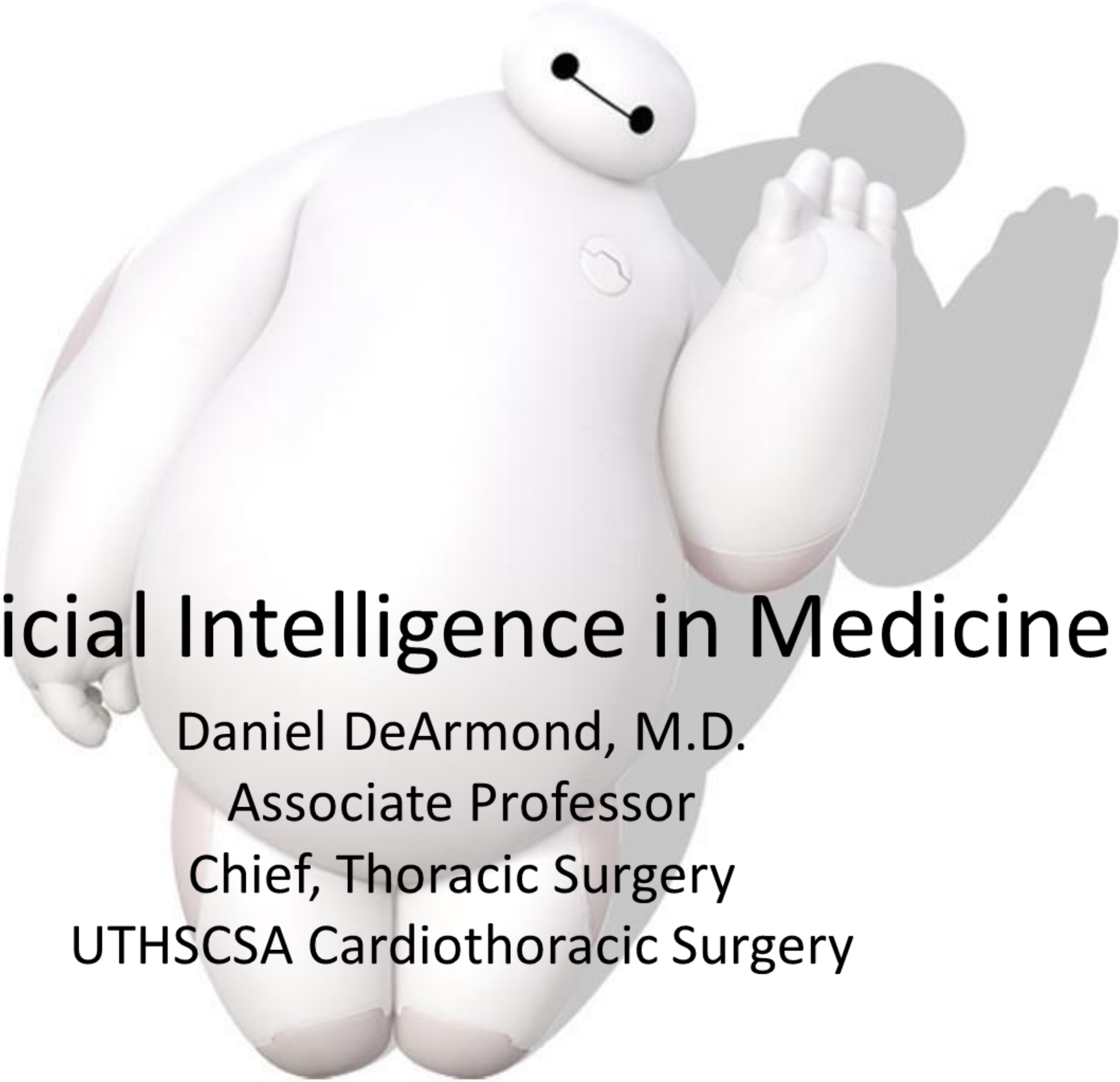


Artificial Intelligence in Medicine

Daniel DeArmond, M.D.
Associate Professor
Chief, Thoracic Surgery
UTHSCSA Cardiothoracic Surgery

Disclosure: Within the past 12 months, I have had no financial relationships with proprietary entities that produce health care goods and services.

Artificial Intelligence (AI): definition

John McCarthy, Dartmouth, 1956:

“…every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it.”

Artificial Intelligence (AI): definition

1. Build systems that think exactly like humans do (“strong AI”)

2. Just get systems to work without figuring out how human reasoning works (“weak AI”)

3. Use human reasoning as a model but not necessarily the end goal

Artificial Intelligence (AI): definition

Encyclopedia Britannica:

“the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings”

Artificial Intelligence (AI): definition

Amazon: the field of computer science dedicated to solving cognitive problems commonly associated with human intelligence, such as learning, problem solving, and pattern recognition

Machine learning is required

IDx-DR AI diagnostics

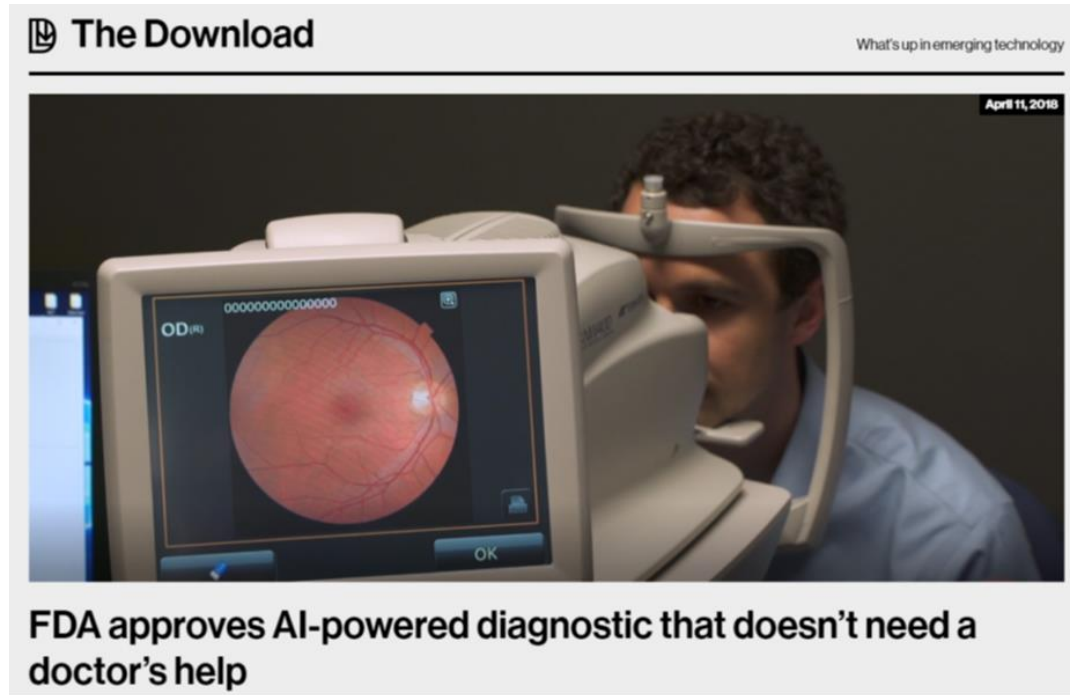
Designed to detect severe diabetic retinopathy

