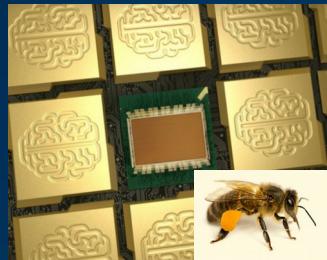


Data Science & Deeplearning for mere mortals

15:30 ~ (16:15)

Willem Hendriks
willem.hendriks@nl.ibm.com





IBM



News · AI · Biotech · Nuclear · Climate · Partner Orgs

This open letter was announced July 28 at the opening of the ICRA 2015 conference on July 28. Journalists who wish to see the press release may contact Toby Heman. Hosting, signature verification and list management are supported by FLI; for administrative questions about this letter, please contact Max Tegmark.

AUTONOMOUS WEAPONS: AN OPEN LETTER FROM AI & ROBOTICS RESEARCHERS 2015

Autonomous weapons are weapons that can select and engage targets without human intervention. They might certain pre-defined criteria, but do not include cruise missiles or remotely piloted drones for which humans make all targeting decisions. Artificial Intelligence (AI) technology has reached a point where the deployment of such systems is – practically if not legally – feasible within years, not decades, and the stakes are high: autonomous weapons have been described as the third revolution in warfare, after gunpowder and nuclear arms.

Prishna Hidayat · *Pris Like a Picasso Painting!* · JULY 14, 2016 · by ERFANUDIN HIDAYAT

2016

Magento® Is Better
200 Top Internet Retailers Chose Magento Over Other eCommerce Platforms

Prisma Photo App: Change The Picture Like Picasso Painting!

TECH

IBM's Watson AI Saves Woman's Life Rare Form of Leukaemia 2016

It took the artificial intelligence just 10 minutes to spot...
© 08/08/2016 11:24

IBM's brain-mimicking computers are getting bigger
2014

IBM recently shipped its NS16e computer with neuromorphic chips, and is working toward computers that come closer to the scale of a human brain

LISTEN: Creepy AI Telemarketer Sounds Human, Denies Being A Robot 2013

TOPICS: Activist Post · Intelligence
DECEMBER 12, 2013
Activist Post

Time Magazine is investigating a healthcare telemarketing firm who has been using an amazingly realistic robot caller which seems to operate on advanced bit creepy artificial intelligence.

Timeline
- Simon Newcomb
1938 - Frank Benford
1961 - Roger Penrose
1992 - Mark Nigrini

k Benford:
analyzed 20,229 sets of numbers, including, areas of rivers, baseball averages, atomic weights of atoms, electricity bills, etc.

fusion
ti digit numbers beginning with 1, 2 or 3 appear more frequently than ti digit numbers beginning with 4, 5, 6, etc.

CASEWARE

THE MULTIVERSE — Movie written by AI algorithm turns out to be hilarious and intense
For Sunspring's exclusive debut on Ars, we talked to the filmmakers about
collaborating with an AI.
ANNALEE NEWITZ (US) · 9/6/2016, 13:00

2016

2016

Unfortunately, the conversational AI didn't stay playful for long. People starting tweeting Tay with a series of misogynistic remarks. And Tay — being essentially a bot parrot with an AI brain — repeated these sentiments back to users, proving correct the Microsoft's concerns about the future of AI.

"Tay" went from "humans are super cool" to full nazi in less than 24 hours. Microsoft's concerns about the future of AI

Tay.ai

Data Science

*We apply techniques from Machine Learning,
on Data,
to gain knowledge / solve problems / create
Terminator / recognize a cat / ...*

Data Science

Data has Features

Example:

Person can have age (number), kids (number), married (True / False), as features

Image can have 256x256x3 color values, as features

Person apply for loan can have Age, Current Balance, and Has Credit-Card (True / False) as features



Data Science

Measure Performance

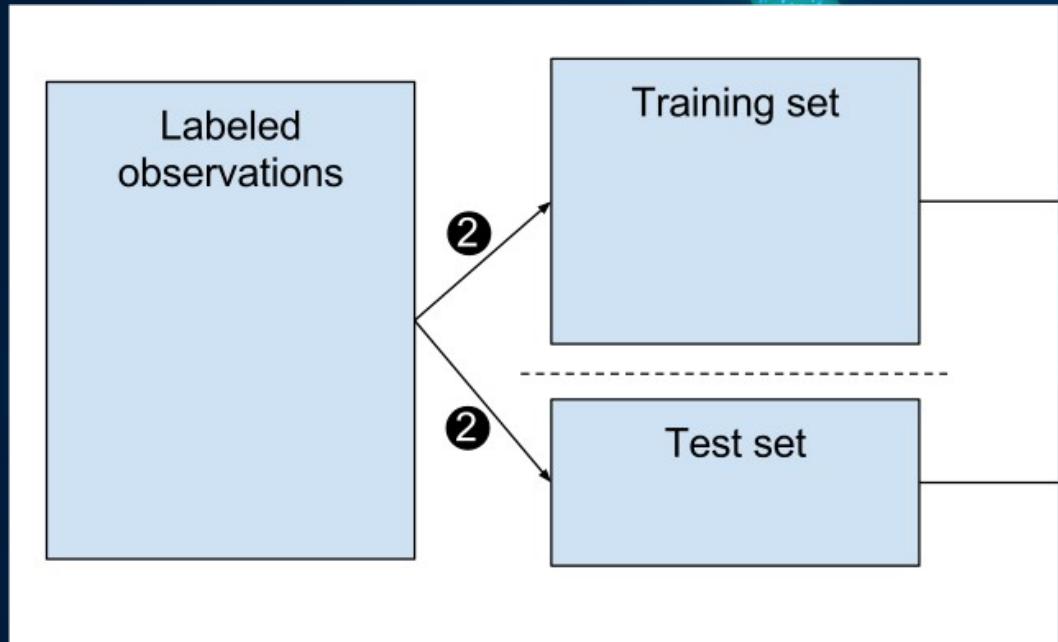
Special Case of Machine Learning - Predicting:

When we apply a Model to predict a value, we want to measure the performance.

How do we often do that?

Data

Data Science



Data Science

Deep-learning!

