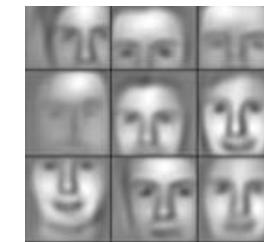
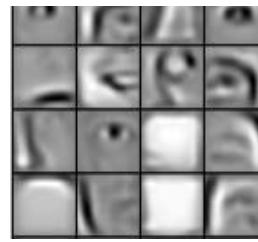
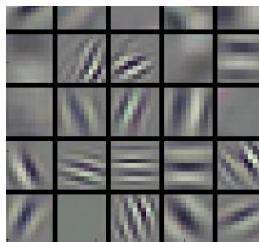
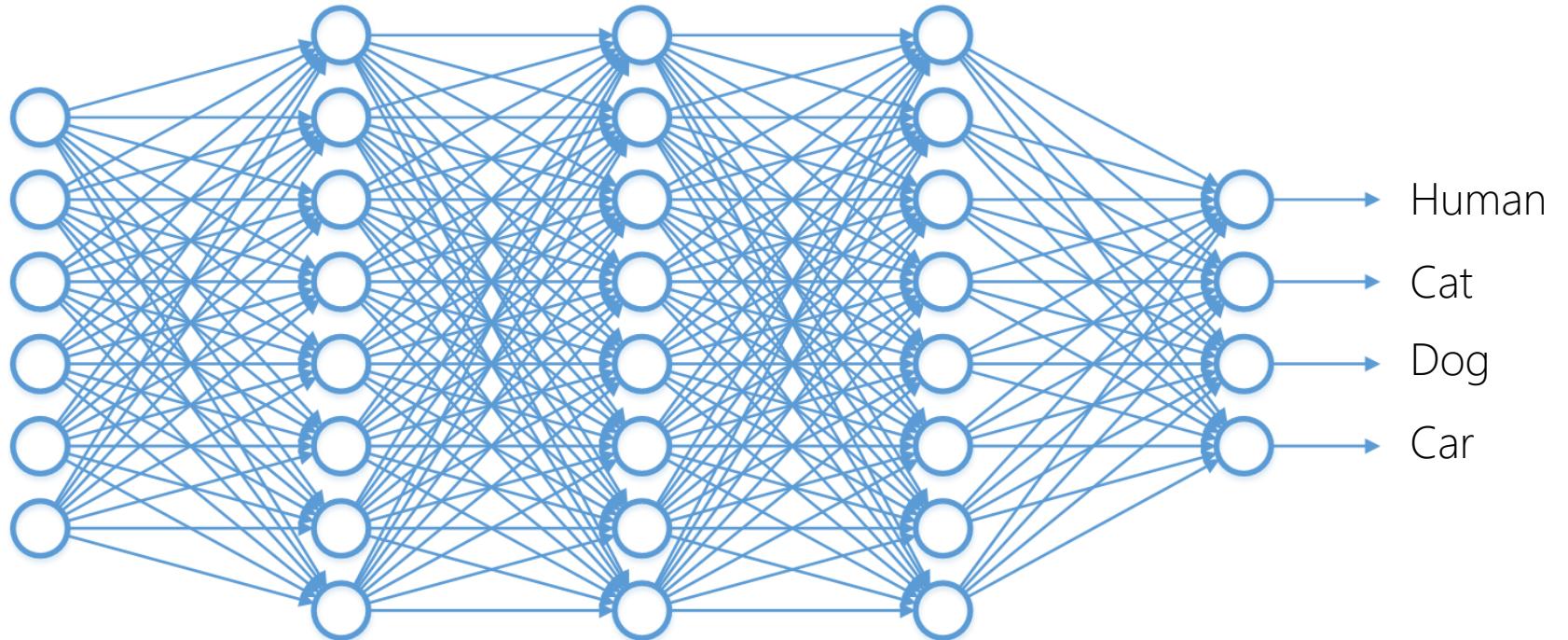


Deep Learning: The Future of AI

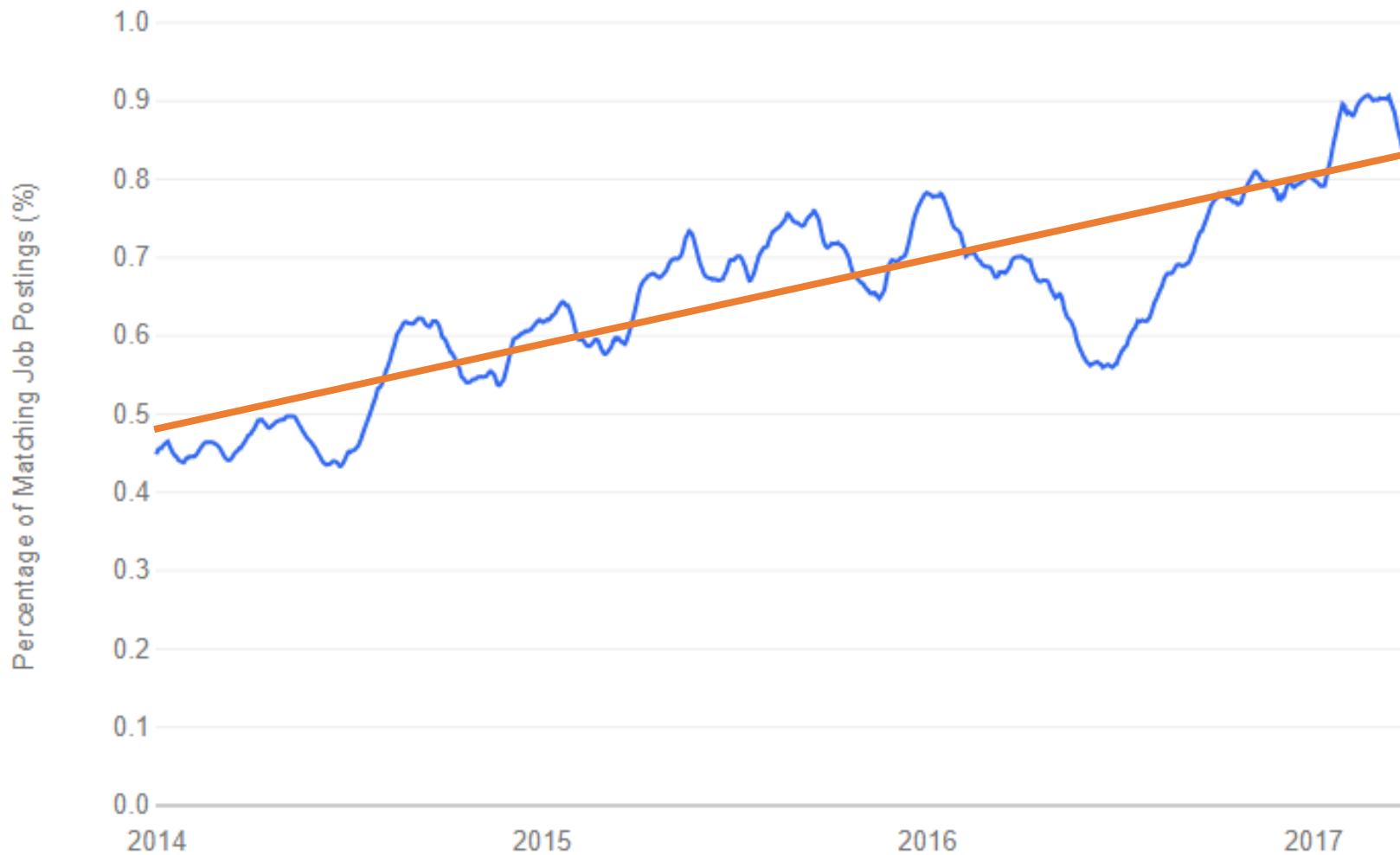
@MatthewRenze
#DevoxxUK





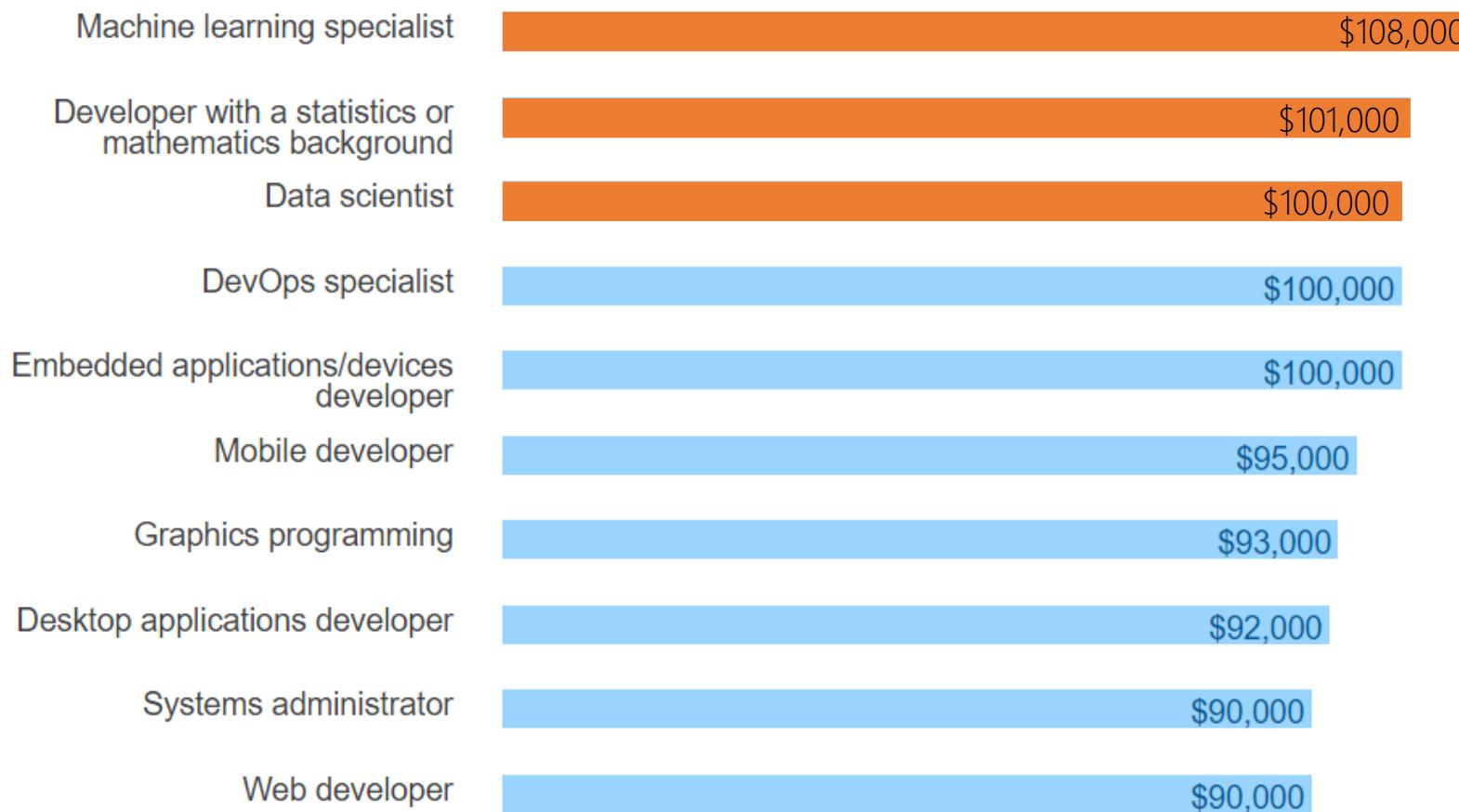


Job Postings for Machine Learning



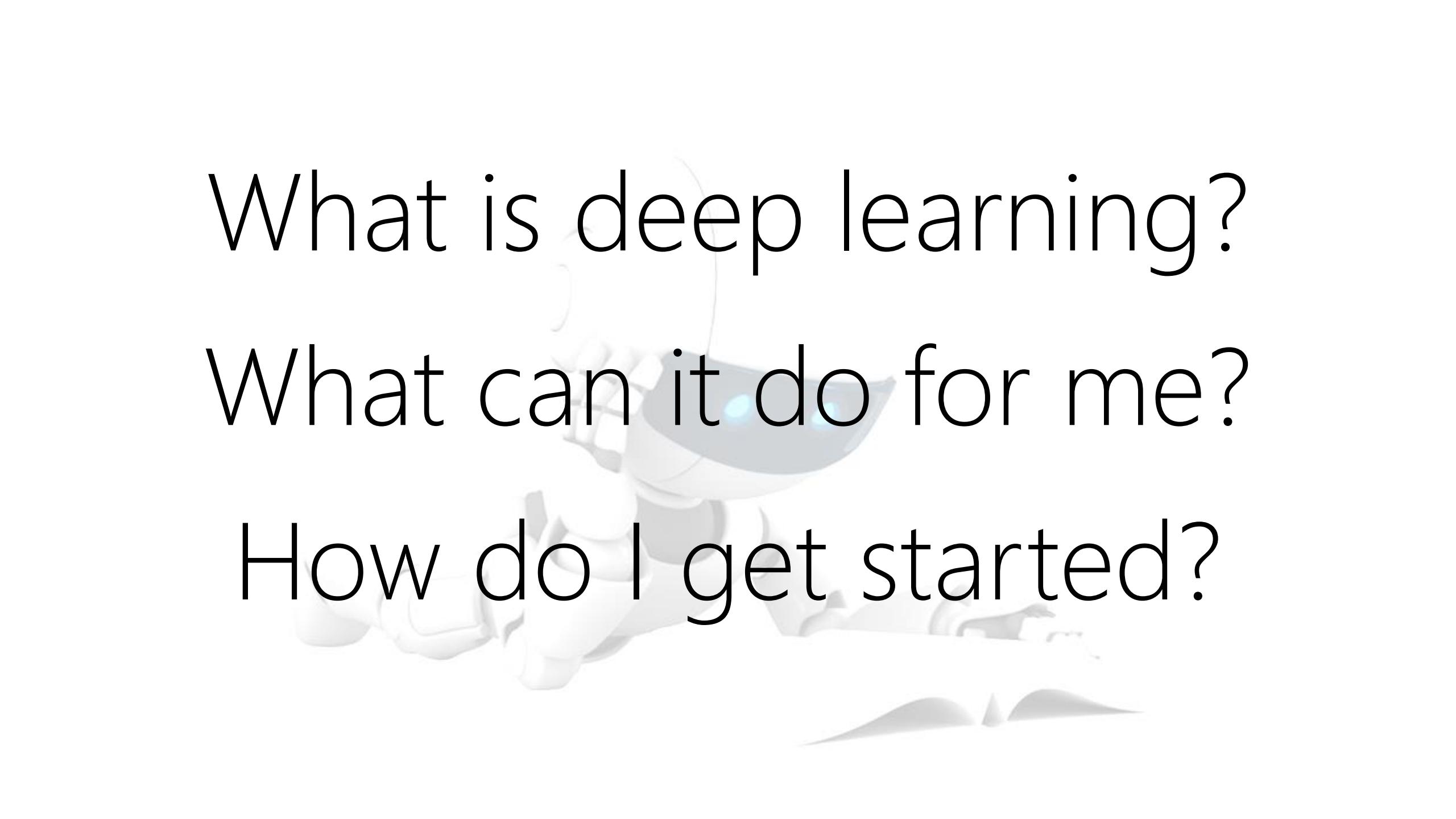
Source: Indeed.com

Average Salary by Job Type (USA)



Source: Stack Overflow 2017





What is deep learning?

What can it do for me?

How do I get started?

A white humanoid robot arm reaches from the right side of the frame towards the center. The robot has a metallic, articulated arm with a hand that appears to be holding or reaching for something. It is set against a light gray background.

What is deep learning?

