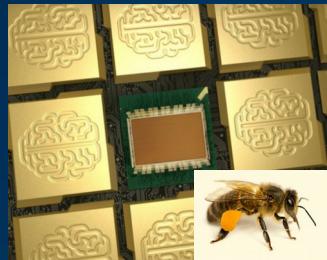


Data Science & Deeplearning for mere mortals

Willem Hendriks
willem.hendriks@nl.ibm.com

14:15 – 15:00 Part I
15:00 – 15:15 Coffee
15:15 – 16:30 Part II





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

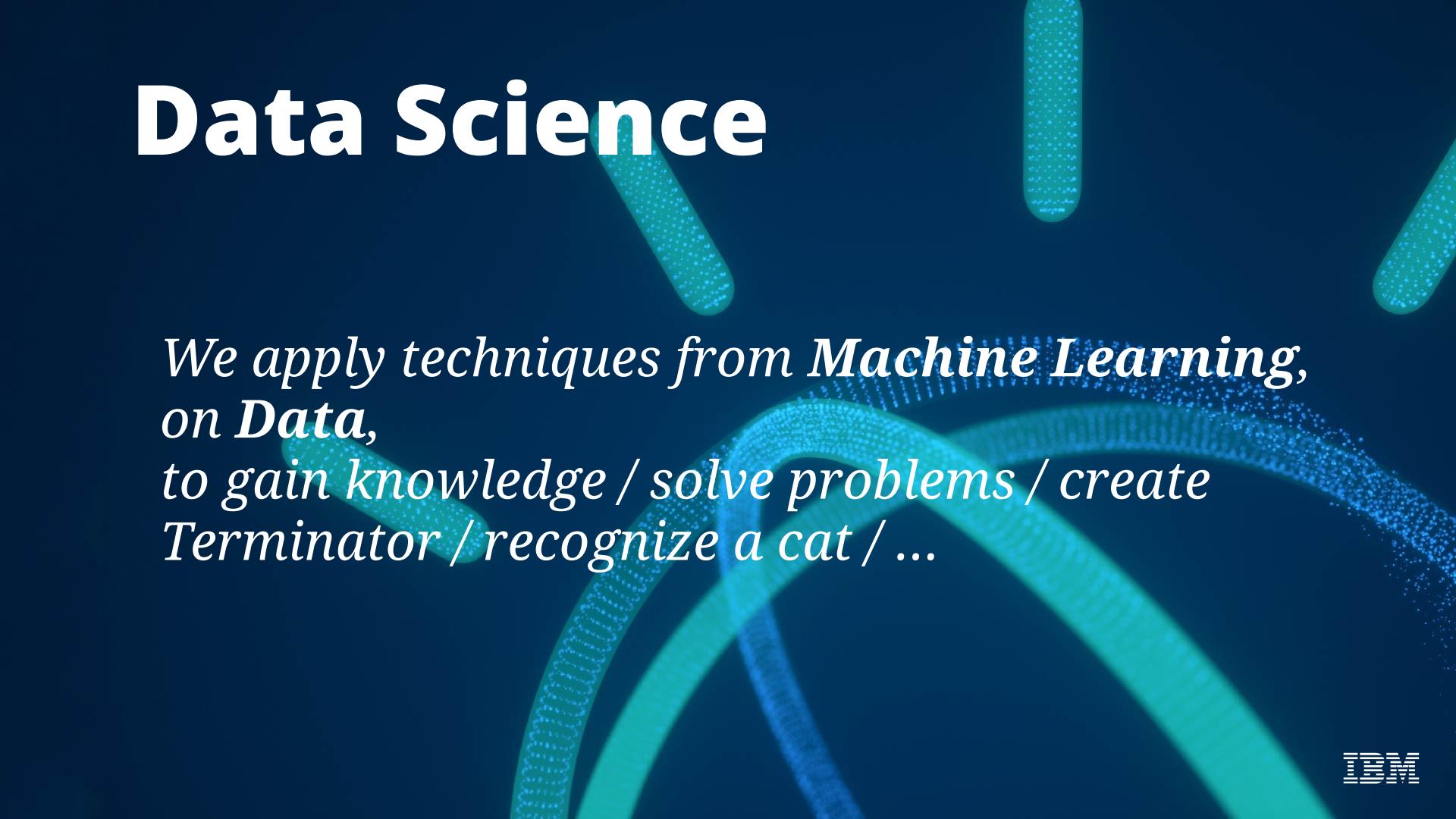
Unfortunately, the conversational AI didn't stay playful for long. People starting tweeting Tay with a series of misogynistic remarks. And Tay — being essentially a bot parrot with an AI brain — repeated these sentiments back to users, proving correct the Microsoft's concerns about the future of AI.

"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

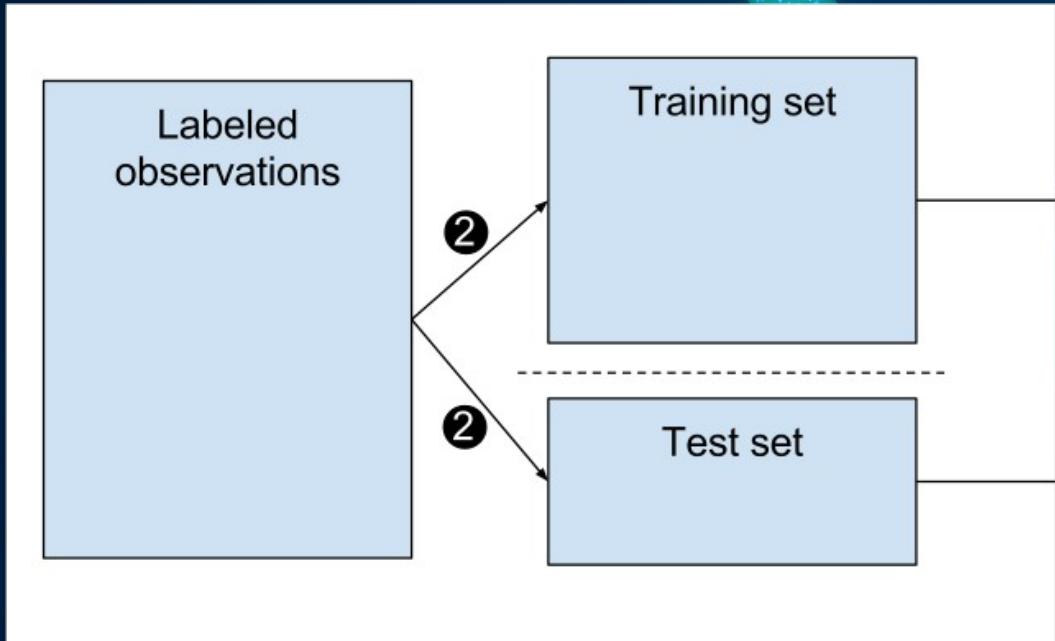
Special Case of Machine Learning - Predicting:

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

How do we often do that?