Supervised Learning

We need Labeled Data

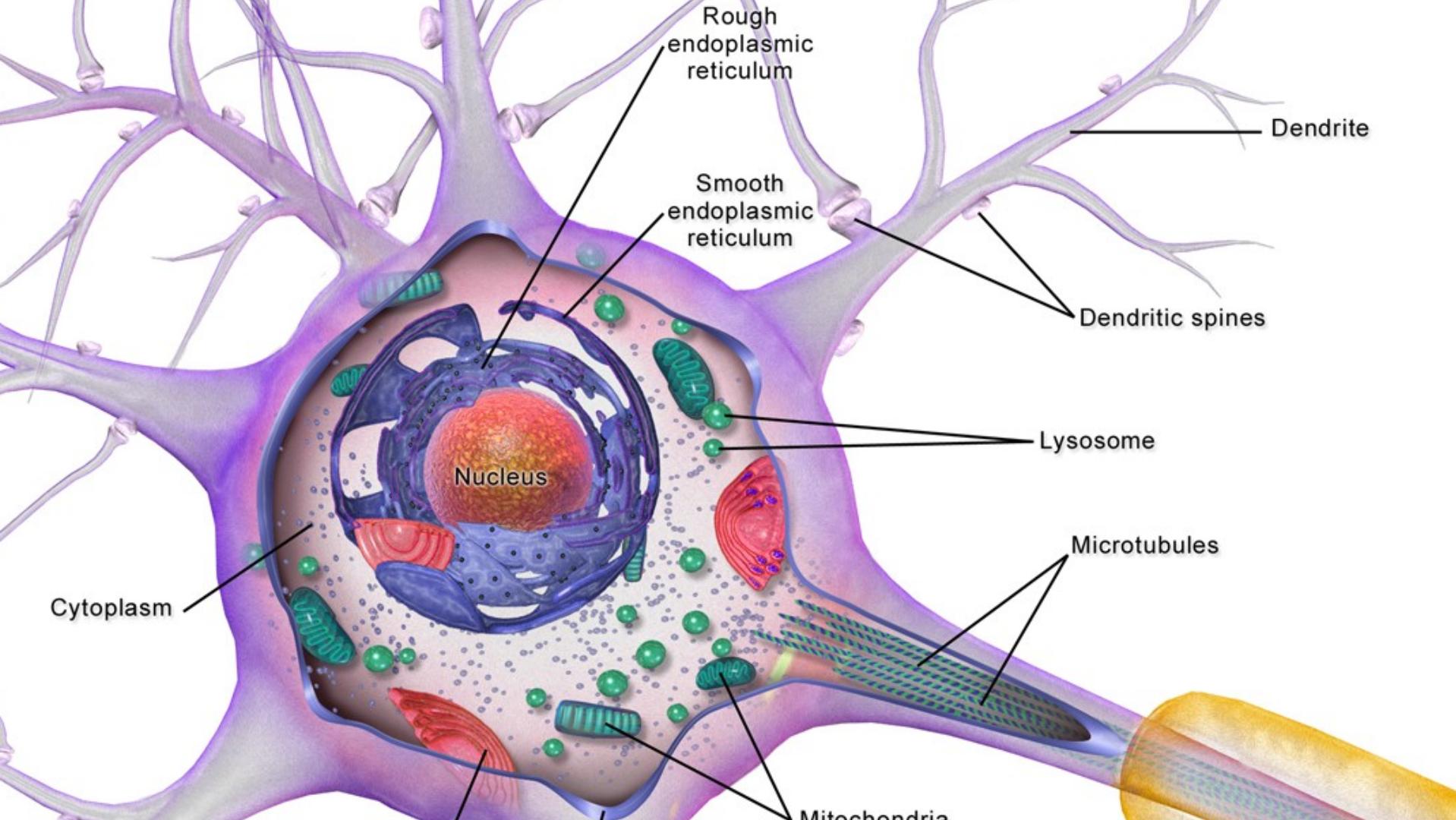
Cost of making a error

Data / Problem Complexity

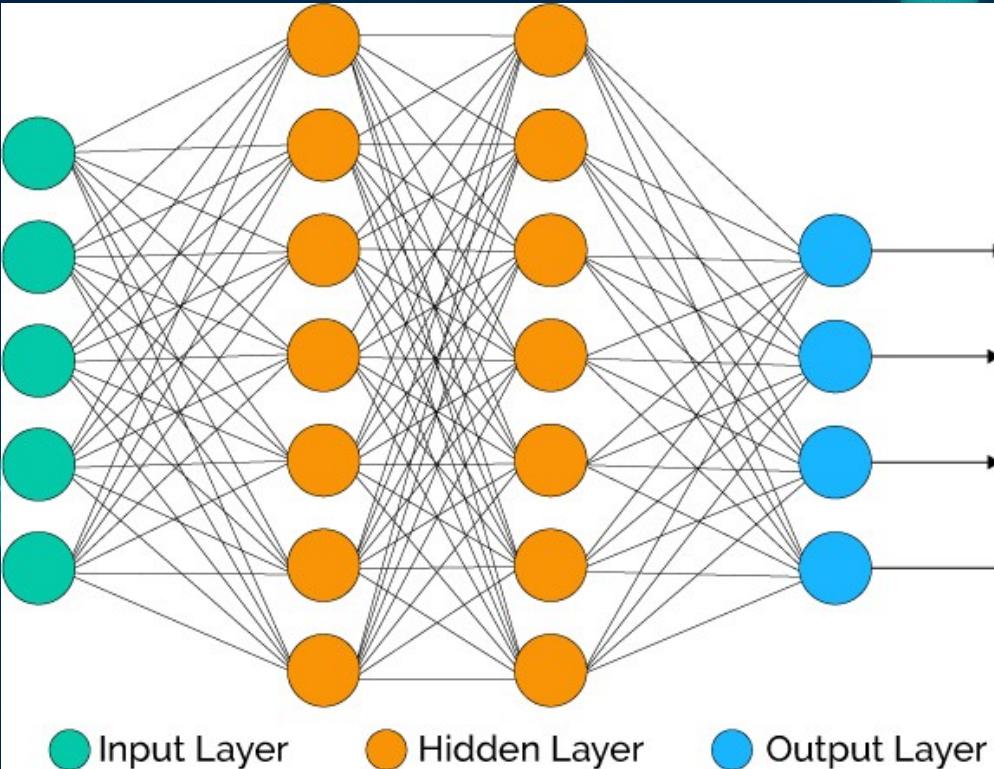
Difficulty to Apply / Maintain

Where would you place:

- *Linear Model*
- *GLM*
- *Log-Logistic Regr.*
- *Random Forest*
- *XGBoost*
- *Deep Learning*

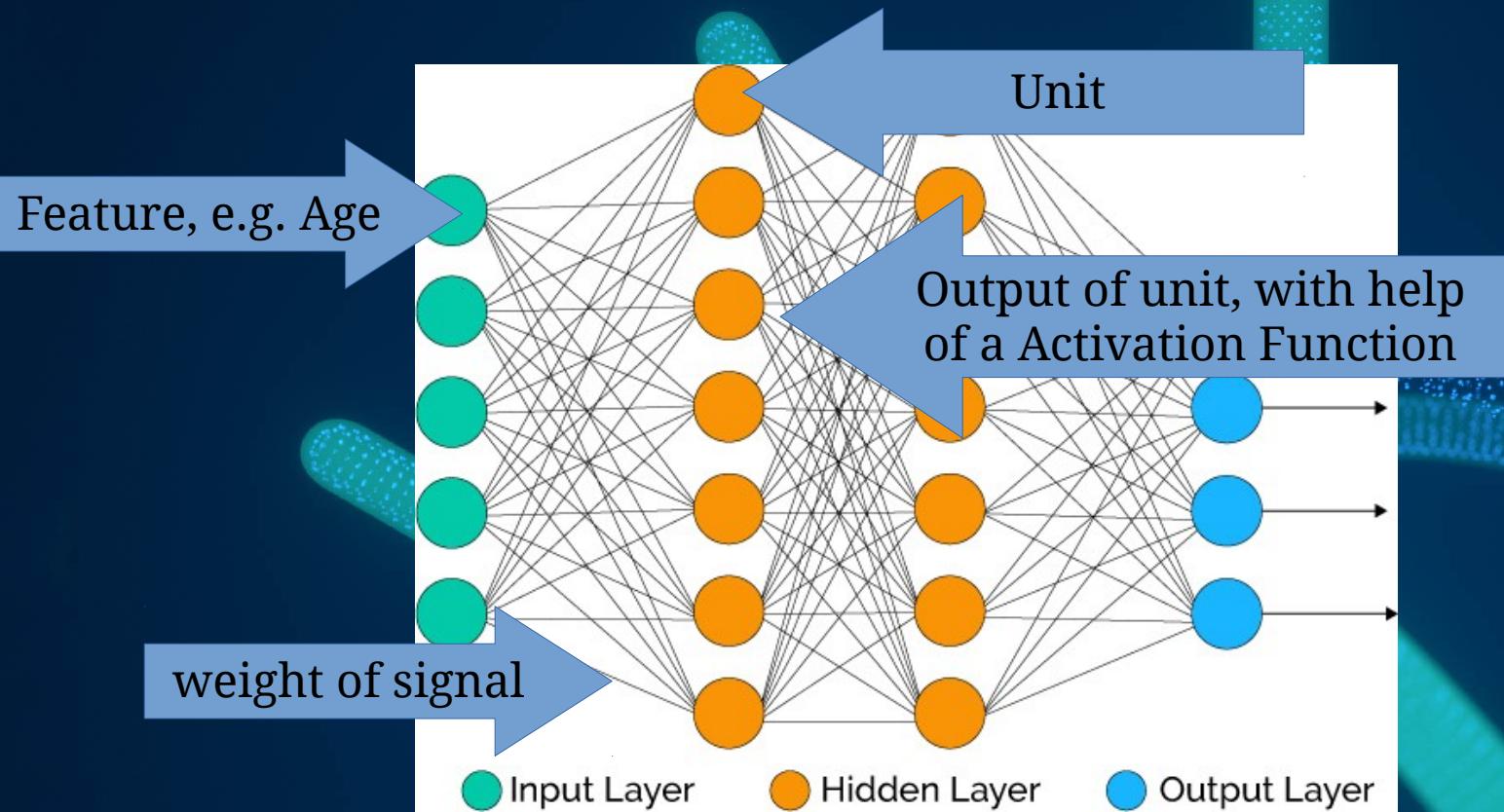


Artificial Neural Network (ANN)



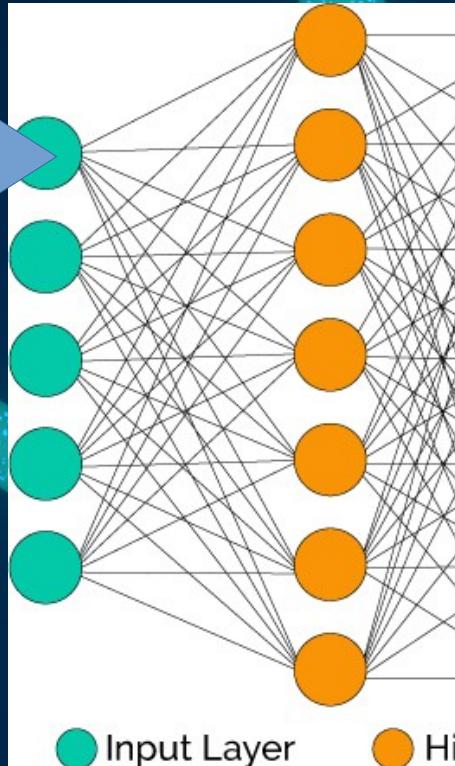
The more Hidden Layers, The more Deep-learning.
1 Layer sometimes represents Classical Models

Artificial Neural Network (ANN)



Artificial Neural Network (ANN)

Feature, e.g. Age



Many Activation Functions:

Linear

Sigmoid

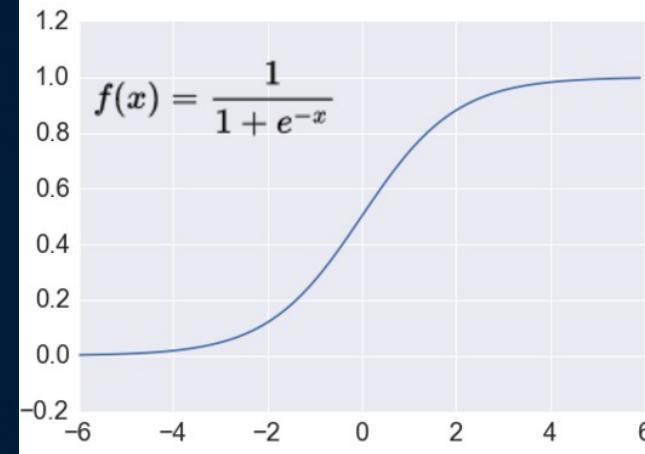
RELU

Tan / Sin family

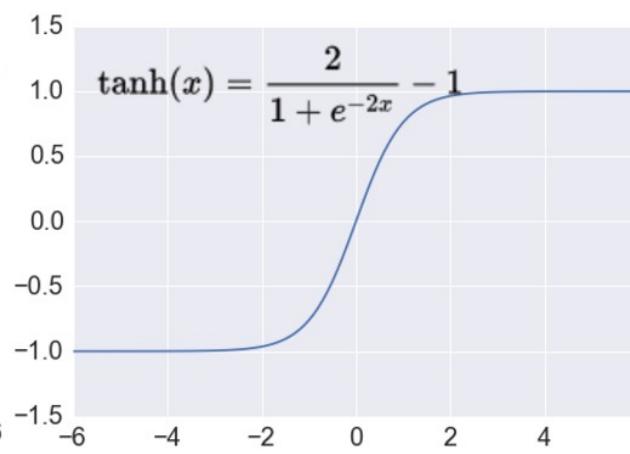
Artificial Neural Network (ANN)

Common Activation Functions

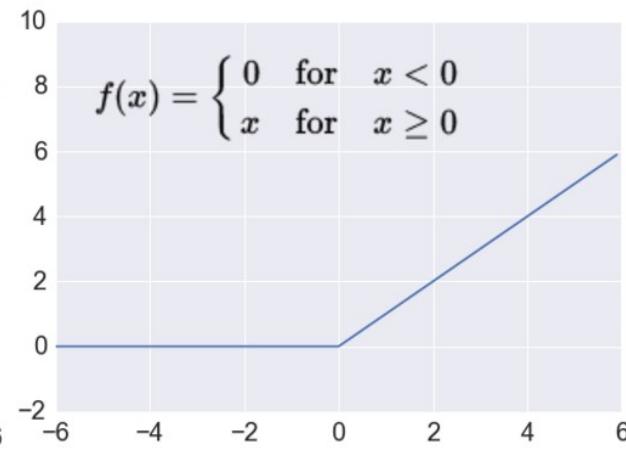
Sigmoid



TanH



ReLU

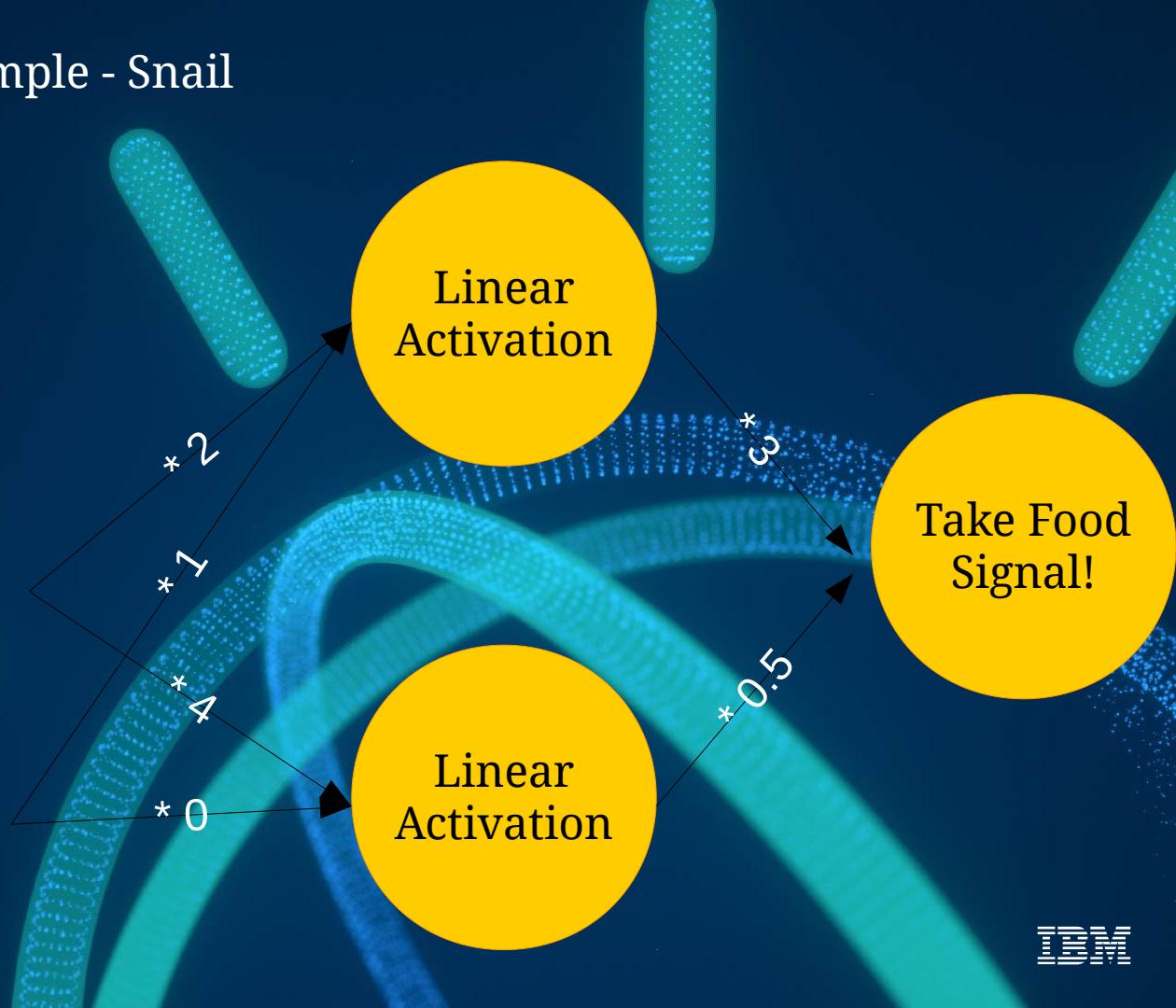


Example - Snail



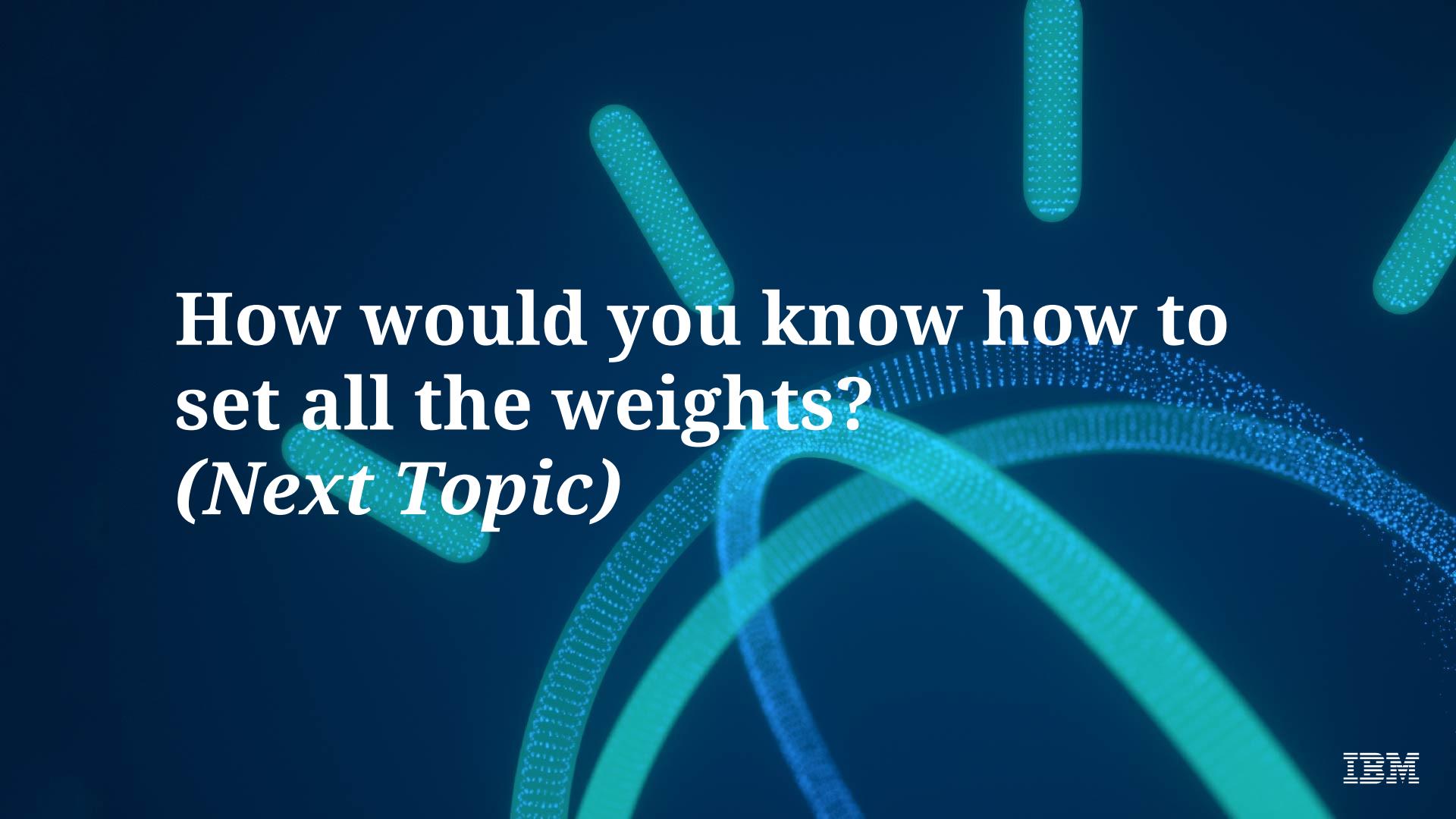
Feature 1: Hunger Level
Input H: 0.5

Feature 2: Sees food in
Range Level
Input S: 1



What is the Most Used Activation Function?