Deep Learning



Deep Learning

Artificial intelligence

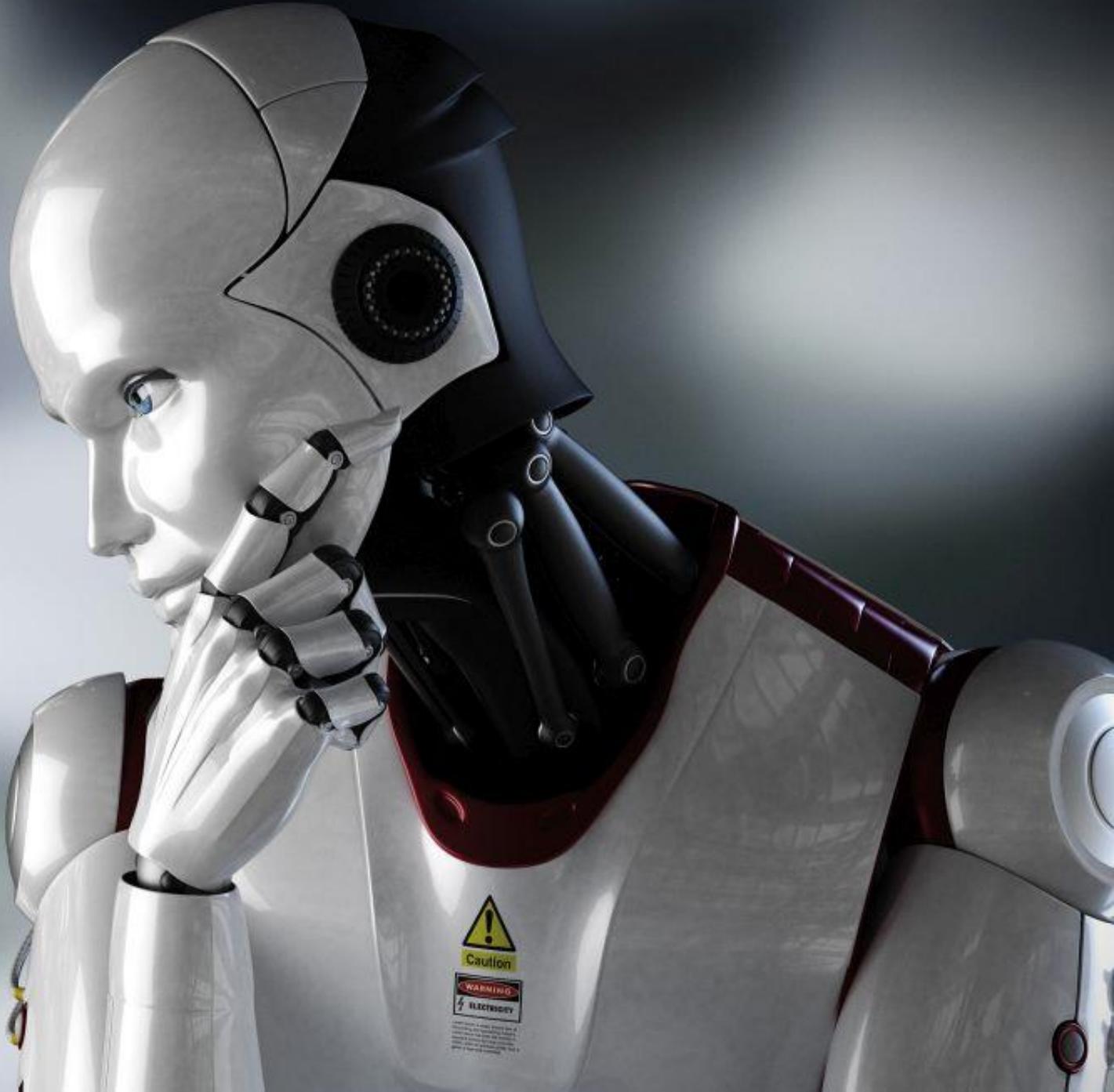
Machine learning

Neural network

Multiple hidden layers

Hierarchical representations

Makes predictions with data



Deep Learning

Artificial intelligence

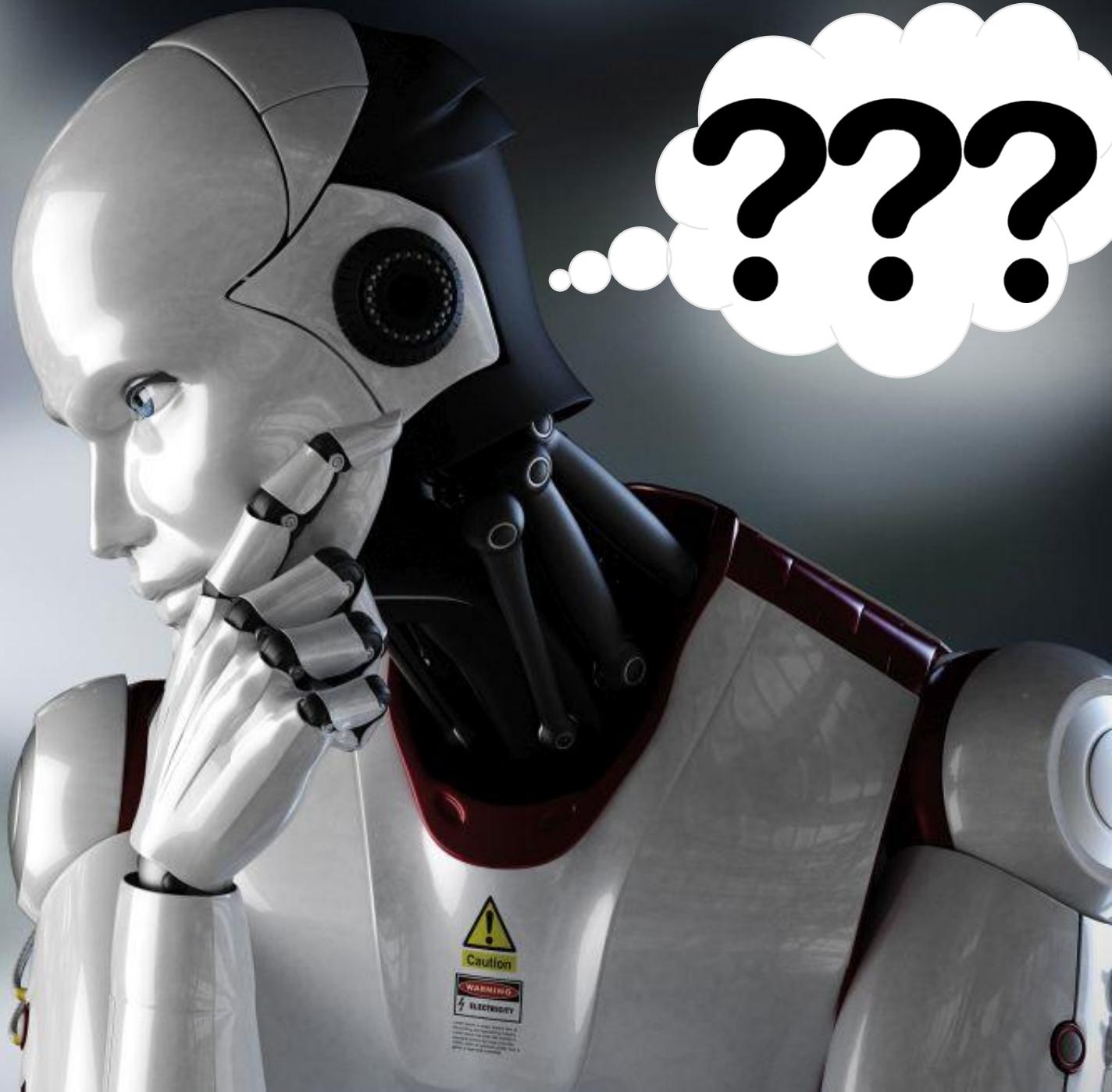
Machine learning

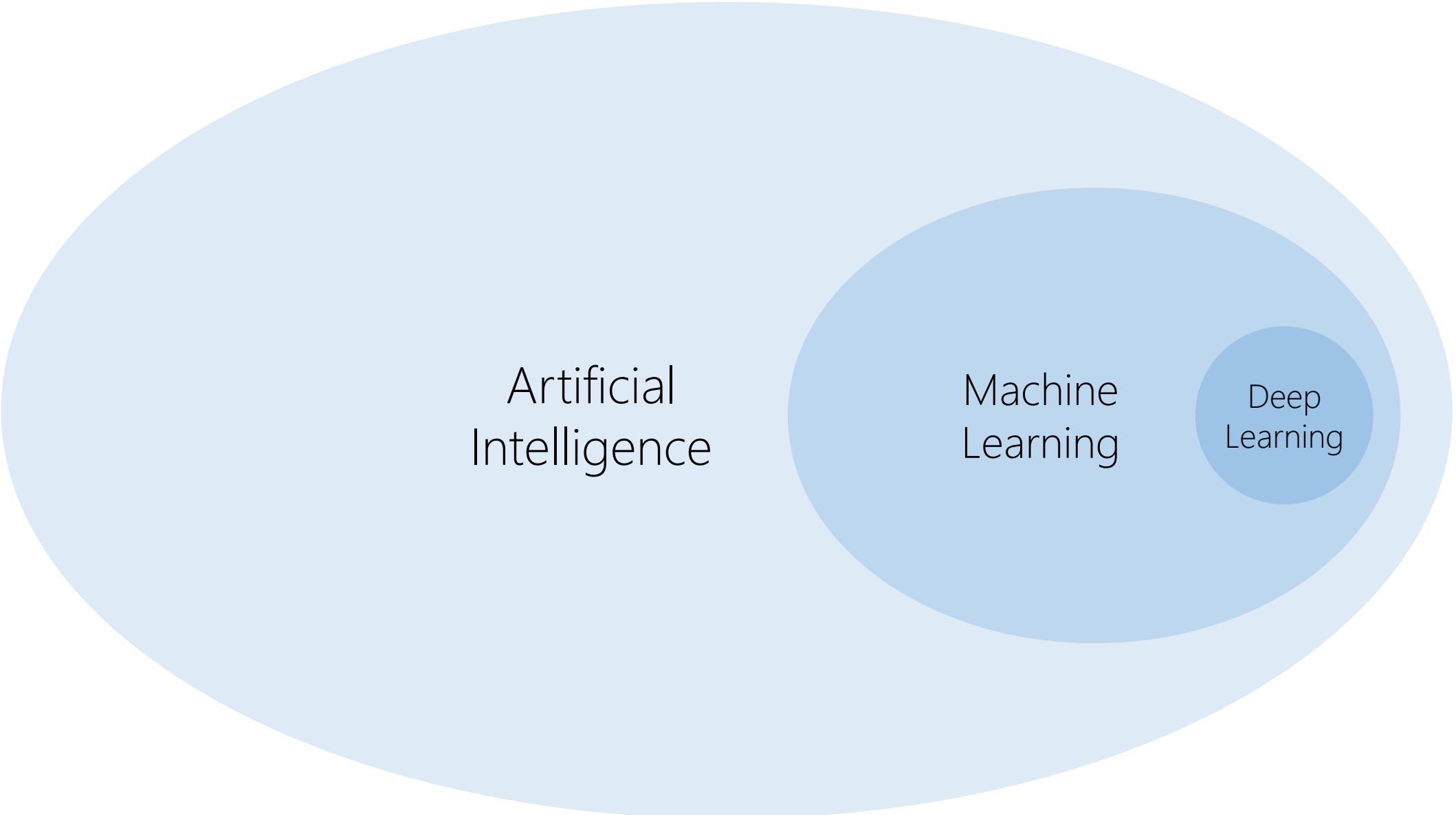
Neural network

Multiple hidden layers

Hierarchical representations

Makes predictions with data



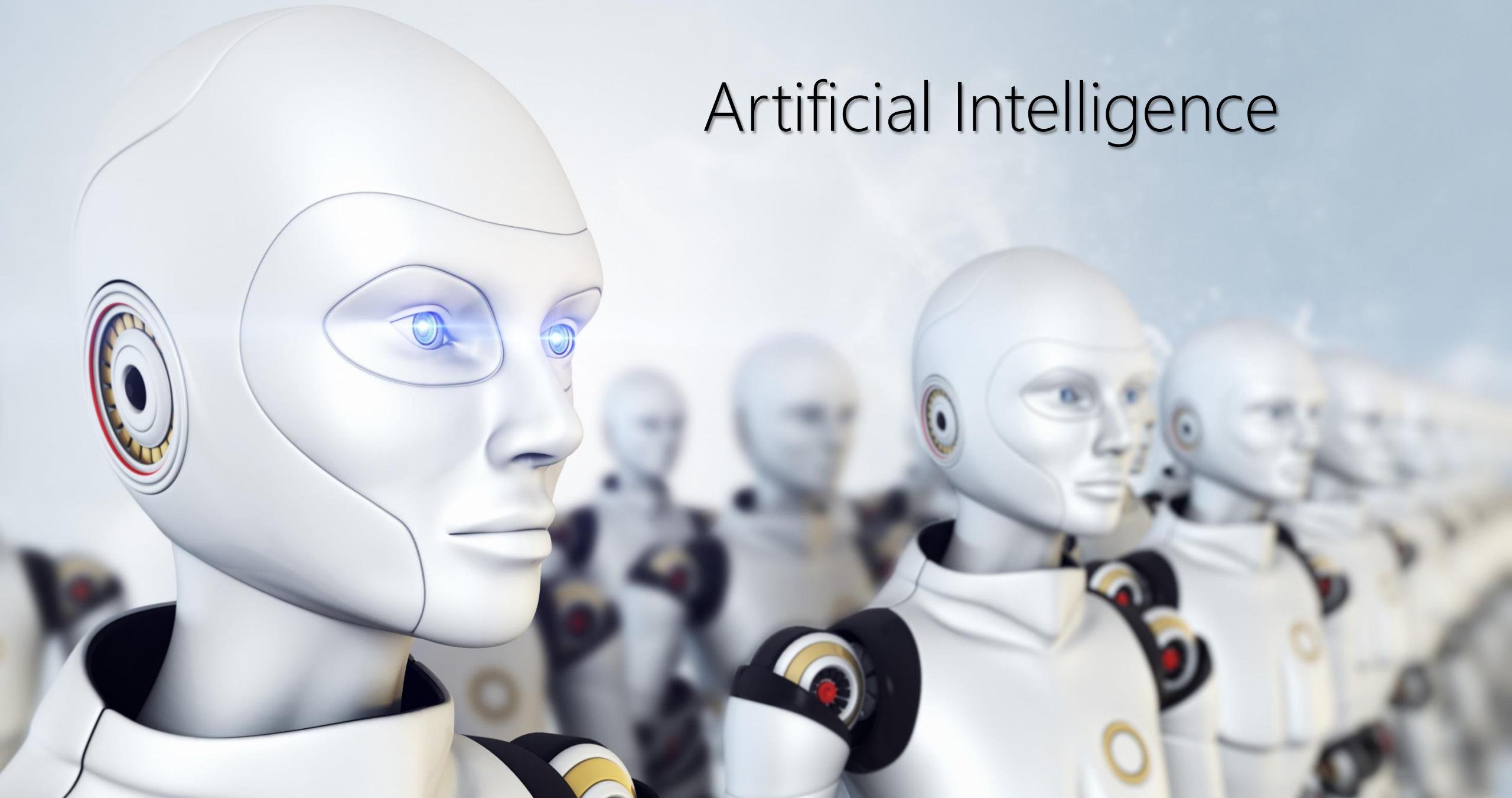


Artificial
Intelligence

Machine
Learning

Deep
Learning

Artificial Intelligence



Explicit programming





Explicit programming

Encoding domain knowledge



Explicit programming

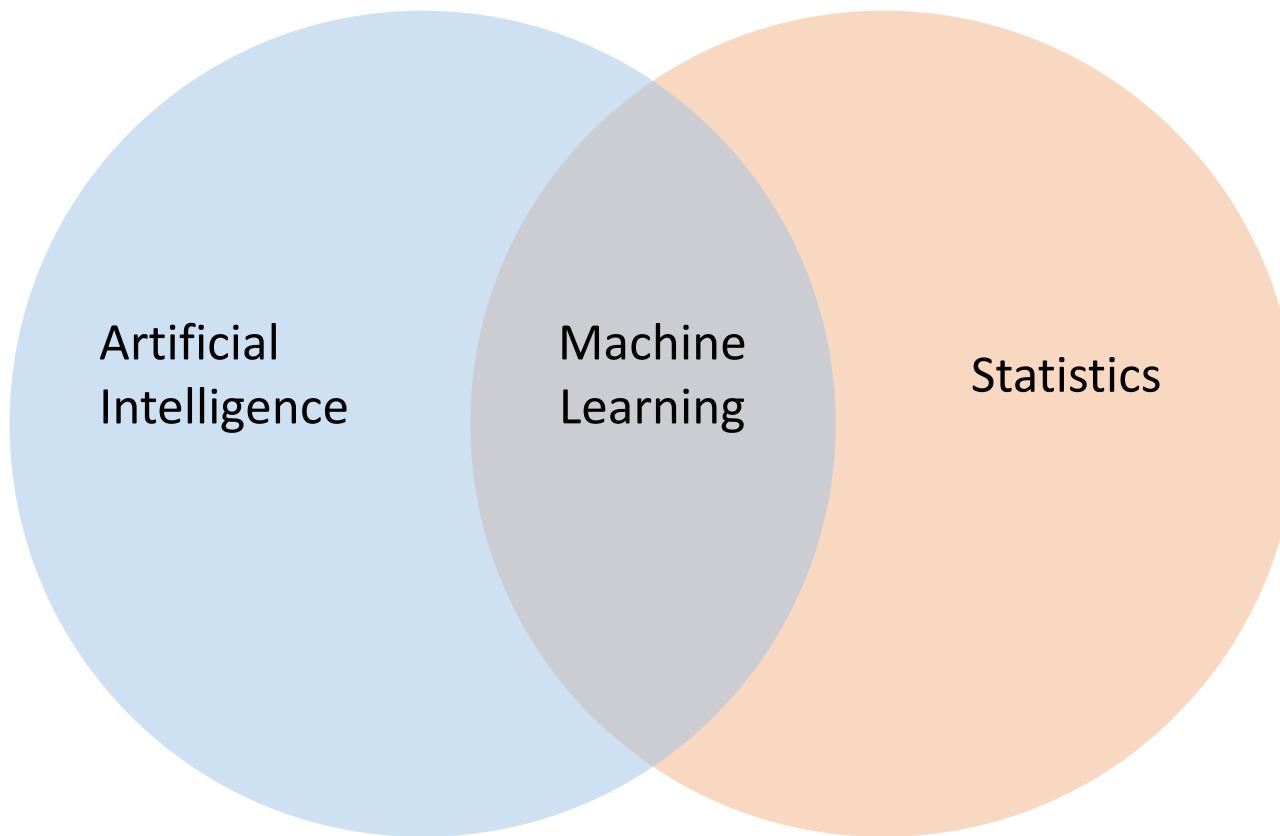
Encoding domain knowledge

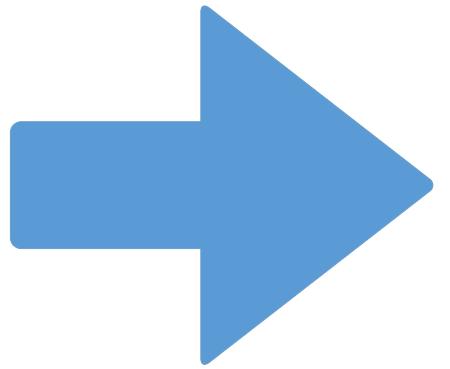
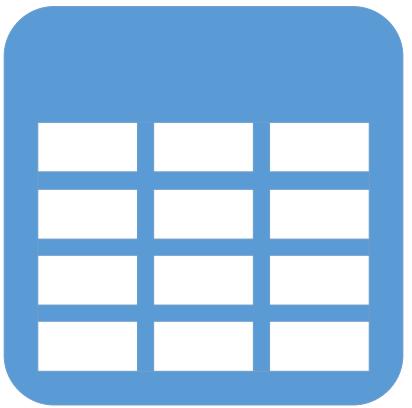
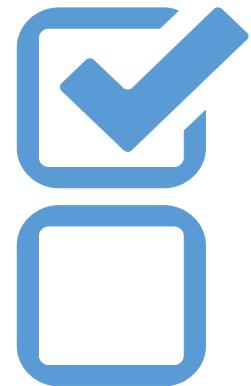
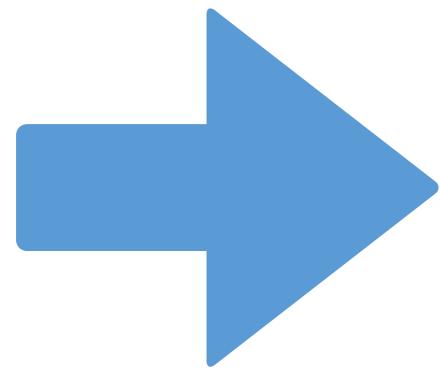
Statistical patterns detection

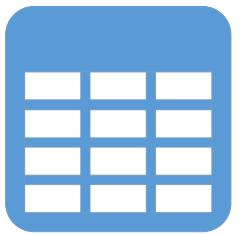


Machine Learning

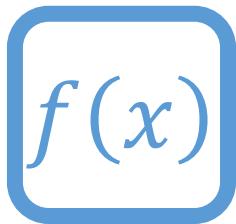
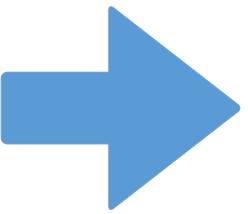
Machine Learning



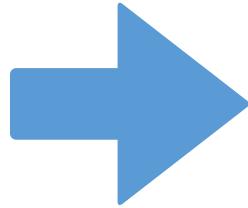
 $f(x)$ 



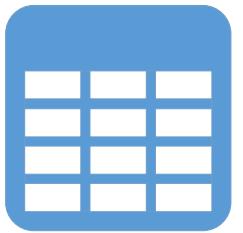
Data



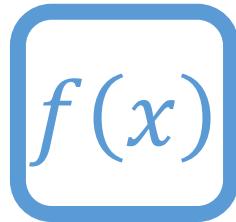
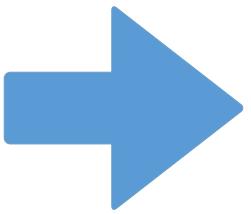
Function



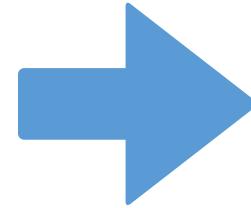
Prediction



Data



Function



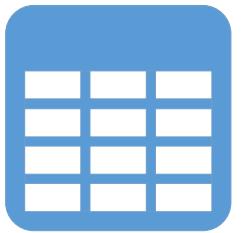
Prediction



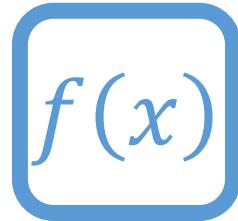
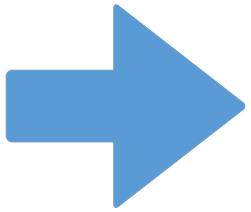
Cat



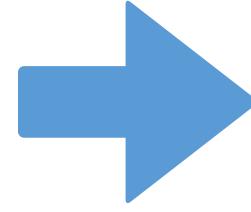
Dog



Data



Function



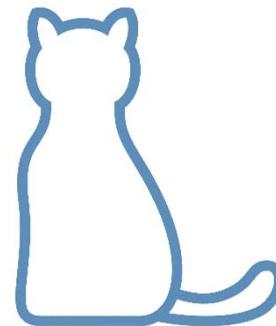
Prediction



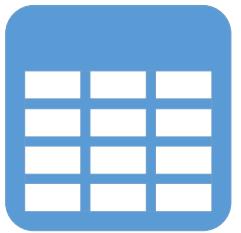
Cat



Dog



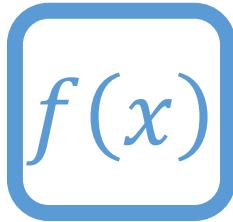
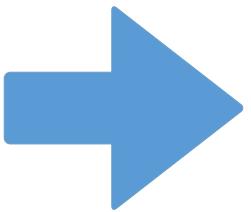
Is cat?



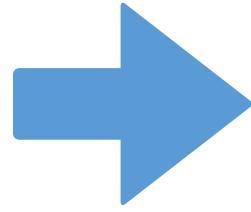
Data



Cat



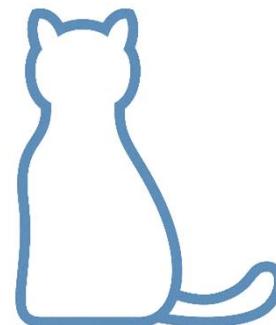
Function



Prediction



Dog



Is cat?



