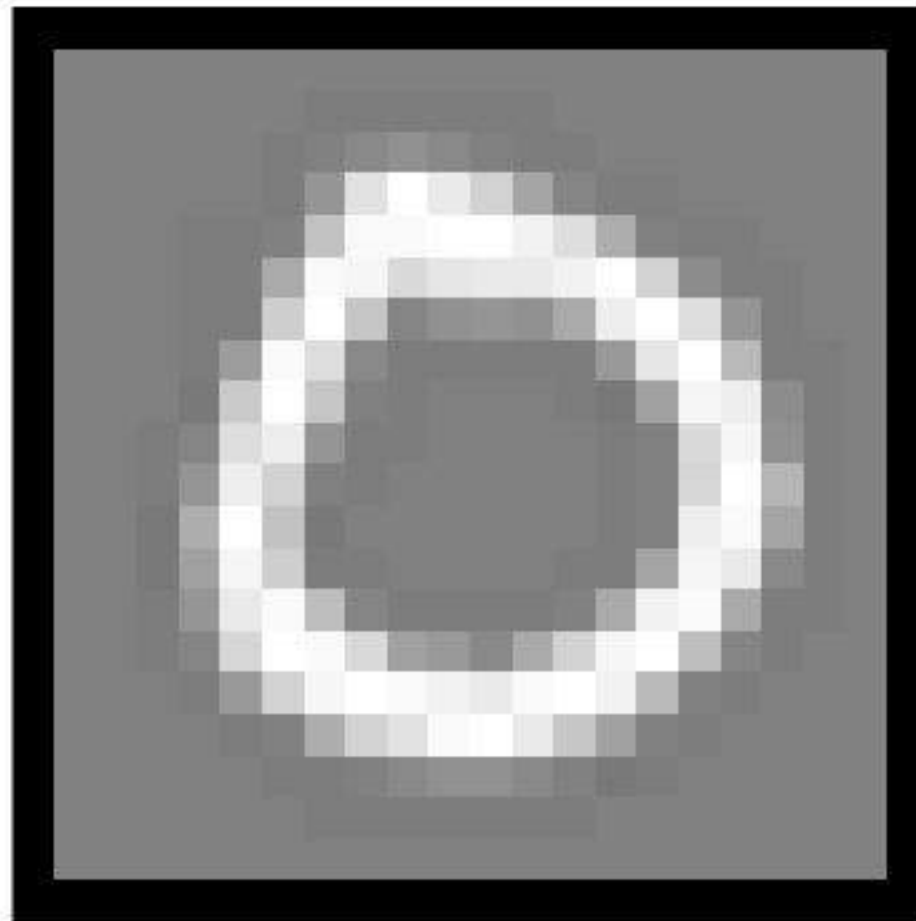
AUTOPSY OF A NEURAL NET

Neural net to recognize hand-written digits



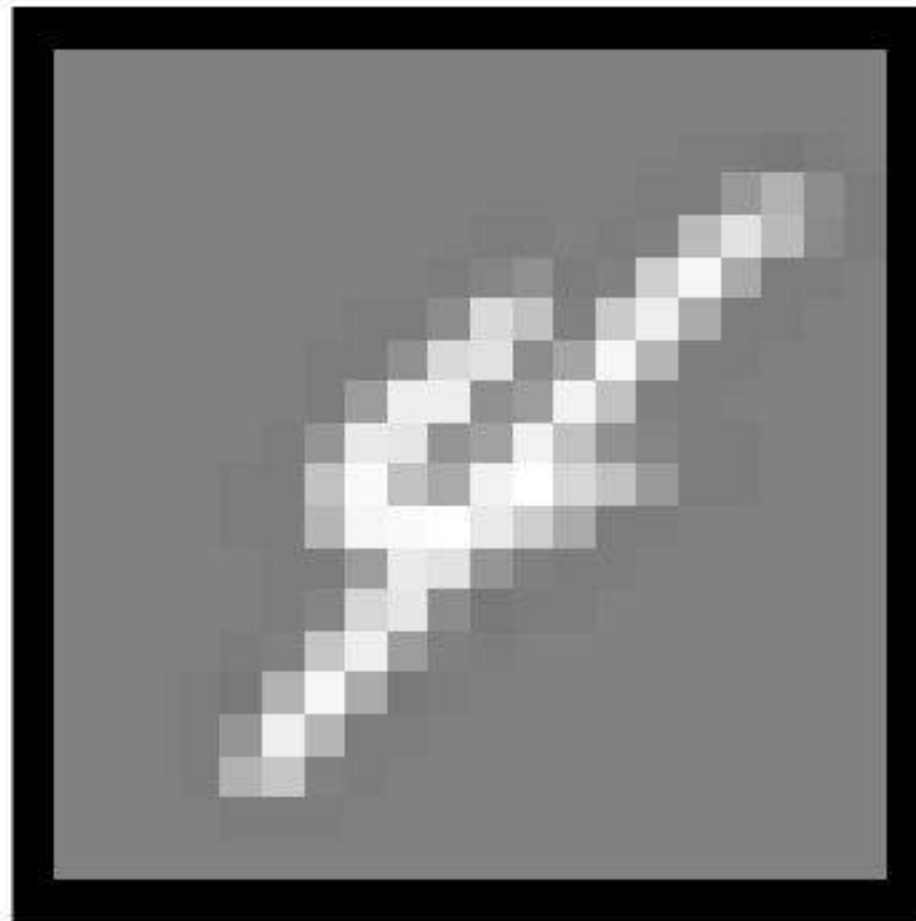
AUTOPSY OF A NEURAL NET

Sample input (20x20 pixels)