AI algorithm analyzes retinal images

Images uploaded to a cloud server

Delivers a positive or negative result

First device that doesn't need physician interpretation



Viz LVO diagnostic AI

Designed to detect stroke

AI algorithm analyzes CT scan brain images

Automatically notifies a neurologic specialist

Involve specialists sooner than normally possible

Notification by cellphone

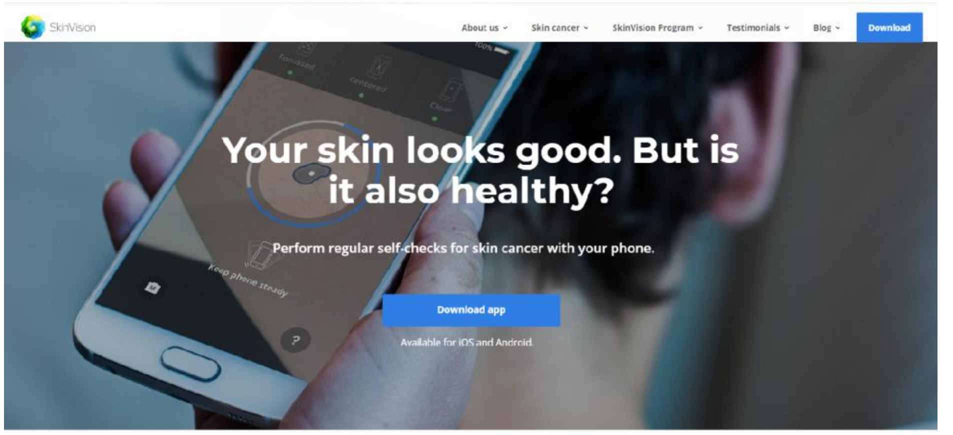
AI in dermatology

Several products directed at the consumer level

Diagnosis of skin lesions by smartphone photo/app

AI driven chatbot makes recommendations about skin products

May be driven in part by human advisors




PHONETIC KEMP INC.
UKIYO CAMERA SYSTEMS

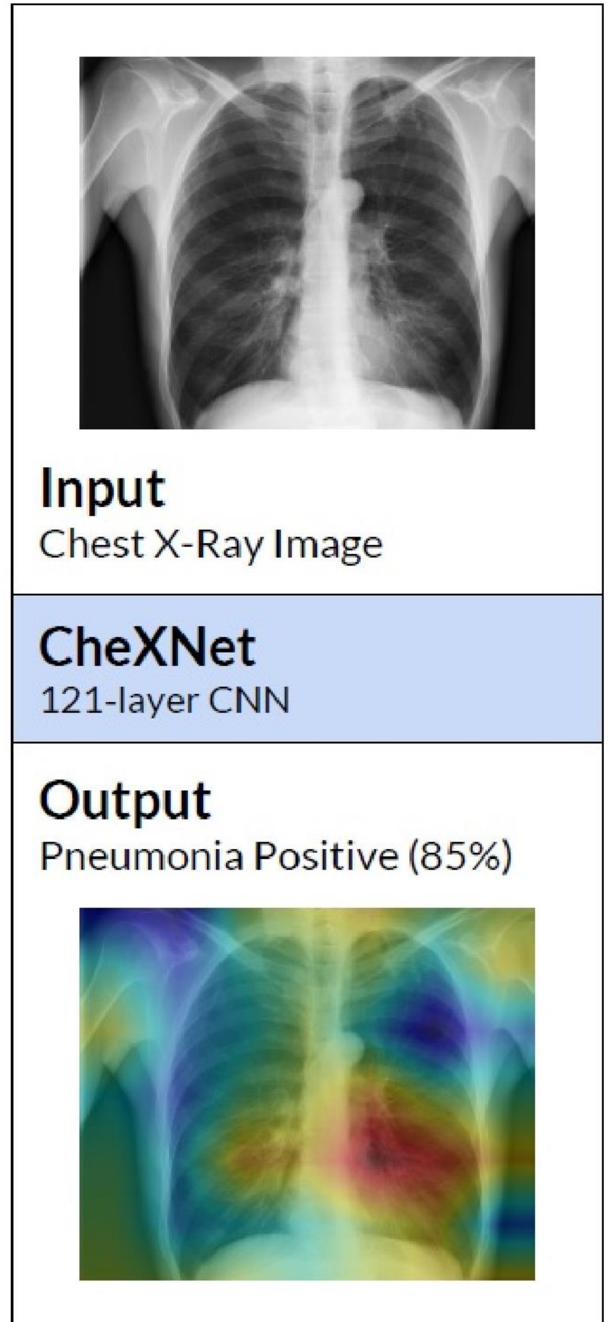
Stanford CheXNet

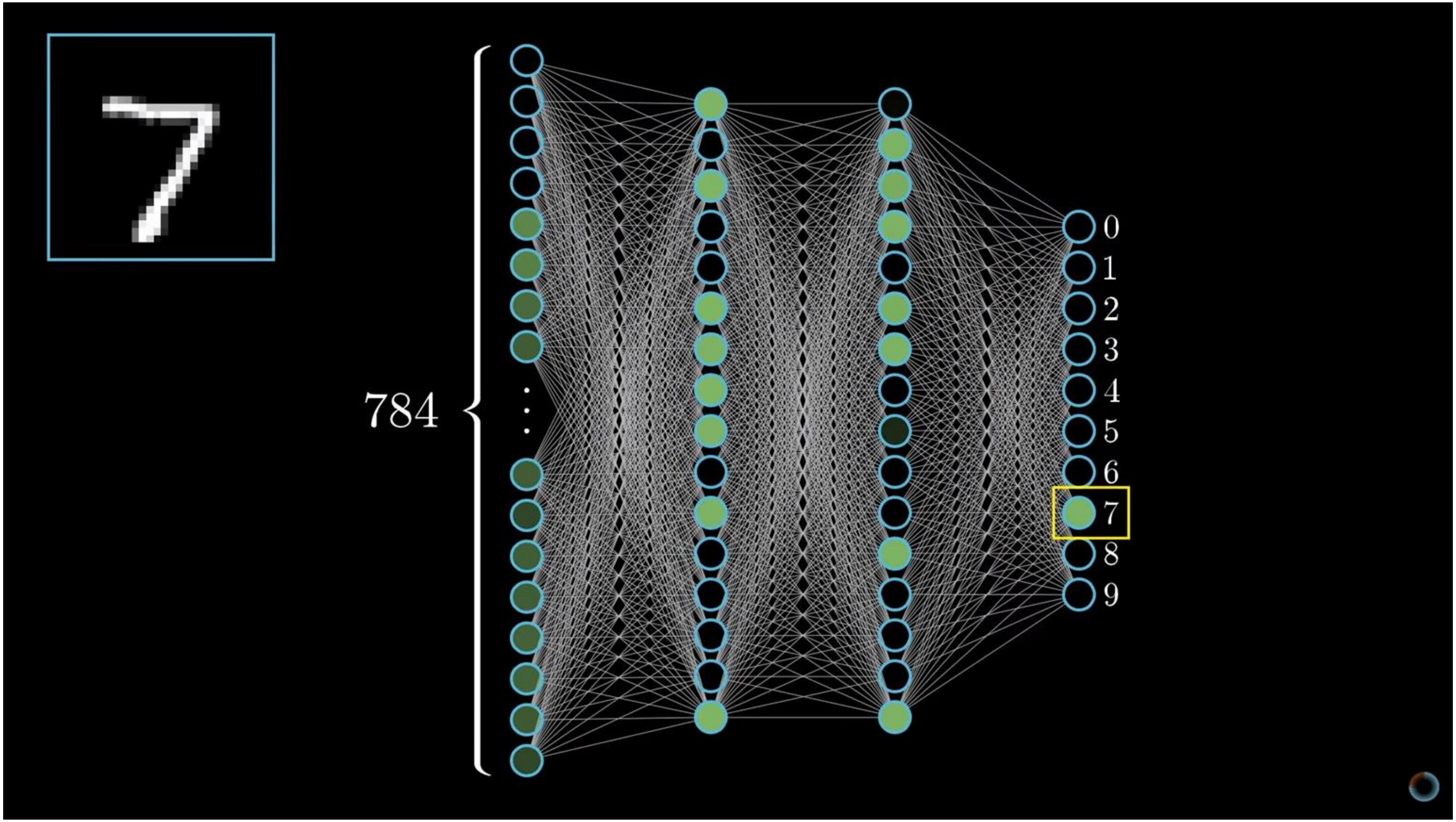
Deep AI machine learning

Detect 14 lung conditions based on chest x-ray

Outperformed human radiologic interpretation

Learning based on dataset of >100,000 chest x-rays





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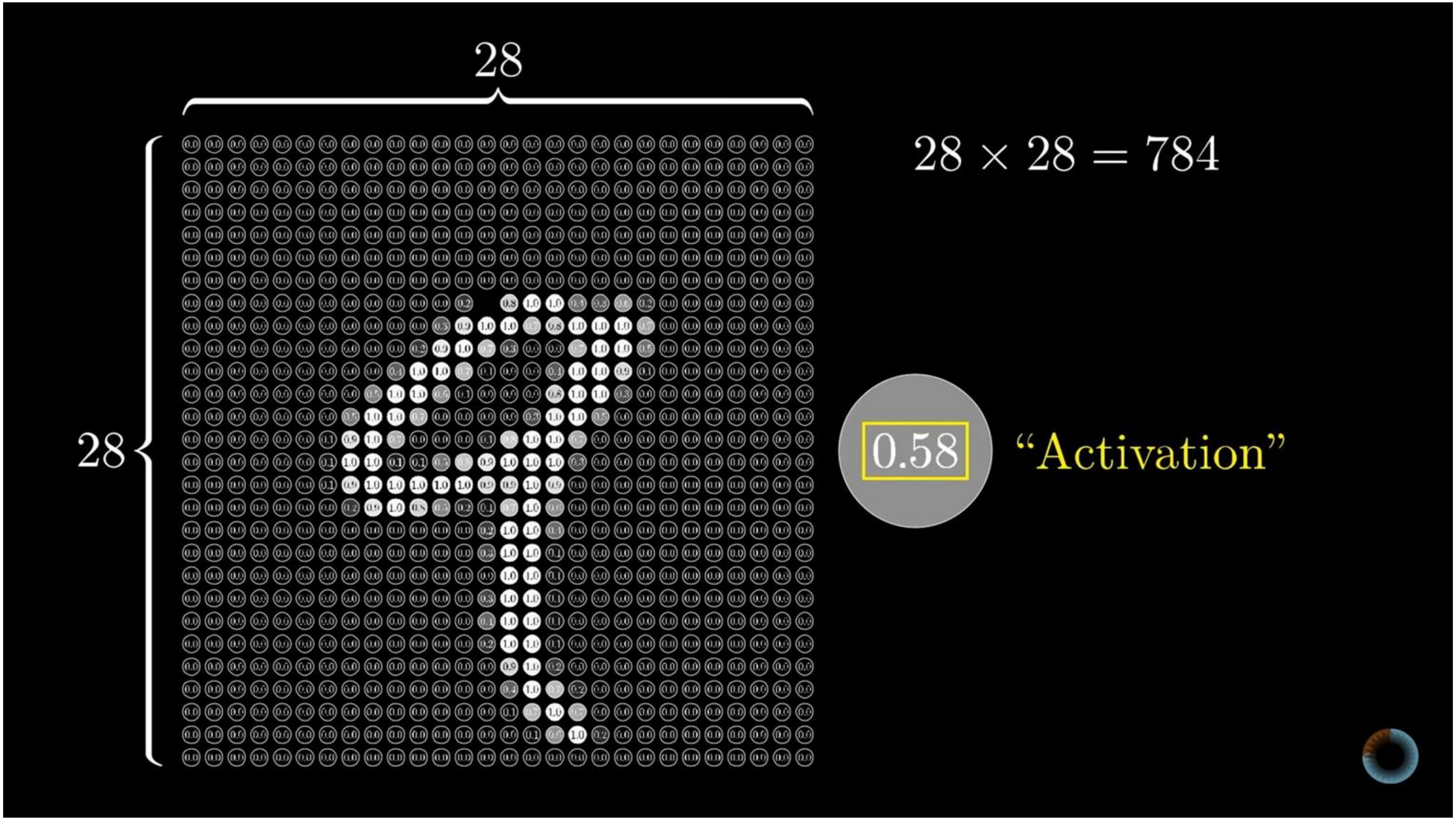

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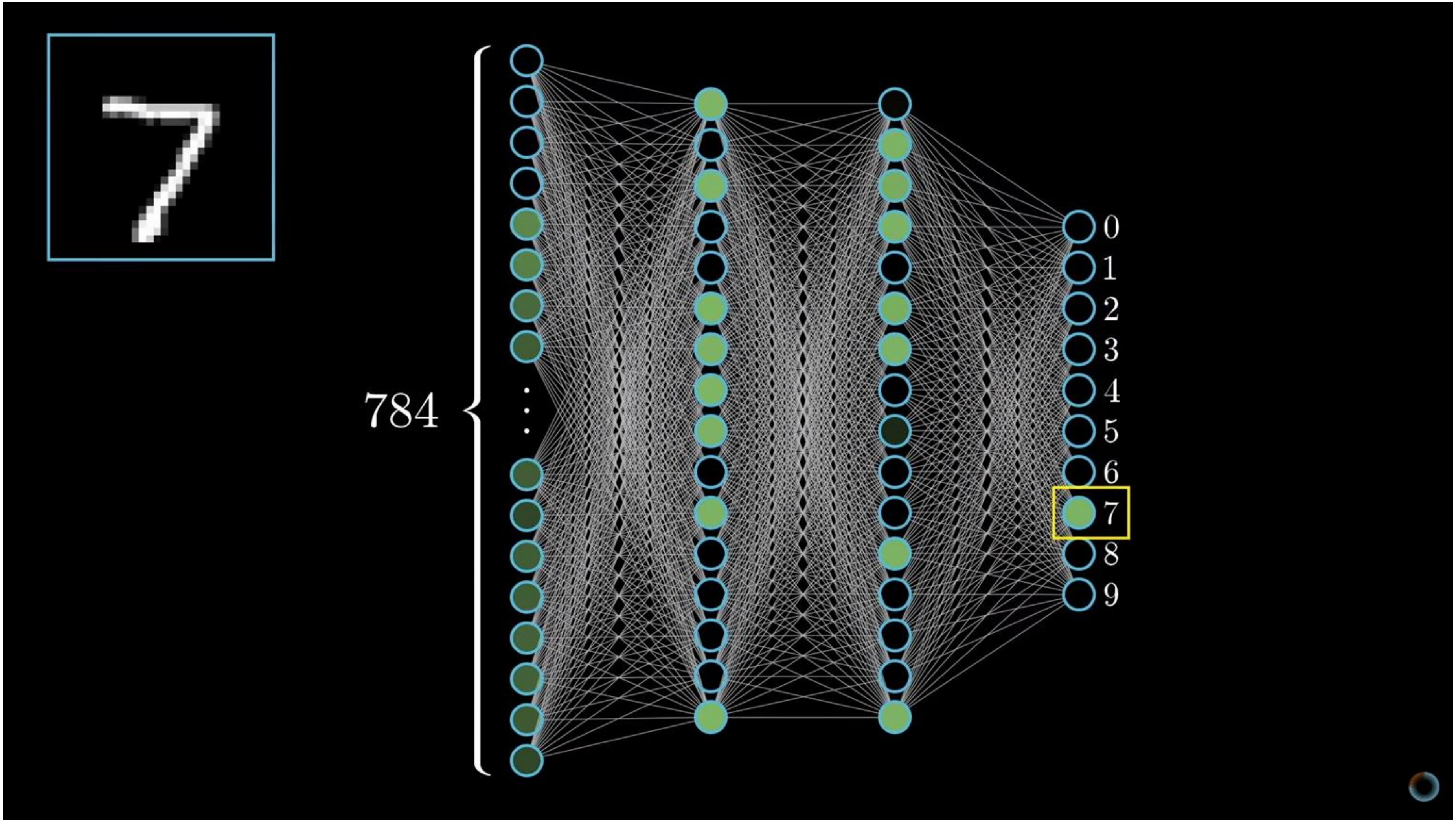