Yes

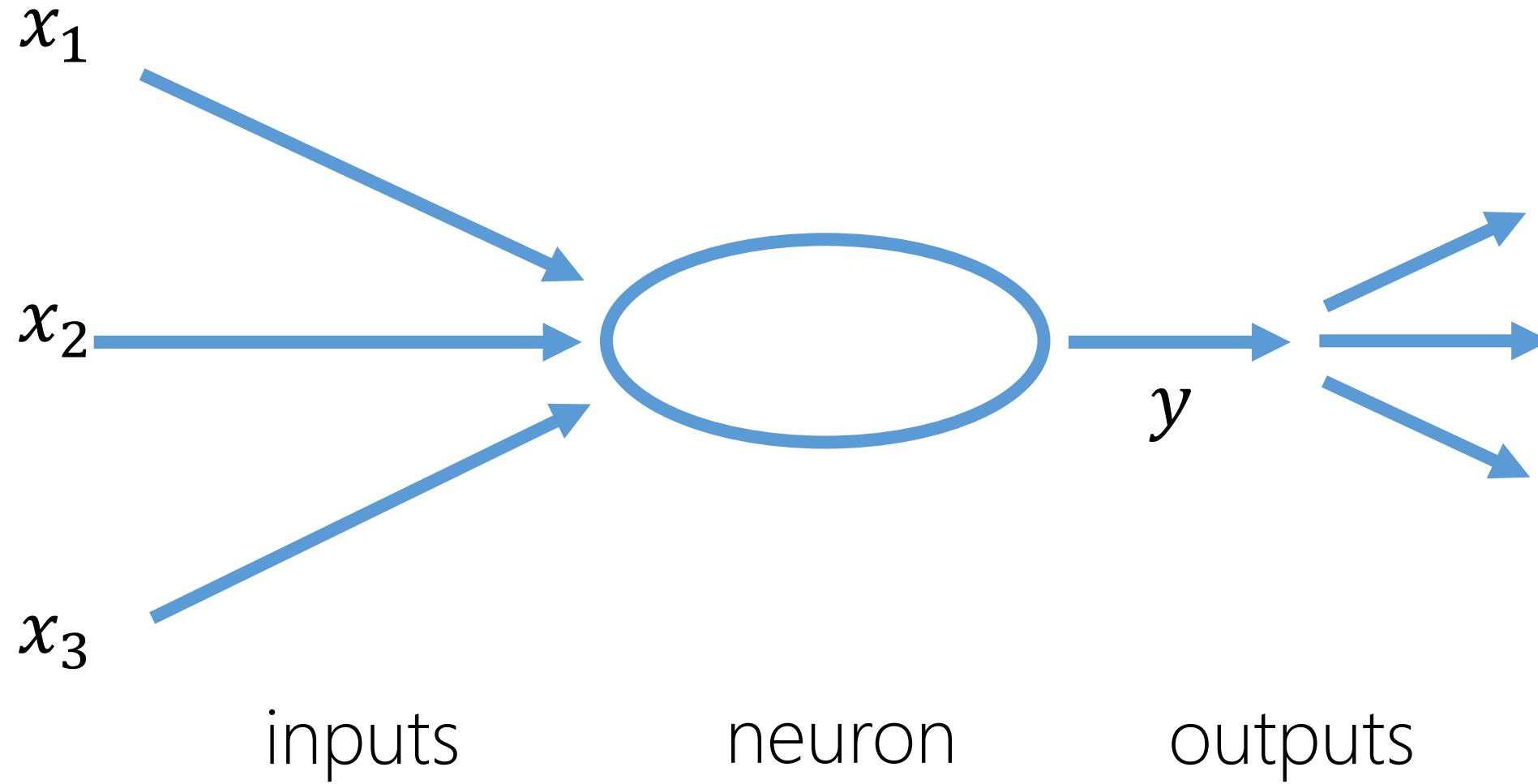




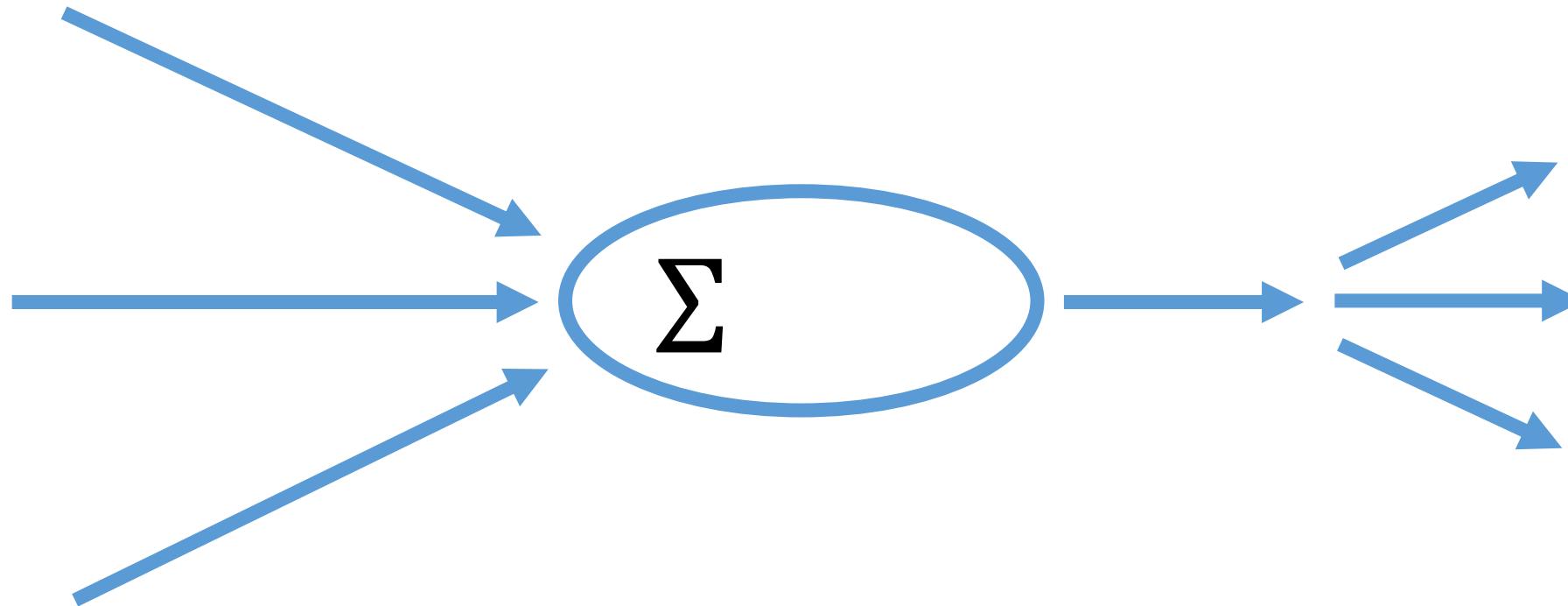




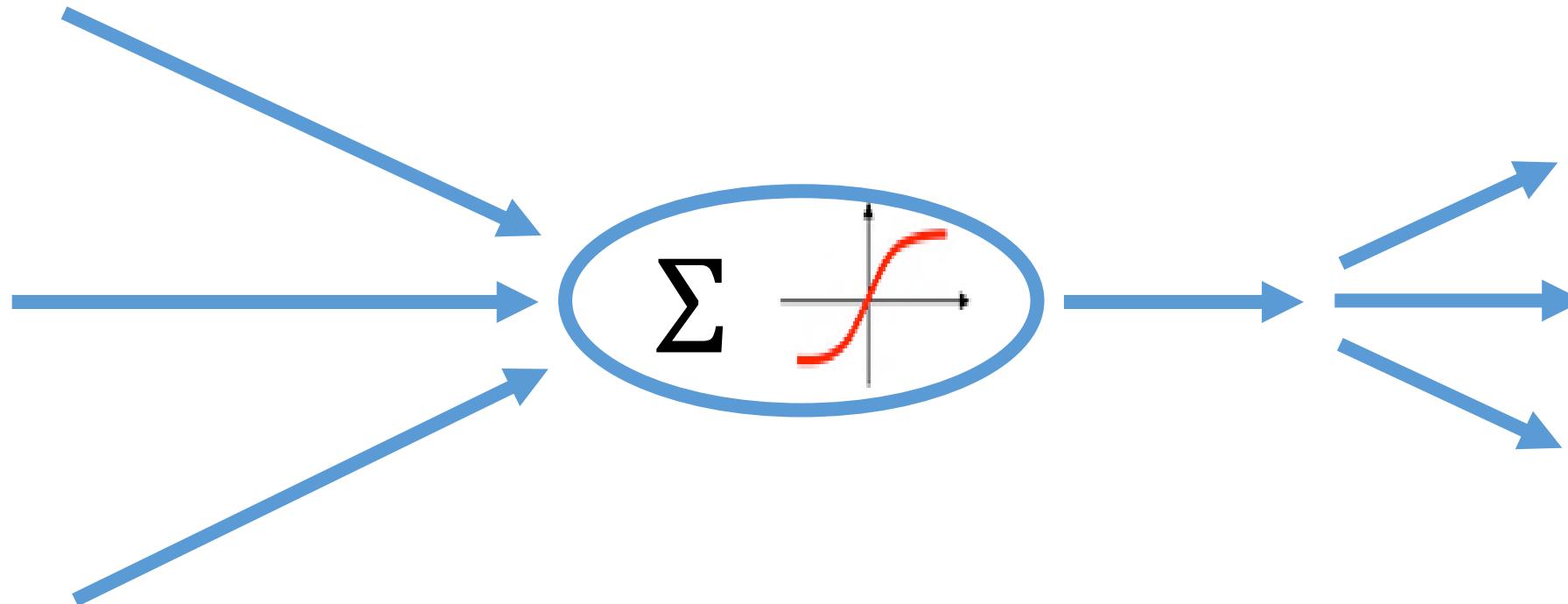
Artificial Neuron



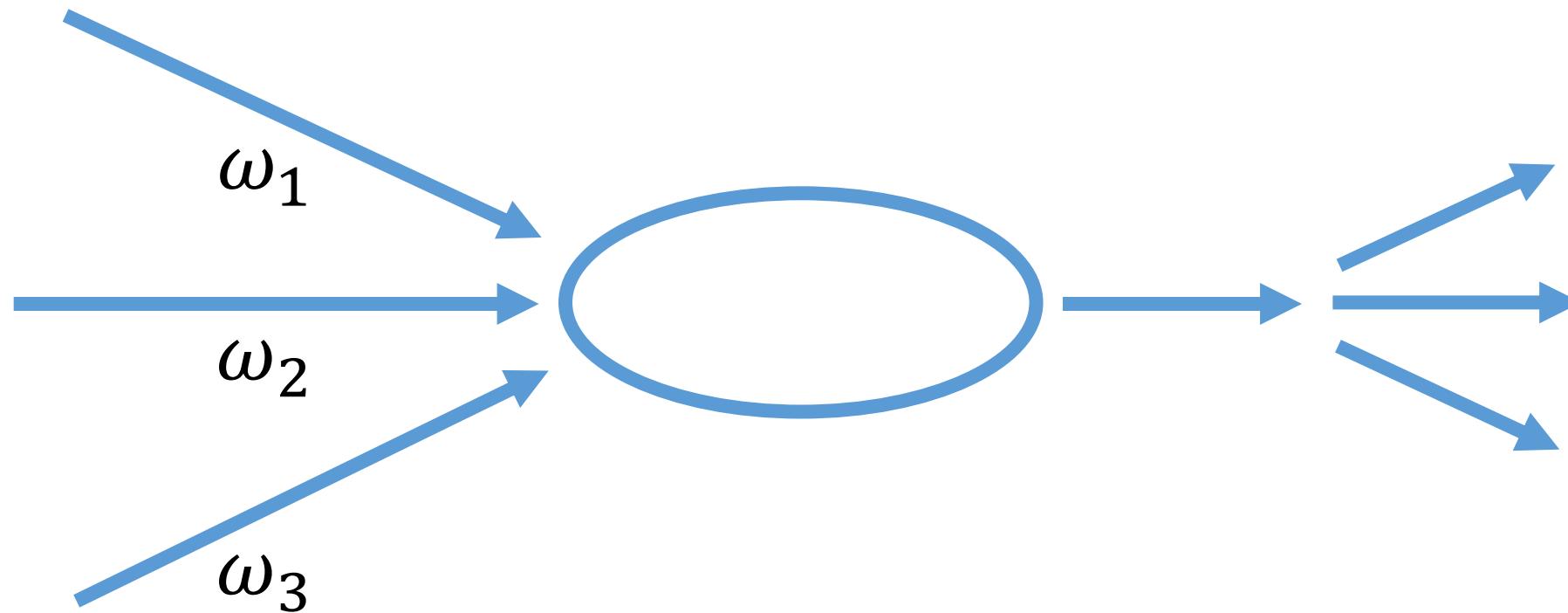
Artificial Neuron



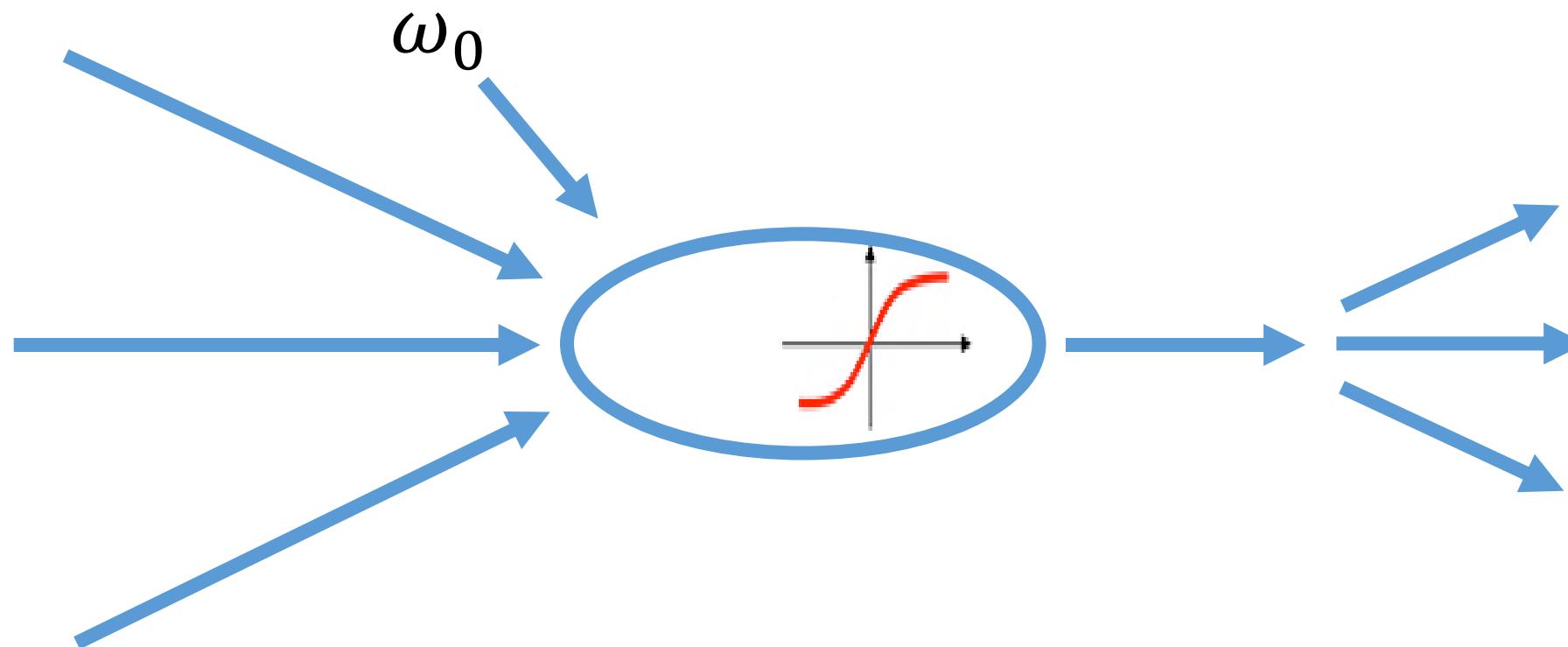
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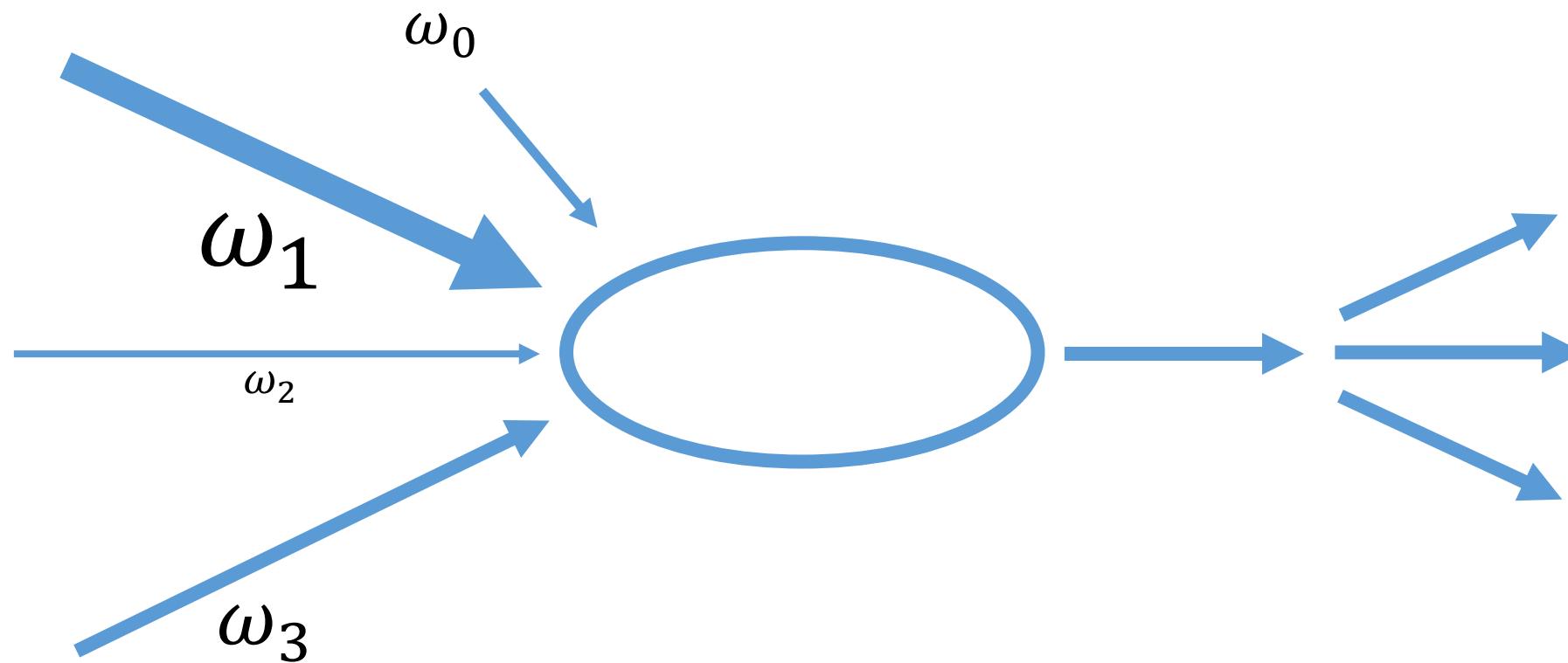
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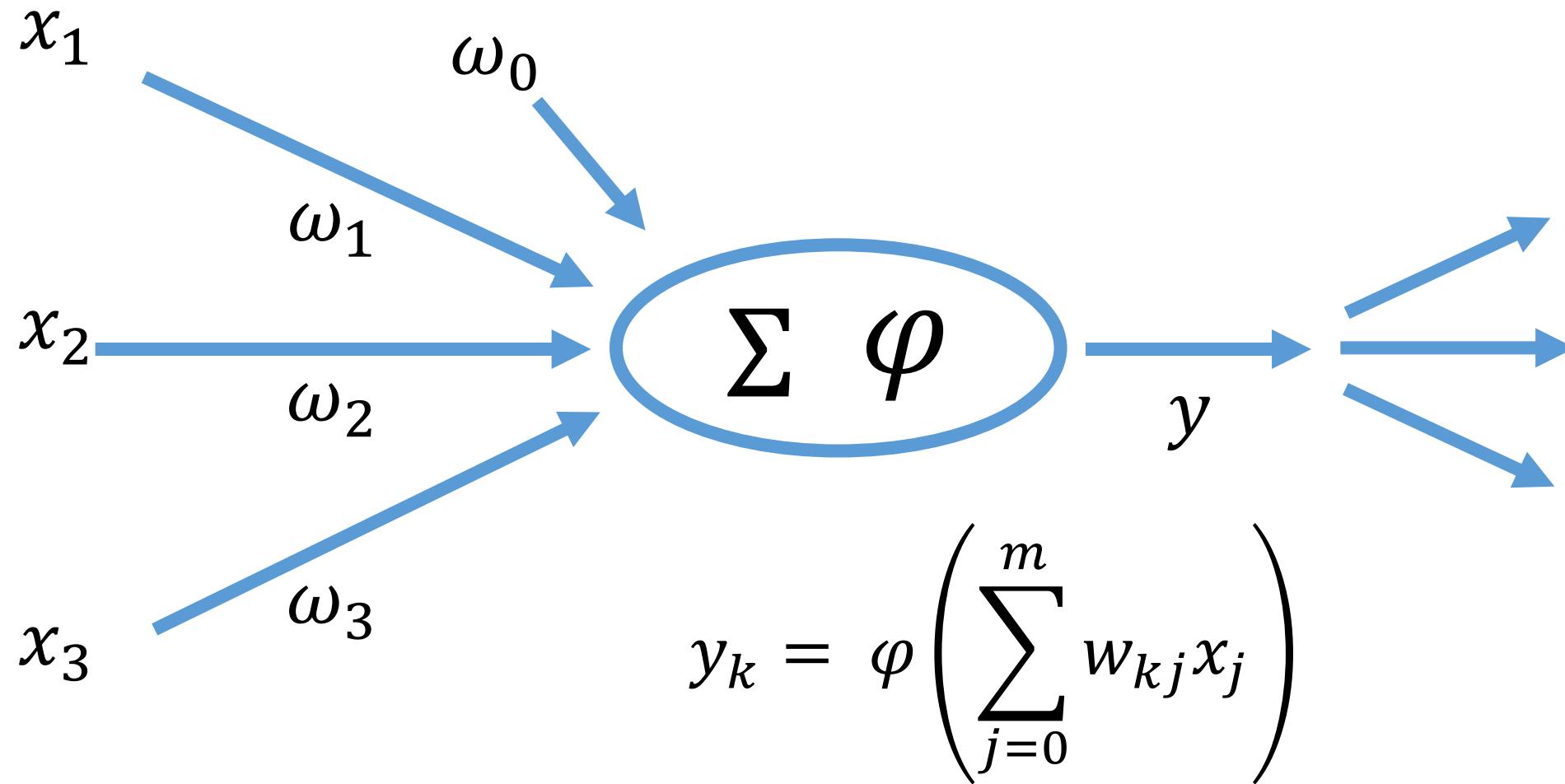
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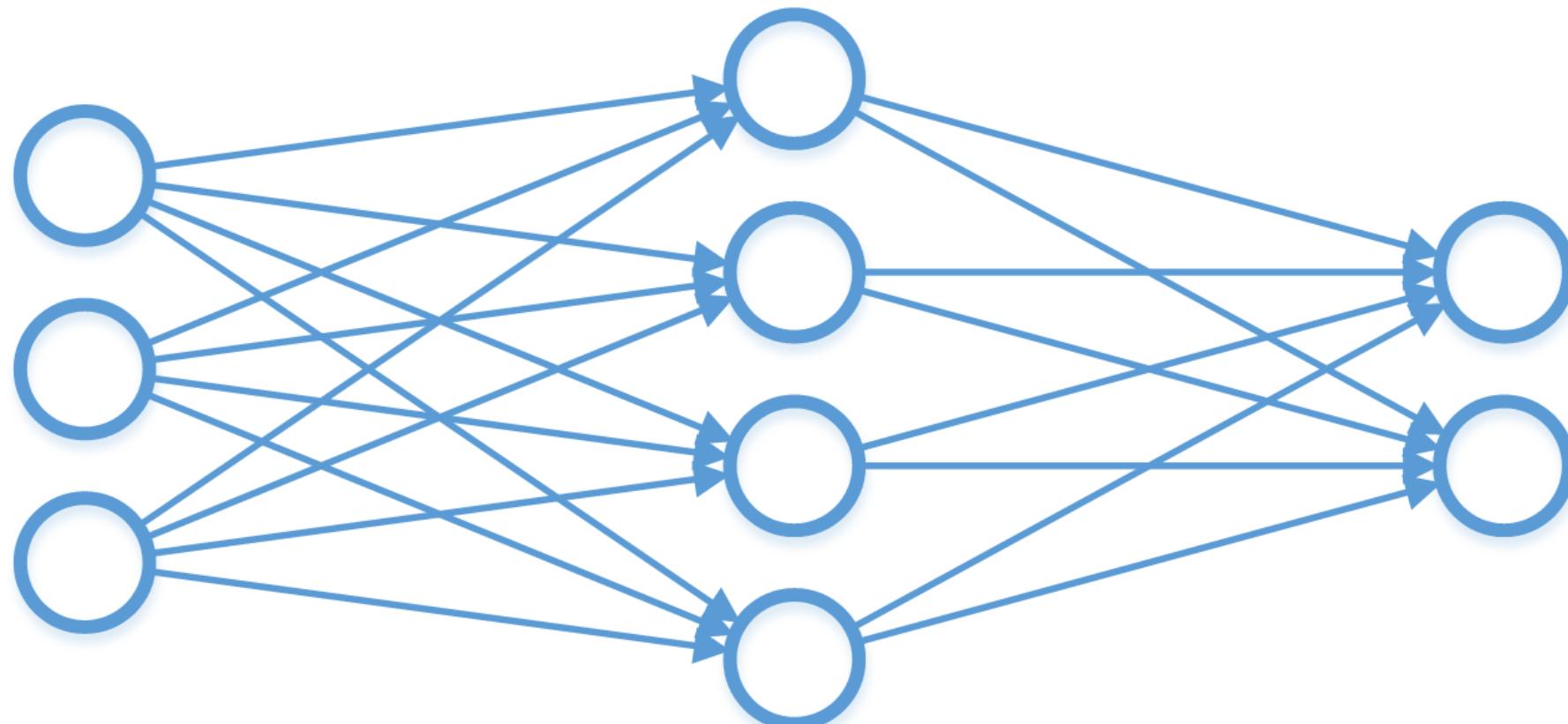
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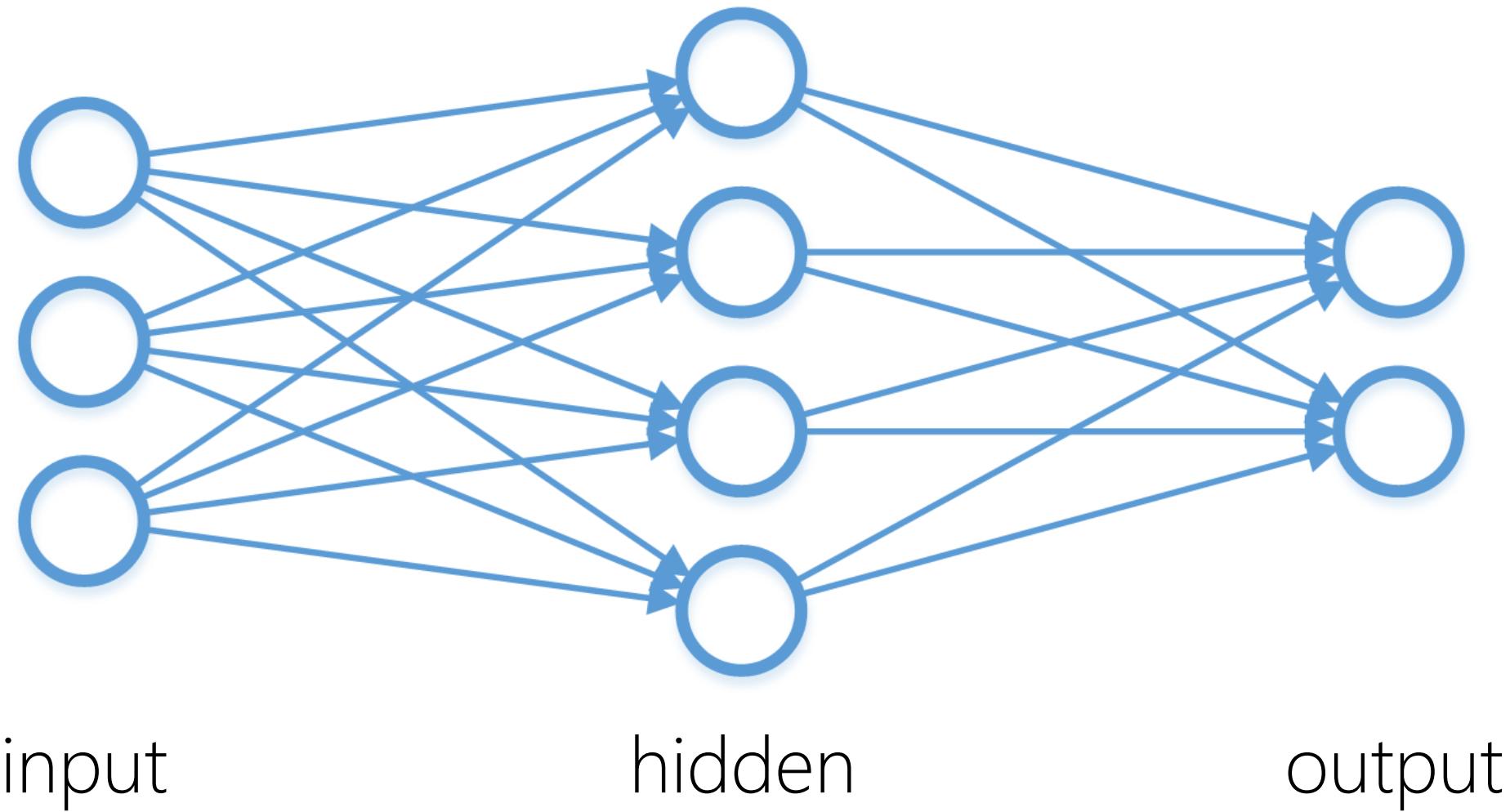
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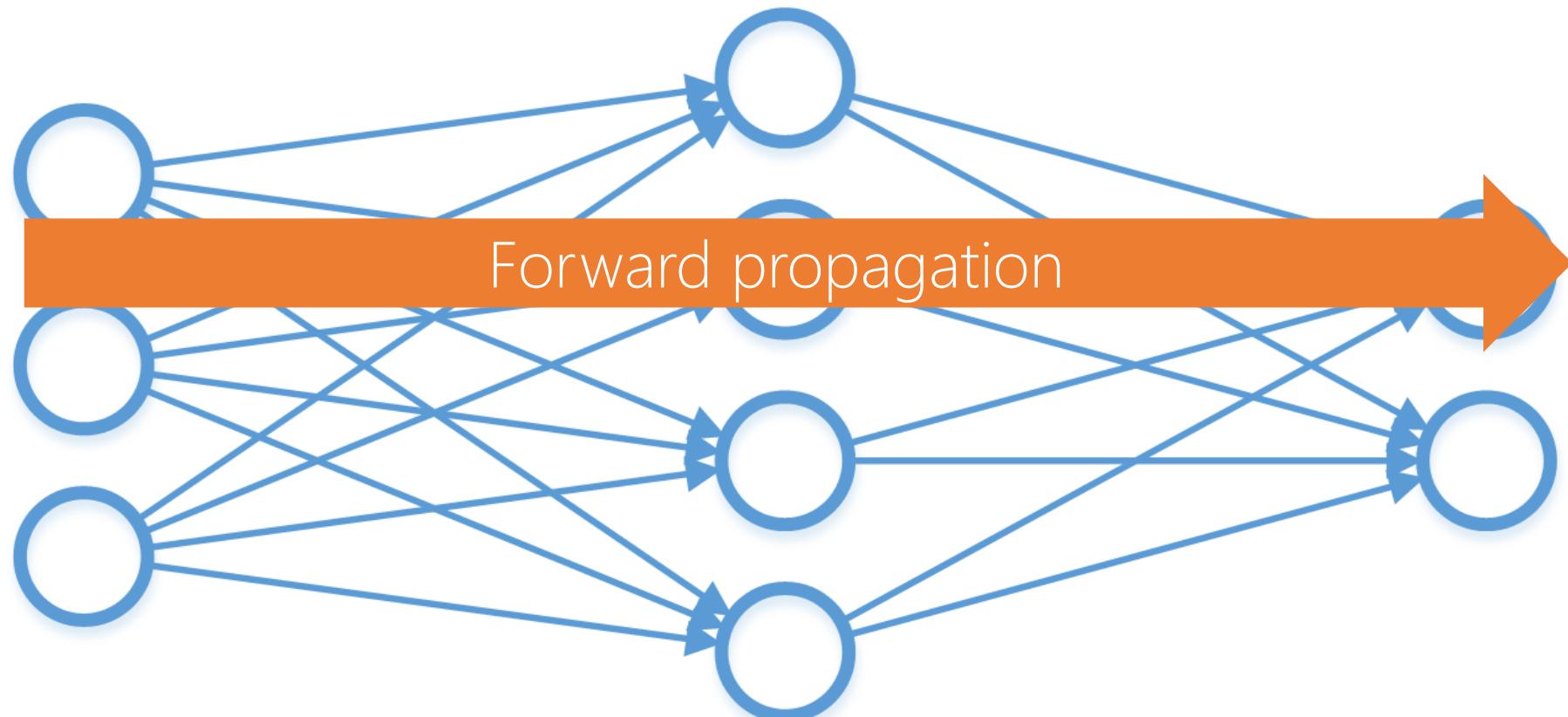
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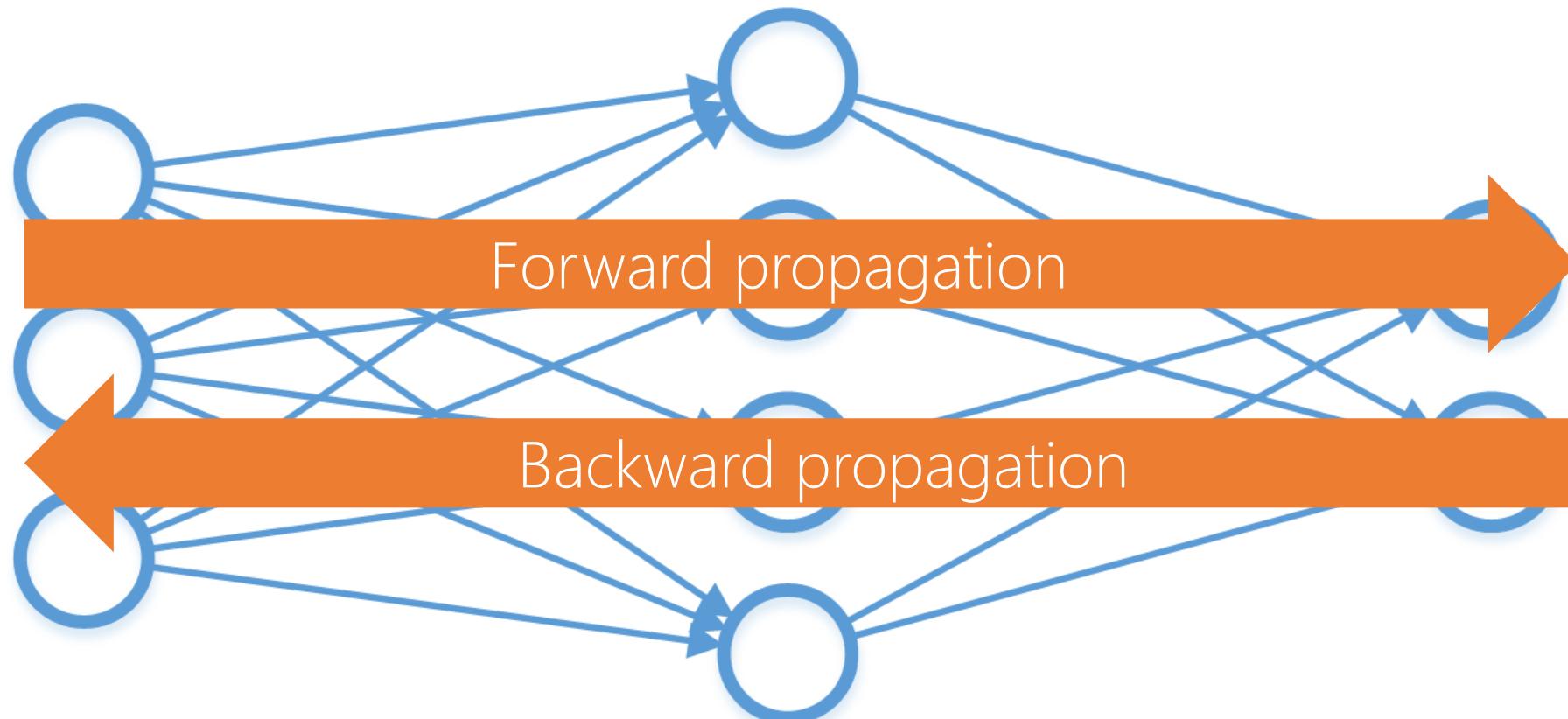
Artificial Neural Network