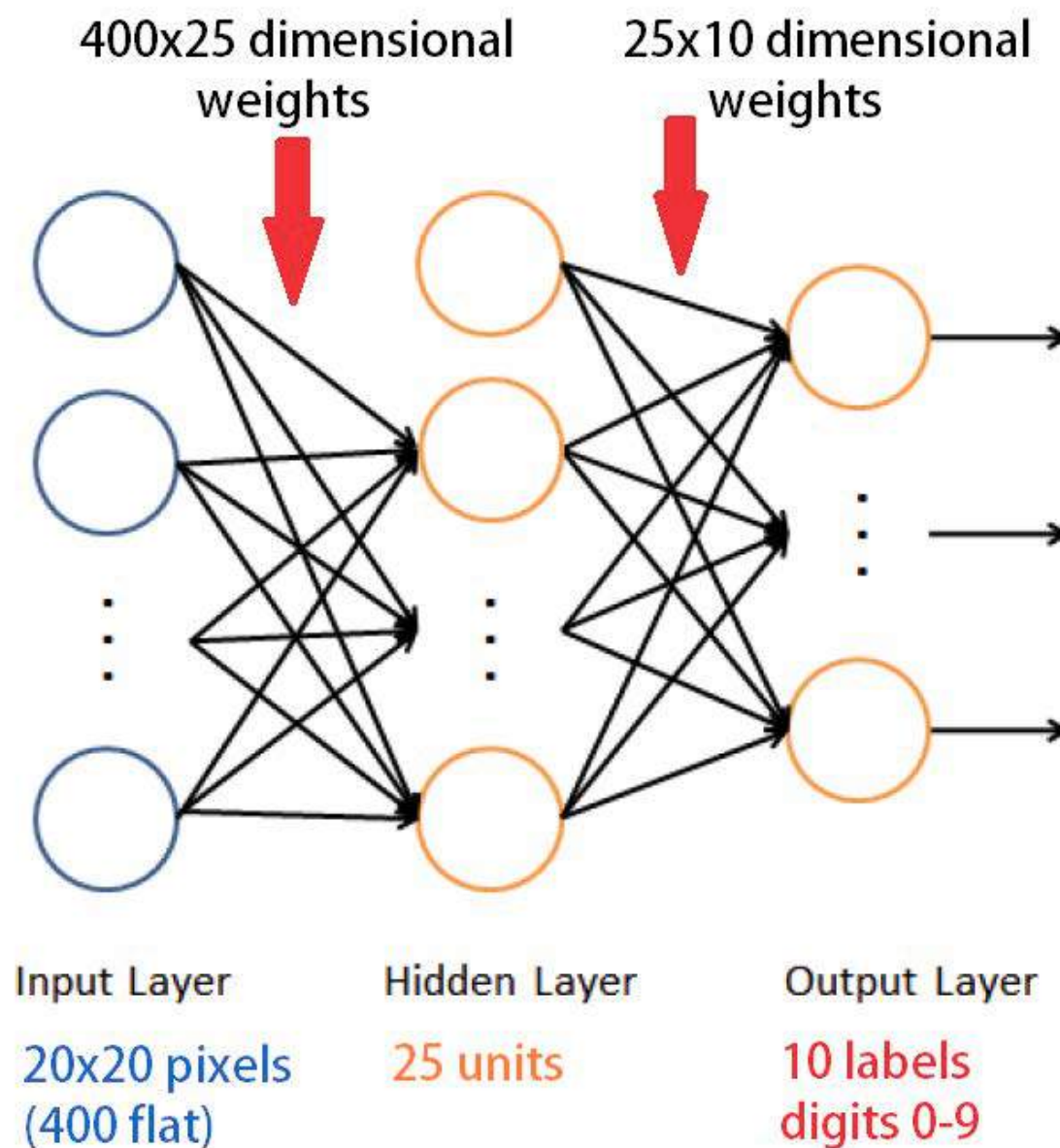
AUTOPSY OF A NEURAL NET

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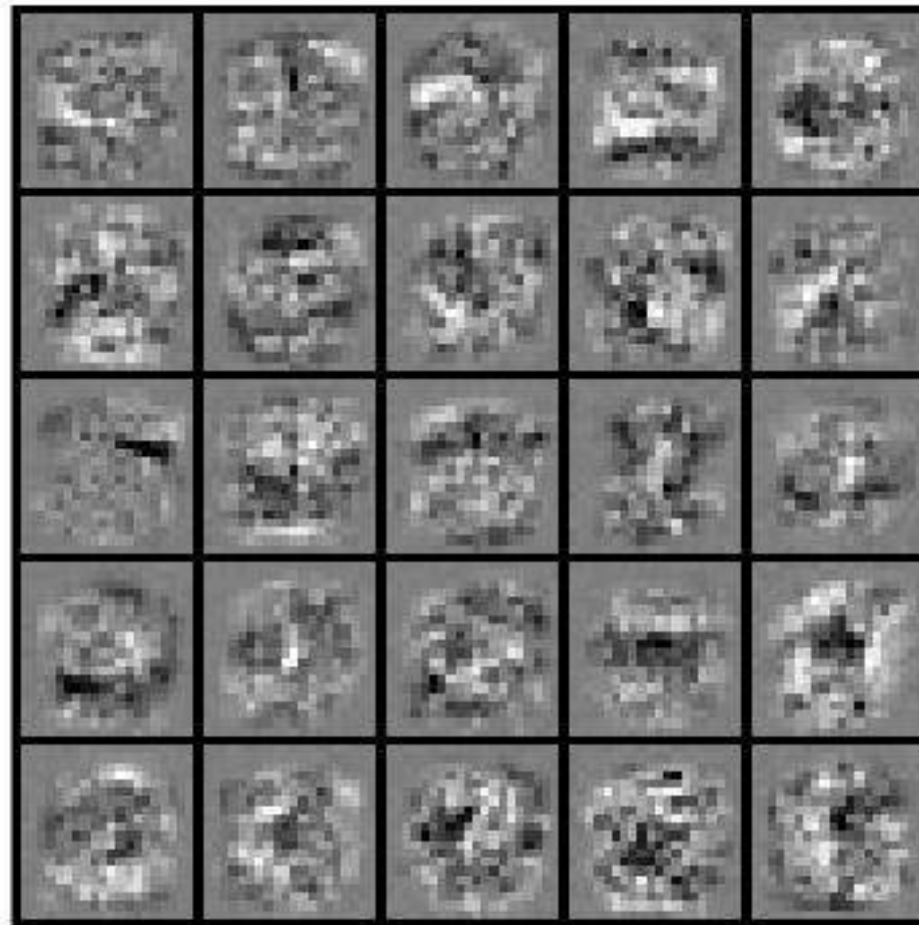
AUTOPSY OF A NEURAL NET