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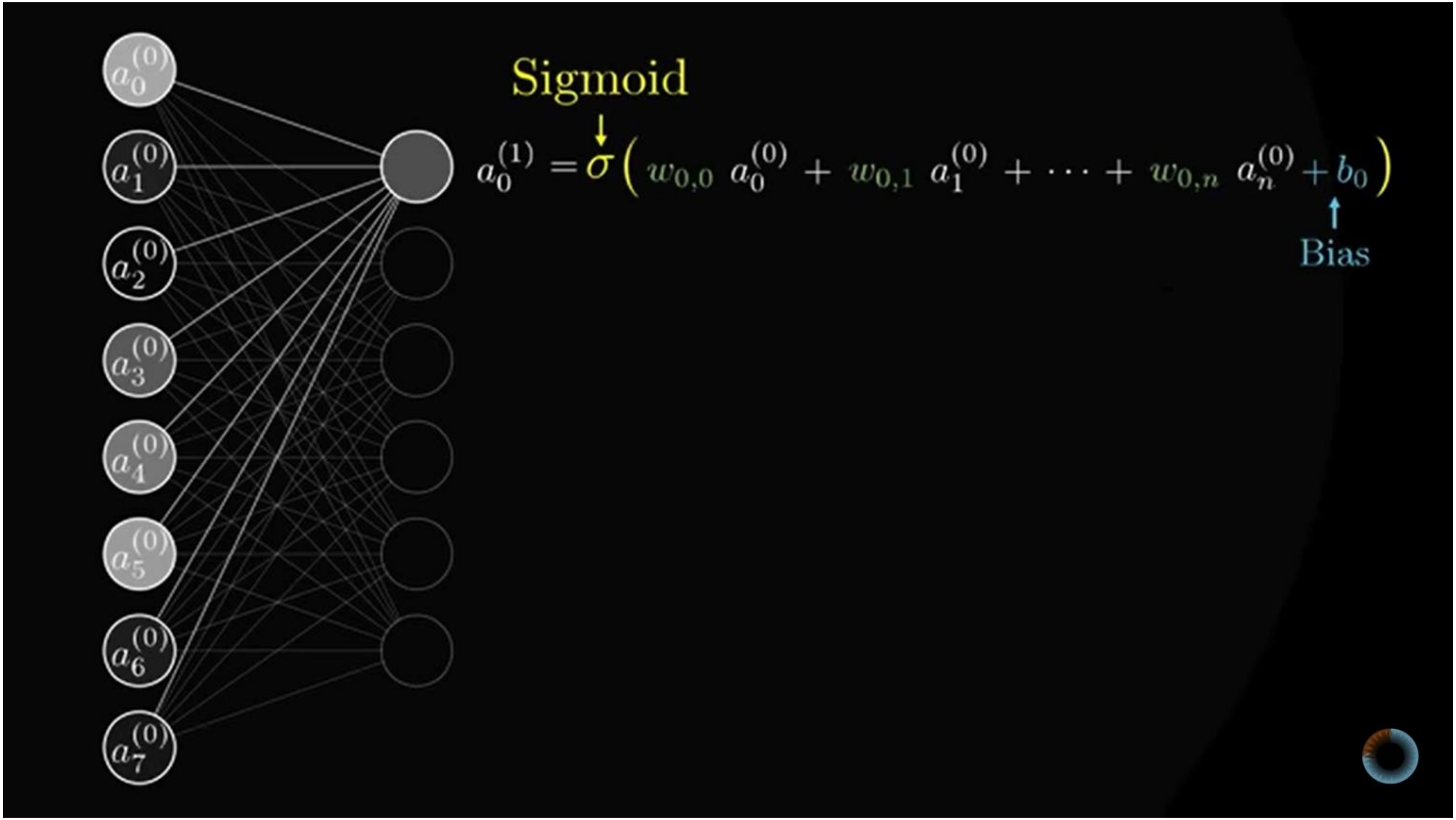

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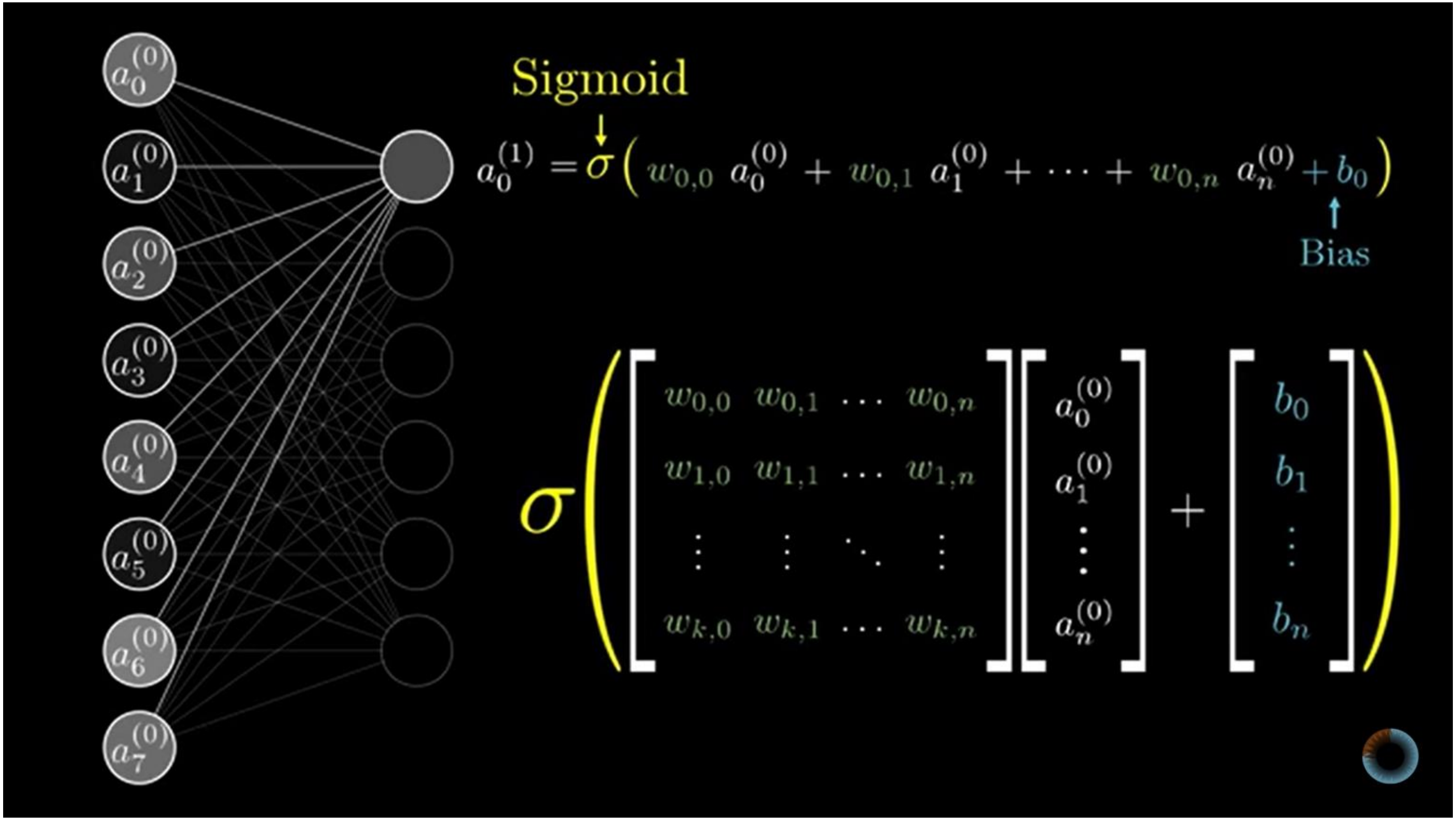

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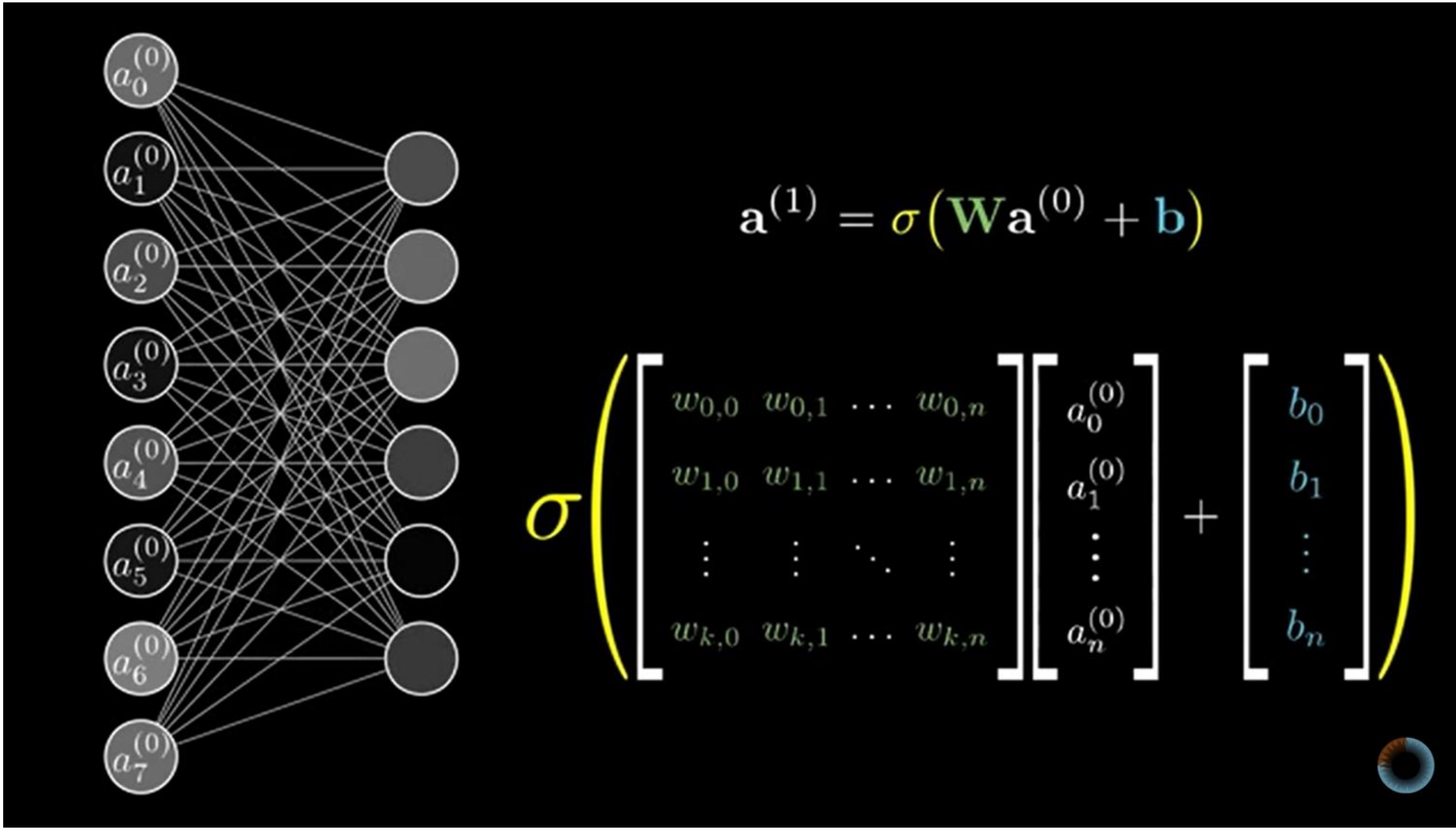