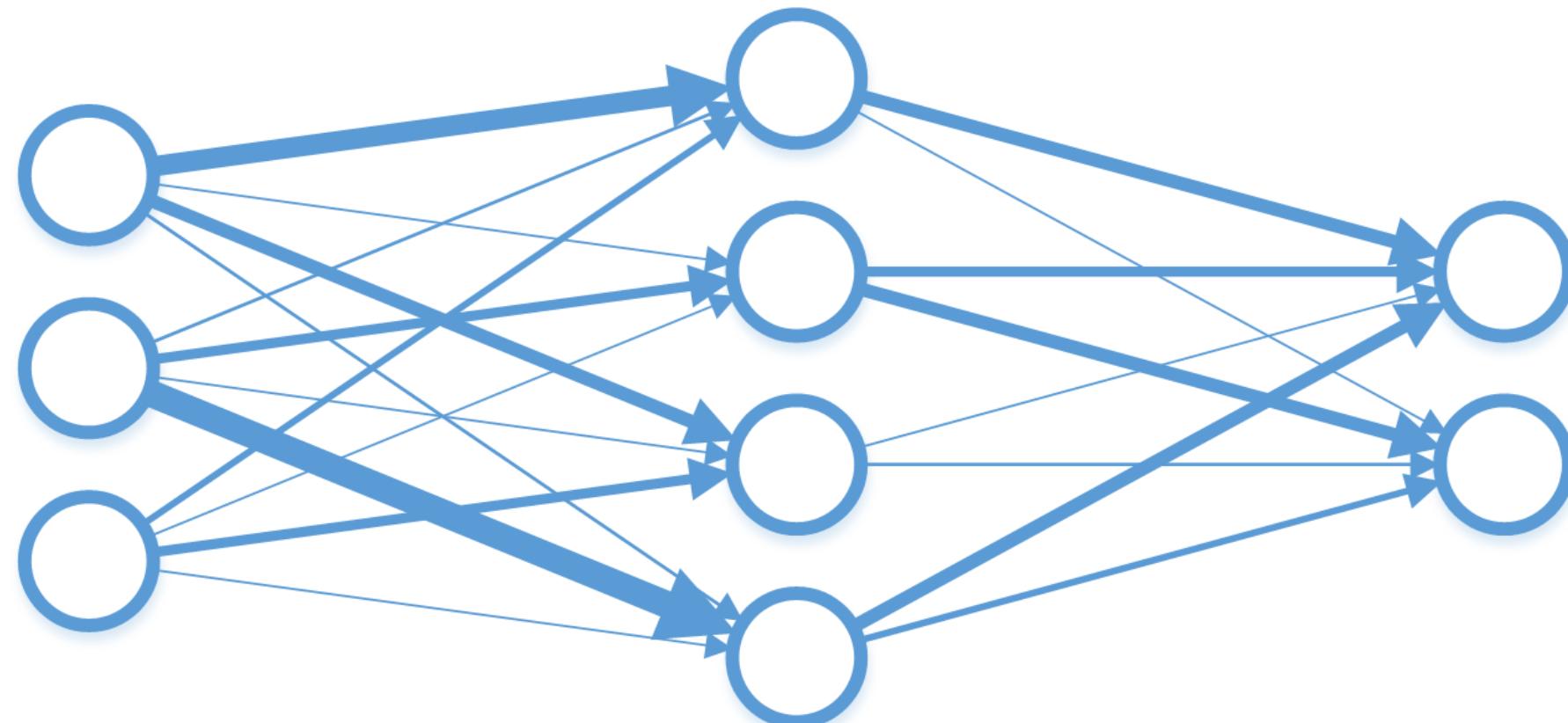
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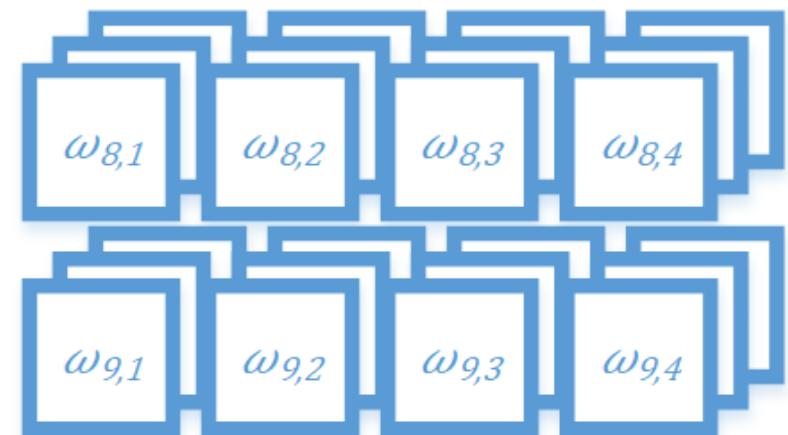
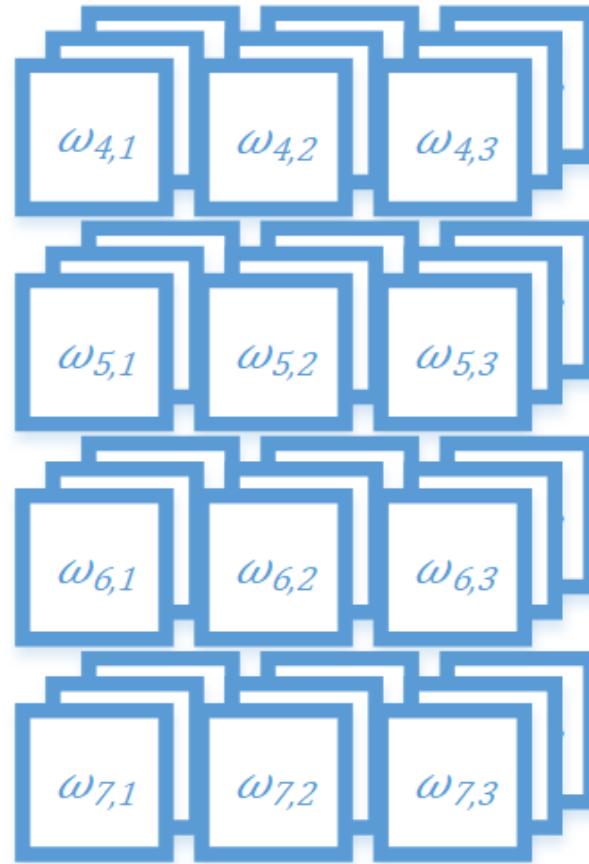
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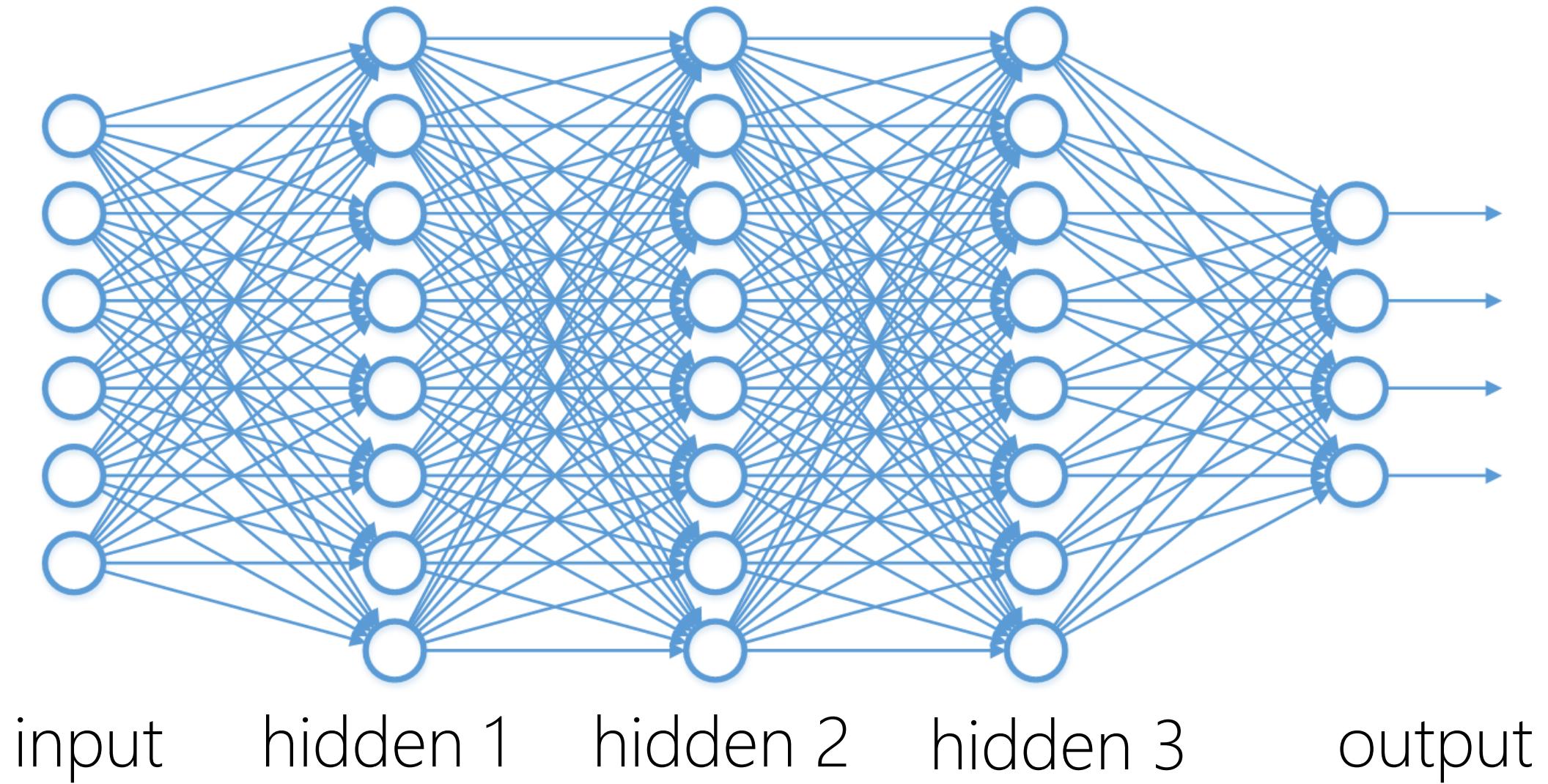
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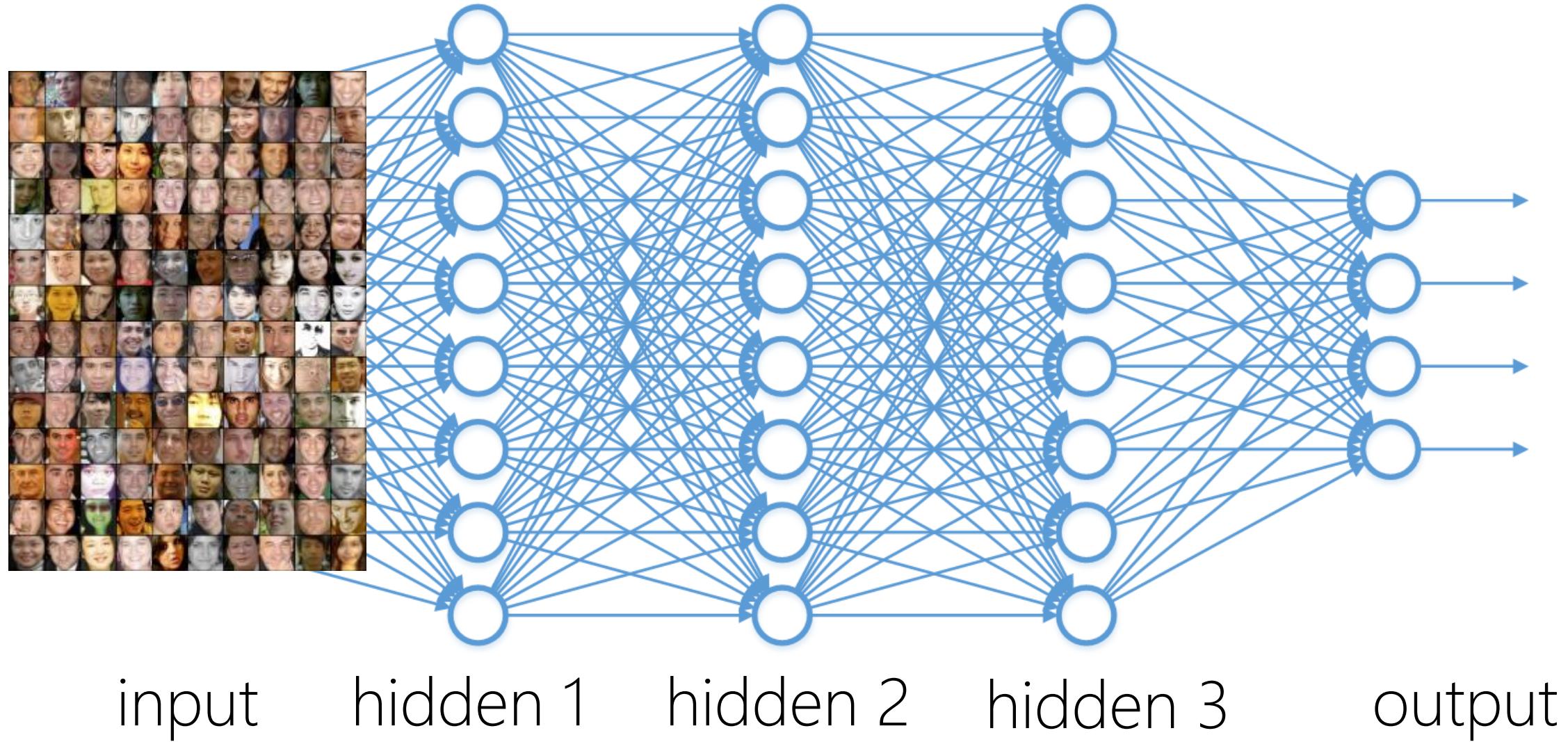
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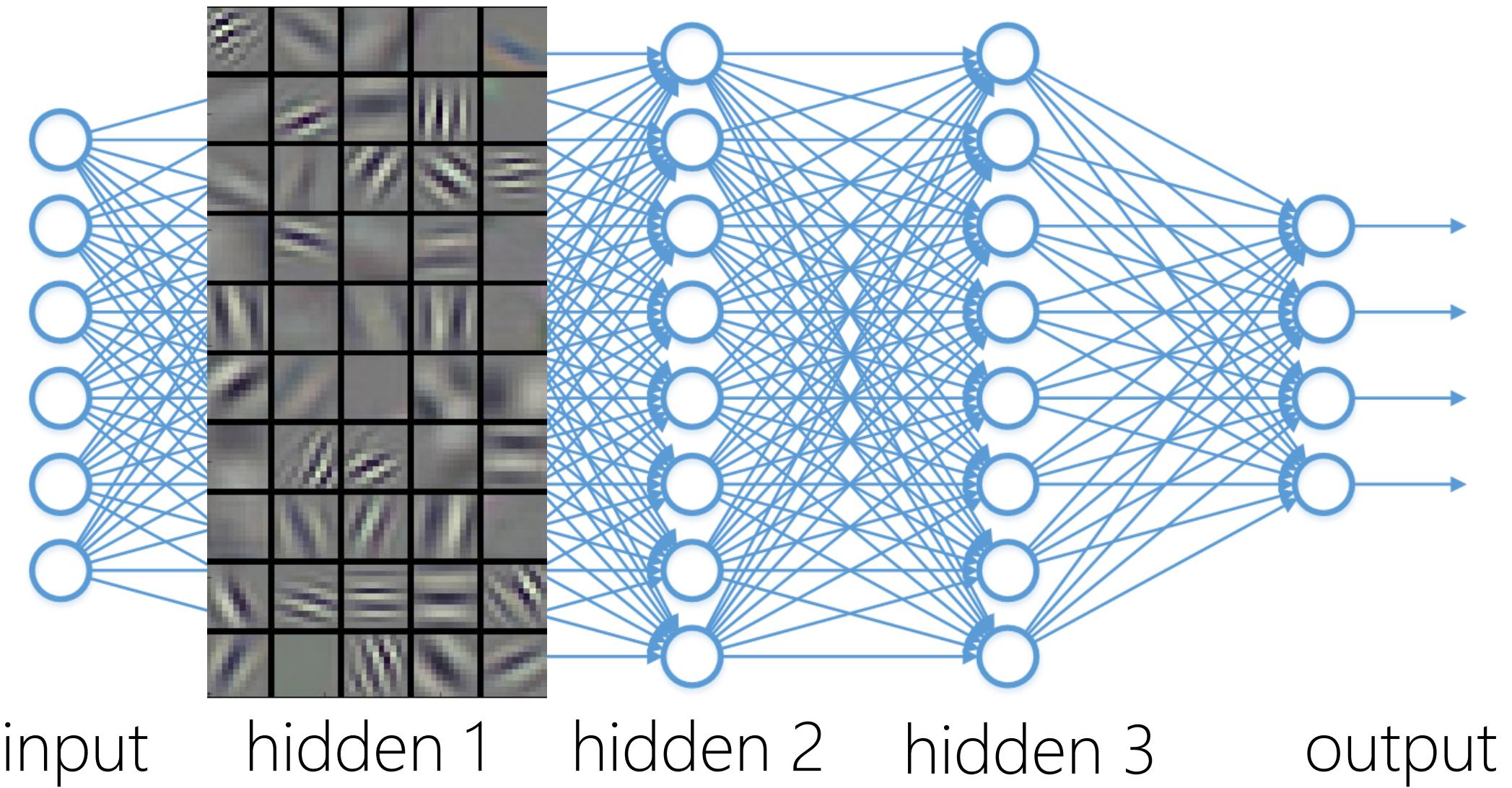
Deep Neural Network