Weights to hidden units



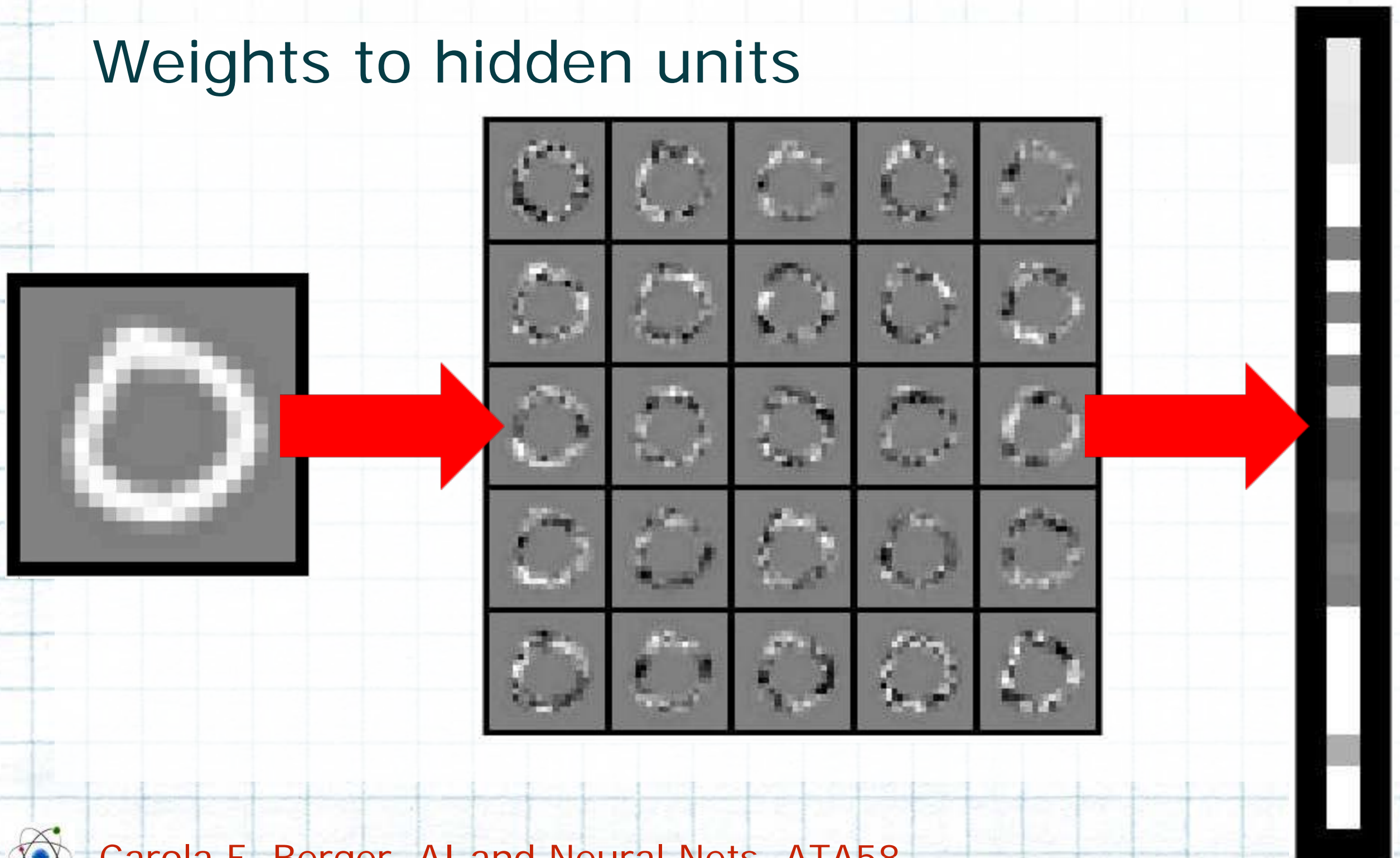
AUTOPSY OF A NEURAL NET

Weights to hidden units –
“feature” extraction



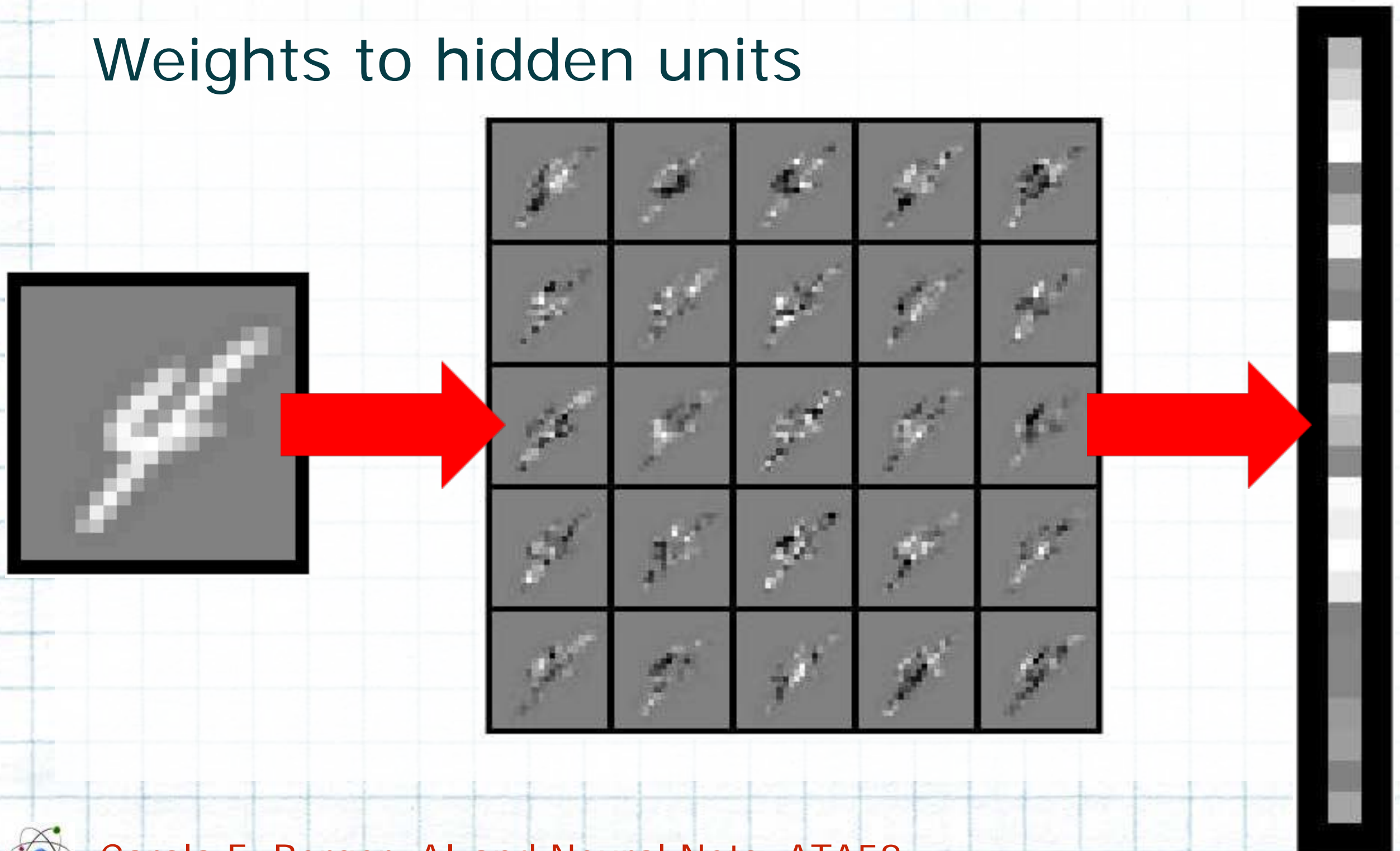
AUTOPSY OF A NEURAL NET