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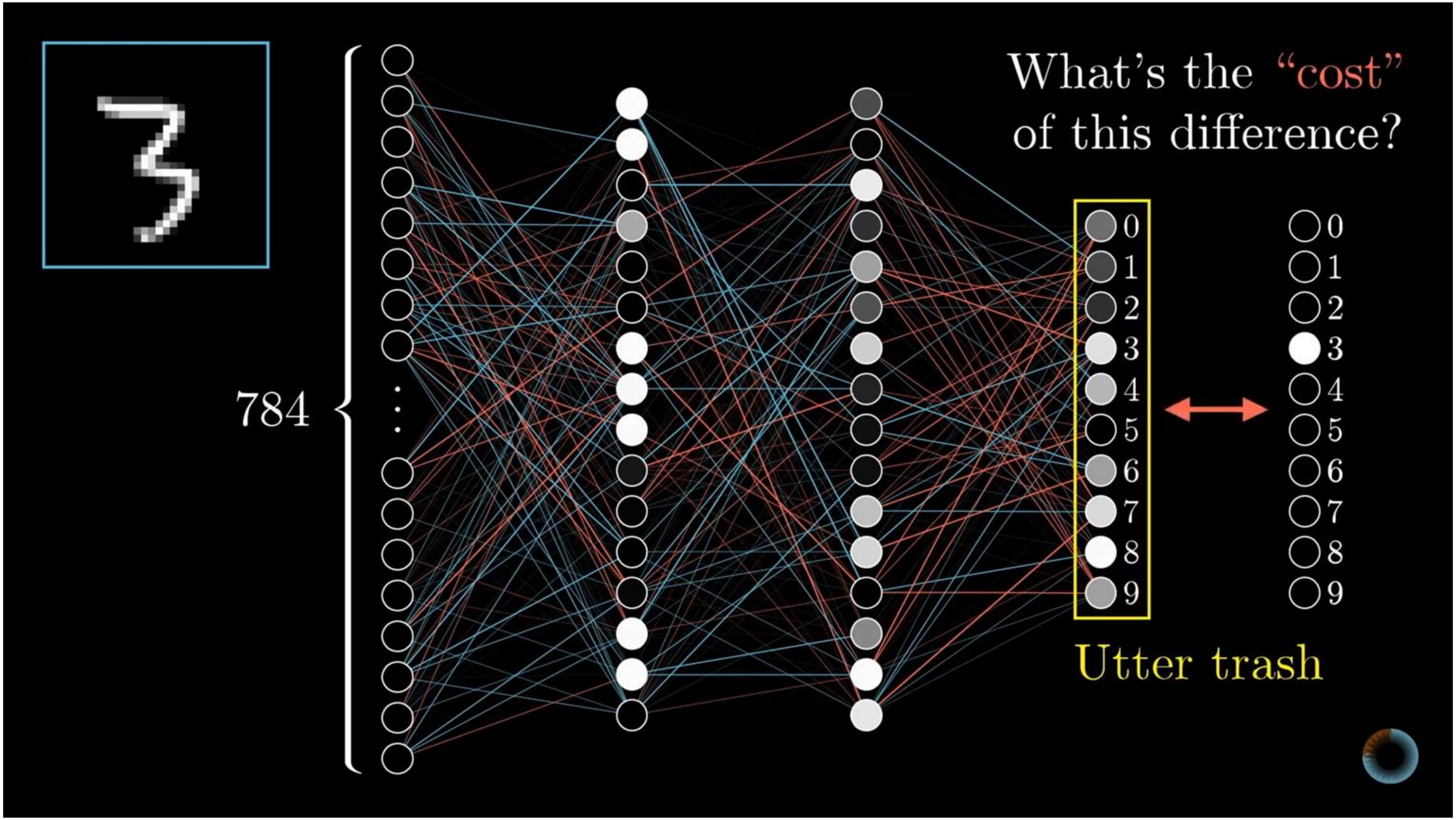

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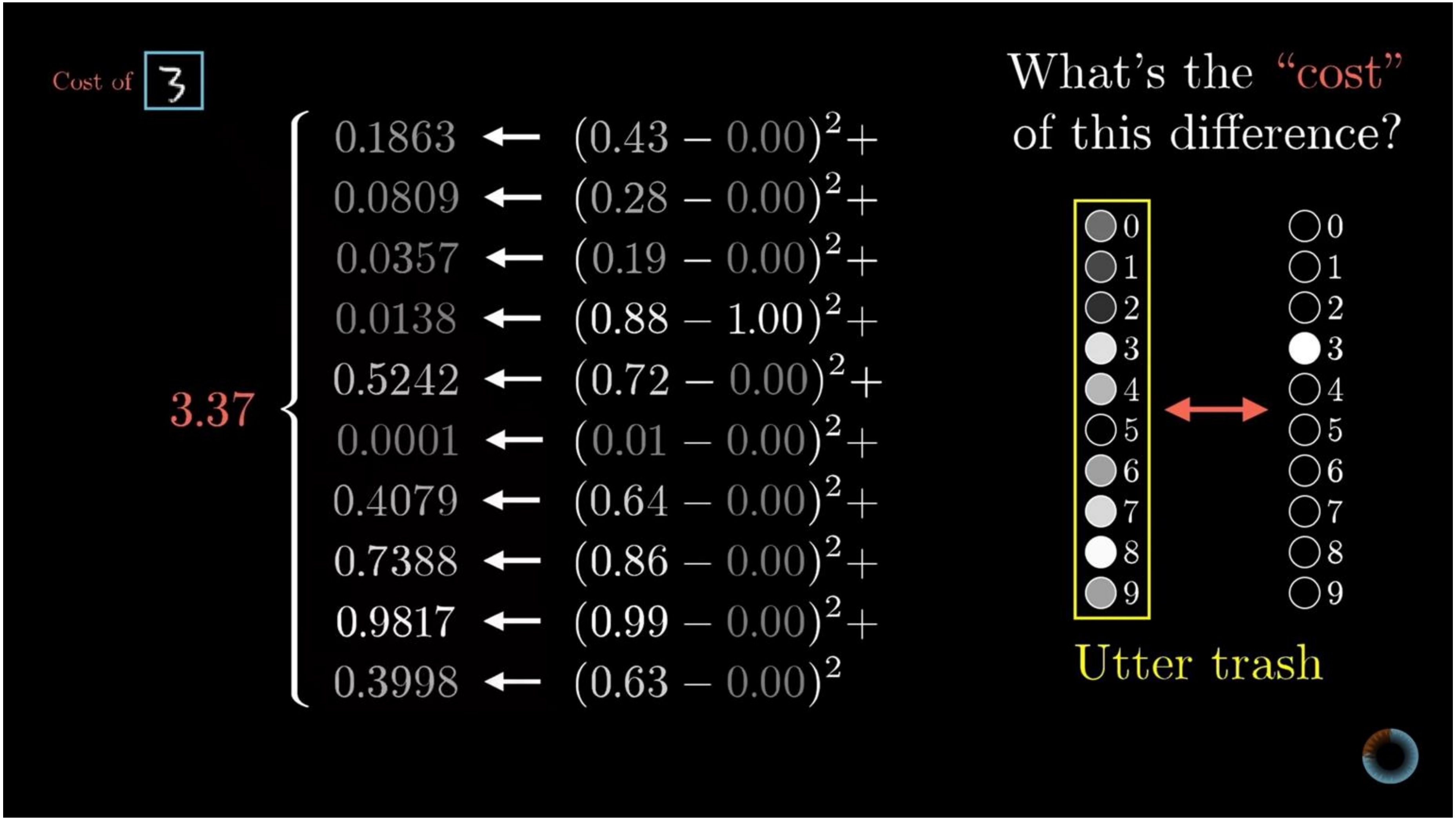

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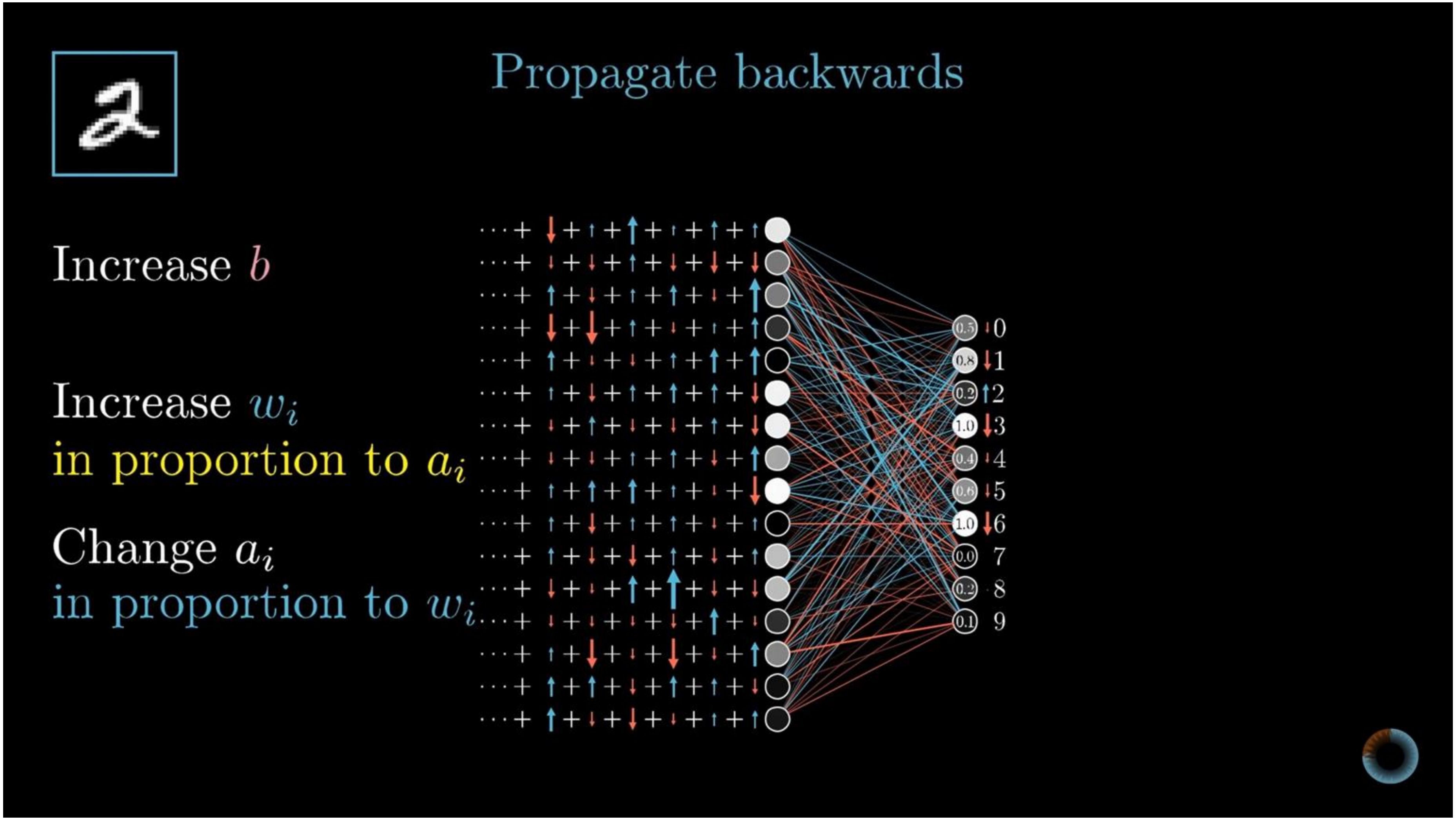