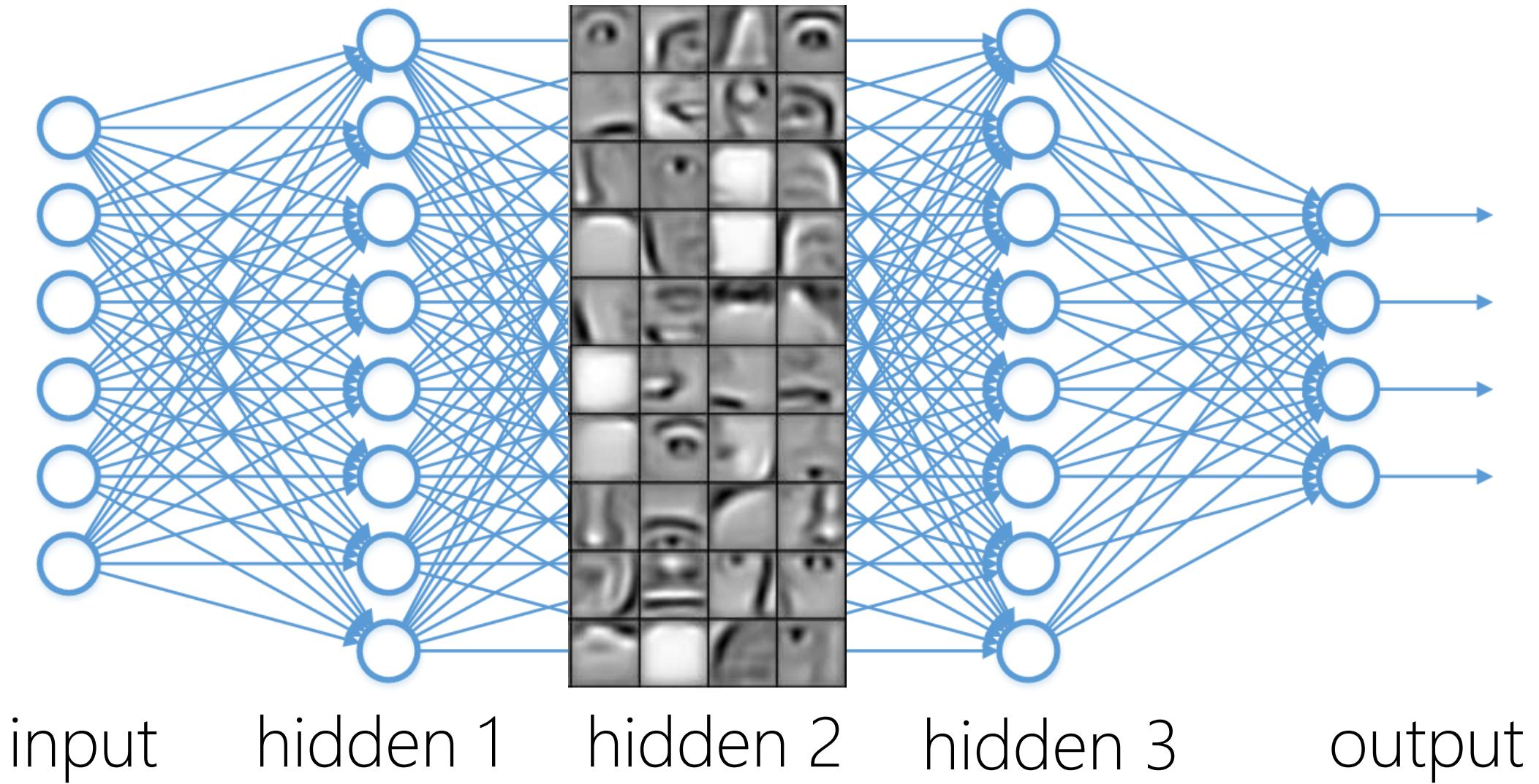
Deep Neural Network



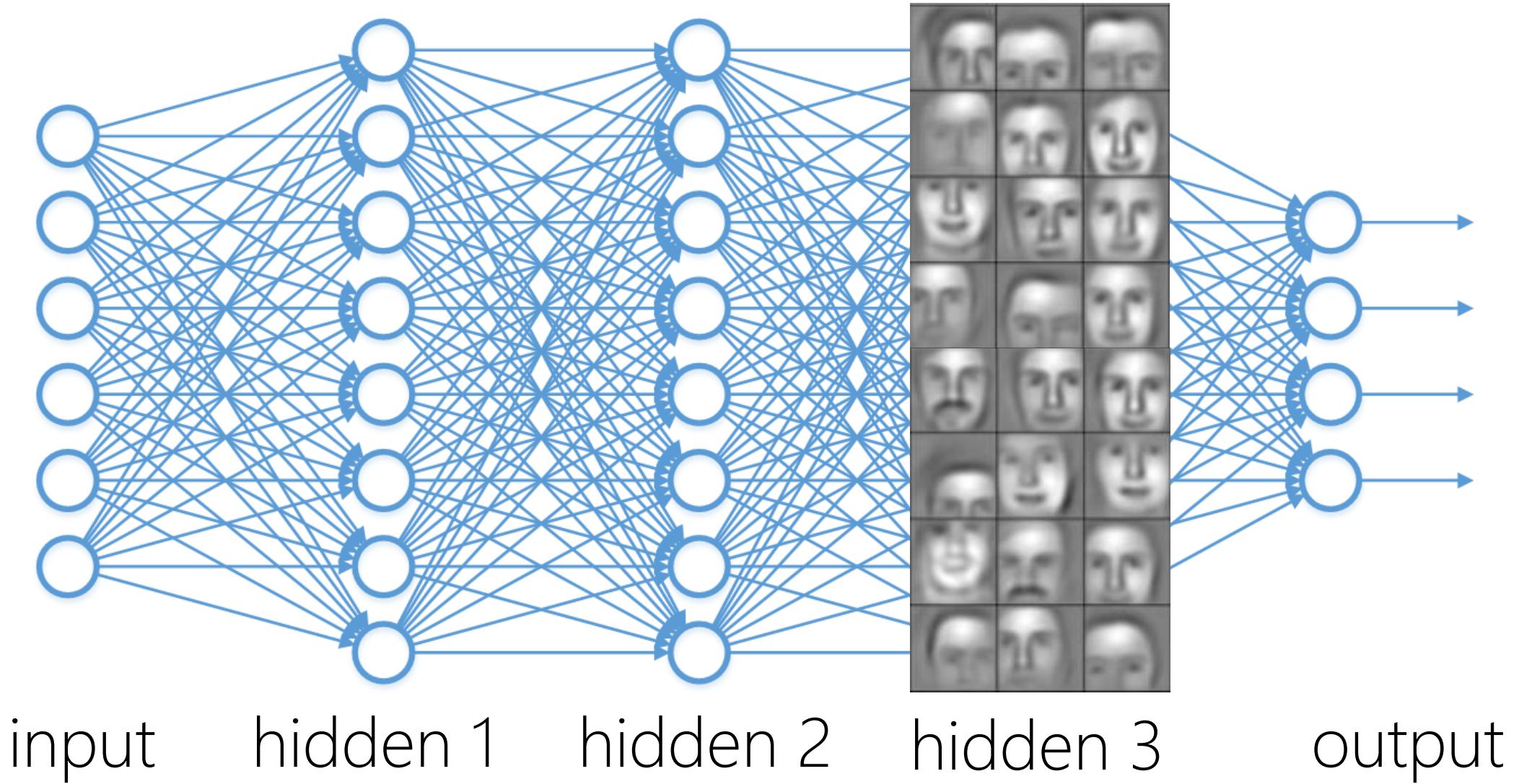
Deep Neural Network



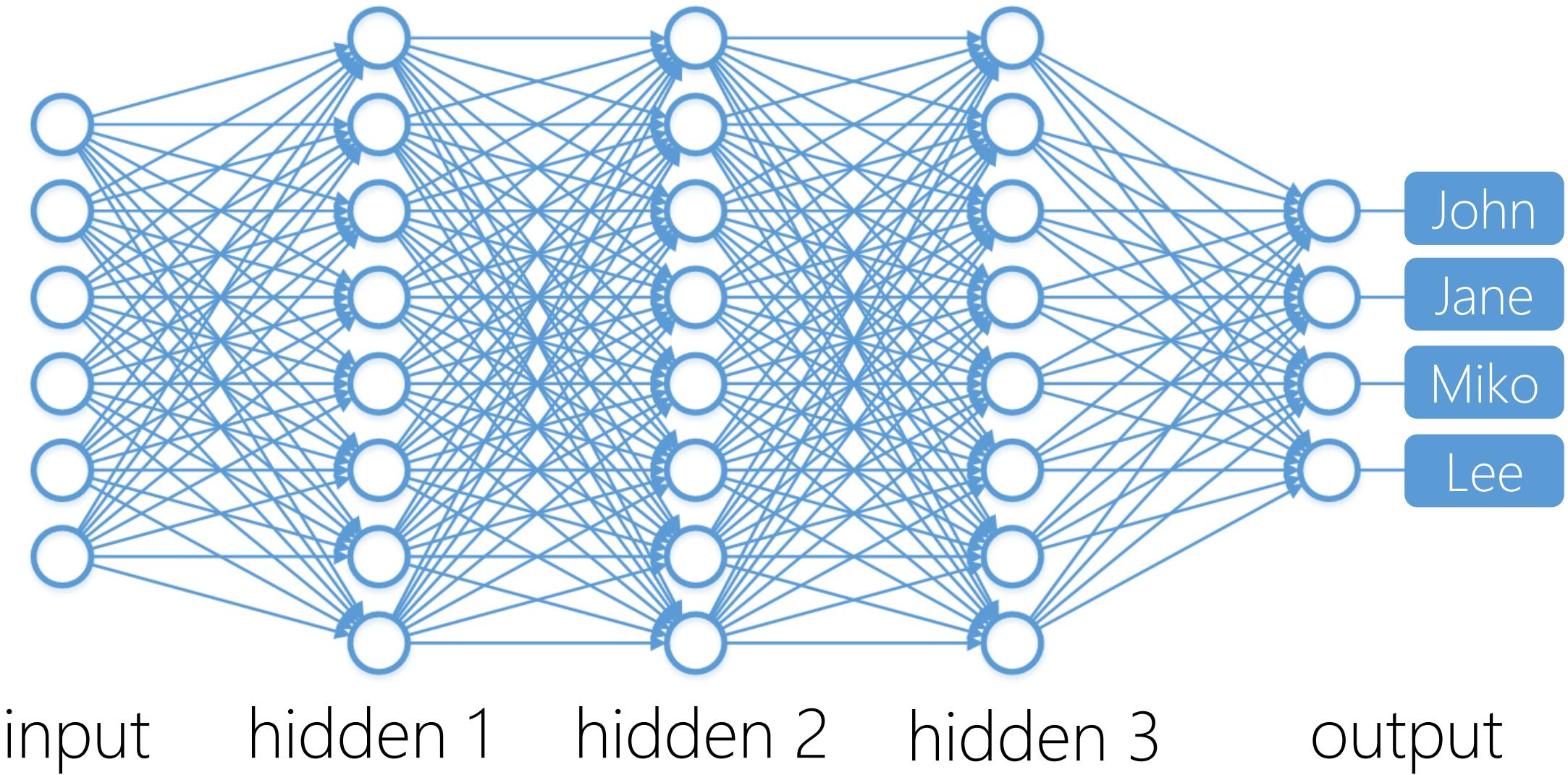
Deep Neural Network



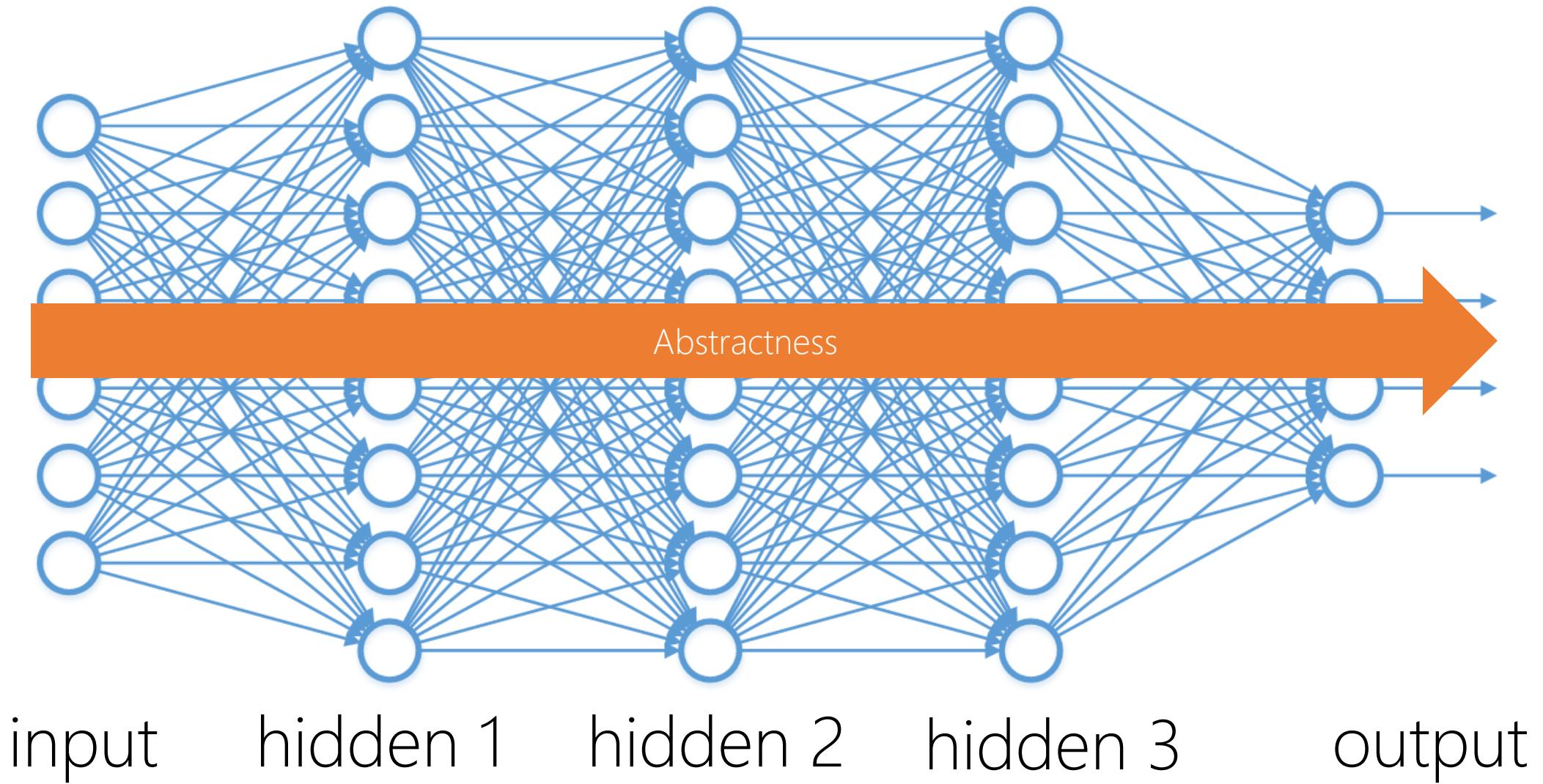
Deep Neural Network



Deep Neural Network



Deep Neural Network



Deep Learning

Artificial intelligence

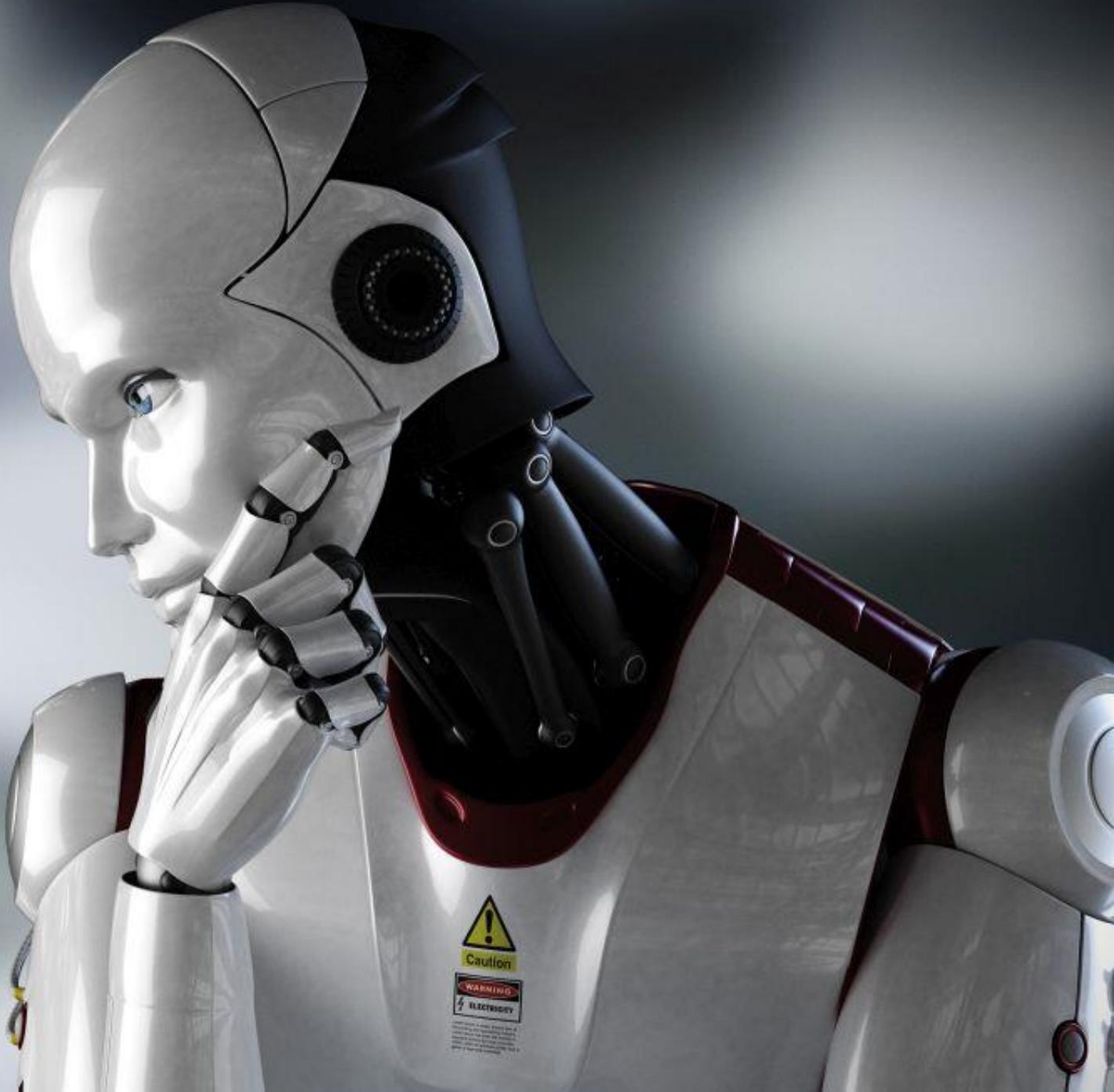
Machine learning

Neural network

Multiple hidden layers

Hierarchical representations

Makes predictions with data



Deep Learning

Artificial intelligence

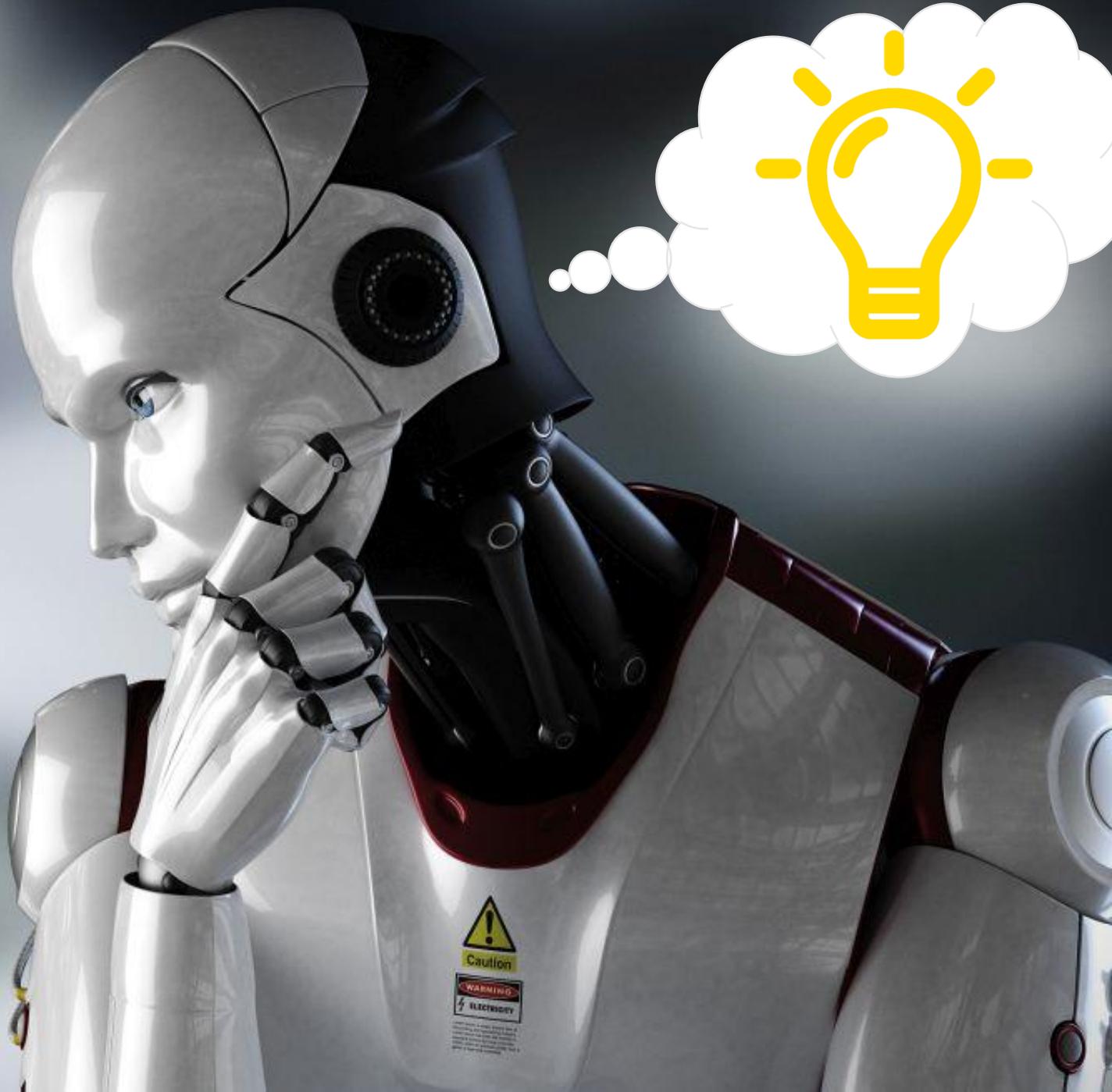
Machine learning

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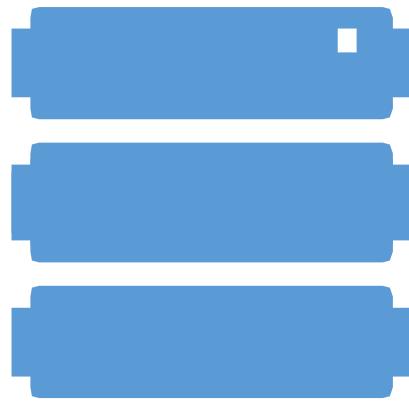
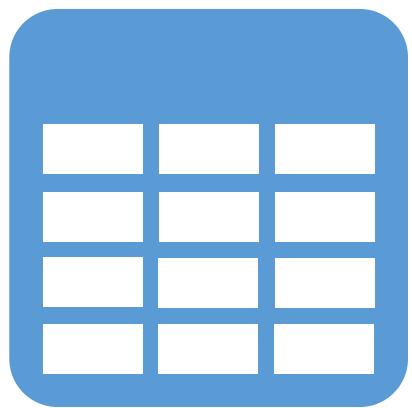


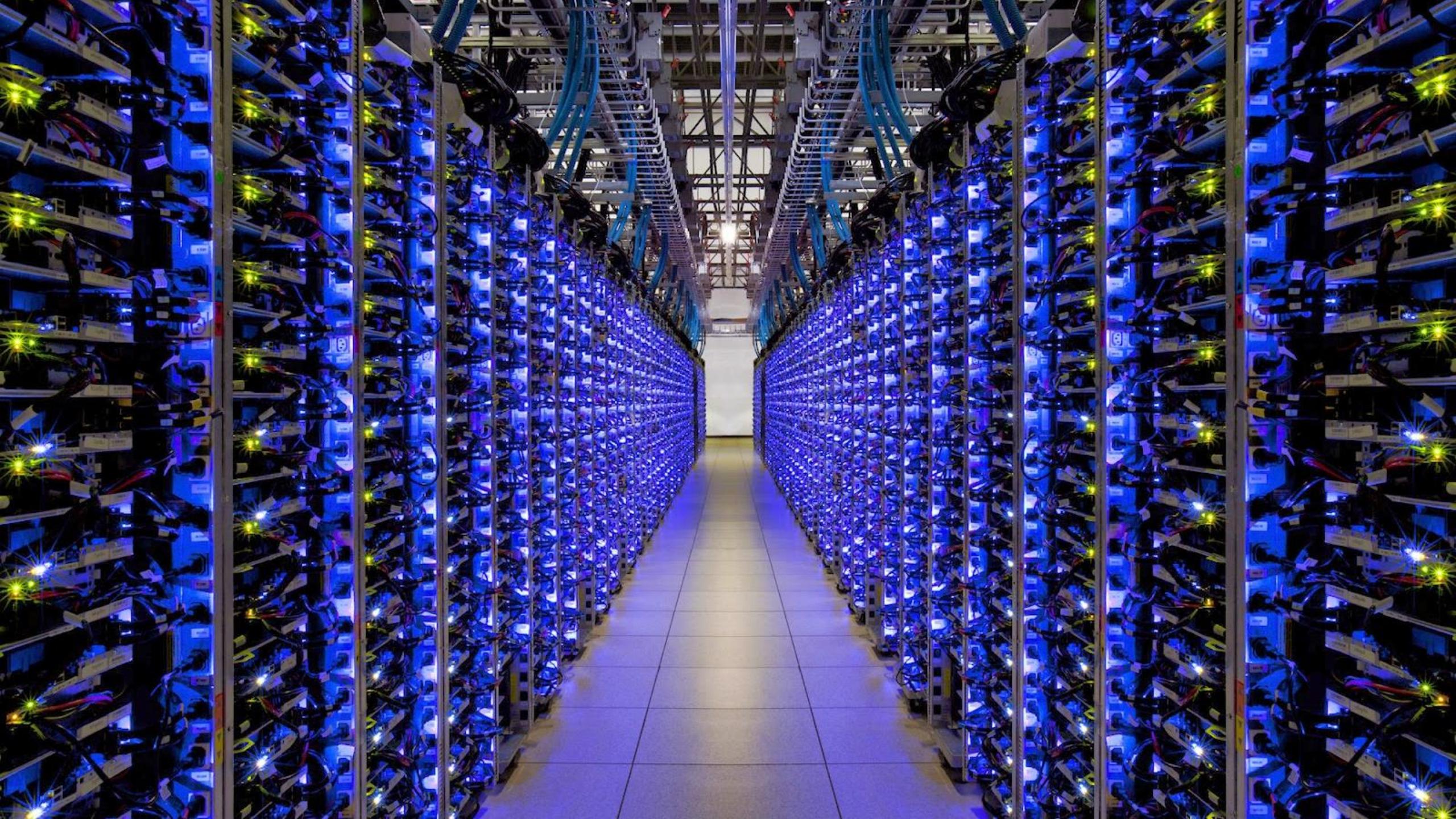


MARK 7

PERCEPTION

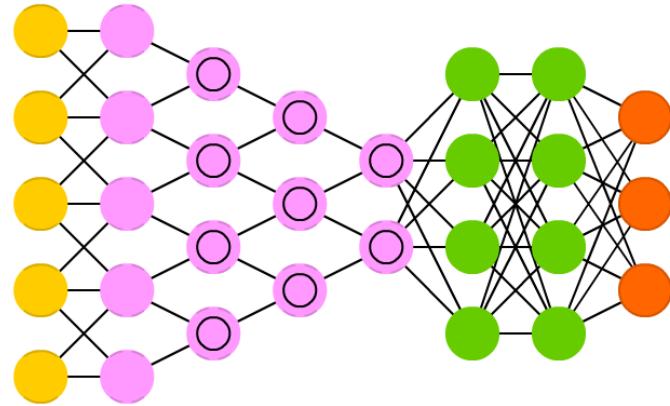
What Changed?

 $f(x)$

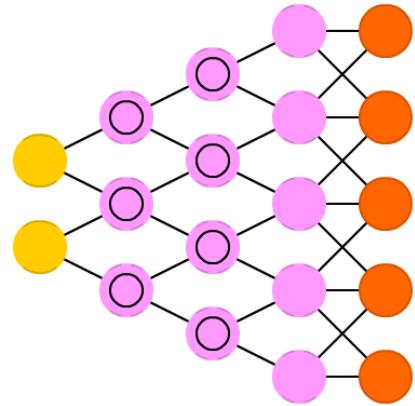




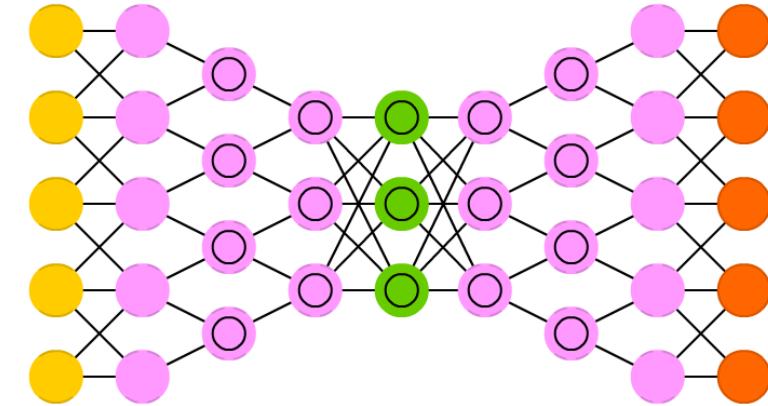