Which Activation mimics our Brain the Best?



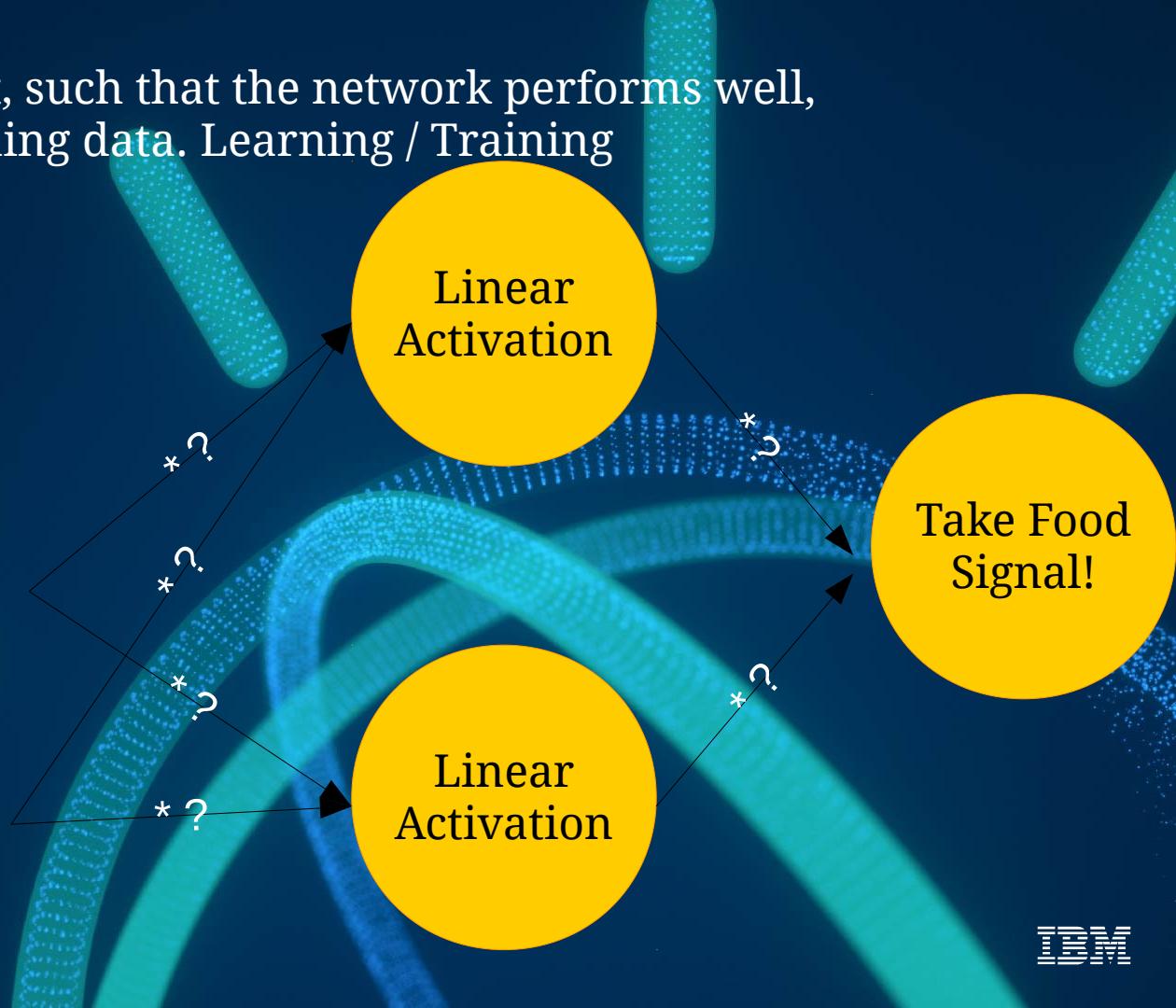
How would you know how to
set all the weights?
(Next Topic)

Weights need to be set, such that the network performs well, on our available Training data. Learning / Training

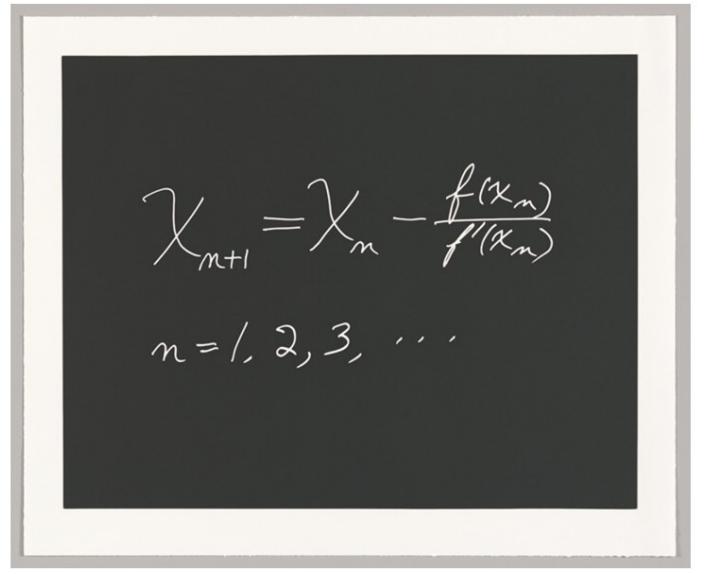


Feature 1: Hunger Level
Input H: 0.5

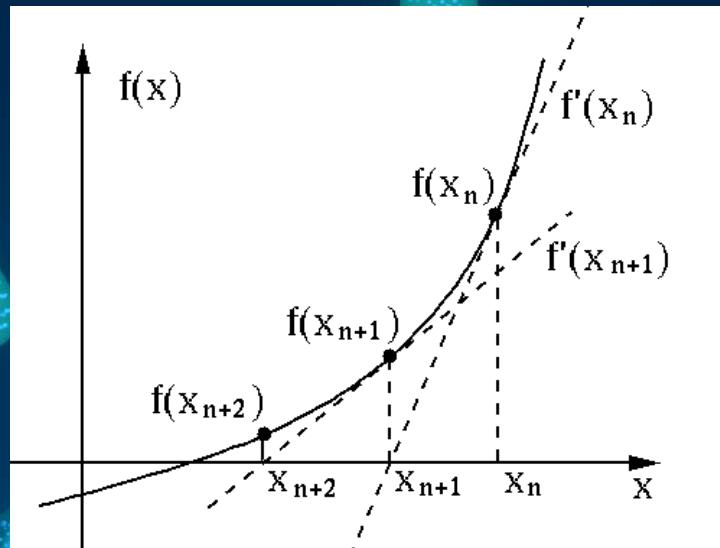
Feature 2: Sees food in
Range Level
Input S: 1



Stephen Smale: "Newton's Method"



Stephen Smale (American, born 1930). *Concinnitas*, 2014



IBM

During the training Phase, of a Neural Network,

Data is fired through the network, and with help of the derivative, a **optimizer** will find the (almost) best **weights**

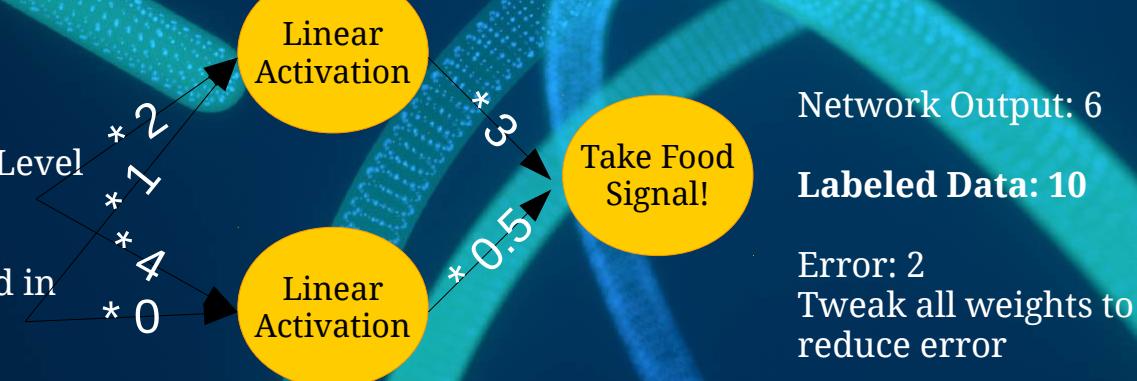
1. Take a data point
2. Calculate output
3. Use output error (in combination with derivative) to re-calibrate all weights
4. repeat , with next data point