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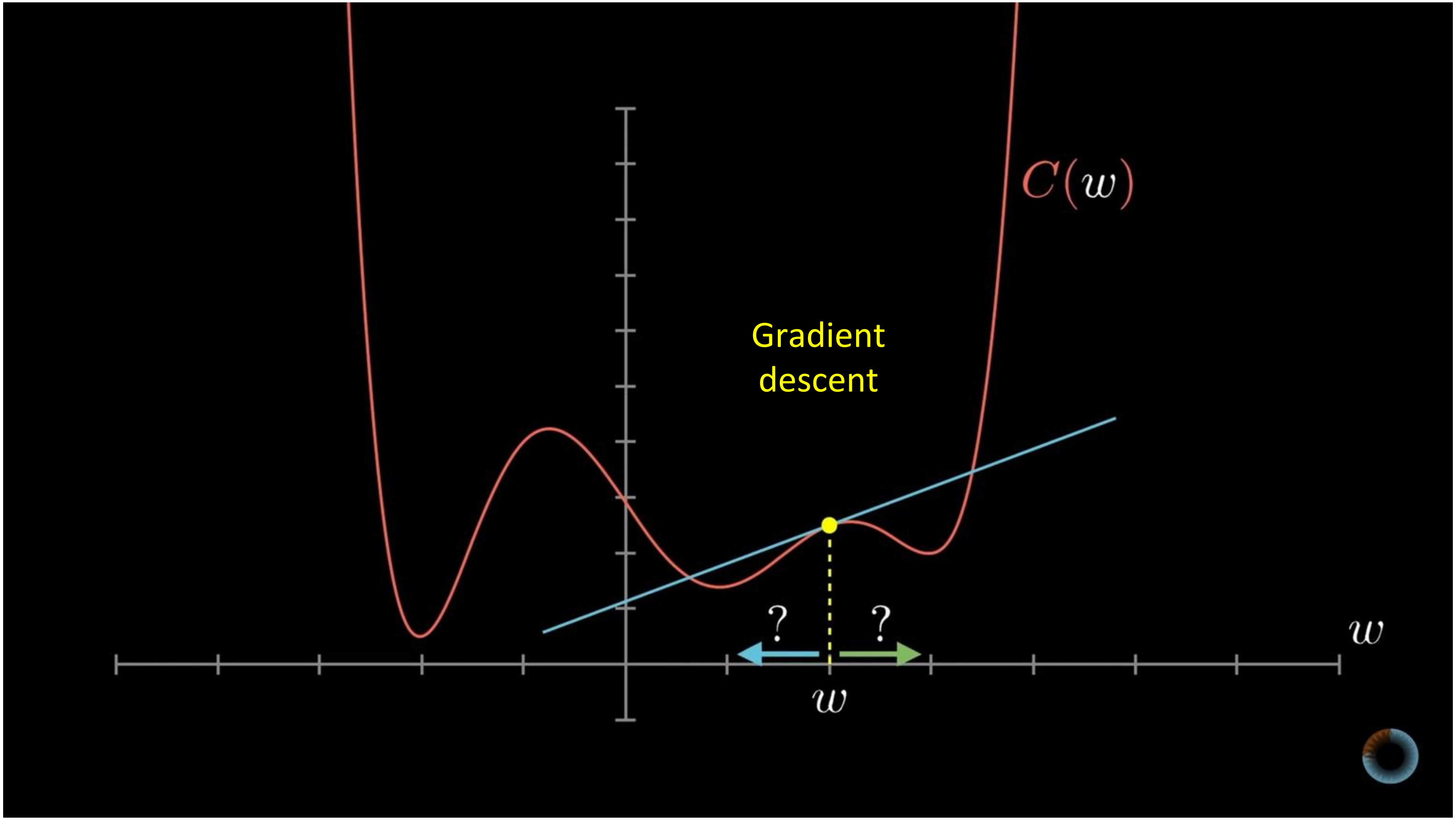

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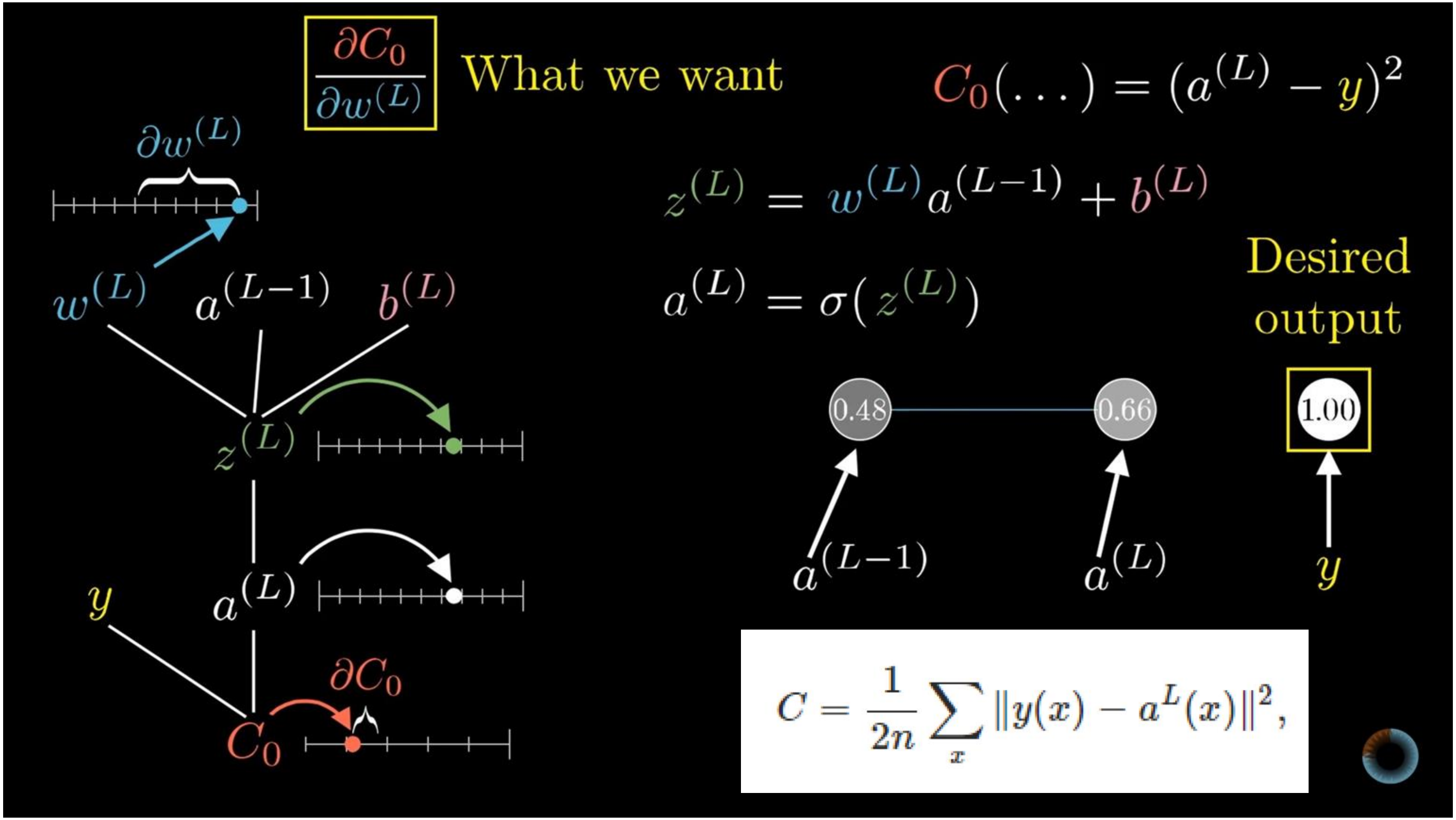
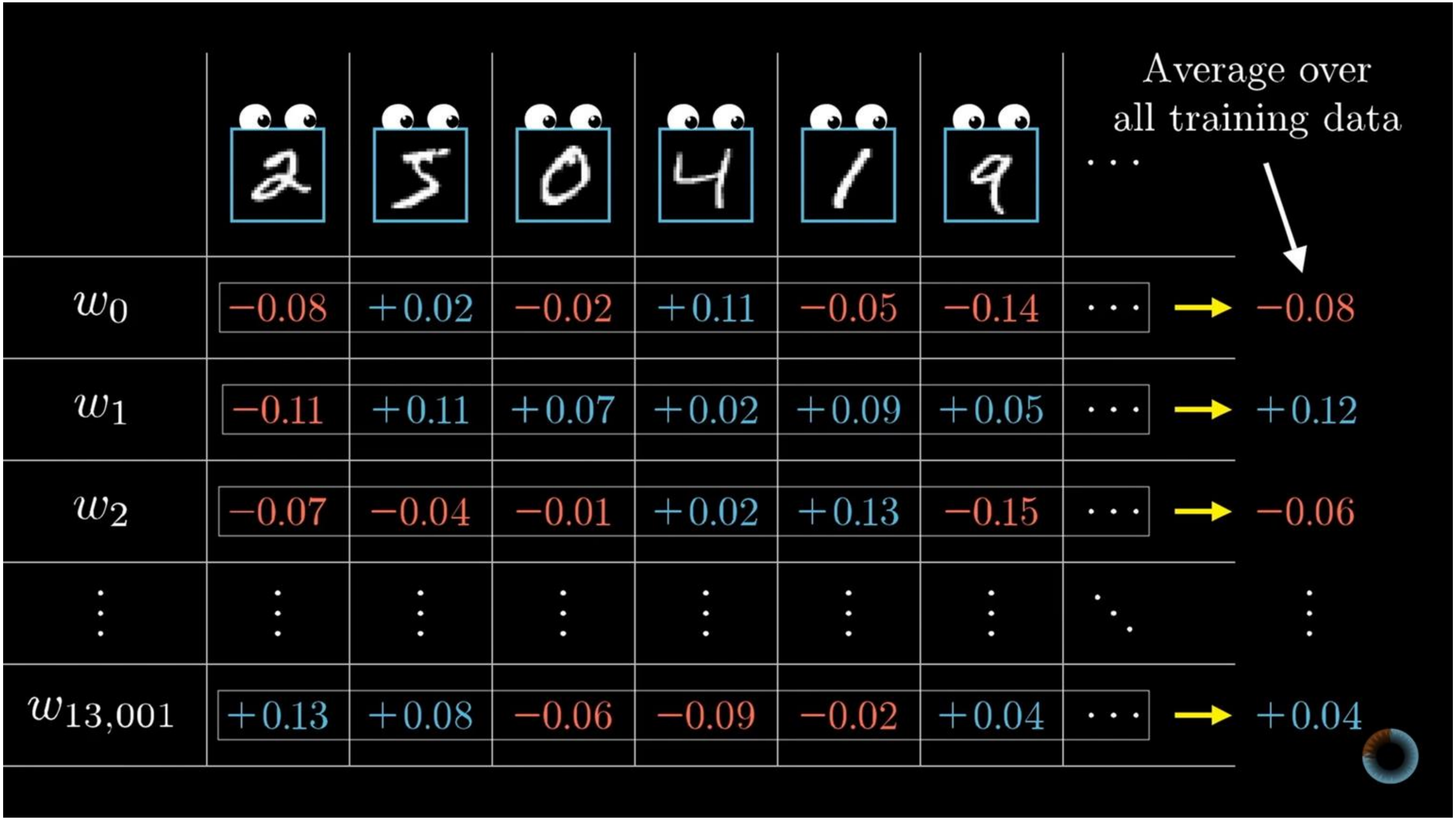


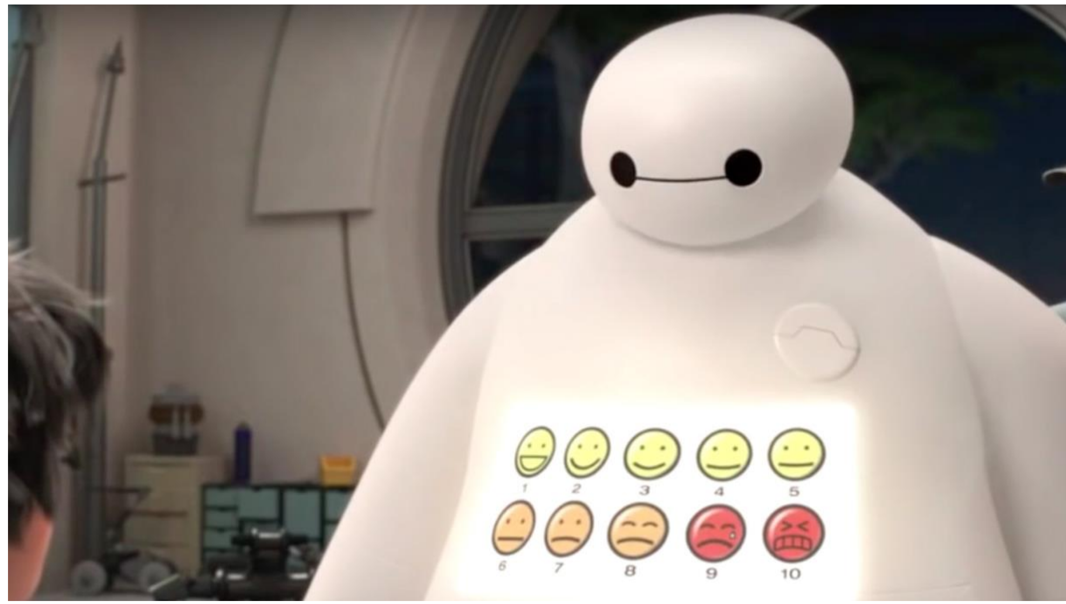
$$C = \frac{1}{2n} \sum_x \|y(x) - a^L(x)\|^2,$$