Deep Convolutional Network (DCN)



Deconvolutional Network (DN)

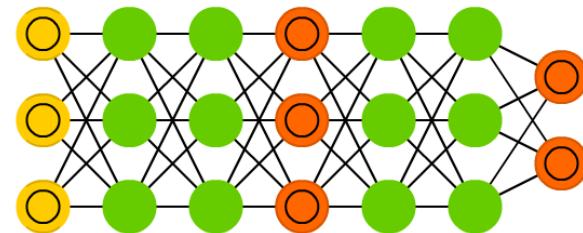


Deep Convolutional Inverse Graphics Network (DCIGN)

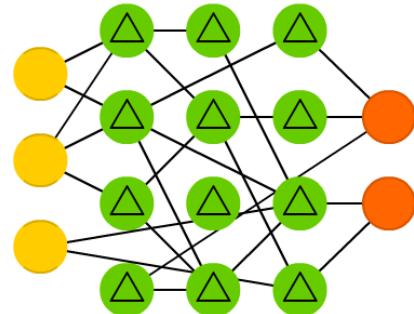


- Backfed Input Cell
- Input Cell
- △ Noisy Input Cell
- Hidden Cell
- Probabilistic Hidden Cell
- Spiking Hidden Cell
- Output Cell
- Match Input Output Cell
- Recurrent Cell
- Memory Cell
- △ Different Memory Cell
- Kernel
- Convolution or Pool

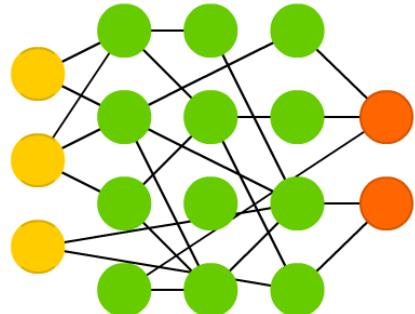
Generative Adversarial Network (GAN)



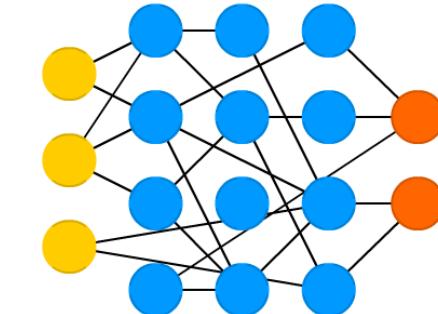
Liquid State Machine (LSM)



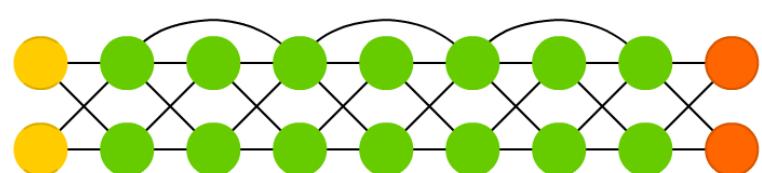
Extreme Learning Machine (ELM)



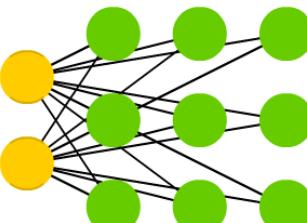
Echo State Network (ESN)



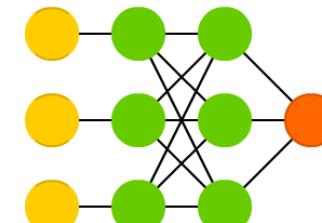
Deep Residual Network (DRN)



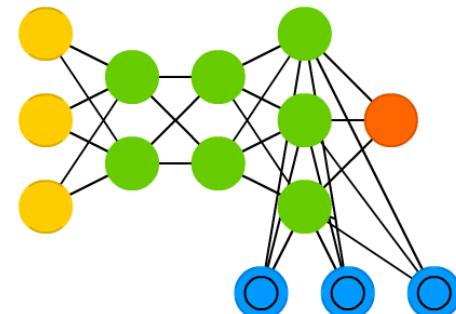
Kohonen Network (KN)



Support Vector Machine (SVM)



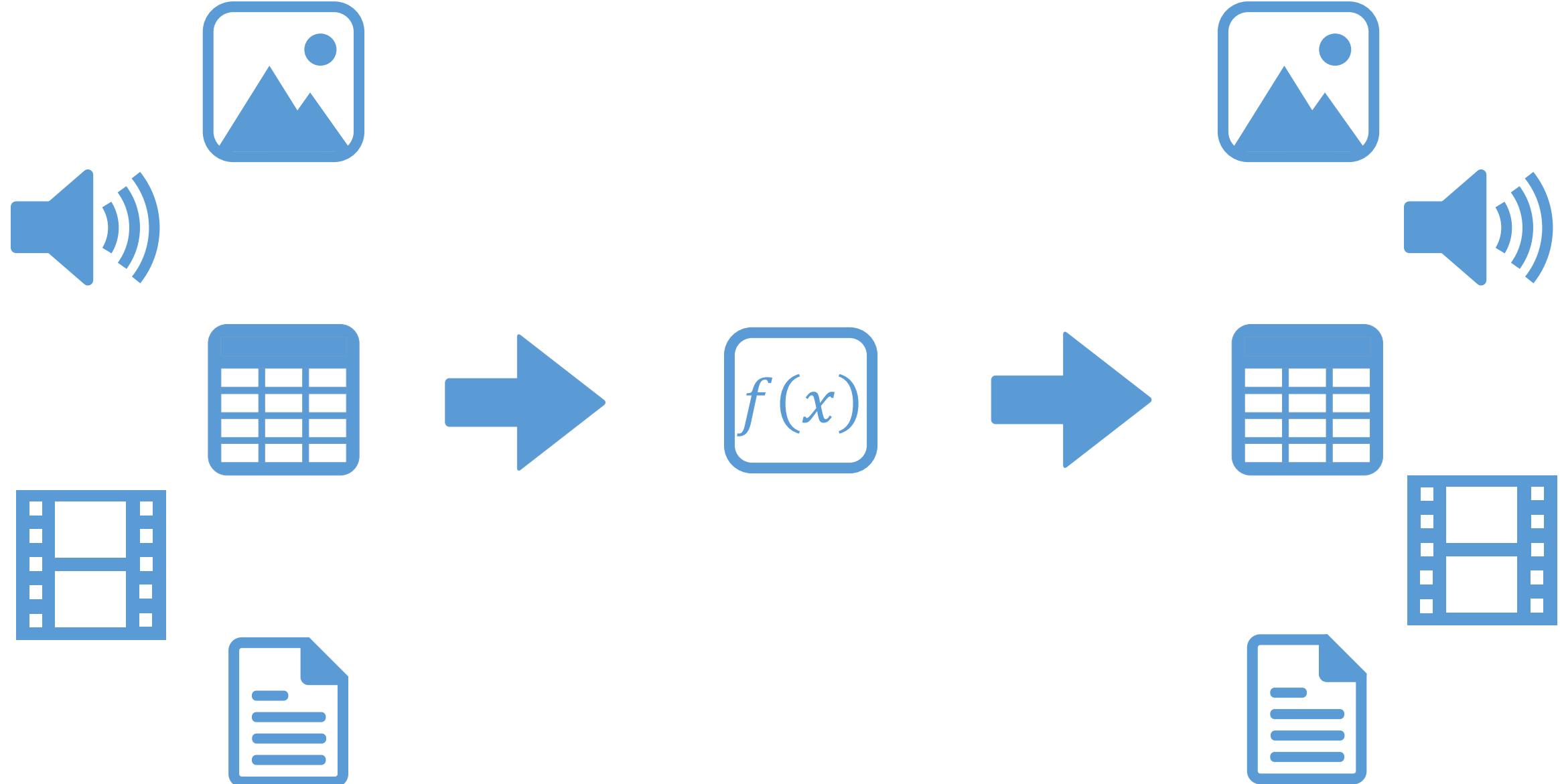
Neural Turing Machine (NTM)