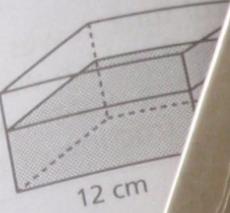
Example - Snail

Feature 1: Hunger Level
Input H: 0.5

Feature 2: Sees food in Range Level
Input S: 1



ains water filled to $\frac{3}{4}$ of its height.
be the water level in the tank,
 cm^3 of water is poured out from the
volume = length \times breadth \times height,
Height = $\frac{\text{volume}}{\text{length} \times \text{breadth}}$



1:
of water in the tank = $\frac{3}{4} \times 8$
= 6 cm
= 12×10
= 720 cm³
e of water in the tank = 60 cm^3
water poured out = 60 cm³
- ?

HOW STUDY TO BY JOSEPH V. LANDY, S.J.

THE ART OF LEARNING
AND MAKING IT STICK

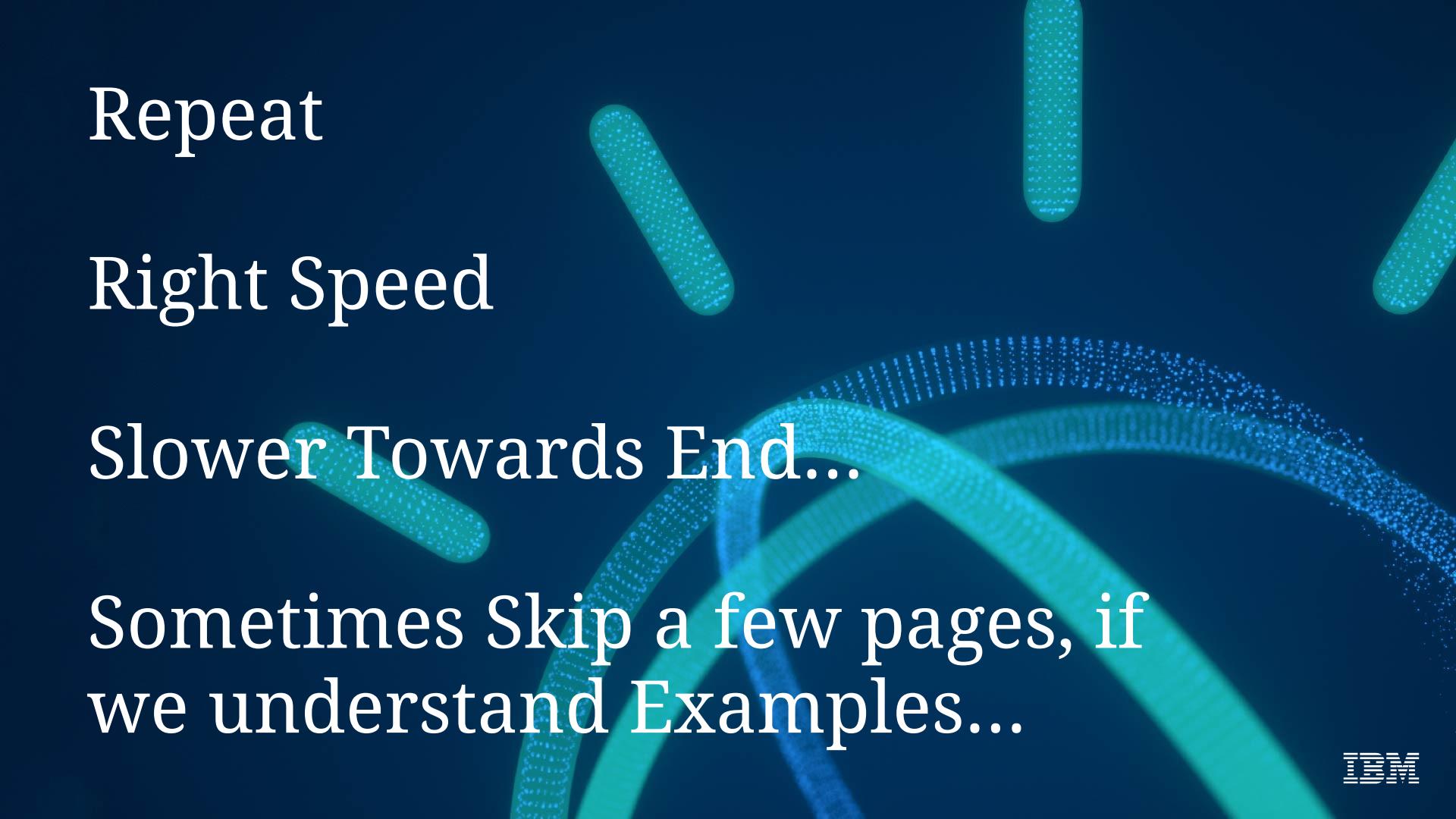


Take Note
Remember that $1 \text{ l} = 1000 \text{ cm}^3$ or 1000 ml. For instance in Example 1, if the volume of water in tank A is 1.728 l, then $1.728 \times 1000 = 1728 \text{ cm}^3$.

counting cubes. This will help you to
counting the same cube twice. One
count vertically.

2, sometimes
or calculation
Example 2(b) —
s are awarded for
simplified answer (as
o make problem-solvin

ight given the volume,
or breadth, if the other
ave been included for
crease) in height may be cal
Example 3. Using this method
orking.



Repeat

Right Speed

Slower Towards End...

Sometimes Skip a few pages, if
we understand Examples...