Data

Data Science



Humans are #1 in generalization.

"I never use buy [Insert Brand you hate]..."

We want models to do the same.

So maybe copy our brain is not so bad idea...

Data Science

Deep-learning!

Super-Vised Learning

We need Labeled Data

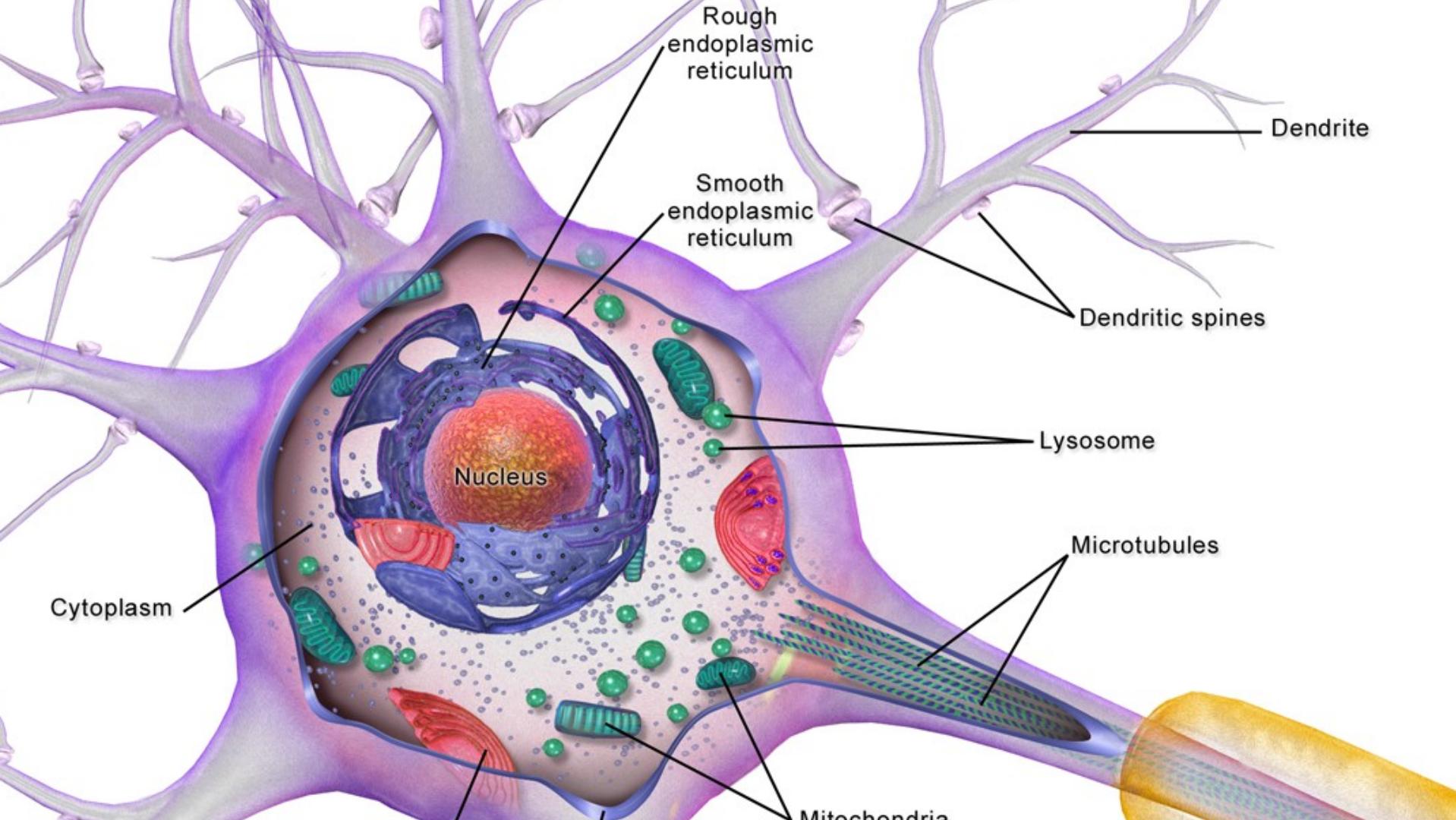
Cost of making a error

Data / Problem Complexity

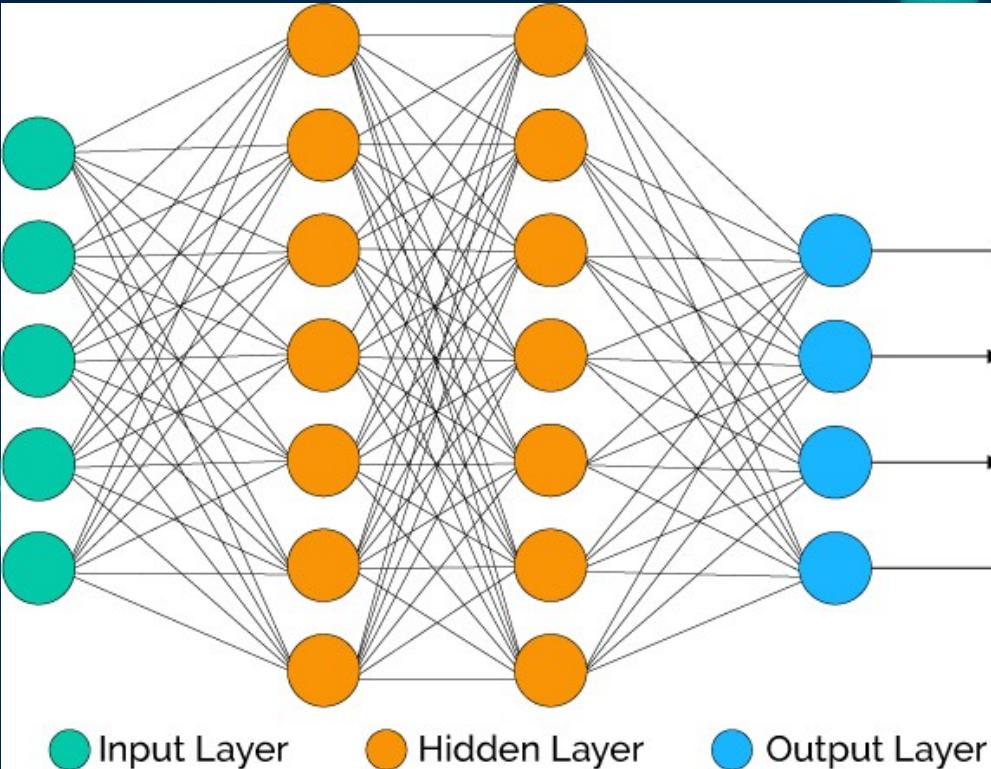
Difficulty to Apply / Maintain

*Where would you
place:*

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