Weights to hidden units



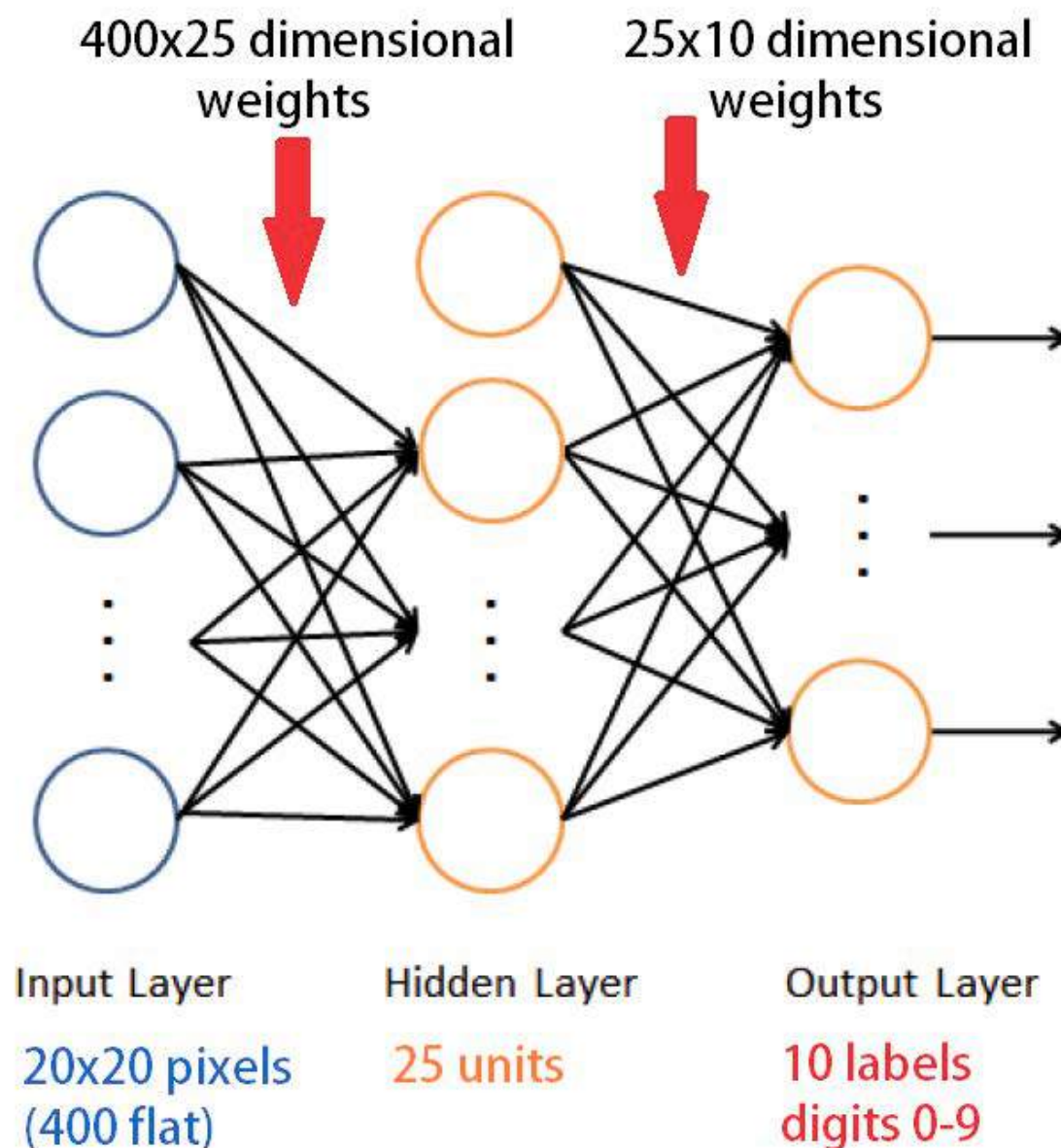
AUTOPSY OF A NEURAL NET

Weights to hidden units



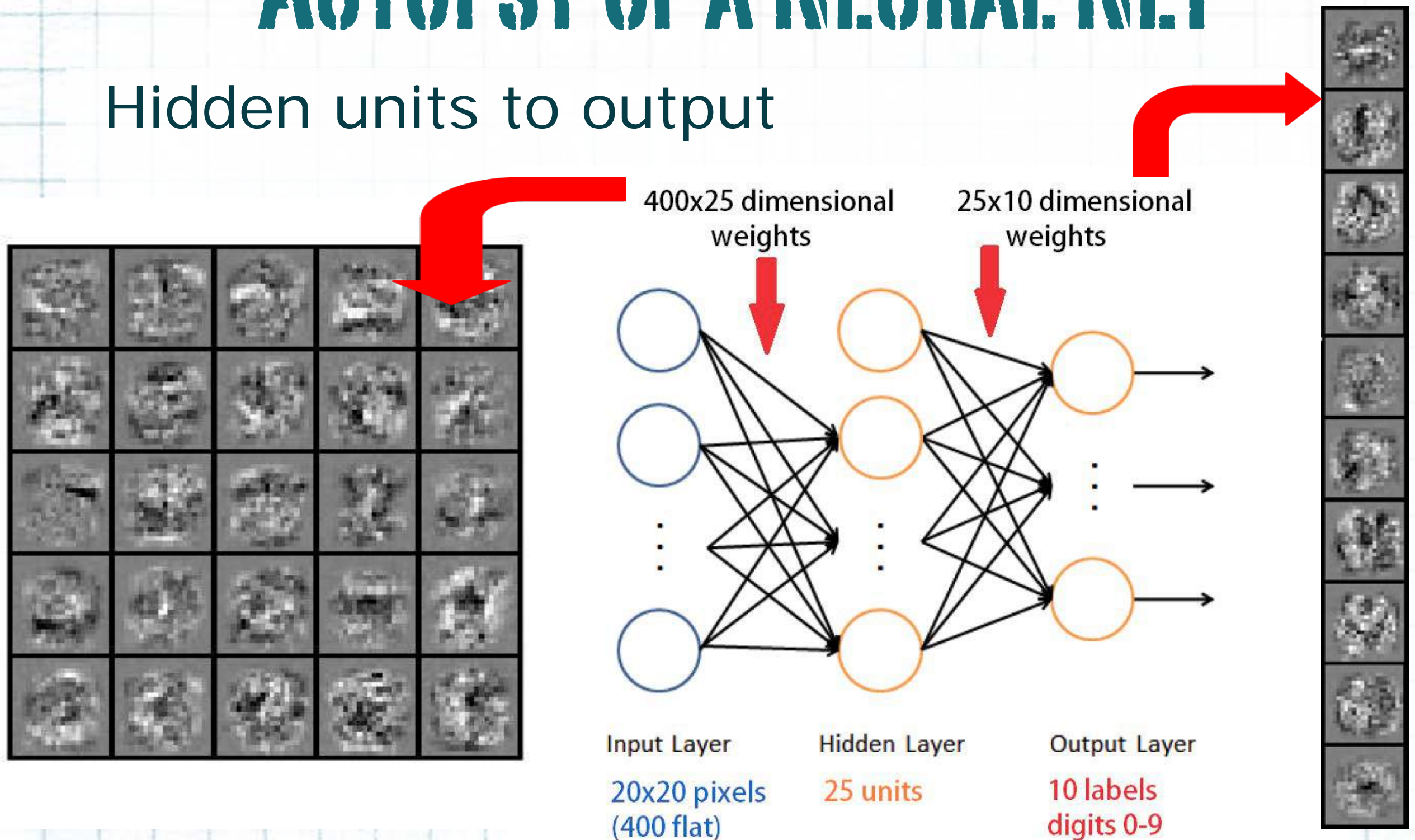
AUTOPSY OF A NEURAL NET