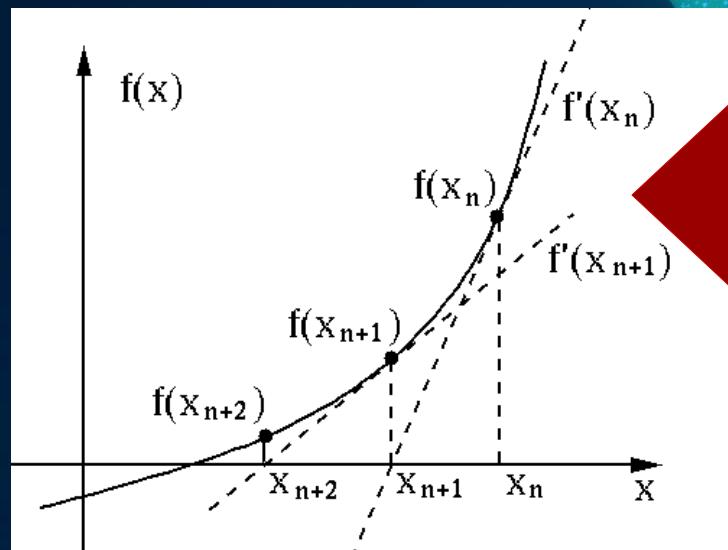
Repeat, Epochs

Right Speed, Learning Rate

Slower Towards End... Decay

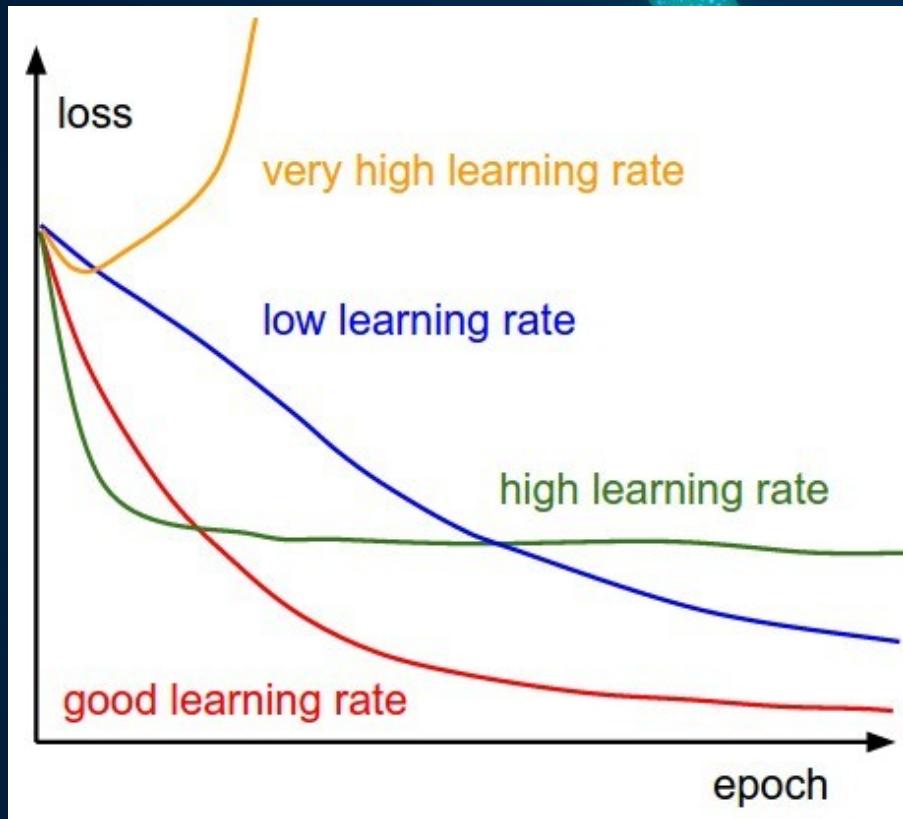
Sometimes Skip a few pages Momentum

Right Speed, Learning Rate



The size of the step, towards
the right direction

Right Speed, Learning Rate



Decay

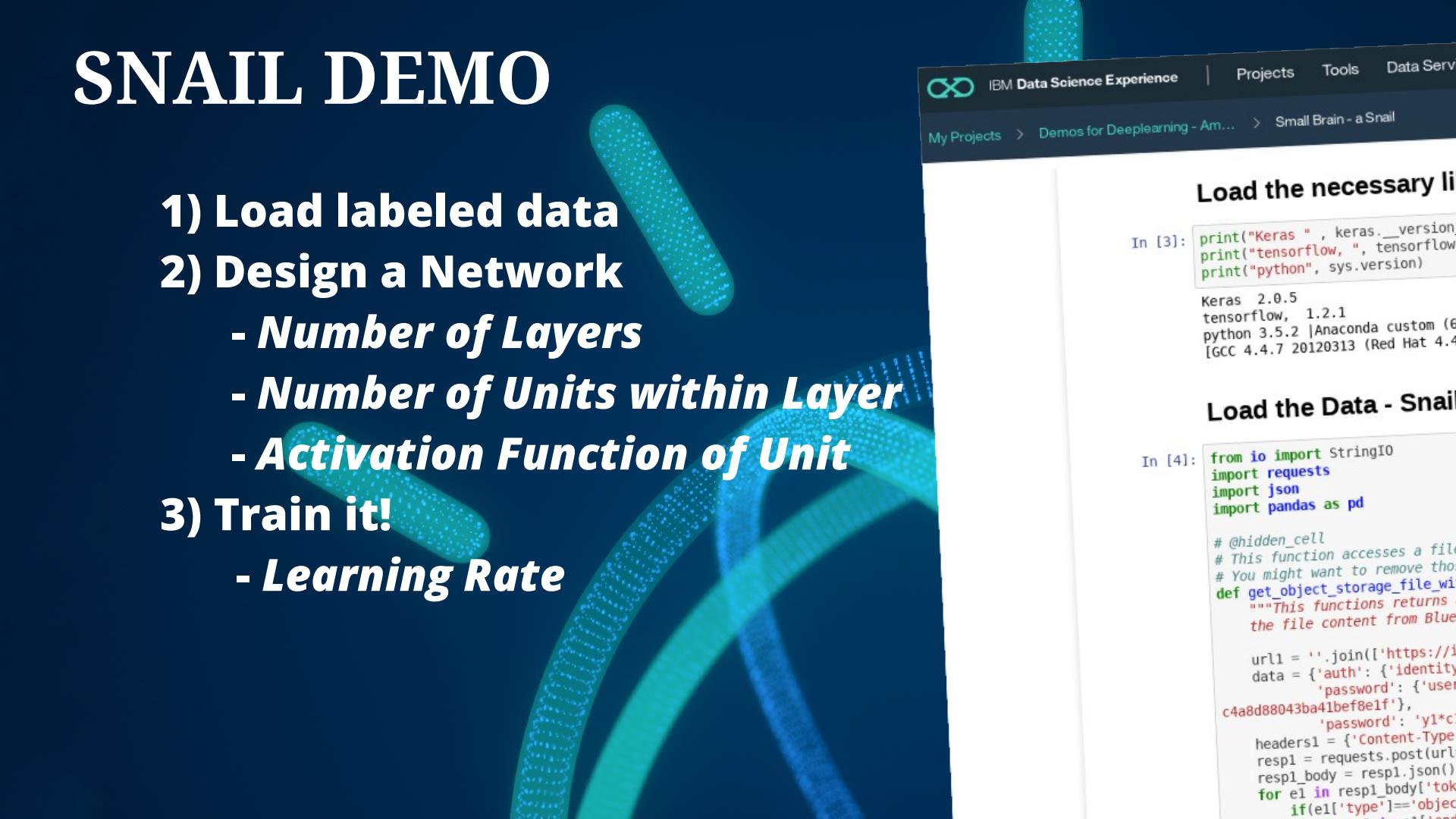
Decrease Learning rate, as the Epochs increase

Momentum

Increase Learning rate, if derivative stays same

SNAIL DEMO

- 1) Load labeled data
- 2) Design a Network
 - *Number of Layers*
 - *Number of Units within Layer*
 - *Activation Function of Unit*
- 3) Train it!
 - *Learning Rate*



IBM Data Science Experience | Projects Tools Data Serv

My Projects > Demos for Deeplearning - Am... > Small Brain - a Snail

Load the necessary libraries

```
In [3]: print("Keras ", keras.__version__)
print("tensorflow, ", tensorflow.__version__)
print("python", sys.version)
```

Keras 2.0.5
tensorflow, 1.2.1
python 3.5.2 |Anaconda custom (64-bit)
[GCC 4.4.7 20120313 (Red Hat 4.4.7-1)]

Load the Data - Snail

```
In [4]: from io import StringIO
import requests
import json
import pandas as pd

# @hidden_cell
# This function accesses a file
# You might want to remove this
def get_object_storage_file_with_token():
    """This function returns the file content from BlueMix
    """

    url1 = ''.join(['https://', os.environ['STORAGE_NAME'], '.mymycosmos.ams.', os.environ['STORAGE_REGION'], '.cloud-object-storage.net/v1/b/'])
    data = {'auth': {'identity': {'username': os.environ['STORAGE_USERNAME'], 'password': os.environ['STORAGE_PASSWORD']}}, 'c4a8d88043ba41bef8e1f': {'password': 'y1*c*!@#'}}

    headers1 = {'Content-Type': 'application/json'}
    resp1 = requests.post(url1, data=json.dumps(data))
    resp1_body = resp1.json()
    for el in resp1_body['tokens']:
        if(el['type']=='object')
```

nu

Maandag 06 november 2017 | Het laatste nieuws het eerst op NU.nl

11 °C 0 NS 554,29 TV gids 0 Live

Voorpagina Net binnen Algemeen Achtergronden Economie Sport Tech Entertainment Lifestyle Overig Wetenschap Opmerkelijk Dieren NUcheckt Auto Video's Regionaal

[NU.nl](#) > [Overig](#) > [Wetenschap](#)

Foto: Thinkstock

Slakken nemen complexe beslissingen met twee hersencellen

Gepubliceerd: 03 juni 2016 19:17 Laatste update: 04 juni 2016 05:23

f t G+

Wetenschappers hebben een simpel hersenmechanisme in kaart gebracht waarmee slakken besluiten of ze gaan eten of niet.

Als een slak langs een blaadje sla kruip, bepaalt de activiteit van twee hersencellen of het dier stopt en het voedsel opeet.

Dat melden onderzoekers van Sussex in het wetenschappelijk tijdschrift *Nature Communications*.

Bij hun onderzoek brachten biologen met elektronische apparatuur de hersenactiviteit in kaart van tientallen slakken die door een ruimte kropen waarin de temperatuur en luchtvochtigheid de levenskostie van de dieren.

Net binnen

- 13:21 - Fossiel van nieuwe prehistorische dolfijne...
- 13:11 - Ook Locadia meldt zich geblesseerd af v...
- 13:01 - Harry Piekema krijgt rol in Sinterklaasjour...
- 12:57 - Rus na partij van ruim drie uur onderuit in...

Google Pixel 2

Ask more of your phone.

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Meest gelezen

1. Dode en gewonde bij schietpartij bij nachtclub...
2. Zeker 26 doden bij schietpartij in kerk Amerika...
3. Autoriteiten tasten nog in duister over motief s...
4. Stations Amsterdam en Schiphol gaan weer o...

[Meer nieuws >](#)

IBM

Find the derivative.

$$f(x) = x^4 + 2x^3 - x^2 + 4x - 1$$

POWER RULE

$$\frac{d}{dx}(x^n) = nx^{n-1}$$

$$f'(x) = 4x^3 + 2 \cdot 3x^2 - 2x^1$$

*How does KERAS
know the
derivatives ?*

$$\frac{d}{dx}[cx] = c$$

$$\frac{d}{dx}[x] = 1$$

Road Blocks:

- Need for Data
- Over-fitting
- Won't learn at all
- Design not Optimal
- Not Fast Enough (GPU)
- “ERROR: Cannot use operator on 232x3 and 12x3”
- ...