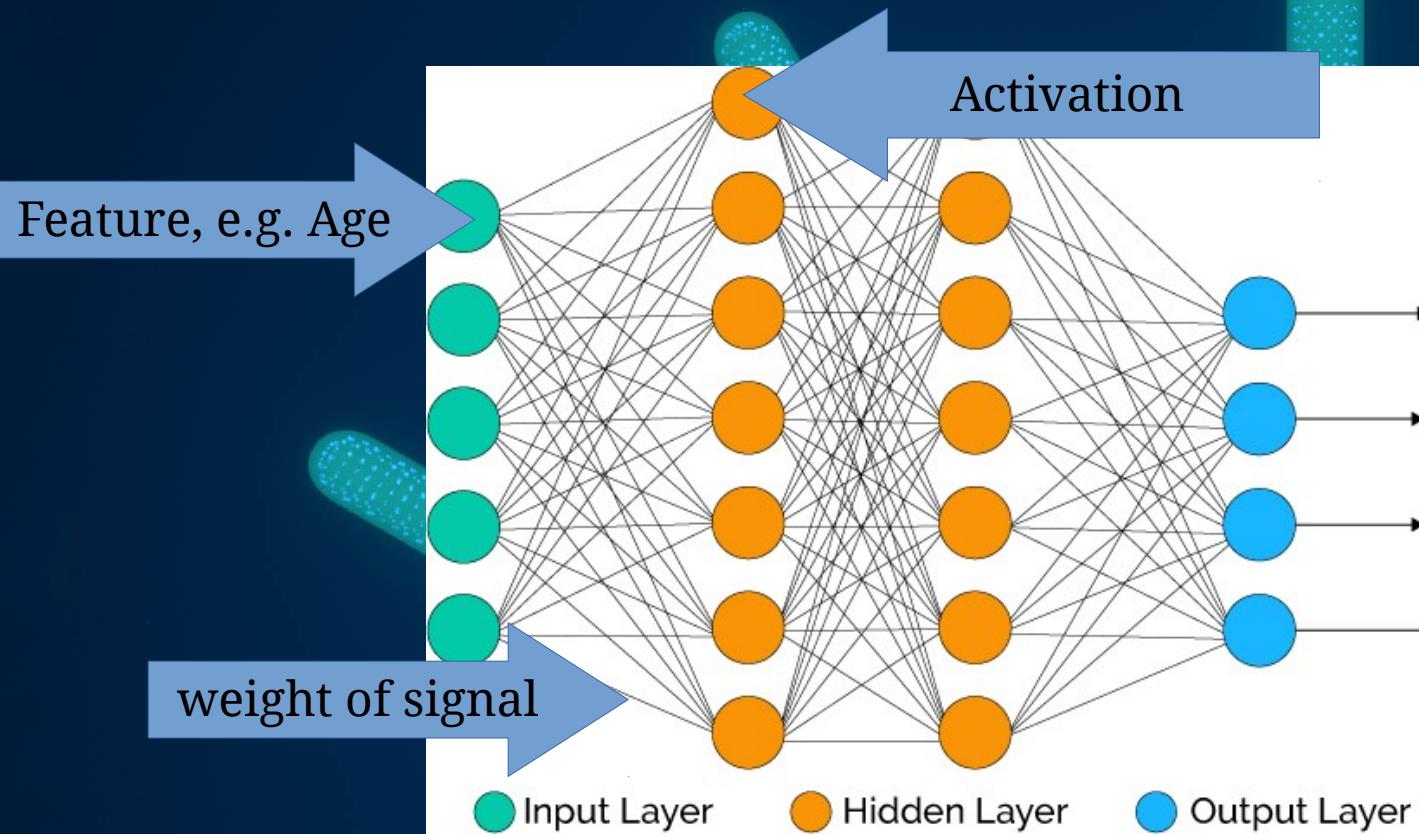


Artificial Neural Network (ANN)



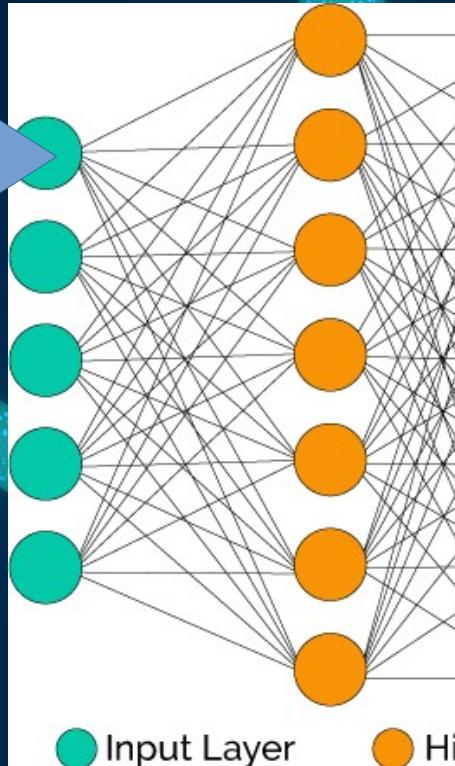
The more Hidden Layers, The more Deep-learning.
1 Layer sometimes represents Classical Models

Artificial Neural Network (ANN)



Artificial Neural Network (ANN)

Feature, e.g. Age



Many Activation Functions:

Linear

Sigmoid

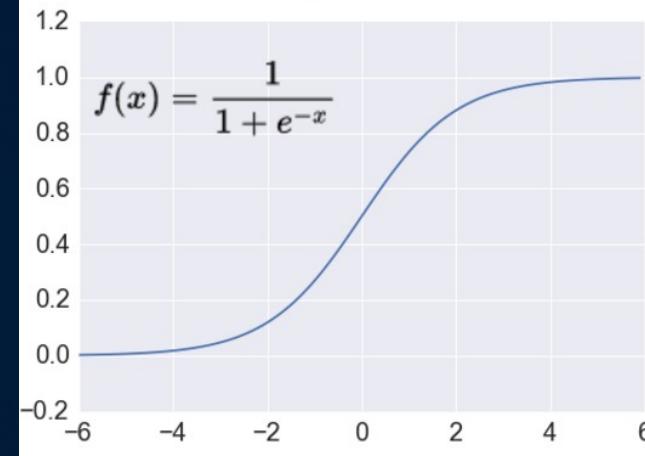
RELU

Tan / Sin family

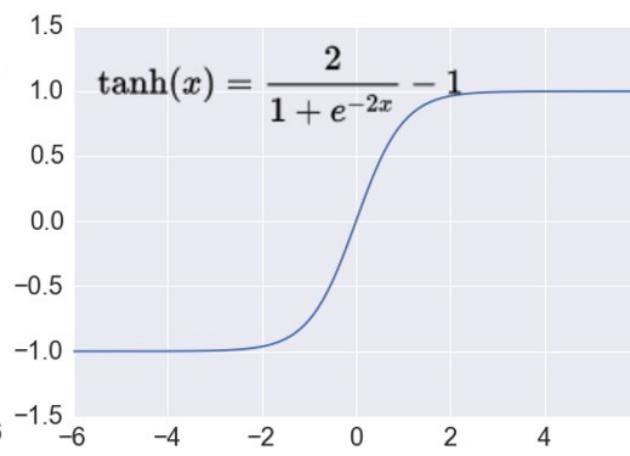
Artificial Neural Network (ANN)