From: Grant Sanderson, 3blue1brown website: https://www.3blue1brown.com
and Neural Networks and Deep Learning (online book) by Michael Nielsen



From: Grant Sanderson, 3blue1brown website: https://www.3blue1brown.com

The limit of the universe is the output



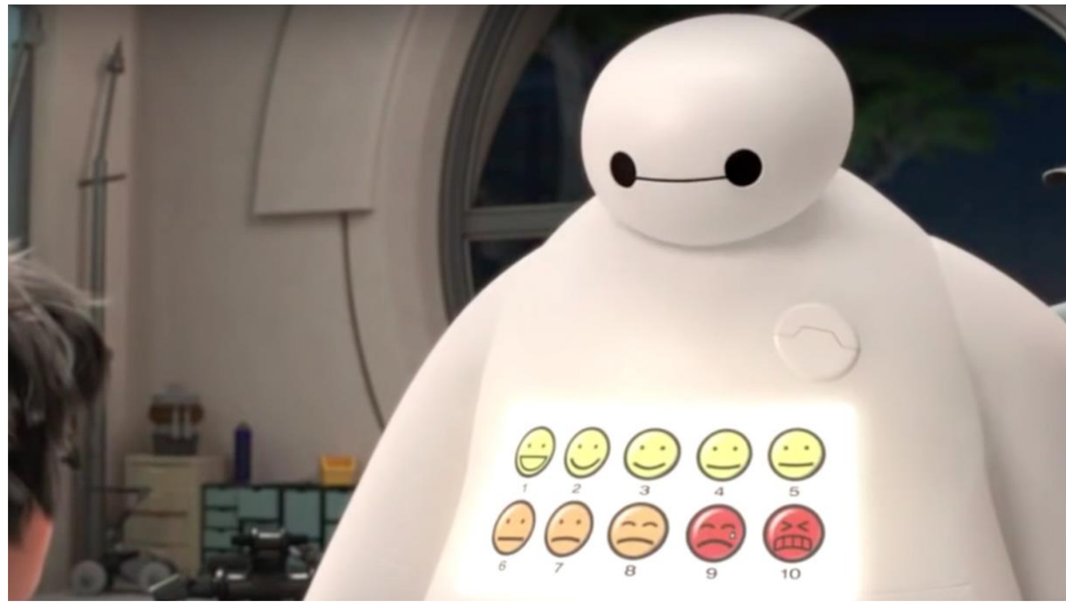
Nothing in the universe is not the output

Any input can produce any programmed output

The limit of the universe is the output

Nothing in the universe is not the output

Any input can produce any programmed output



More artificial than intelligent?

"Deep learning" - over a hundred neural net levels

What are all those levels doing? Even the engineers don't know

Will the network always make the right call?

Is there any way to have oversight?

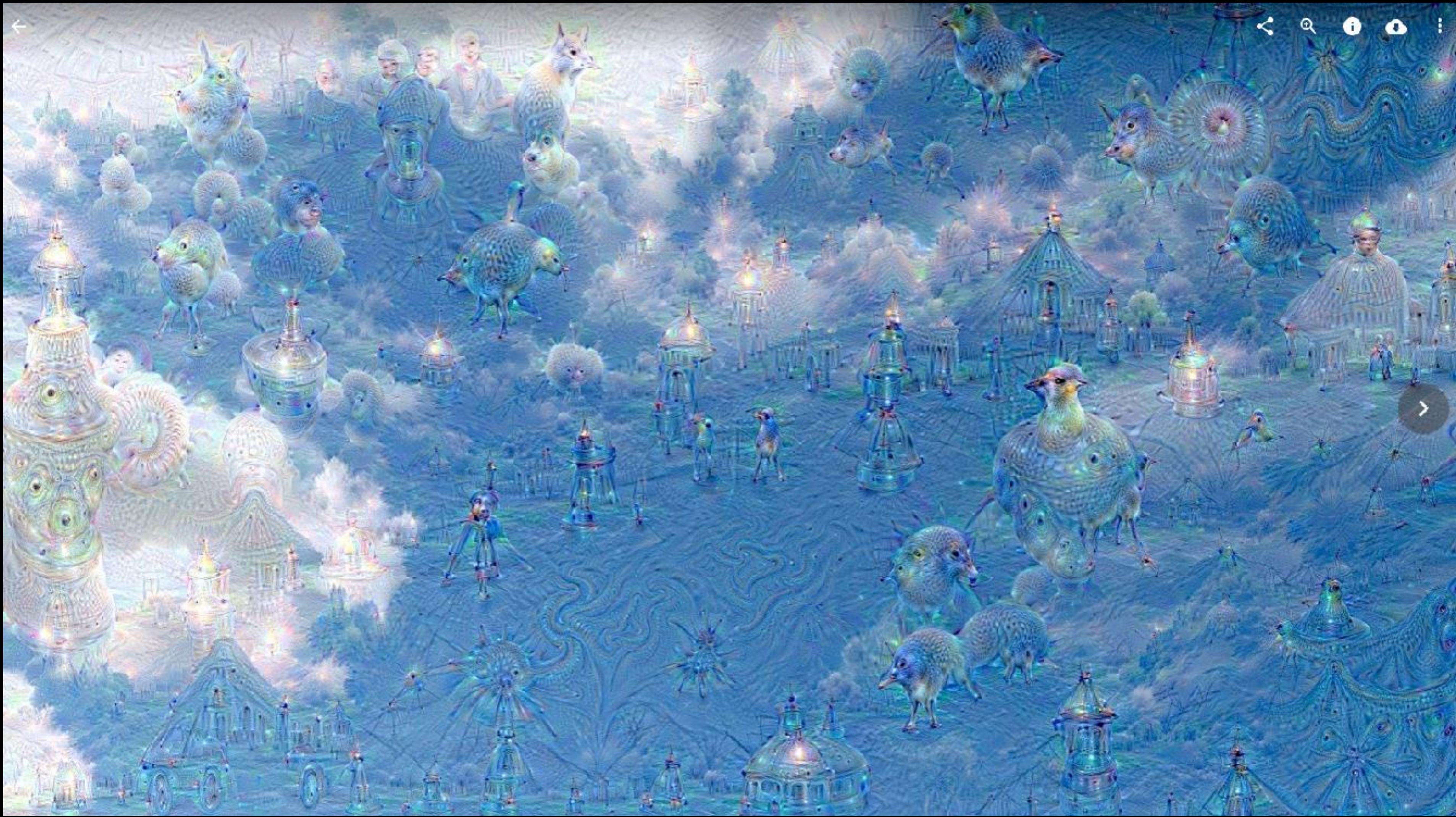
MIT Technology Review

Intelligent Machines

The Dark Secret at the Heart of AI

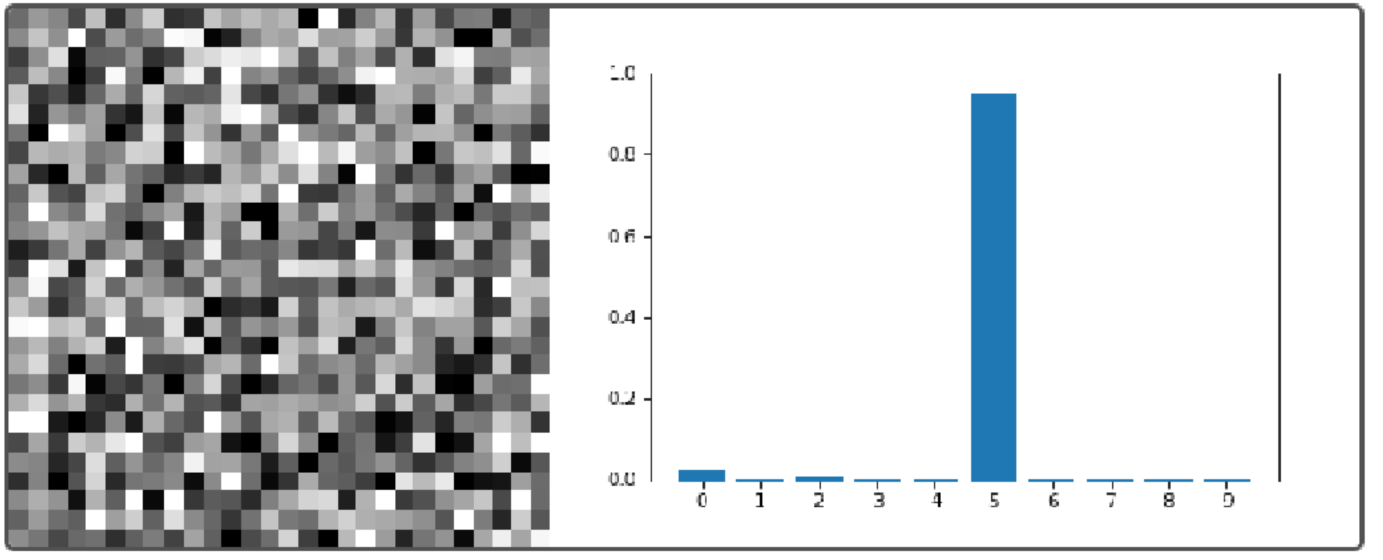
No one really knows how the most advanced algorithms do what they do. That could be a problem.

by Will Knight April 11, 2017



adversarial example

Non-Targeted "5"

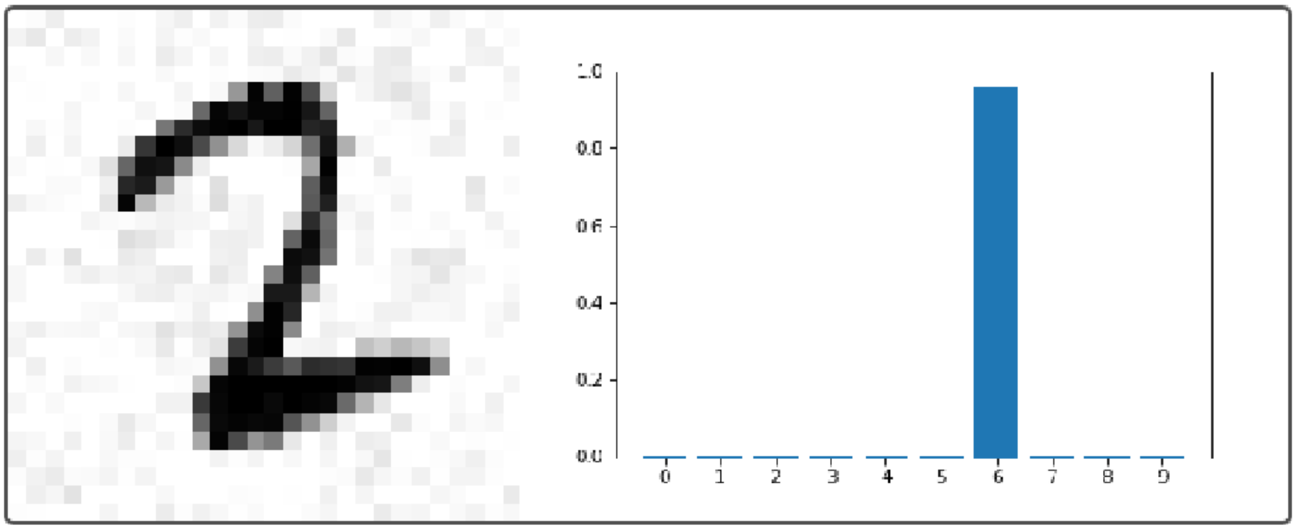


The left side is the non-targeted adversarial exampele (a 28 X 28 pixel image). The right side plots the activations of the network when given the image.