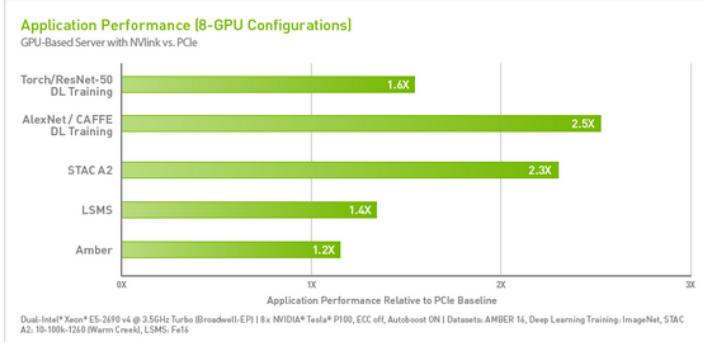
IBM & NVIDIA

NVIDIA NVLINK HIGH-SPEED INTERCONNECT

MAXIMUM THROUGHPUT FOR SUPERIOR APPLICATION PERFORMANCE

NVIDIA® NVLink™ is a high-bandwidth, energy-efficient interconnect that enables ultra-fast communication between the CPU and GPU, and between GPUs. The technology allows data sharing at rates 5 to 12 times faster than the traditional PCIe Gen3 interconnect, resulting in dramatic speed-ups in application performance and creating a new breed of high-density, flexible servers for accelerated computing. [Download the whitepaper](#) for more details on NVLink.

Designed to meet the challenges of exascale computing, NVLink is a fundamental ingredient of the U.S. Department of Energy's [next-generation supercomputers](#). One such system—"Titan" at Oak Ridge National Laboratory—is currently the fastest supercomputer in the US*. Read more about these supercomputers by [downloading the technology brief](#). Also, for Deep Learning applications, Tesla GPUs can accelerate you time to results from months to days. Read more about deep learning on Tesla platforms [here](#).



The screenshot shows the NVIDIA homepage with a news article overlay. The article title is "New IBM Servers with Tesla P100 GPUs and NVLink Mark a Milestone in High Performance Computing". The text discusses how data center workloads are changing and how enterprise companies benefit from analyzing large amounts of data.

Posted on SEPTEMBER 8, 2016 by IAN BUCK

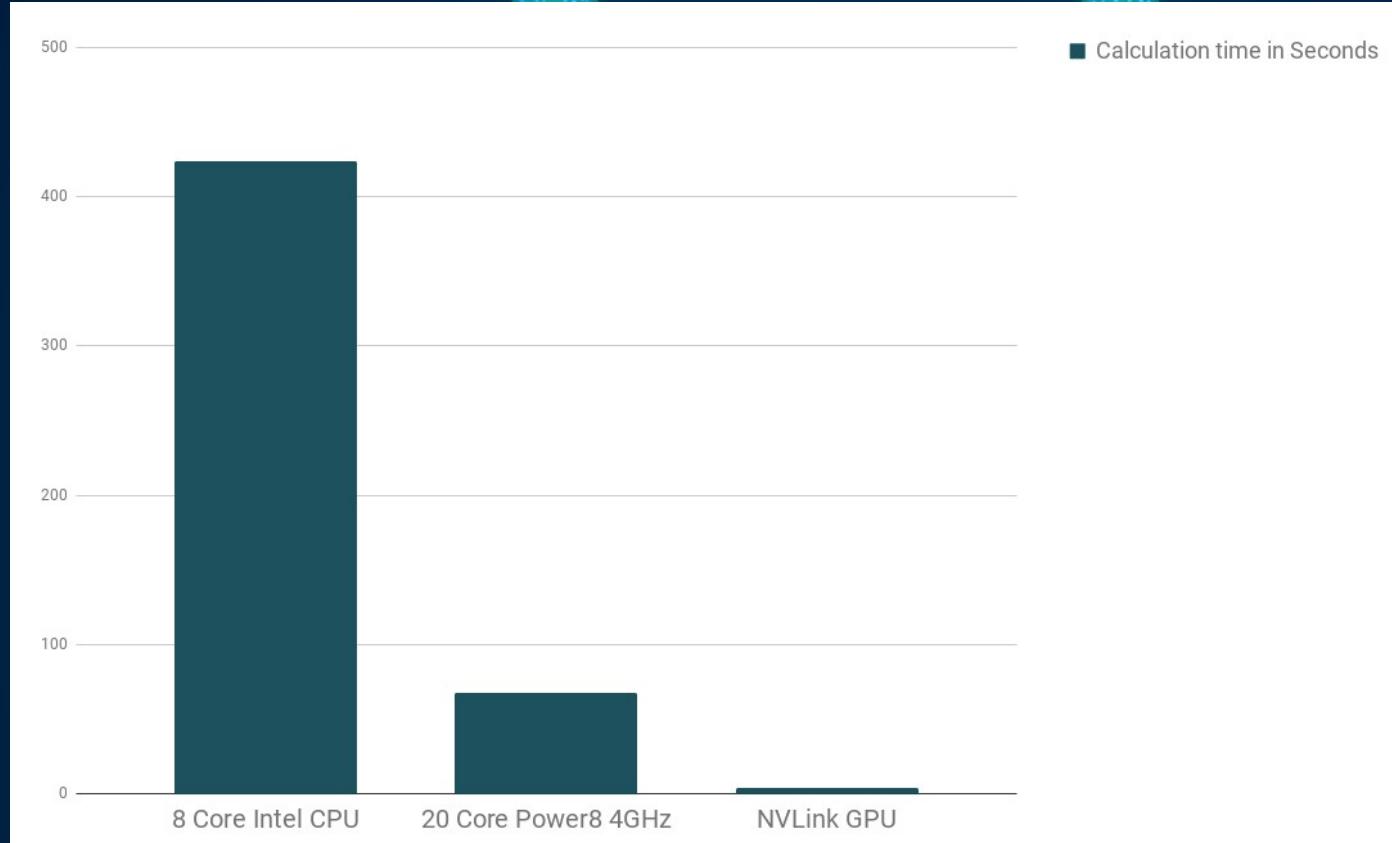
New IBM Servers with Tesla P100 GPUs and NVLink Mark a Milestone in High Performance Computing

Data center workloads are changing. Not long ago these systems were primarily used to handle storage and serve up web pages, but now they're increasingly tasked with AI workloads like understanding speech, text, images and video or analyzing big data for insights.

Billions of consumers want instant answers to a multitude of questions, while enterprise companies want to analyze mountains of data to better serve their customers' needs. Where do those answers come from? In data centers.

...al years ago, and partnered with us to ...duced its

Fastest Data Bus to GPU is here behind us in A'dam NVLink on Power



IBM



Over-fitting....

Too Focused on details, when learning:

- Don't look on page number, when learning in a book, it is not related

When A network is too complex for a problem, it tries to find relations which are not part of the phenomenon we try to teach

Brain Myth: Drinking alcohol kills brain cells

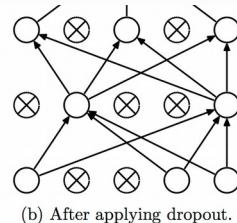
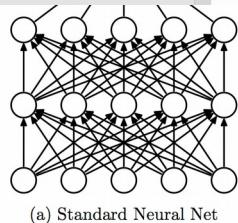
Brain Fact: Moderate alcohol use doesn't kill brain cells, and while rampant alcohol use can damage the brain, it's not due to cell death.

Does alcohol kill brain cells? You've probably heard this myth, but it's not really true. Moderate alcohol intake doesn't kill brain cells, or even damage them. That's because the amount of alcohol needed to kill brain cells would also kill the person drinking it!

That doesn't mean that alcohol can't damage the brain, though. Alcoholics can experience brain damage related to drinking, but it's not because alcohol kills brain cells. There are a few things that can happen when people drink a lot of alcohol over a long period of time. **While it can't kill brain cells, it can damage the dendrites, which are the branch-like ends of the brain cells. Dendrites are key for passing messages from one neuron to another**, so a degradation of the dendrites can cause cognitive problems. Recent research shows that dendrite damage can be reversed with certain kinds of therapy and training.

<https://www.brainhq.com/brain-resources/brain-facts-myths/brain-myth-alcohol-kills-brain-cells>

The screenshot shows a web browser displaying the brainHQ website. The page title is "Brain Myth: Drinking alcohol kills brain cells". The main content area contains the text from the slide, followed by a detailed explanation of how alcohol damage is not due to cell death but rather to the degradation of dendrites. The URL in the address bar is visible as https://www.brainhq.com/brain-resources/cool-brain-facts-myths/brain-myth-alcohol-kills-brain-cells. The brainHQ logo, featuring a stylized brain icon, is at the top left. The navigation bar includes links for Home, Why BrainHQ?, World Class Science, help, and Brain Resources. A breadcrumb trail on the left side of the page indicates the current location: Home > Brain Resources > Cool Brain Facts & Myths > Brain Mythology > Brain Myth: Drinking alcohol kills brain cells.

[Home](#)[Getting started](#)[Guide to the Sequential model](#)[Guide to the Functional API](#)[FAQ](#)[Models](#)[About Keras models](#)[Sequential](#)[Model \(functional API\)](#)[Layers](#)[About Keras layers](#)[Core Layers](#)[Dense](#)[Activation](#)[Dropout](#)[Flatten](#)[Reshape](#)[Permute](#)

Same shape as input.

Dropout

[\[source\]](#)

```
keras.layers.Dropout(rate, noise_shape=None, seed=None)
```

Applies Dropout to the input.