Common Activation Functions

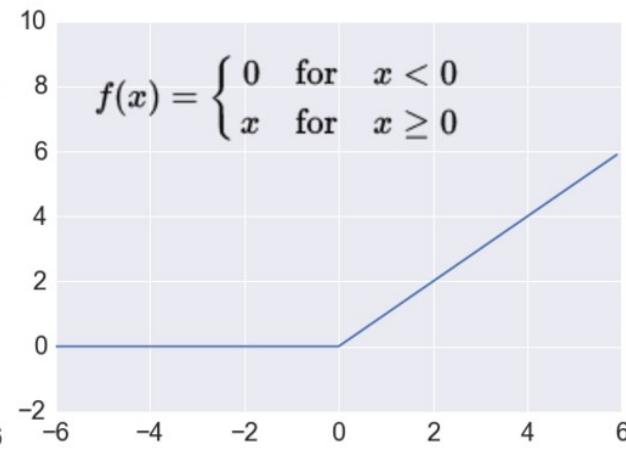
Sigmoid



TanH



ReLU

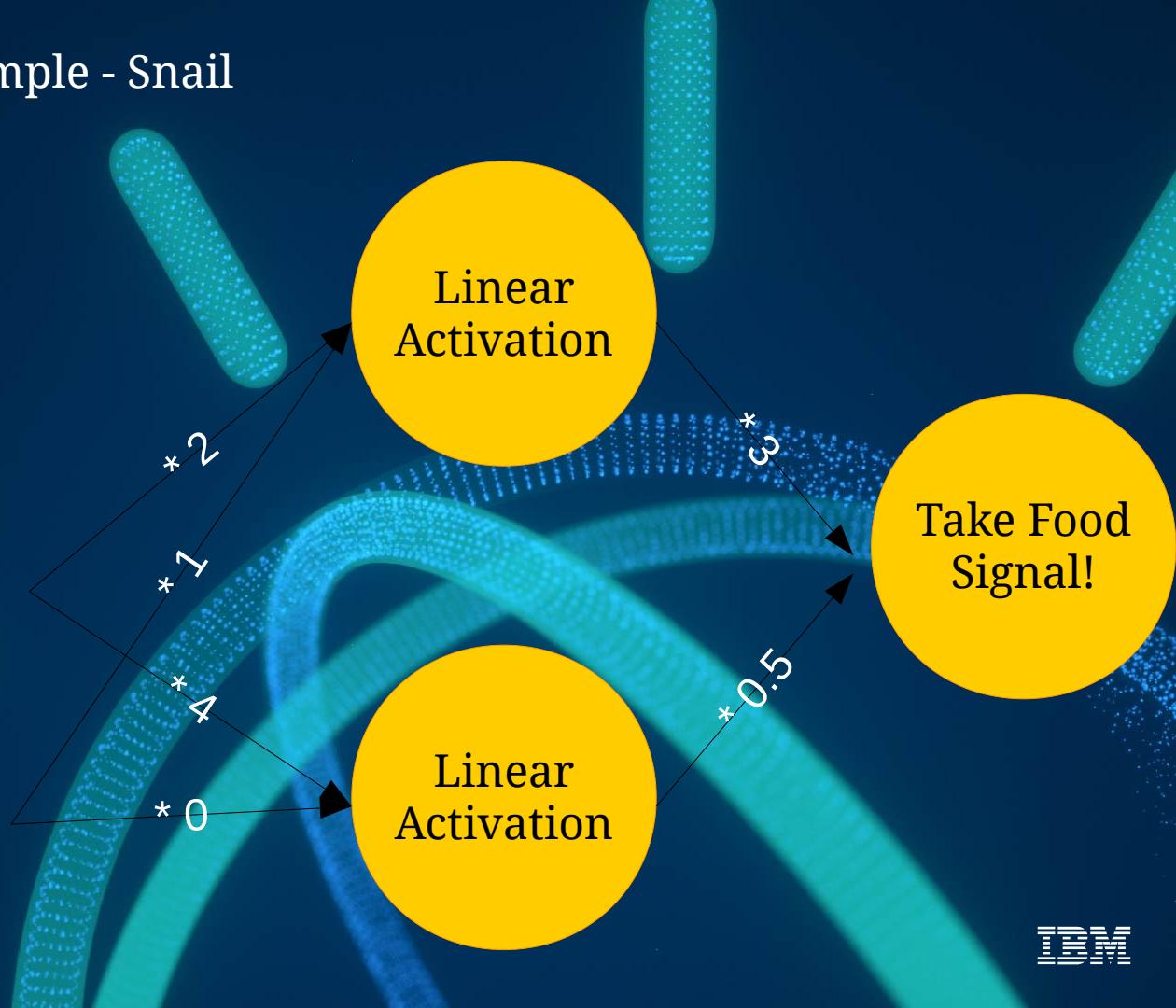


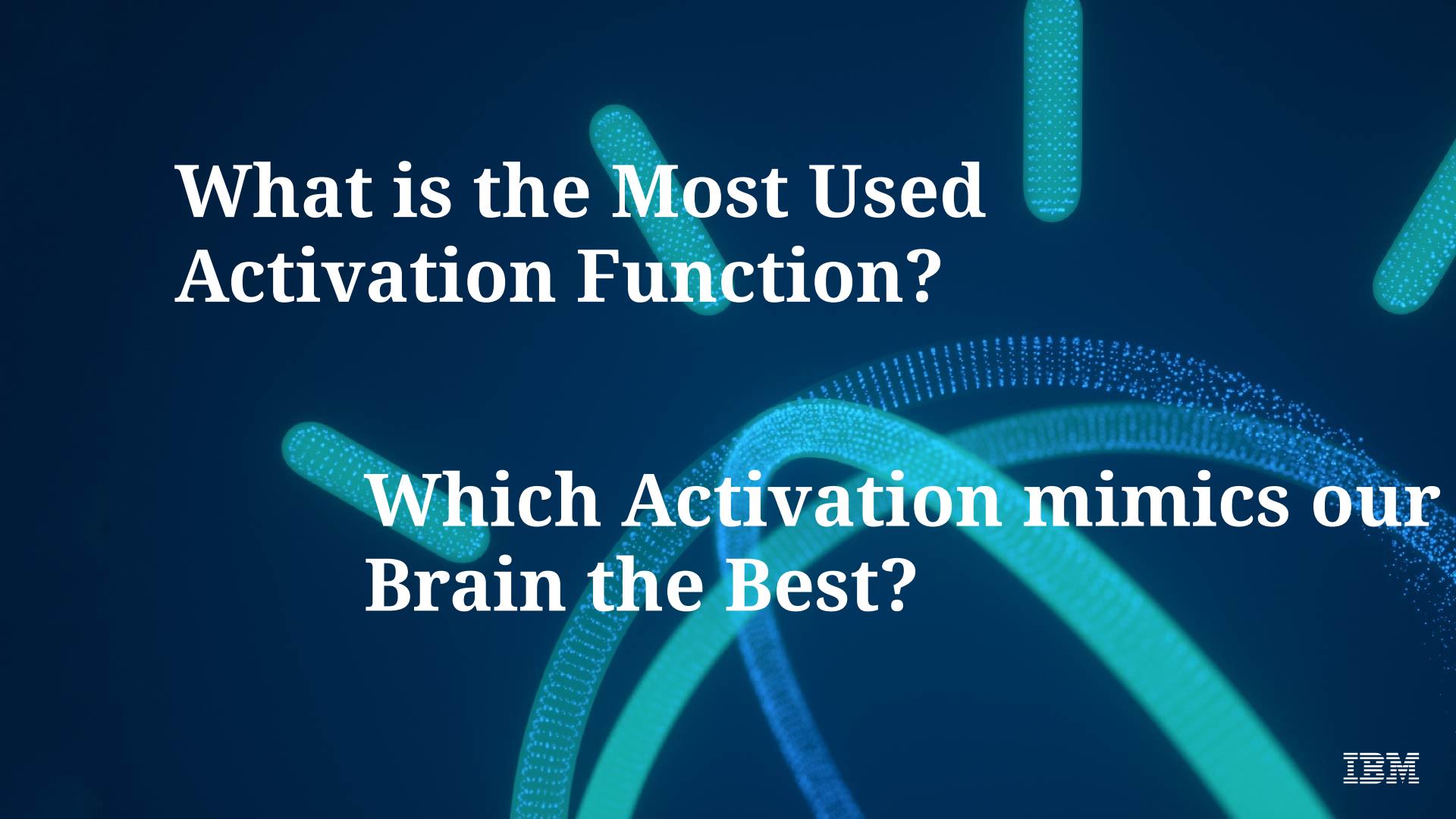
Example - Snail



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?

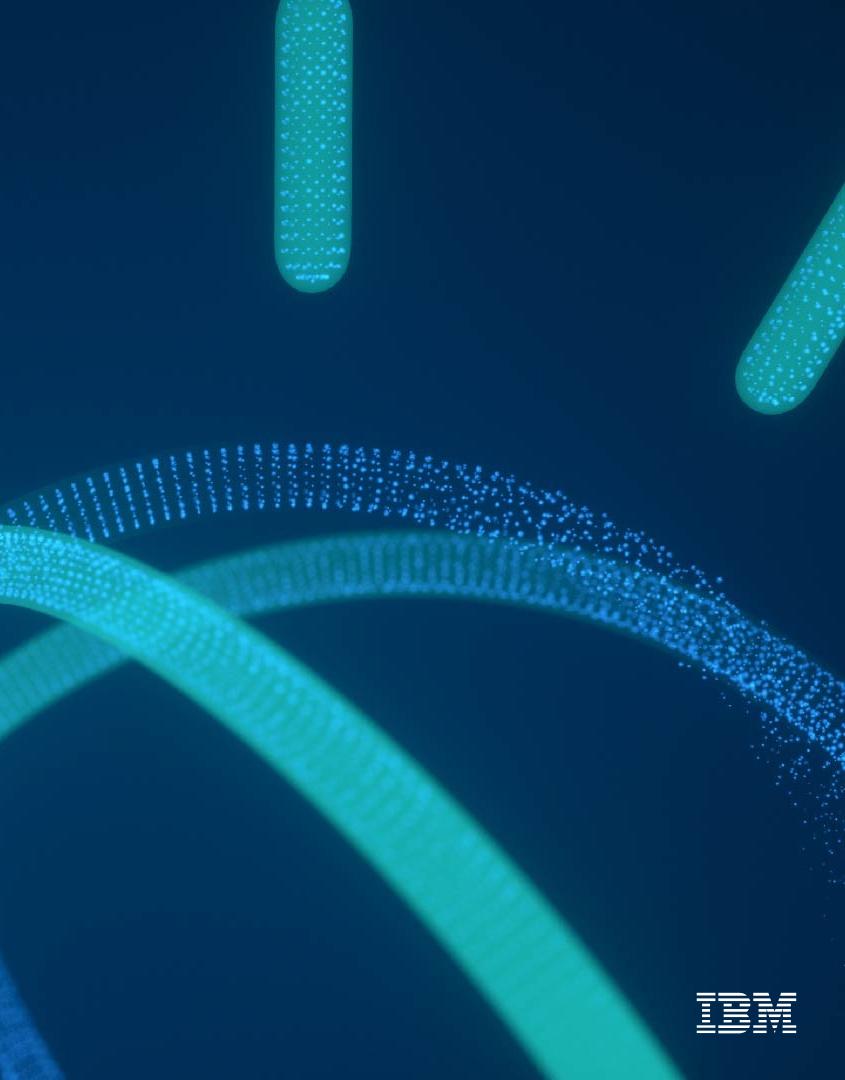
Which Activation mimics our Brain the Best?

What are these Networks Capable off?

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

neurons:

Fruit fly	250,000	$< 1 \times 10^7$			[15] [16]
Larval zebrafish	100,000				[17]
Lobster	100,000				[18]
Ant	250,000		Varies per species		[19] [20]
Honey bee	960,000	$\sim 1 \times 10^9$			[21]
Cockroach	1,000,000				[22]
Adult zebrafish	$\sim 10,000,000$		cells (neurons + other)		[23]
Frog	16,000,000				[24]
Smoky shrew	36,000,000				[25]
Short-tailed shrew	52,000,000				[25]