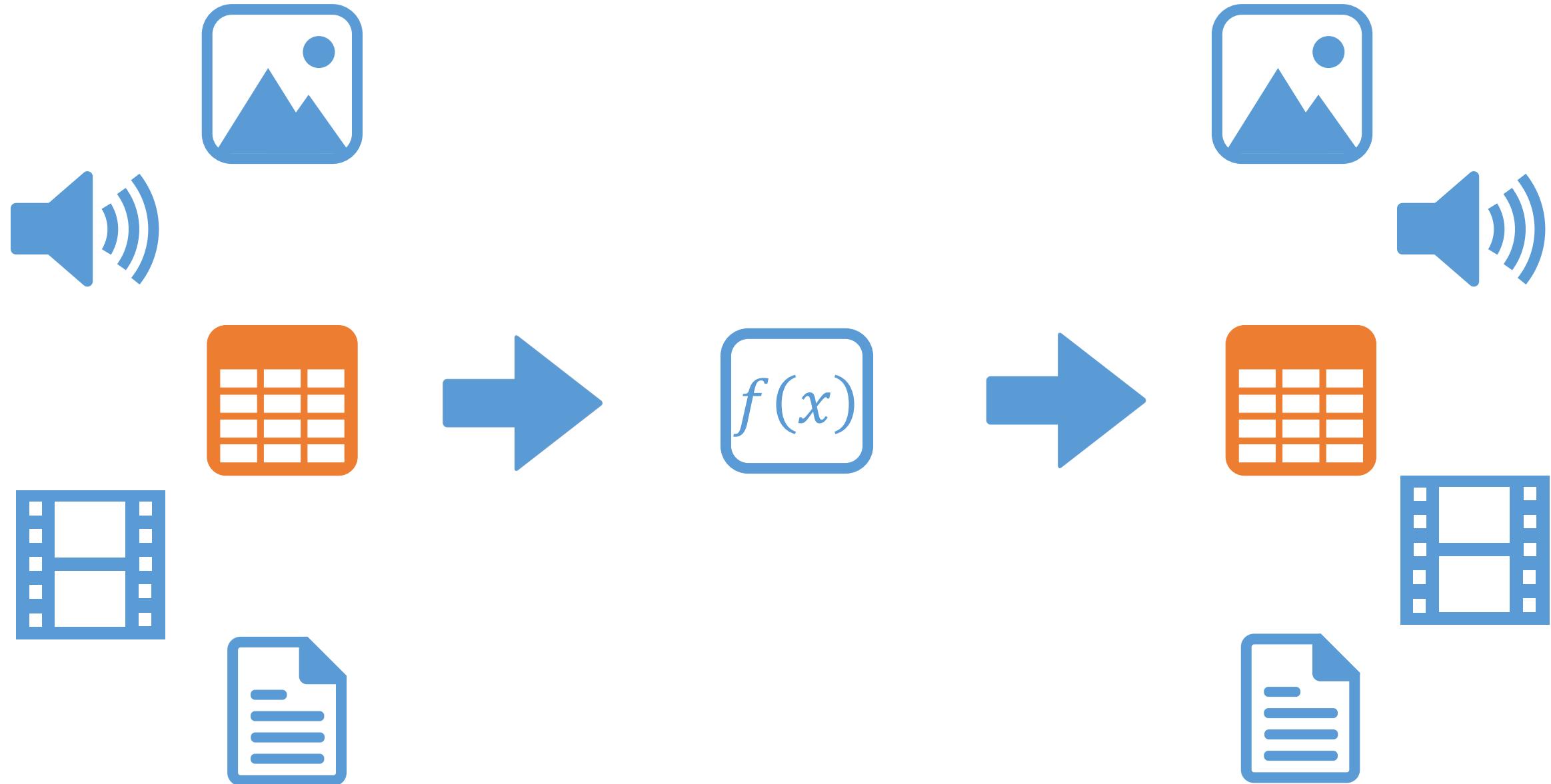


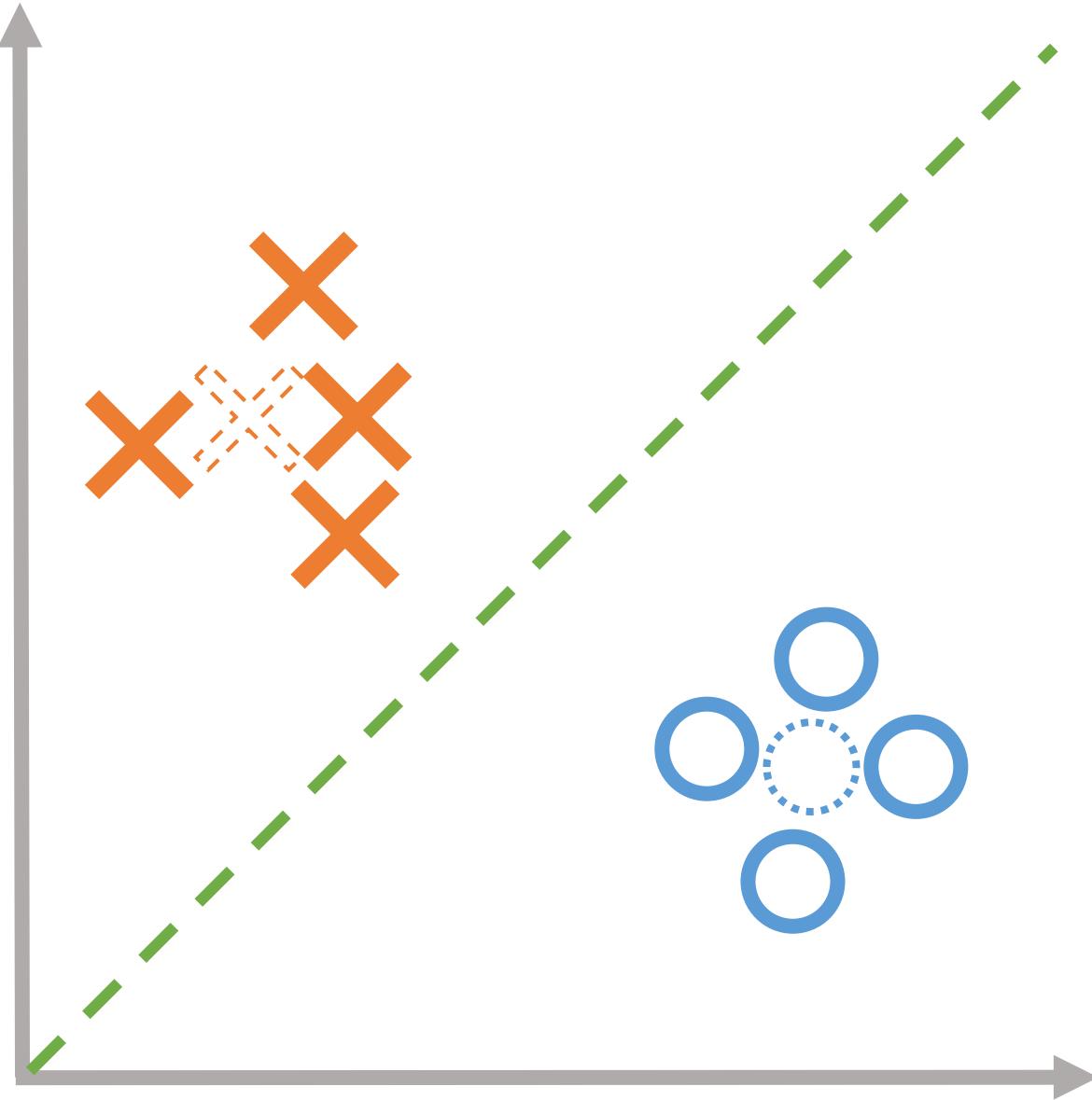


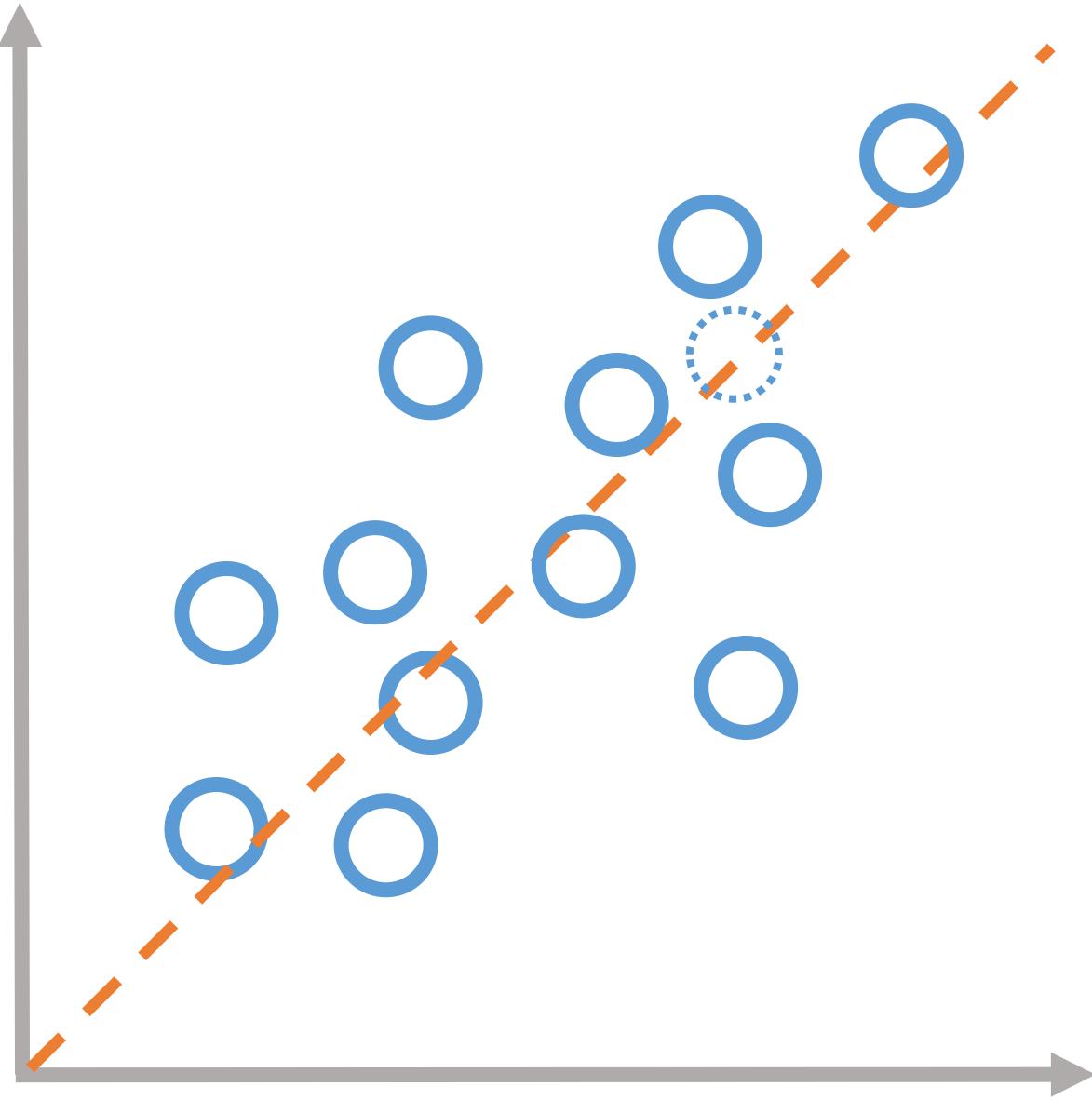
What can deep learning do?

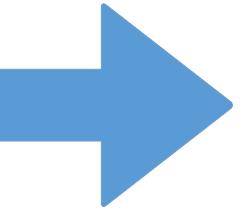
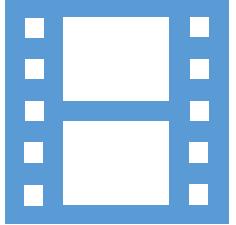
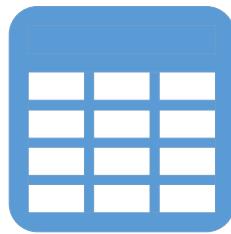
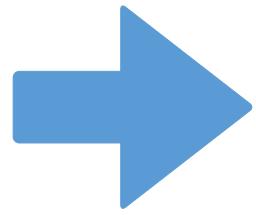


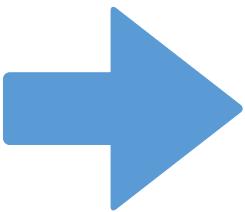








 $f(x)$ 



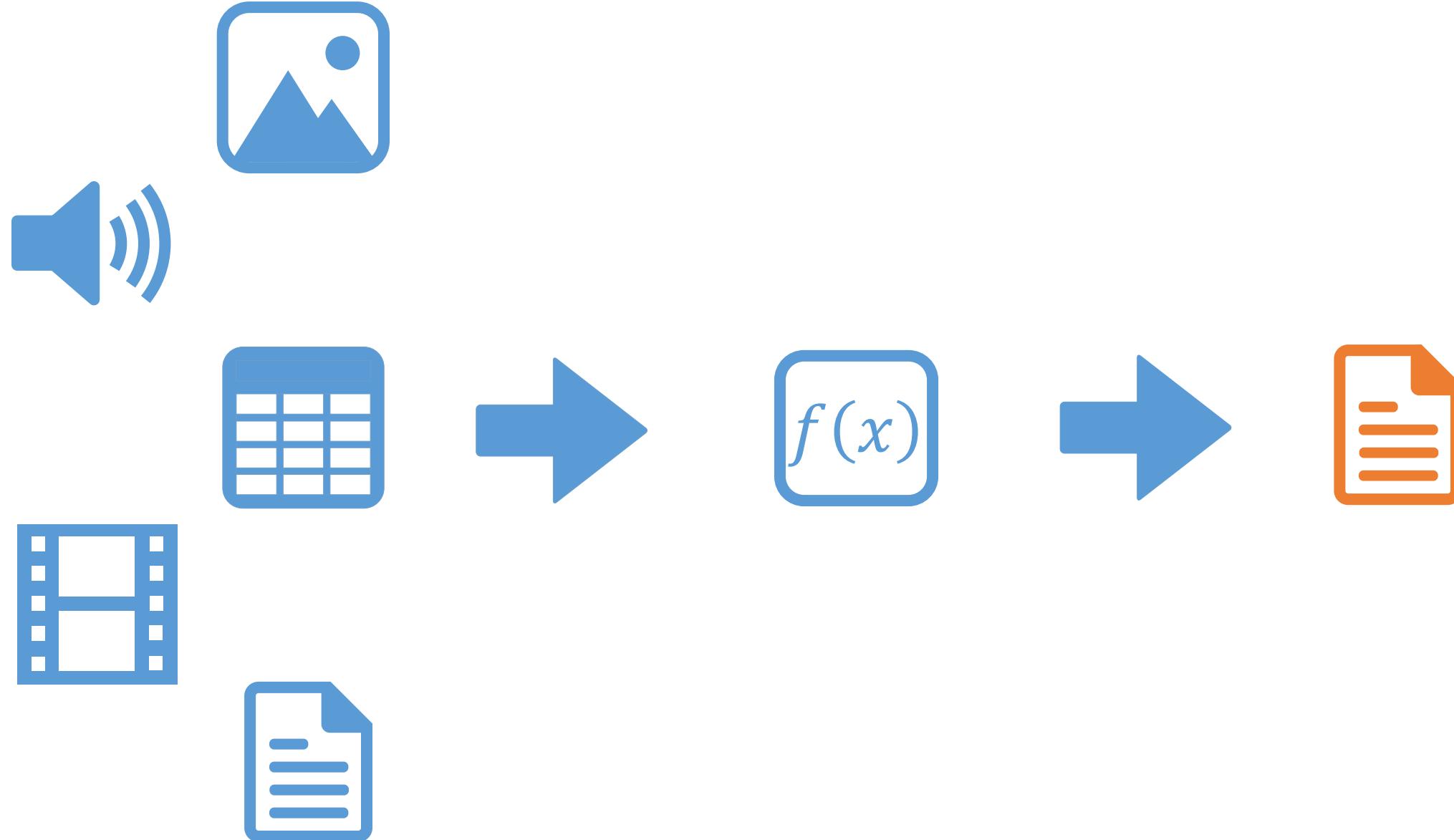
Technology



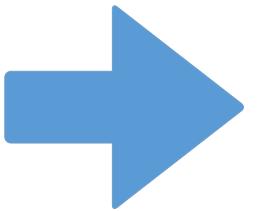
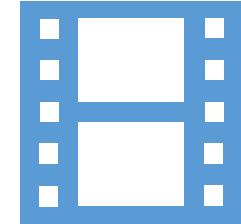
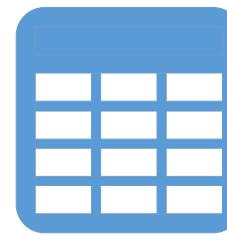
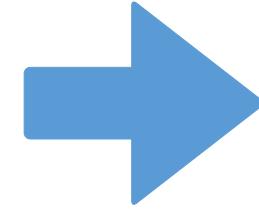
Sports

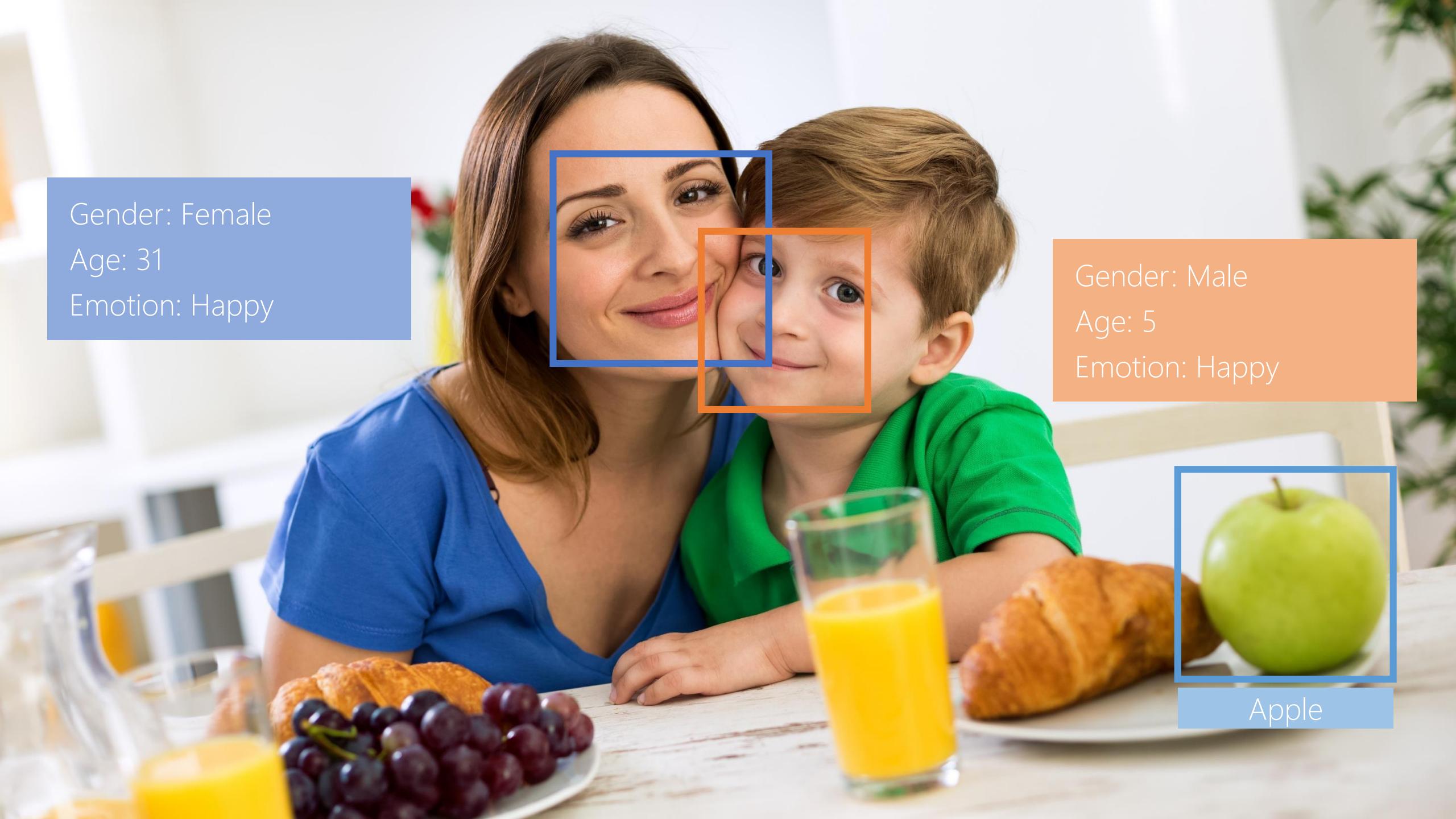


Entertainment



Article Text	Predicted Headline
At least 72 people died and scores more were hurt when a truck crowded with pilgrims plunged into a gorge in the desert state of Rajasthan on Friday, police told the press trust of India.	At least 72 dead in Indian road accident
One of the last remaining routes for Iraqis trying to flee their country has effectively been closed off by new visa restrictions imposed by Syria, the U. N. refugee agency said Tuesday.	U.N. refugee agency closes last routes to Iraq
Democratic presidential candidates said Thursday they would step up pressure on Pakistan's president Pervez Musharraf over democracy, and criticized White House policy towards Islamabad.	Democratic presidential hopefuls call for pressure on Musharraf

 $f(x)$ 



Gender: Female
Age: 31
Emotion: Happy

Gender: Male
Age: 5
Emotion: Happy

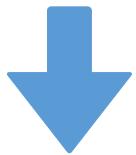


Apple

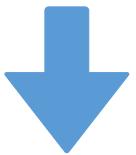




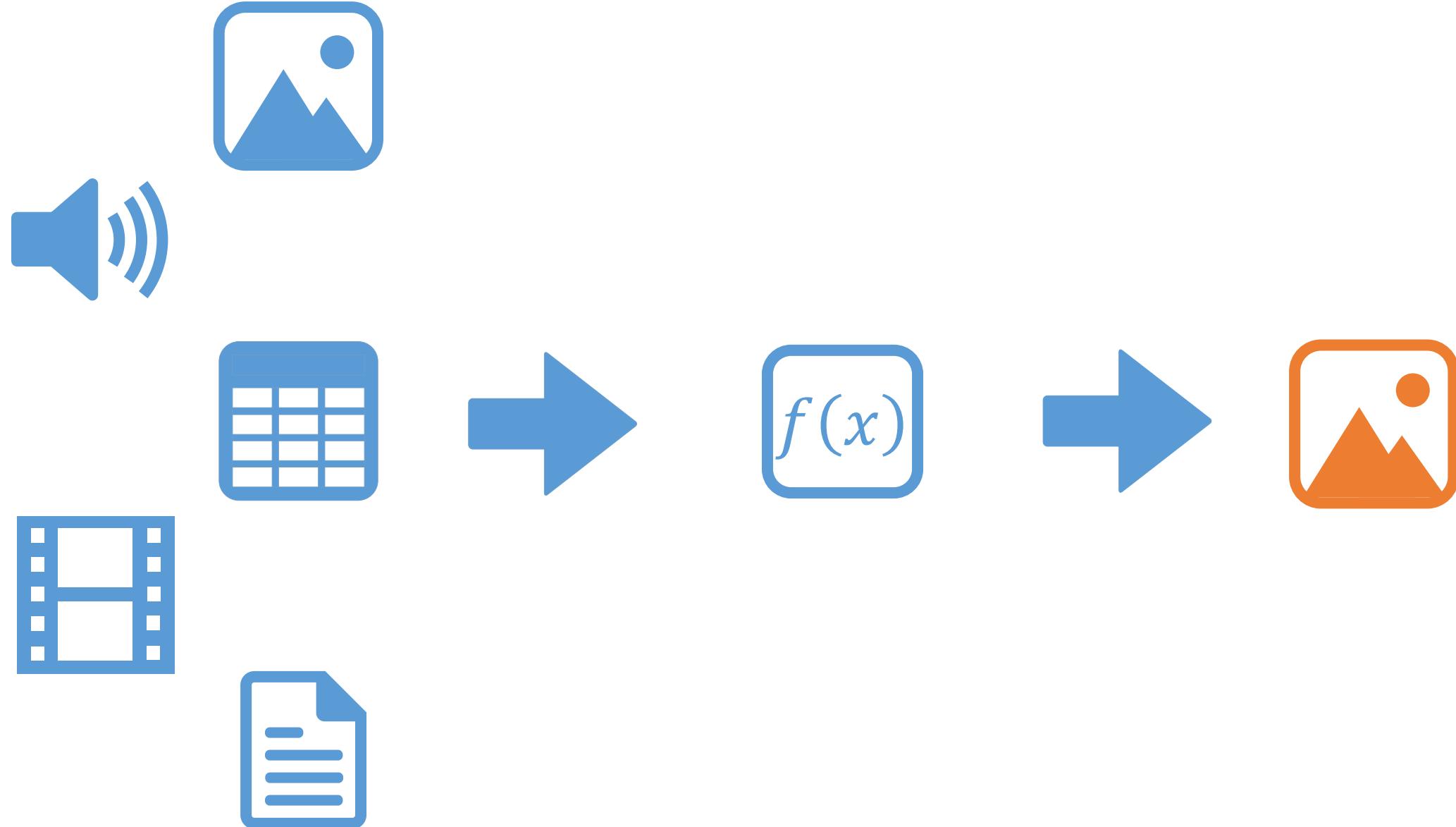
A person riding a motorcycle on a dirt road.