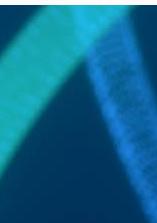
Dropout consists in randomly setting a fraction `rate` of input units to 0 at each update during training time, which helps prevent overfitting.

Arguments

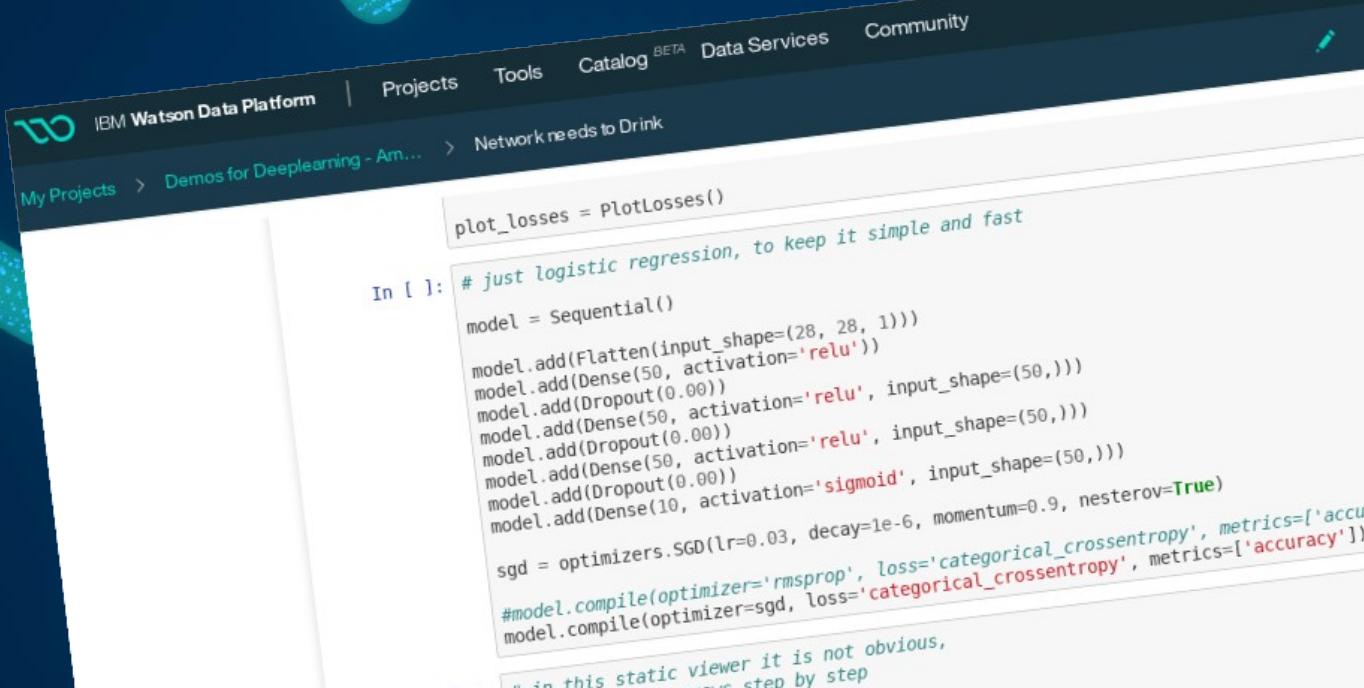
- `rate`: float between 0 and 1. Fraction of the input units to drop.
- `noise_shape`: 1D integer tensor representing the shape of the binary dropout mask that will be multiplied with the input. For instance, if your inputs have shape `(batch_size, timesteps, features)` and you want the dropout mask to have the same shape, you can use `noise_shape=(batch_size, timesteps, features)`.
- `seed`: A Python integer to use as random seed.

References

- [Dropout: A Simple Way to Prevent Neural Networks from Overfitting](#)



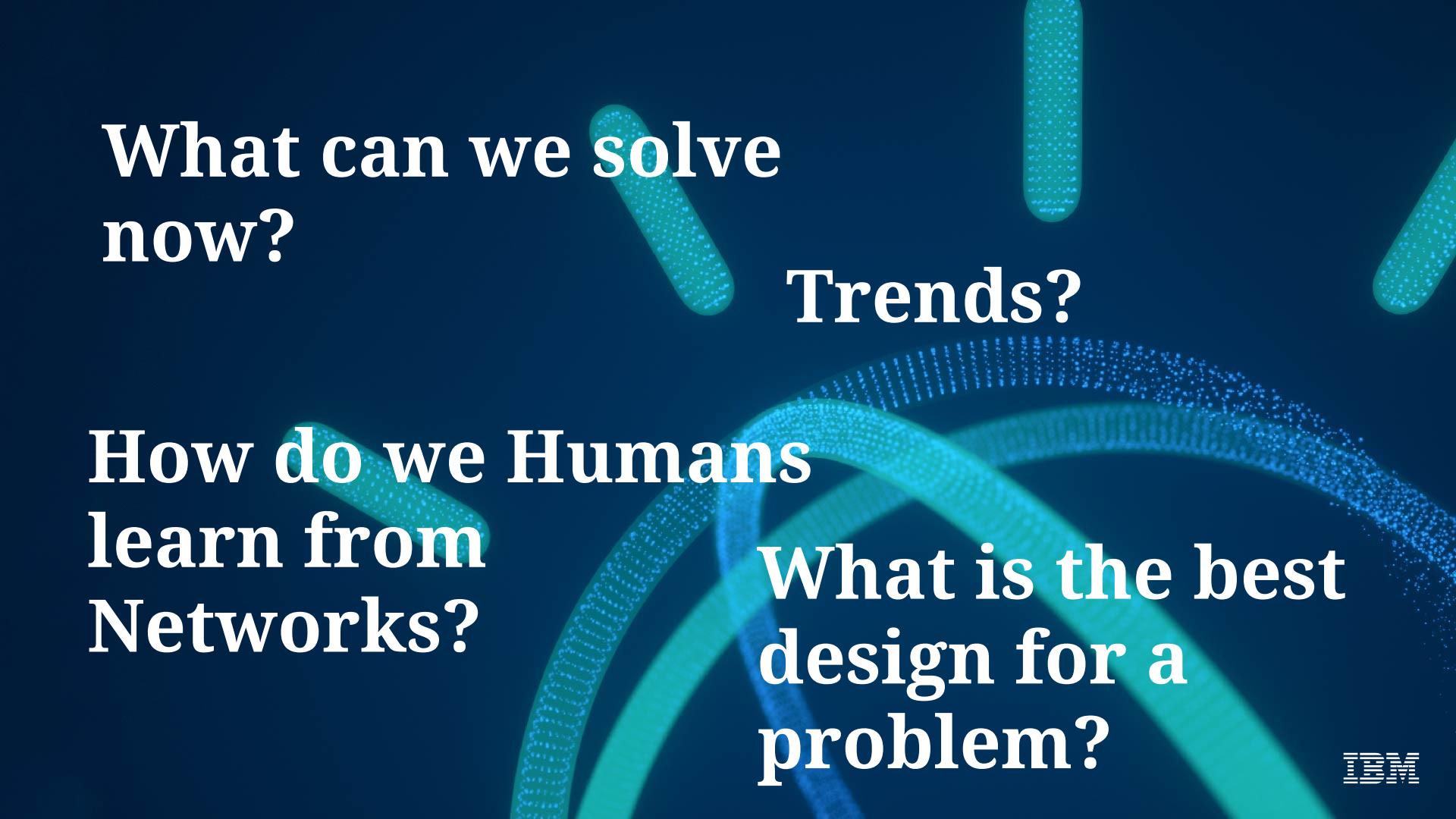
DROP OUT DEMO



The screenshot shows the IBM Watson Data Platform interface. The top navigation bar includes links for Projects, Tools, Catalog BETA, Data Services, and Community. Below the navigation, the breadcrumb navigation shows "My Projects > Demos for Deeplearning - Arn... > Network needs to Drink". The main content area displays a Jupyter notebook cell with the following Python code:

```
plot_losses = PlotLosses()  
  
In [ ]: # just logistic regression, to keep it simple and fast  
model = Sequential()  
model.add(Flatten(input_shape=(28, 28, 1)))  
model.add(Dense(50, activation='relu'))  
model.add(Dropout(0.00))  
model.add(Dense(50, activation='relu', input_shape=(50,)))  
model.add(Dropout(0.00))  
model.add(Dense(50, activation='relu', input_shape=(50,)))  
model.add(Dropout(0.00))  
model.add(Dense(10, activation='sigmoid', input_shape=(50,)))  
sgd = optimizers.SGD(lr=0.03, decay=1e-6, momentum=0.9, nesterov=True)  
#model.compile(optimizer='rmsprop', loss='categorical_crossentropy', metrics=['accuracy'])  
model.compile(optimizer=sgd, loss='categorical_crossentropy', metrics=['accuracy'])
```

A callout box highlights the line `# just logistic regression, to keep it simple and fast`. Another callout box at the bottom right contains the text: "in this static viewer it is not obvious, ... step by step".



What can we solve
now?

Trends?

How do we Humans
learn from
Networks?

What is the best
design for a
problem?