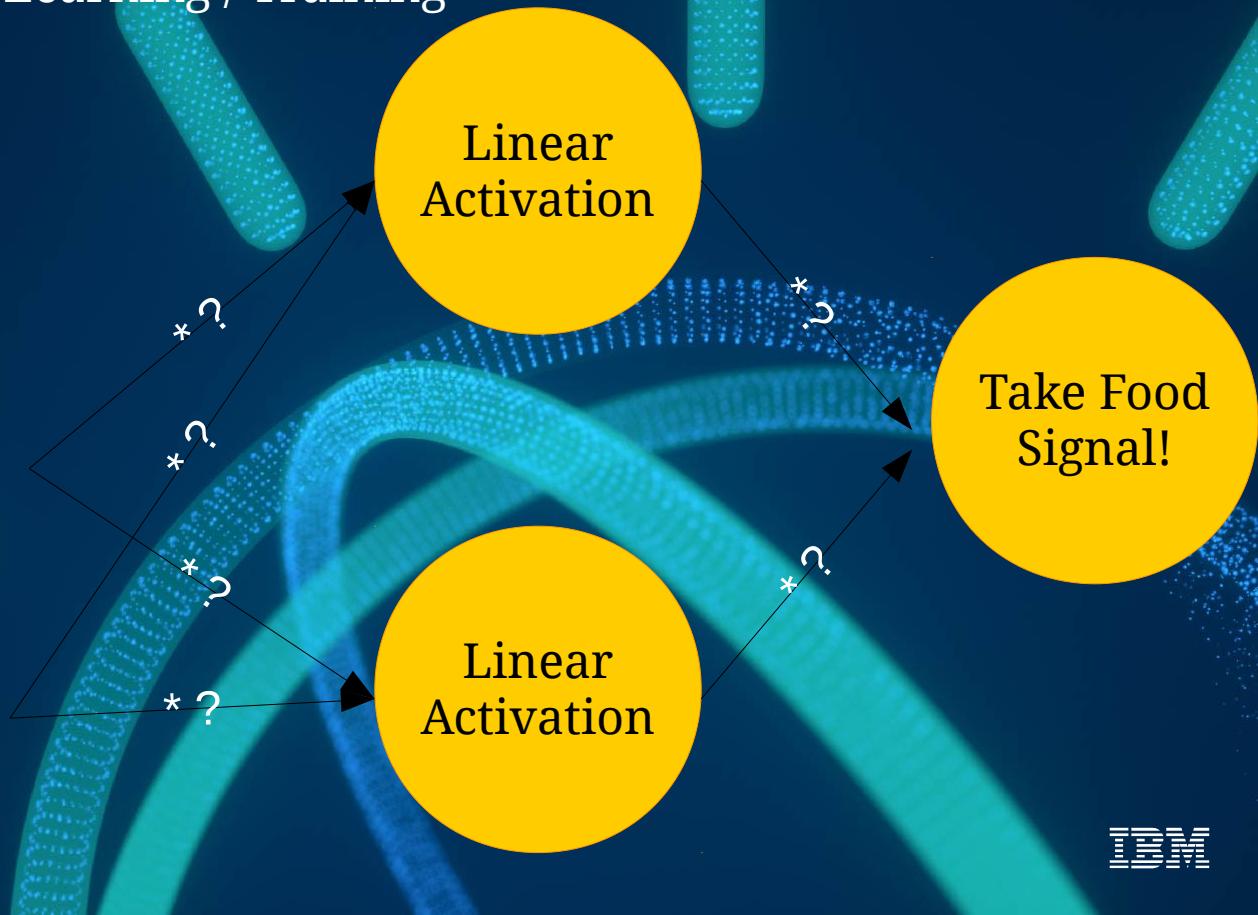


Weights need to be set, such that the network performs well, on our available data. Learning / Training

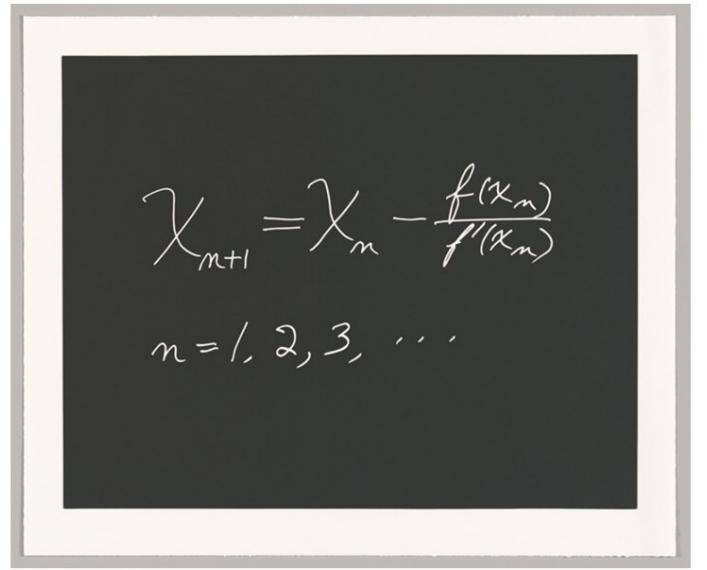


Feature 1: Hunger Level
Input H: 0.5

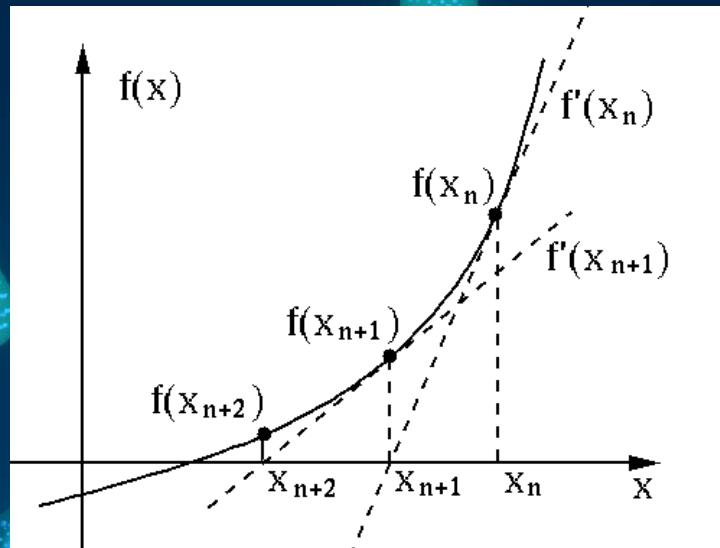
Feature 2: Sees food in
Range Level
Input S: 1



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**

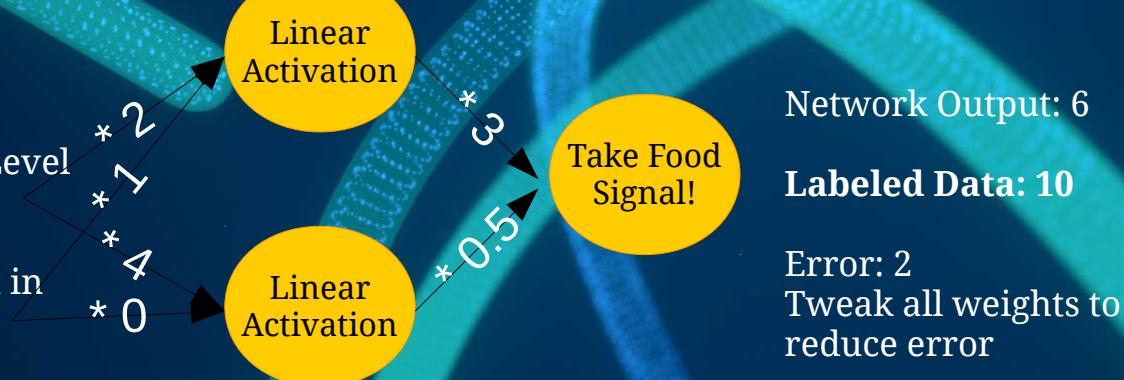
1. Take a data point
2. Calculate output
3. Use output error (in combination with derivative) to re-calibrate all weights
4. repeat , with next data point



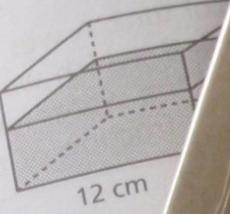
Example - Snail

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 TO STUDY

BY JOSEPH V. LANDY, S.J.