Source: Machine Learning at Berkeley blog

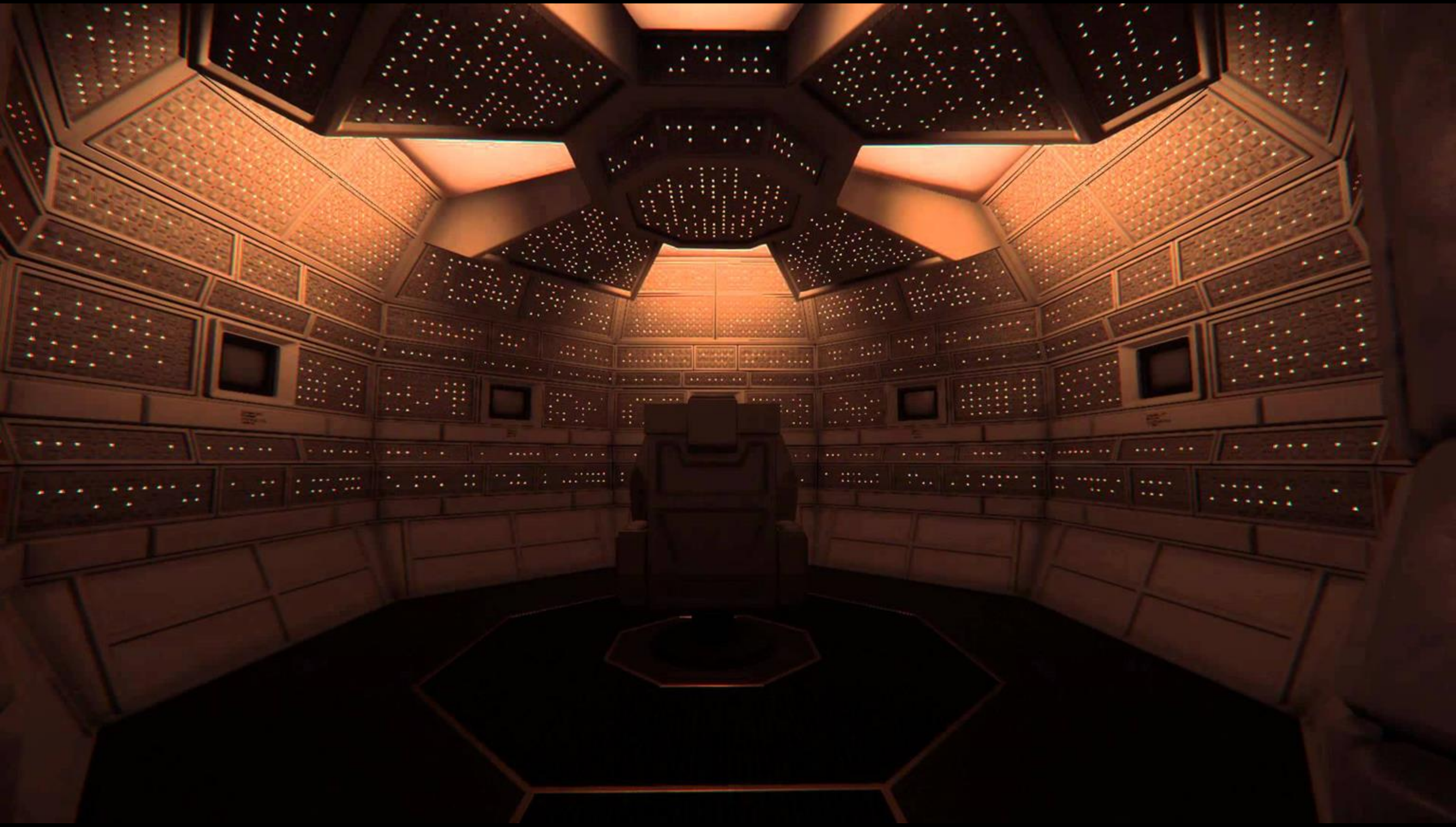
adversarial example

Targeted "6" [x_target=2]



The left side is the targeted adversarial exampele (a 28 X 28 pixel image). The right side plots the activations of the network when given the image.

Source: Machine Learning at Berkeley blog



“I keep sounding the alarm bell but until people see robots going down the street killing people, they don’t know how to react because it seems so ethereal." - Elon Musk

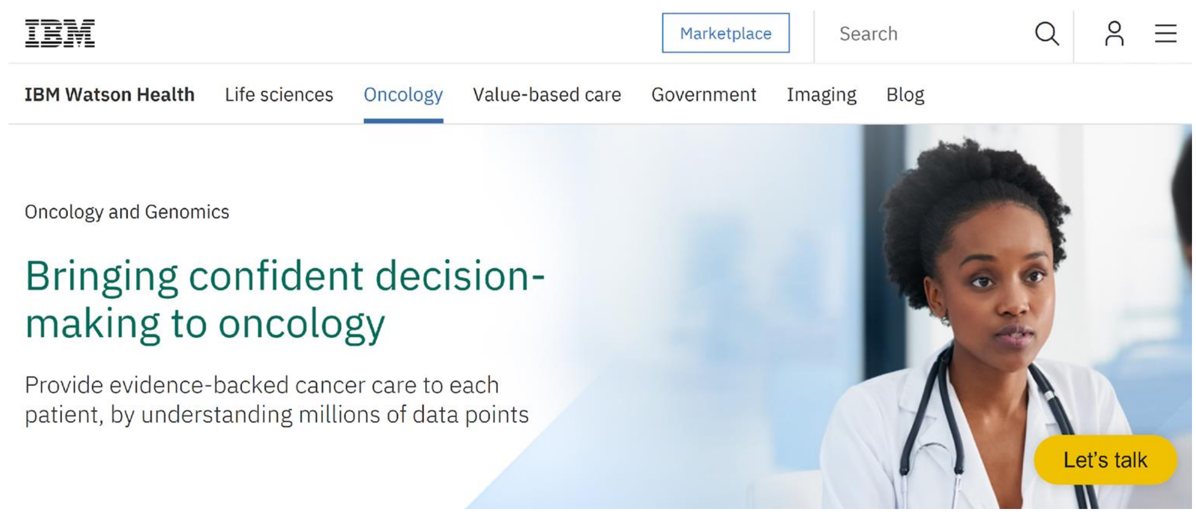
1. **Core public agencies, such as those responsible for criminal justice, healthcare, welfare, and education (e.g "high stakes" domains) should no longer use "black box" AI and algorithmic systems.** This includes the unreviewed or unvalidated use of pre-trained models, AI systems licensed from third party vendors, and algorithmic processes created in-house. The use of such systems by public agencies raises serious due process concerns, and at a minimum they should be available for public auditing, testing, and review, and subject to accountability standards.

Genomics, drug discovery, oncology

Oncology – lots of data and treatments

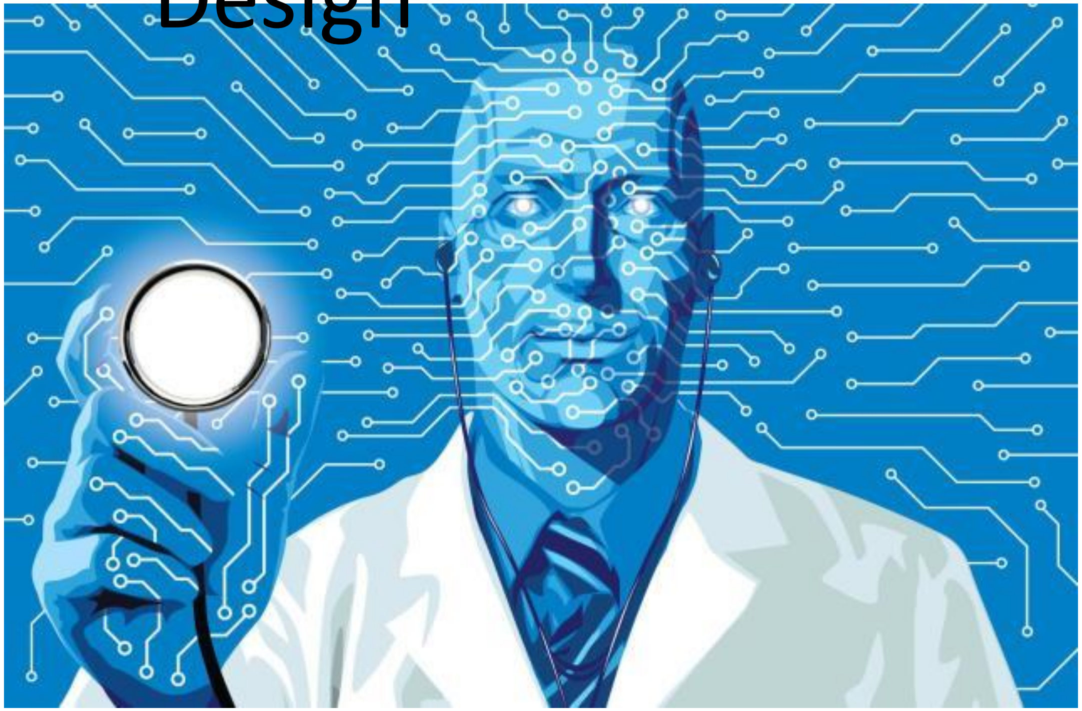
Watson – “reads” literature, protocols, patient charts

Treatment plans concordant with tumor board 93% of breast cancer cases



Some published studies are erroneous

AI Treatment Design



Some published studies cannot be reproduced

Some published studies are fraudulent

Algorithms can be taught to make biased decisions

Frequent auditing will probably be needed

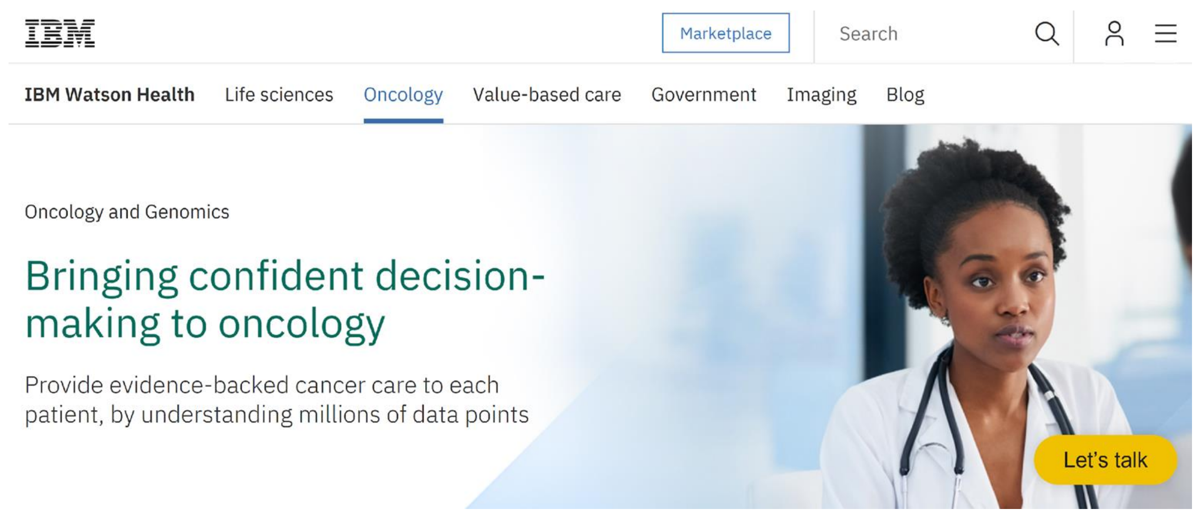
MD Anderson fallout: $39M loss

Requires costly, well-organized data input

Data input requires lots of time and labor

Can only draw conclusions on the data it is trained on

No recent system updates



"Human intelligence outperforms machine-learning applications in complex decision making routinely required during the course of care, because machines do not yet possess mature capabilities for perceiving, reasoning, or explaining."

"… machine learning can be effectively deployed today to reduce more routine, time-consuming, and resource-intensive tasks, allowing freed-up personnel to be redeployed to support higher-end work."