Hidden units to output



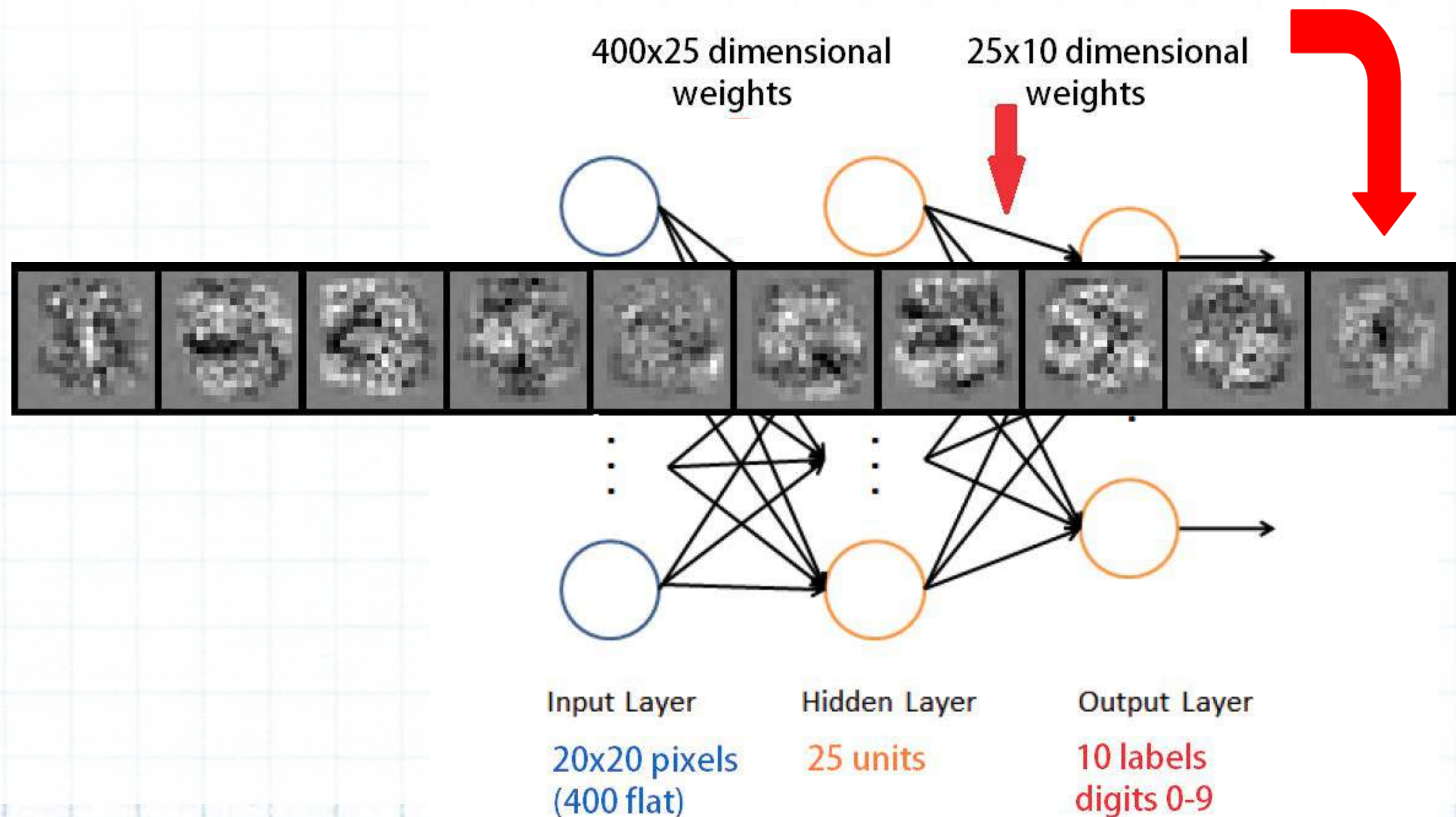
AUTOPSY OF A NEURAL NET

Hidden units to output

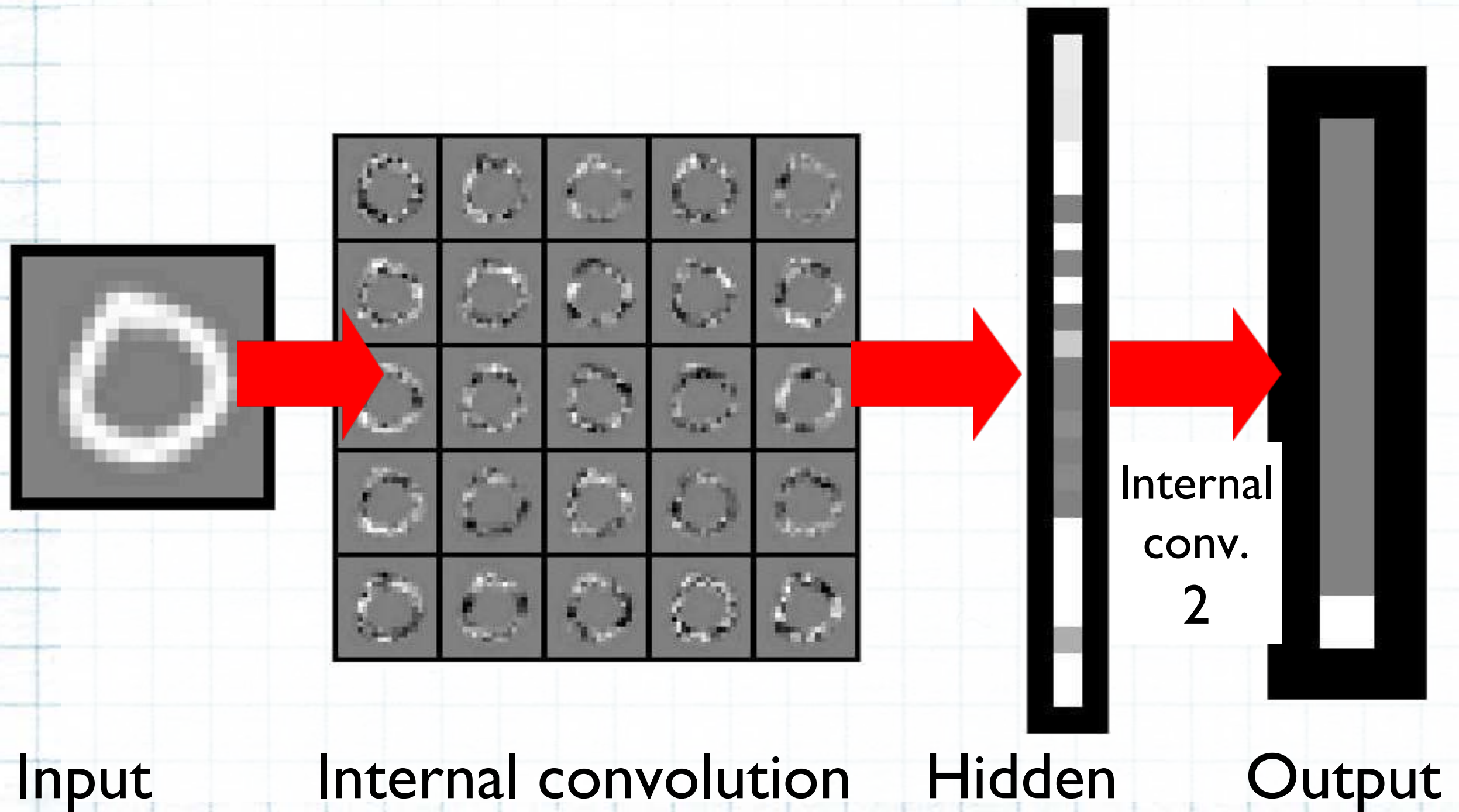


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