THE ART OF LEARNING
AND MAKING IT STICK

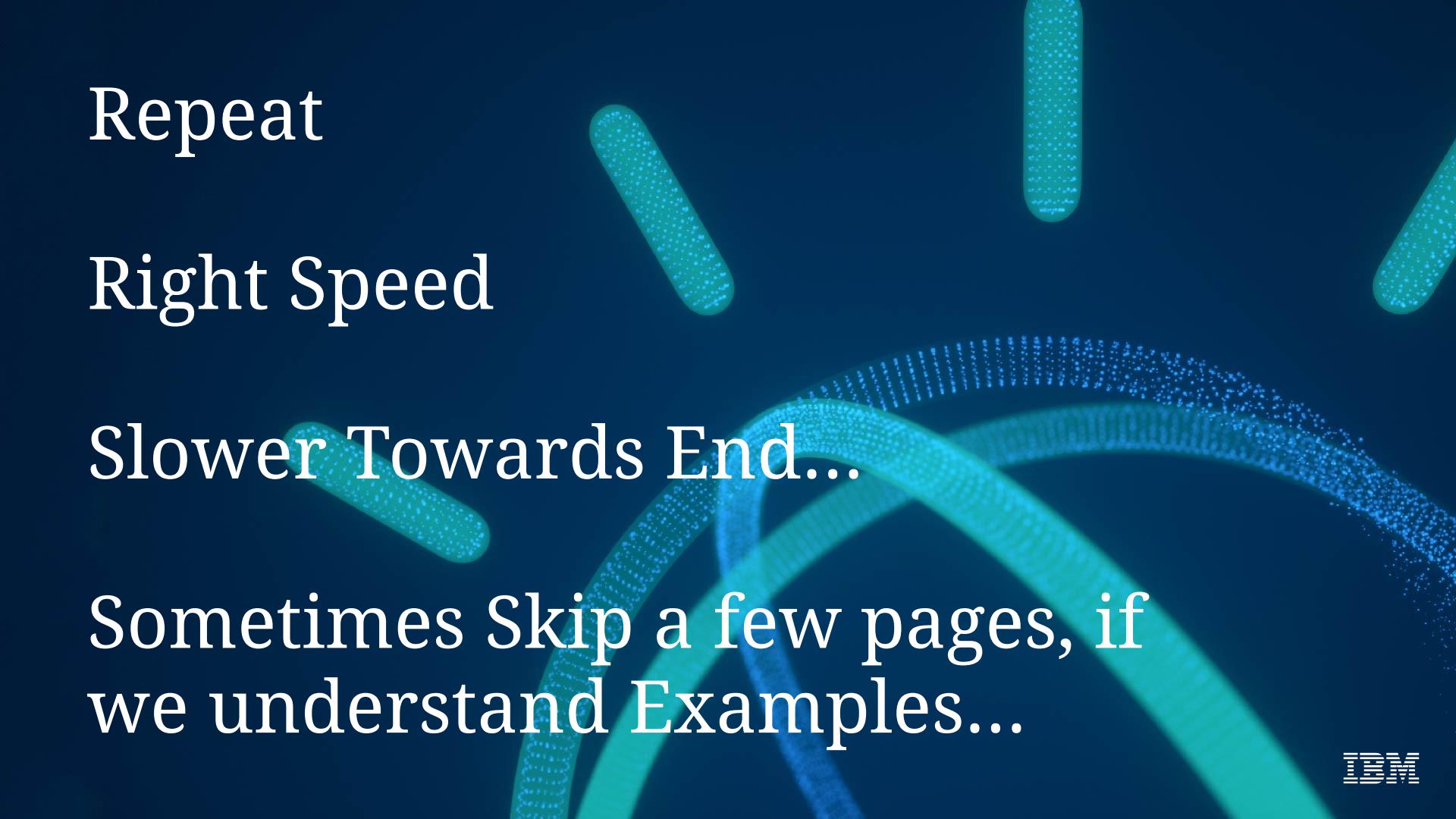


Take Note
Remember that $1 \text{ l} = 1000 \text{ cm}^3$ or 1000 ml. For instance in Example 1, if the volume of water in tank A is 1.728 l, then $1.728 \times 1000 = 1728 \text{ cm}^3$.

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

2, sometimes
or calculation
Example 2(b)—
cks 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...