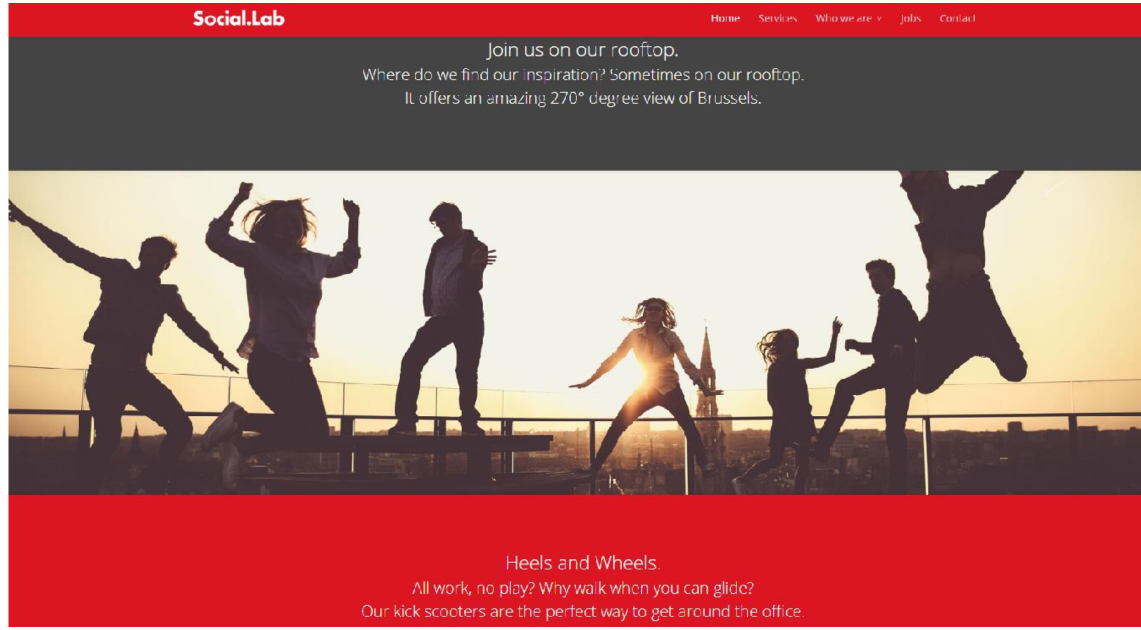
AI embedded in workplace messaging system

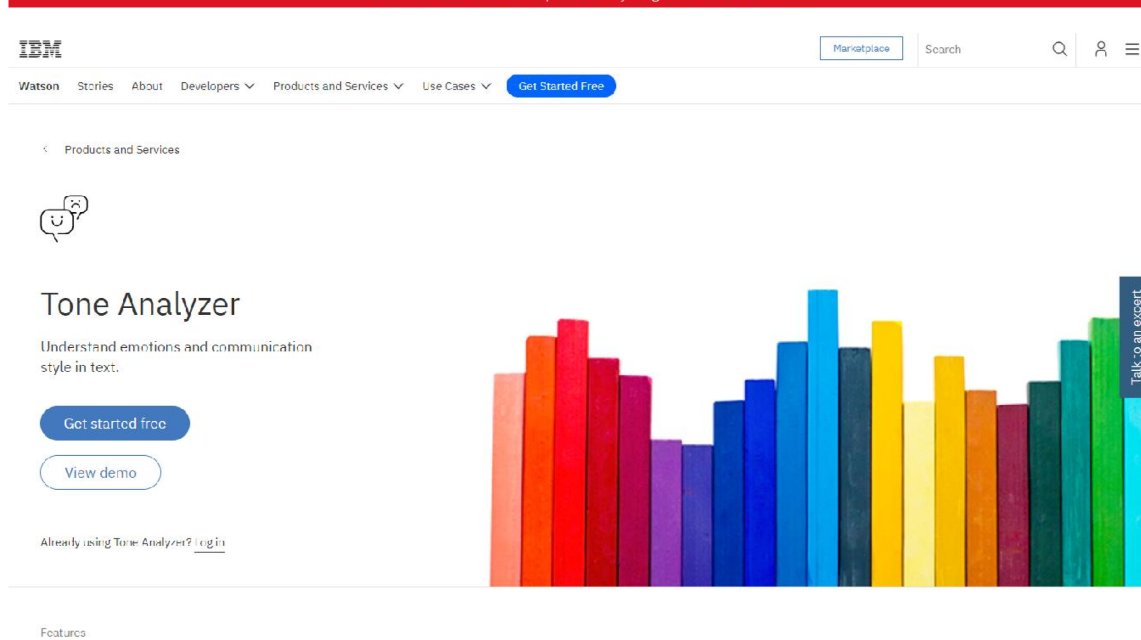
Prompts managers to solicit feedback from workers stress level

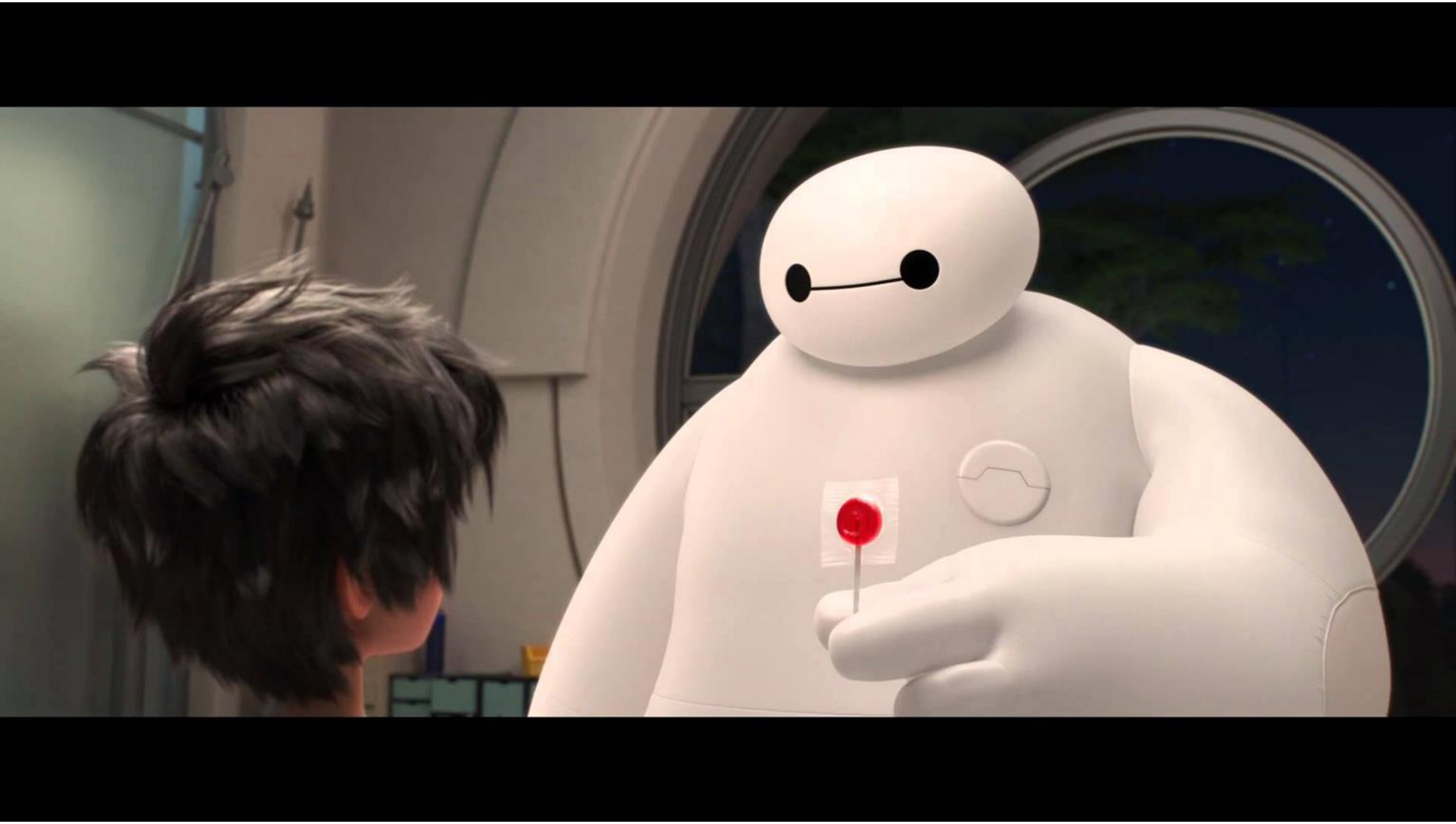
Suggests reading material

IBM Watson Tone Analyzer

Analyzes emails for negative language







Physician burnout is skyrocketing

EMRs don't help

Solution?

Digital scribes!

Fill out the EMR through voice recognition

Suggest diagnoses

Educational tool

HEALTH

How Tech Has Undermined—and May Now Save—the Doctor-Patient Relationship

AI software with voice recognition

Simplifies patient note preparation

Shares note to the cloud

Allows MD more face time with patients

Interacts with EMR for orders, lab trends

AI software

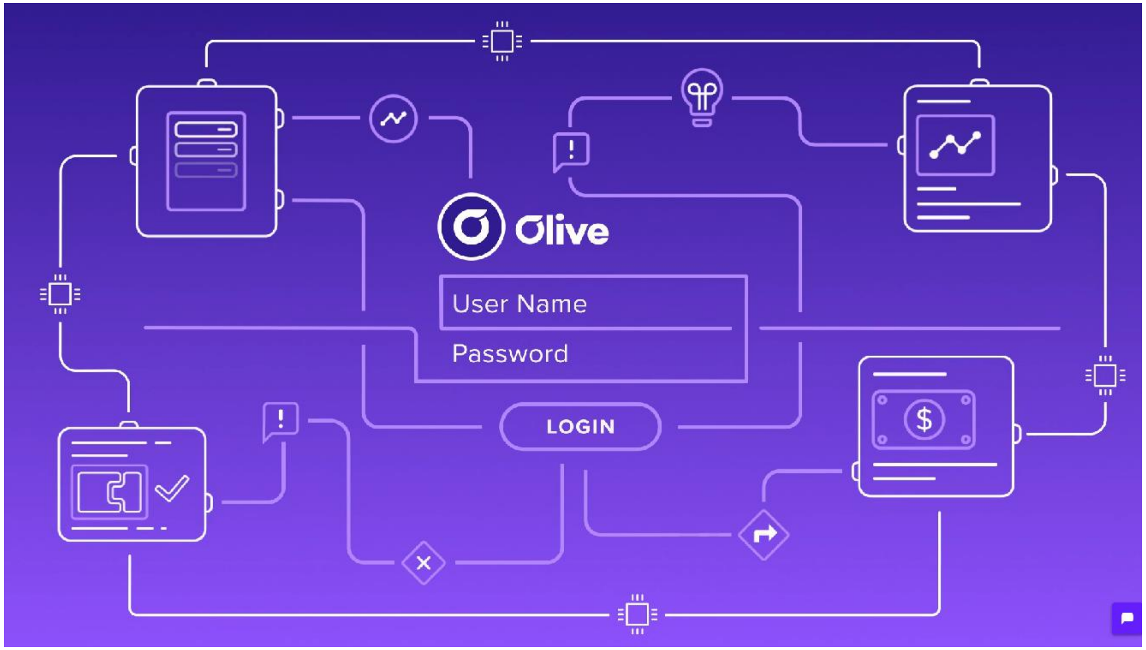
Gets an email account and EMR sign-in

Checks patient insurance eligibility against online portals

Reduced insurance denials

Reduced days in AR

Scheduling, orders, patient engagement



Geared toward Medicare Advantage

AI identification of diagnosis codes from patient chart

PDF, EMR, scanned files

Improve risk adjustment and reimbursement

Research?

106 STARTUPS TRANSFORMING HEALTHCARE WITH AI

CBINSIGHTS

Conclusions

Powerful technology

Existent or likely:

- diagnostics
- digital scribes
- chart mining
- call centers
- treatment design

Too early:

- complex clinical decision making

BUSINESS 02.01.18 09:22 AM

THE WIRED GUIDE TO ARTIFICIAL INTELLIGENCE

Supersmart algorithms won't take all the jobs, but they are learning faster than ever, doing everything from medical diagnostics to serving up ads.

BY TOM SIMONITE

ARTIFICIAL INTELLIGENCE IS overhyped—there, we said it. It's also incredibly important.