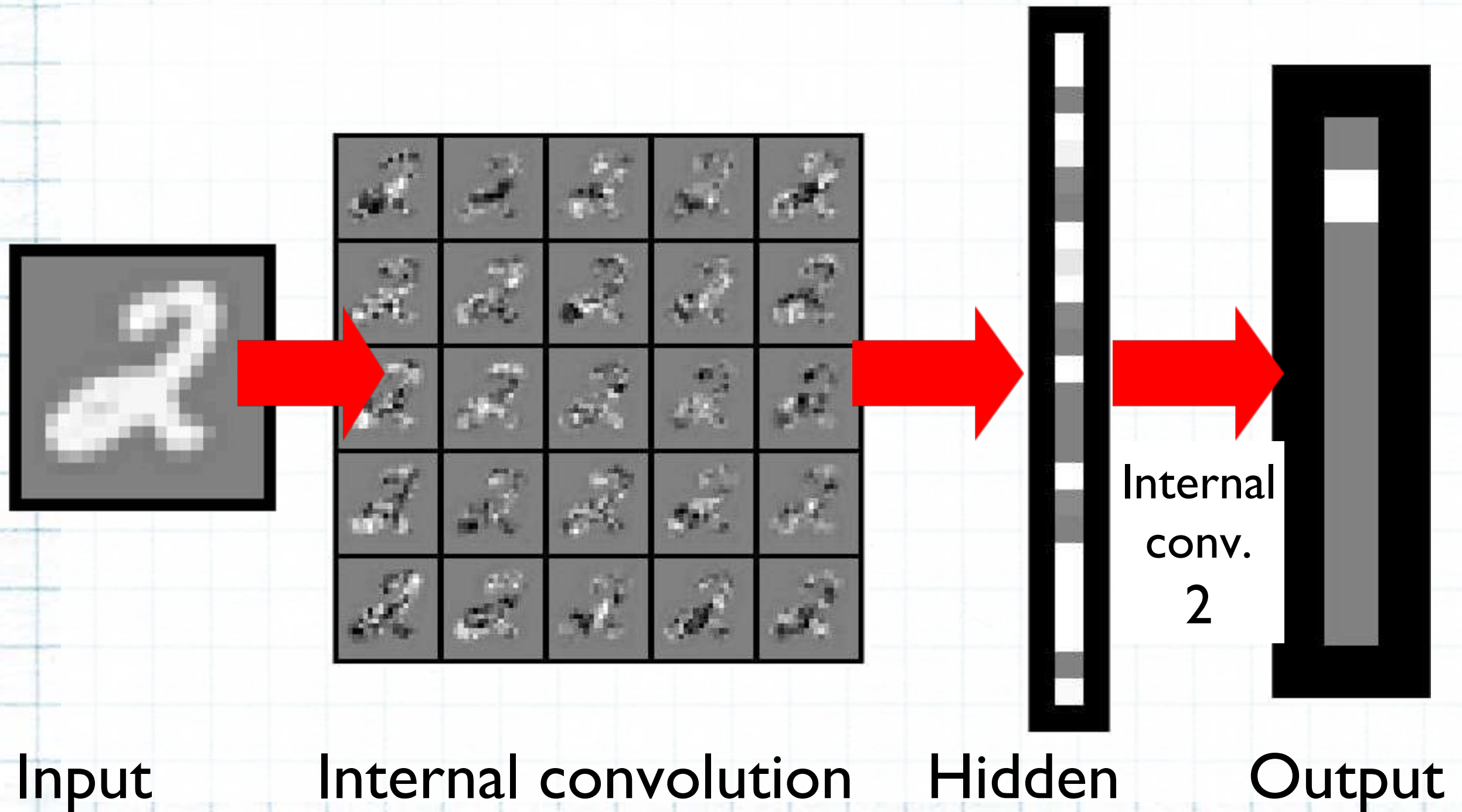
Hidden units to output



AUTOPSY OF A NEURAL NET

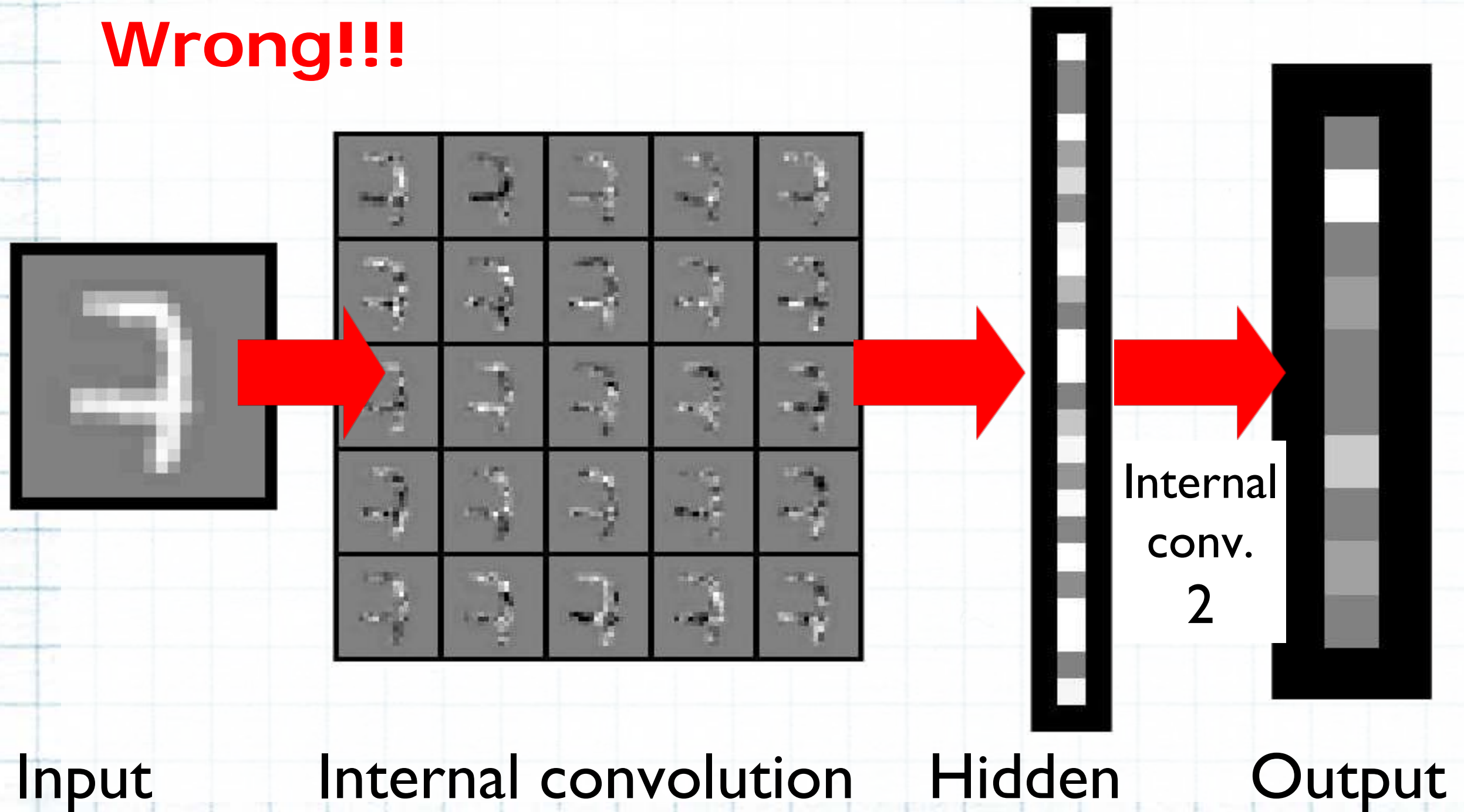


AUTOPSY OF A NEURAL NET



AUTOPSY OF A NEURAL NET

Wrong!!!