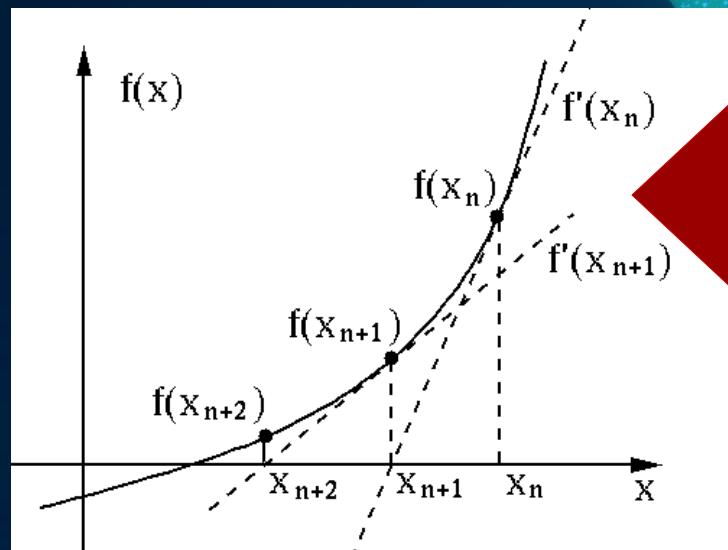
Repeat, Epochs

Right Speed, Learning Rate

Slower Towards End... Decay

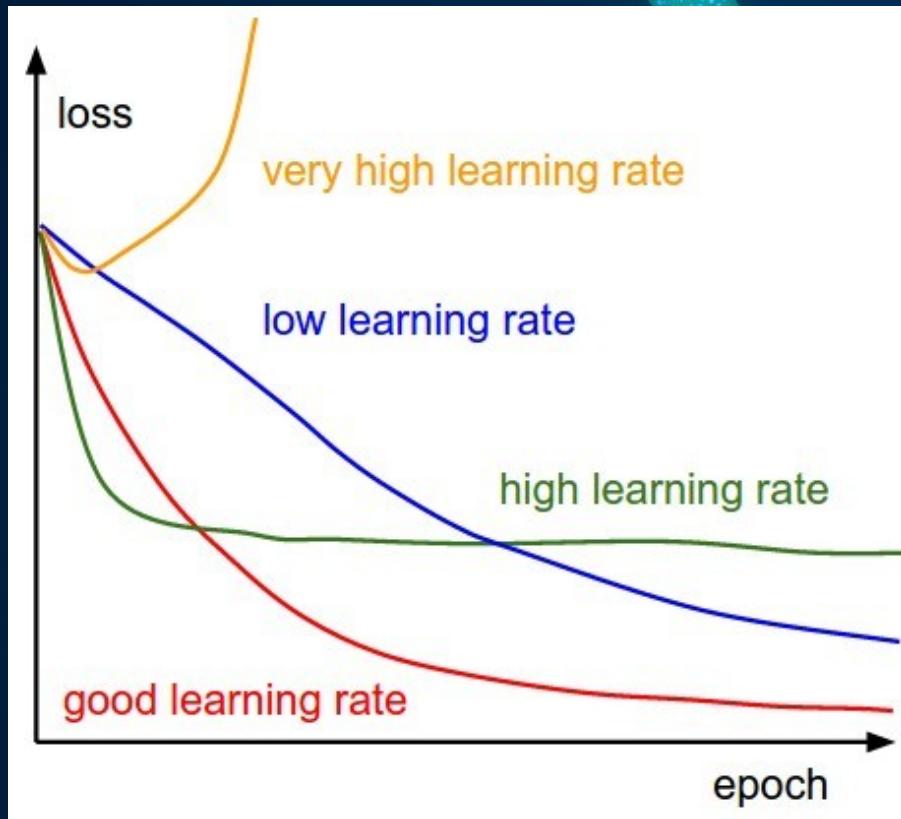
Sometimes Skip a few pages **Momentum**

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

Let's stop talking,
And start walking

C / CUDA from
scratch

Matlab / Octave

PyTorch,
Tensorflow, Keras,
Caffe,
Deeplearning4J



Data

Design Network:

- Units
- Activation Function
- Output

Select Optimization

- Method,
- Learning Rate
- Momentum, Decay

Keep track of
learning,
test with Test-Set

SNAIL DEMO

Zondag 22 oktober 2017 | Het laatste nieuws het eerst op NU.nl

10 °C 0 Files 544,63 TV gids 0 Live

[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 veel sia was neergelegd (het lievelingskostje van de dieren).

Net binnen

- 23:37 - Max Verstappen noemt steward 'mongool' ... >
- 23:20 - Grote demonstratie Malta na moord op jo... >
- 23:18 - Homer denkt dat protest tegen tijdsstraf V... >
- 22:55 - De Ligt ziet spelers Ajax meer voor elkaar... >

[Meer nieuws >](#)

Meest gelezen

- 1. SBS6-programma rond Alzheimer levert 8900 ... >

[Meer nieuws >](#)

Techvideo's



- Prul of Praal? - Miniprinter van 42 euro
- Pokémon Go krijgt nieuwe spook-Pokémon voor Halloween



- Megarobots vechten tegen elkaar voor eerst
- Wearable kijkt of je 'verkeerd licht'

<https://dataplatform.ibm.com/projects/67bac30-1f36-42c7-8886-a6db978523cd/assets?context=analytics>



How does KERAS know the derivatives ?

Road Blocks:

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





Overfitting....

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

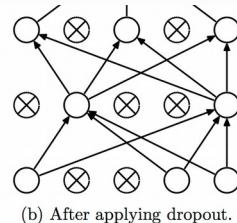
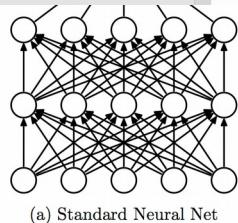
Brain Fact: Moderate alcohol use doesn't kill brain cells, and while rampant alcohol use can damage the brain, it's not due to cell death.

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 URL in the address bar is https://www.brainhq.com/brain-resources/cool-brain-facts-myths/brain-myth-alcohol-kills-brain-cells. 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 page also includes navigation links like "Home", "Why BrainHQ?", "World Class Science", "Brain Resources", and "Help". A sidebar on the right is titled "Making the Most of Your Brain" and discusses Wernicke-Korsakoff syndrome.

[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.

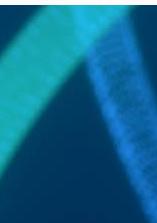
Dropout consists in randomly setting a fraction `rate` of input units to 0 at each update during training time, which helps prevent overfitting.

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

[https://dataplatform.
ibm.com/projects/67ba
bc30-1f36-42c7-8886-a
6db978523cd/assets?co
ntext=analytics](https://dataplatform.ibm.com/projects/67bac30-1f36-42c7-8886-a6db978523cd/assets?context=analytics)

TASKS

|<

< PREV

RANDOM

NEXT >

>|



IN CS, IT CAN BE HARD TO EXPLAIN
THE DIFFERENCE BETWEEN THE EASY
AND THE VIRTUALLY IMPOSSIBLE.

|<

< PREV

RANDOM

NEXT >

>|

WATSON IMAGE DEMO

THANK YOU

UNITED STATES · ENGLISH

EUROPE ASIA EURASIA AFRICA S. AMERICA N. AMERICA

The languages included in this map are those with existing Living Language courses.
The countries representing each language were selected based on population.



FRANCE
Merci.
FRENCH



GERMANY
Danke.
GERMAN



ITALY
Grazie.
ITALIAN



CZECH
REPUBLIC
Děkuji.
CZECH



GREECE
ef-kah-ree-STO.
Ευχαριστώ.
GREEK



CROATIA
Hvala.
CROATIAN



NETHERLANDS
Dankjewel.
DUTCH



HUNGARY
Köszönöm.
HUNGARIAN



SWEDEN
Tack.
SWEDISH



POLAND
Dziękuję.
POLISH



JAPAN
arigatoo
gozaimasu.
ありがとうございます.
JAPANESE



N&S KOREA
gamsahamnida.
감사합니다.
KOREAN



CHINA
xièxie.
謝謝。
CHINESE



ISRAEL
toda.
תודה.
HEBREW



INDIA
dhanyavād.
ধন্যবাদ।
HINDI



VIETNAM
Cám ơn bạn.
VIETNAMESE



TURKEY
Teşekkür ederim.
TÜRKISH



RUSSIA
spah-SEE-bah.
Спасибо.
RUSSIAN



EGYPT
shukran.
شُكْرًا.
ARABIC



TANZANIA
Asante.
SWAHILI



BRAZIL
Obrigado/Obrigada.
(male/female)
PORTUGUESE



MEXICO
Gracias.
SPANISH

From LIVING LANGUAGE
visit www.livinglanguage.com