AUTOPSY OF A NEURAL NET

What happens with unknowns?
Klingon 6 [jav]



Input

Internal convolution

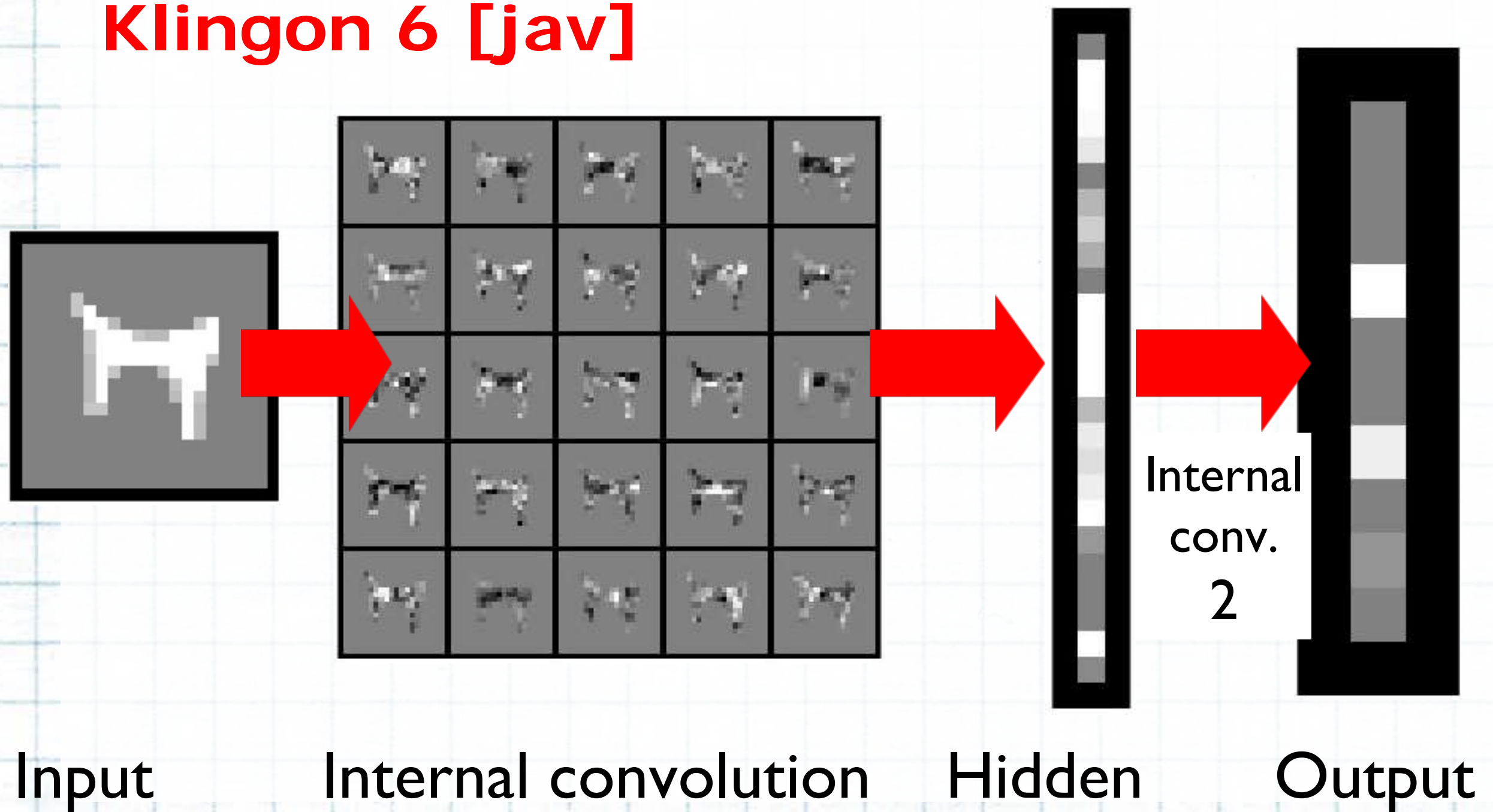
Hidden

Output



AUTOPSY OF A NEURAL NET

Klingon 6 [jav]



NEURAL NETS - RECAP

- ✓ Training = extraction of “features” (= **patterns**) from training data



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NEURAL NETS - RECAP

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- ✓ ANNs work well for **pattern recognition** after training, including “**context**”
- ✓ Completely **unpredictable** when confronted with new, hitherto unknown data



NEURAL NETS - RECAP

Recall:

Definition of “intelligence” according to Merriam-Webster:

“the ability to learn or understand or to deal with **new** or trying situations”



IS THE ROBOT APOCALYPSE NEAR?



IS THE ROBOT APOCALYPSE NEAR?

The Real Threat Is Machine Incompetence, Not Intelligence

Forget super-AI. Crappy AI is more likely to be our downfall, argues researcher.

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TWEET



Michael Byrne

Feb 6 2017, 6:00am



https://motherboard.vice.com/en_us/article/jpdvjg/the-real-threat-is-machine-incompetence-not-intelligence



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FINANCIAL TIMES

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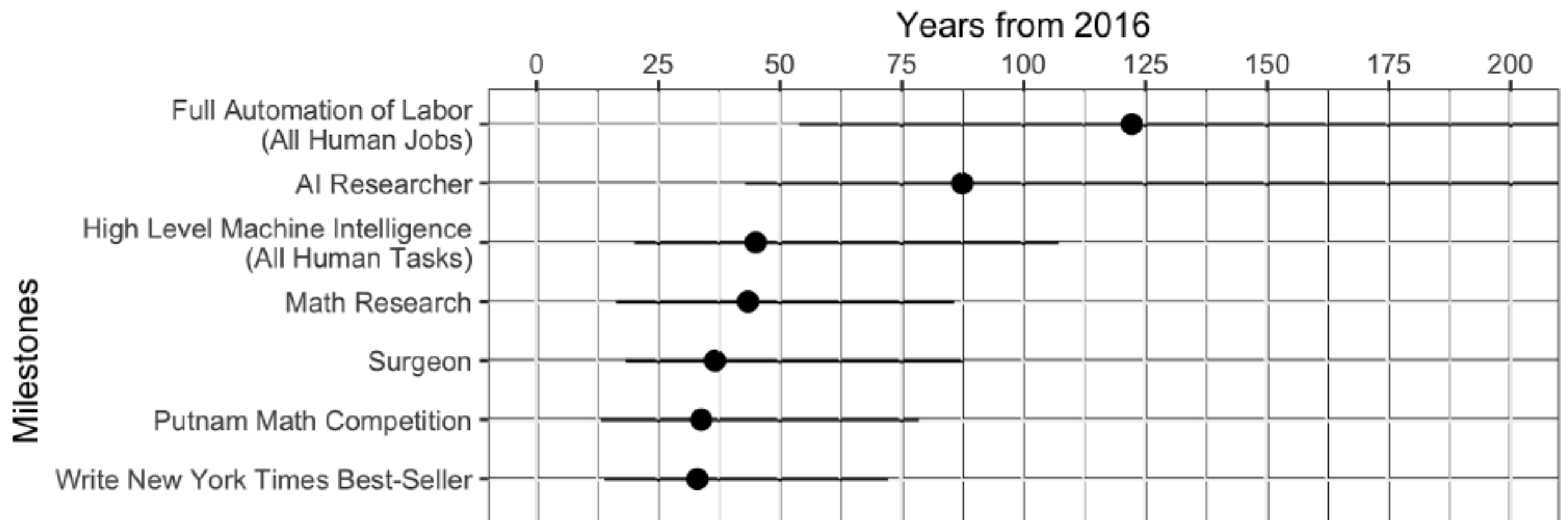
Comment: 'Algo bots' could cause another flash crash

High speed traders are still rewarded at the expense of safety



WILL WE BE REPLACED BY ROBOTS?

Survey among 352 AI researchers:

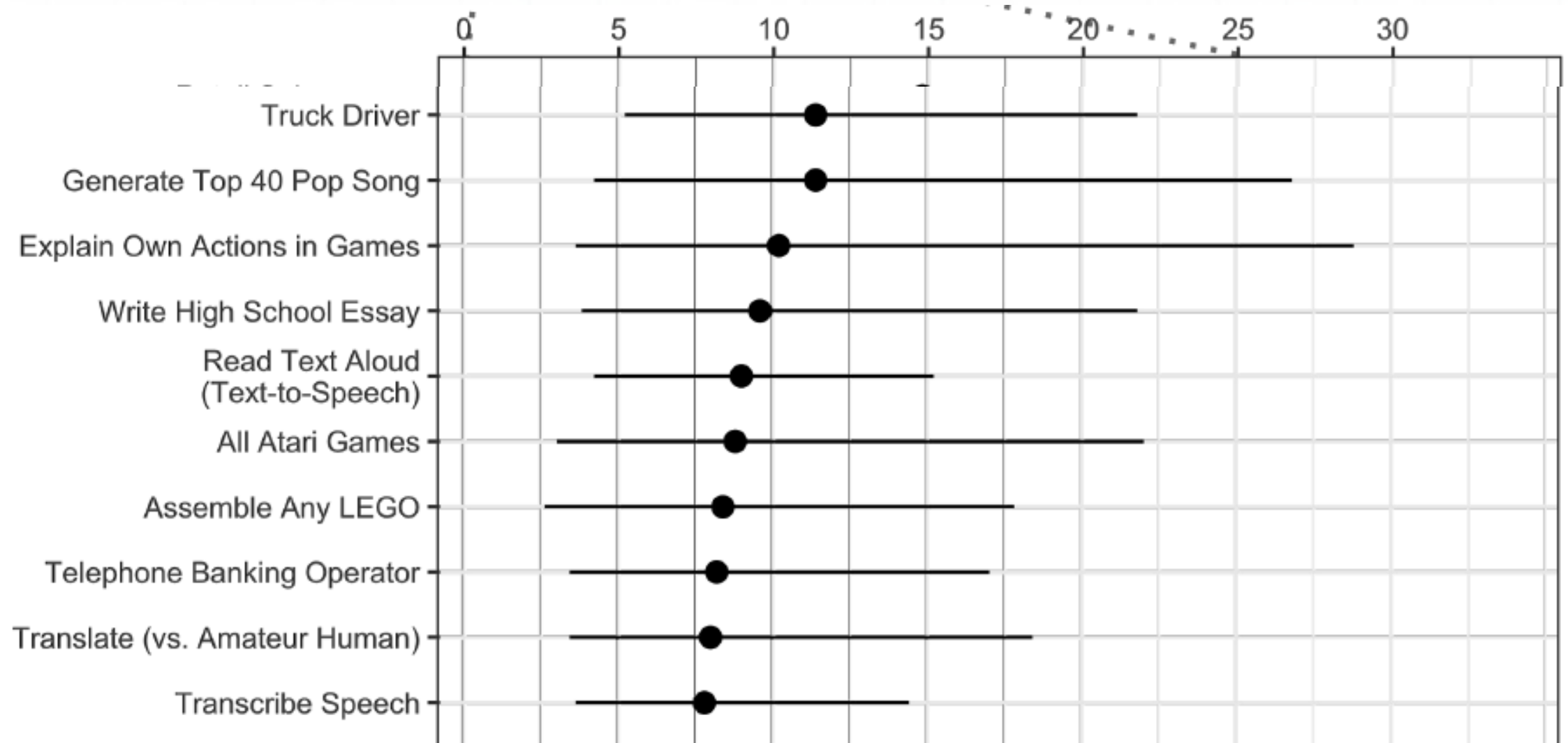


K. Grace et al., *When Will AI Exceed Human Performance? Evidence from AI Experts*,
<https://arxiv.org/abs/1705.08807>



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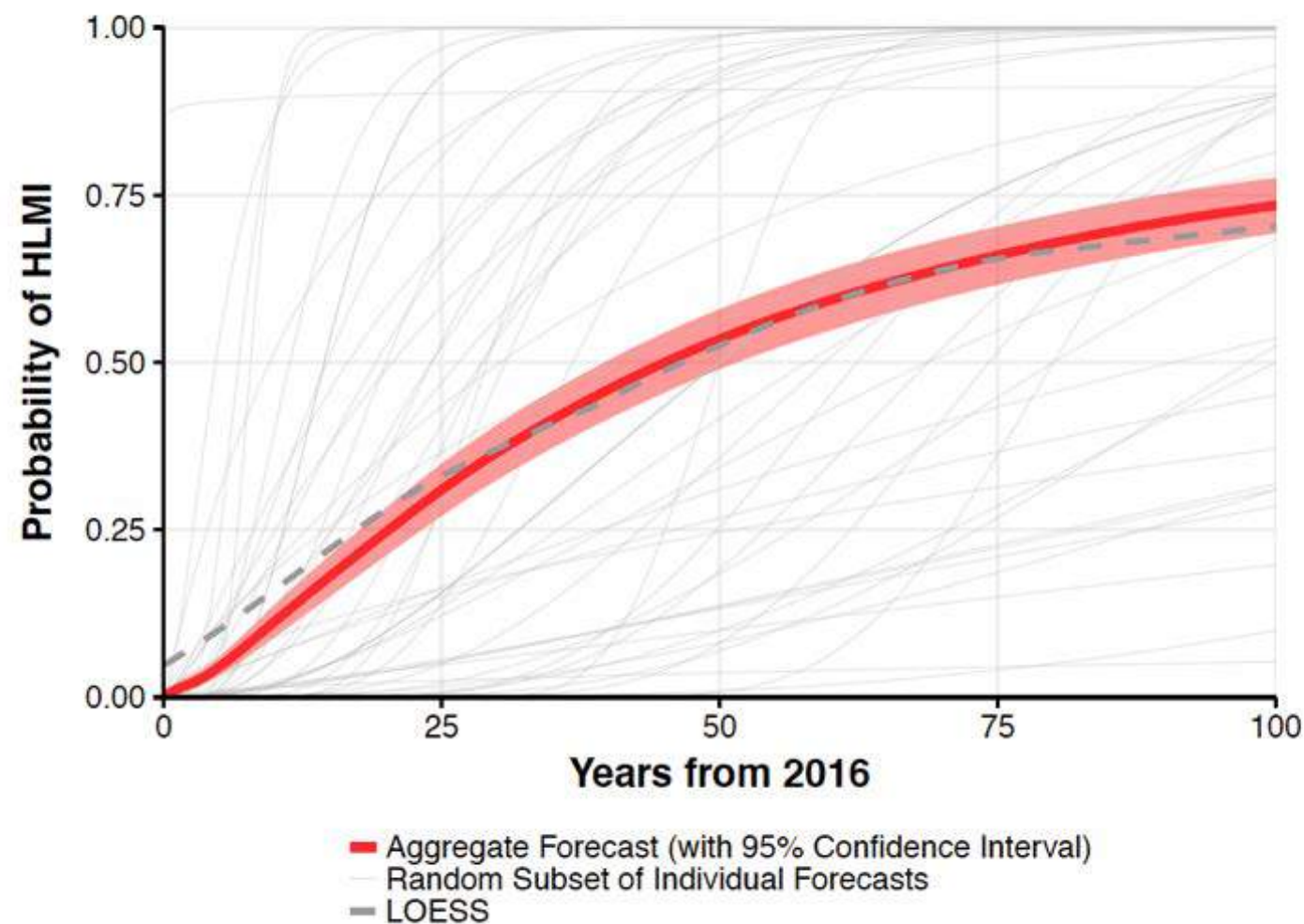


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REFERENCES & FURTHER READING

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- A. Ng, *Machine Learning*, Coursera,
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