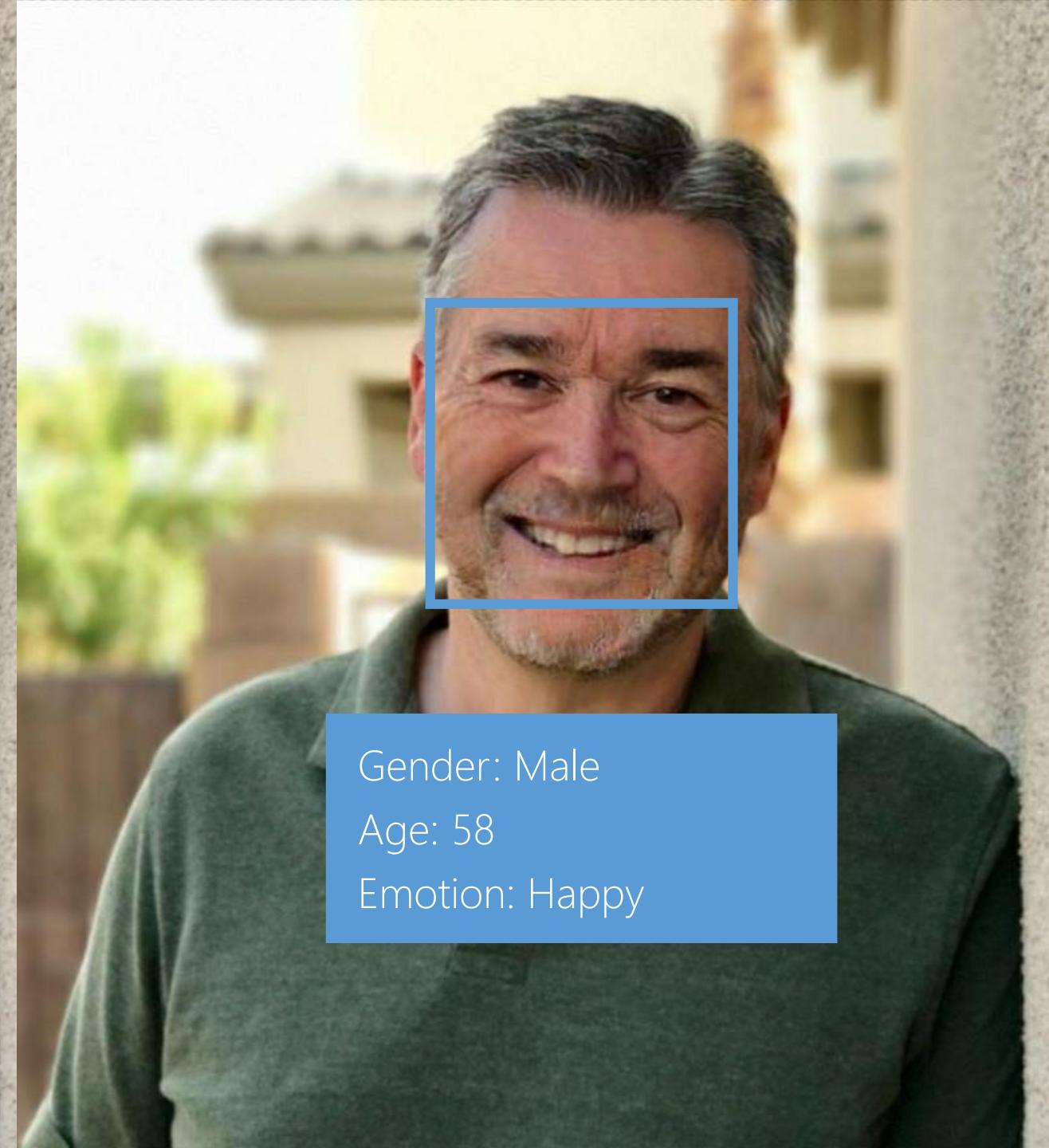


A group of young people playing a game of frisbee.



A herd of elephants walking across a dry grass field.





Gender: Male

Age: 58

Emotion: Happy





Source: Nvidia

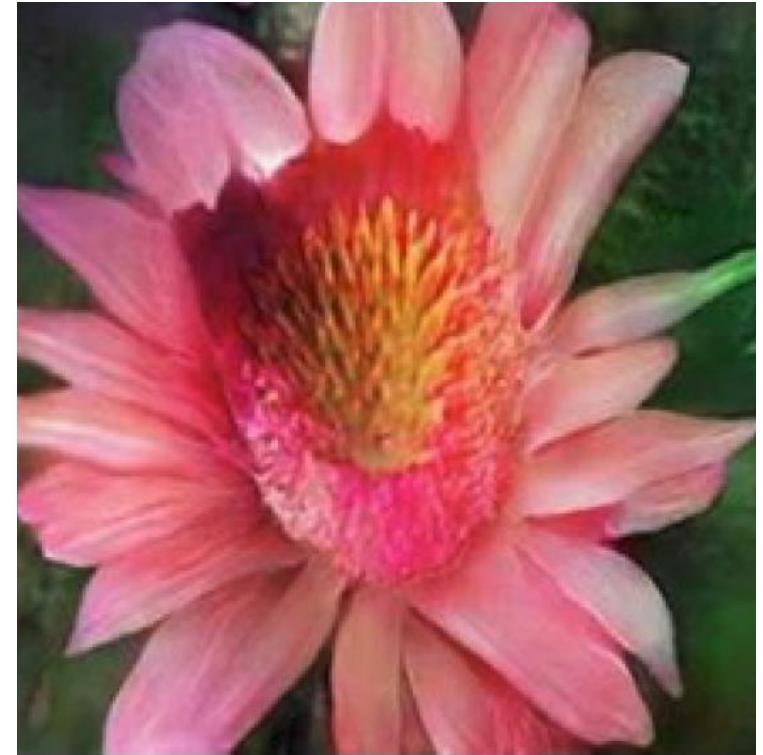
This bird has a yellow belly and tarsus, grey back, wings, and brown throat, nape with black face

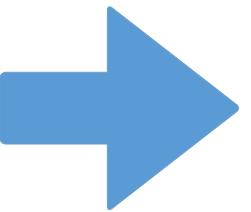
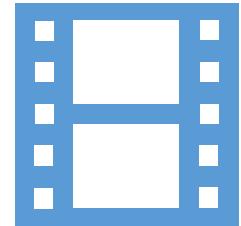
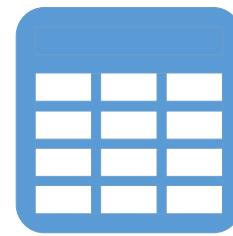
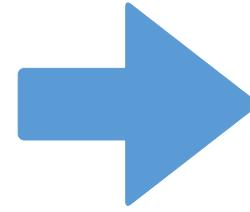


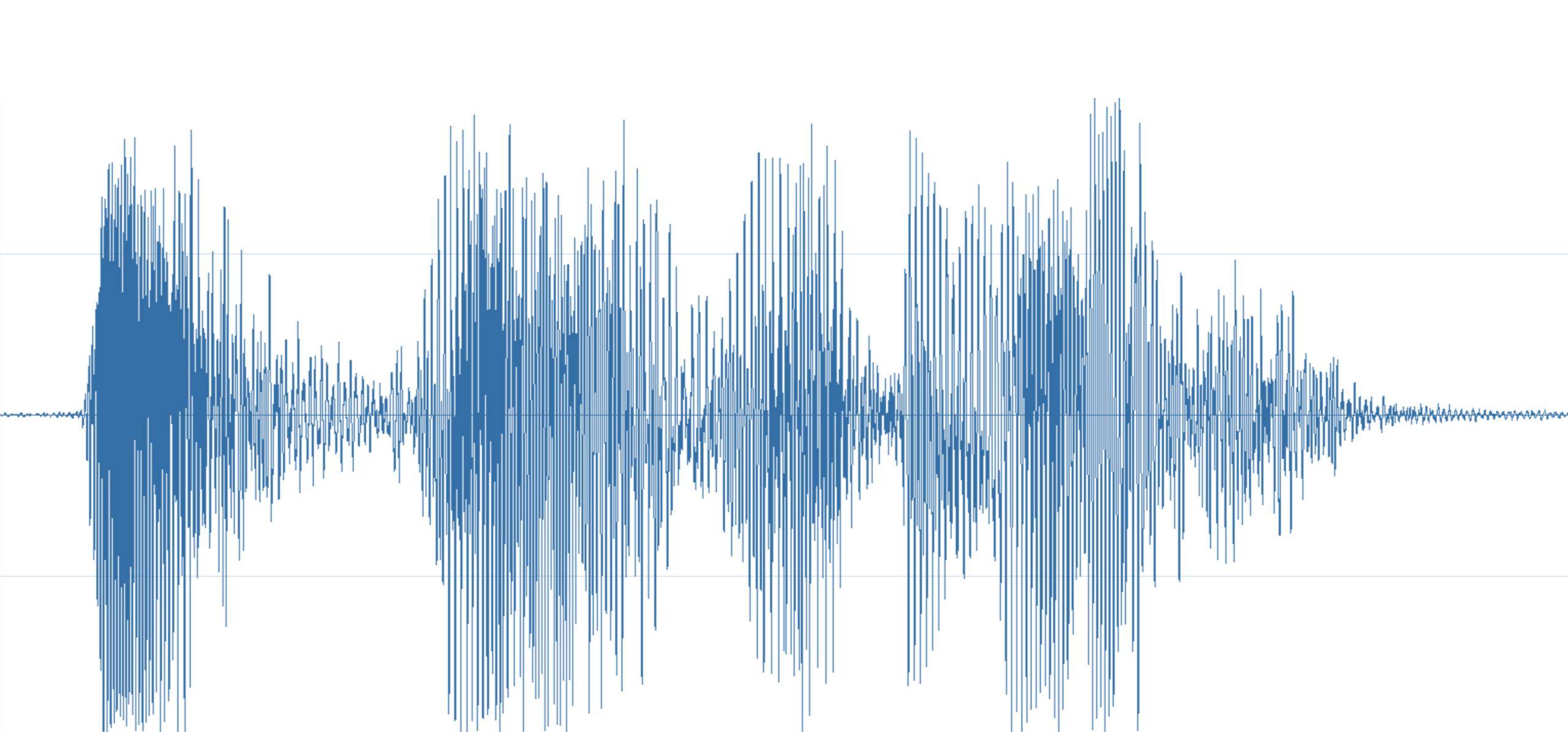
This bird is white with dome black on its head and wings and has a long orange beak



This flower has overlapping pink pointed petals surrounding a ring of short yellow filaments



 $f(x)$ 

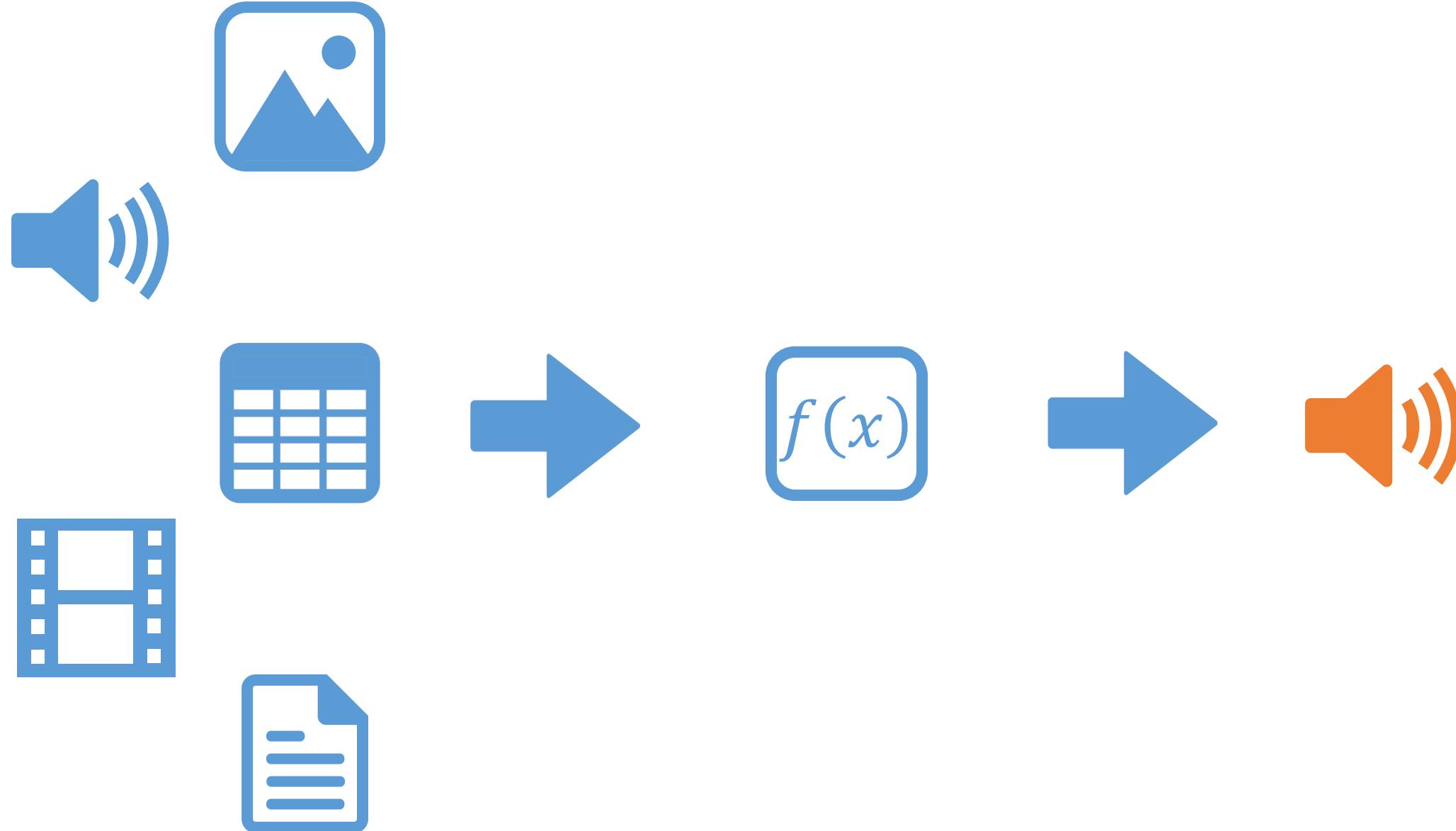


Hi

my name is

Matthew

Renze





Open Project a0007 reset

0

AND UR

And ur I kissed my dogs and my wife

play WIFE

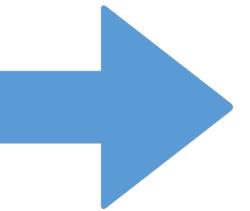
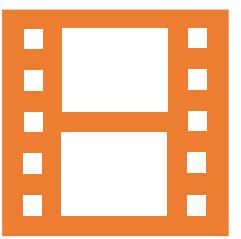


Hello

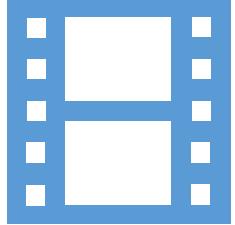
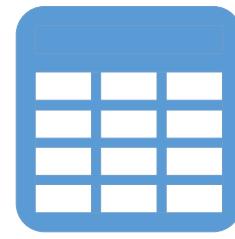
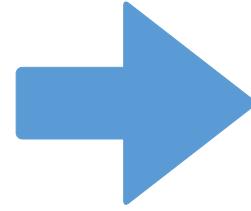
my name is

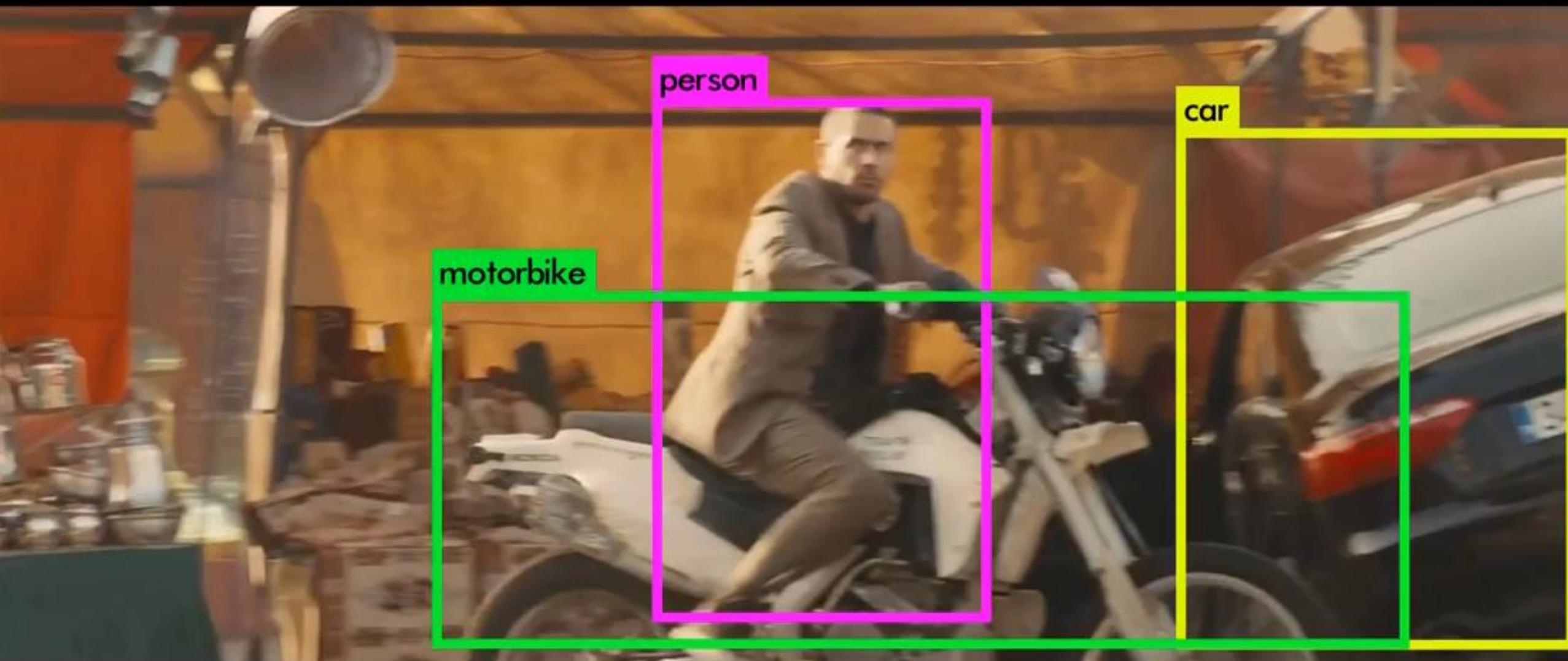
Matthew

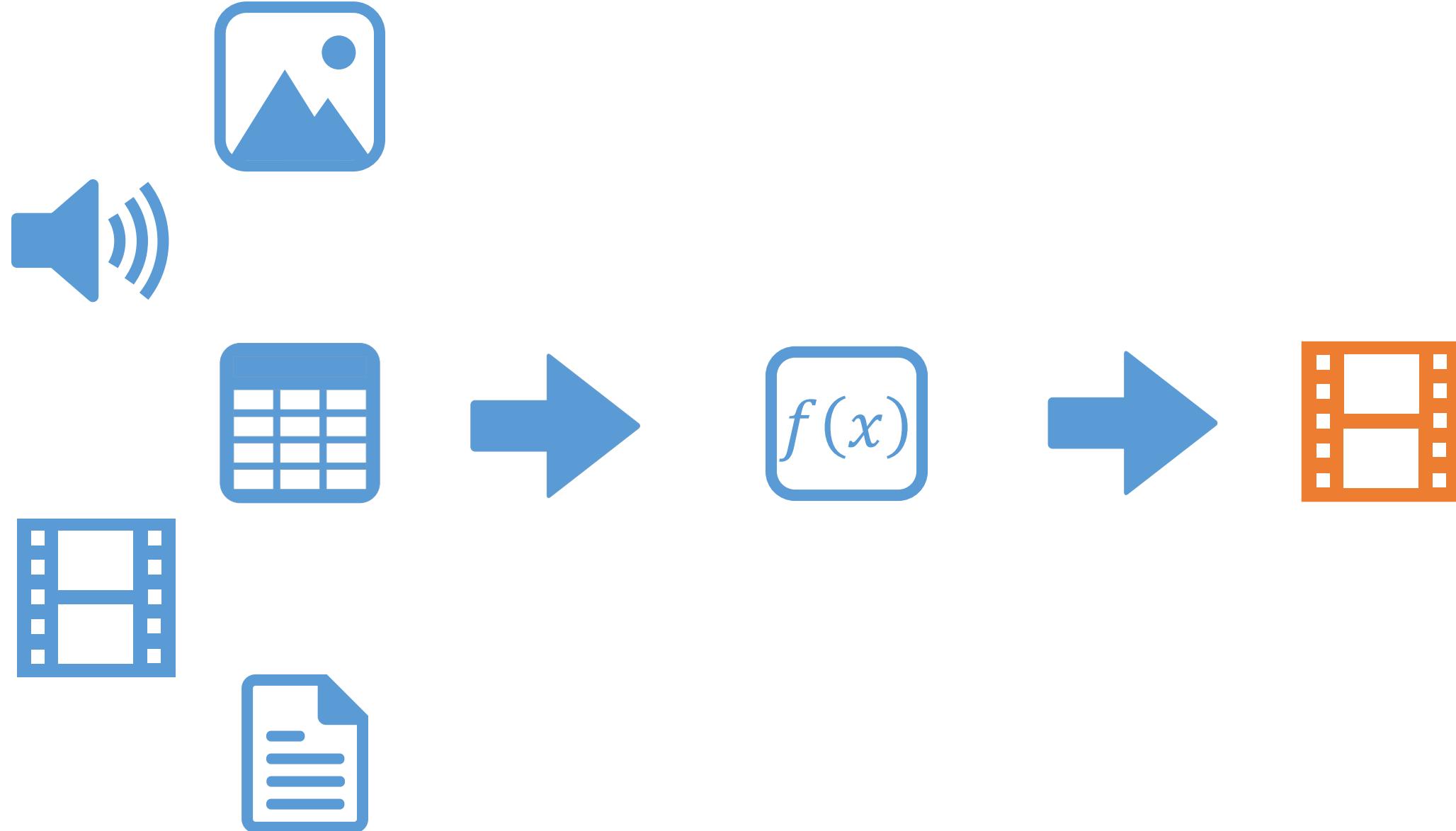
Renze



$$f(x)$$





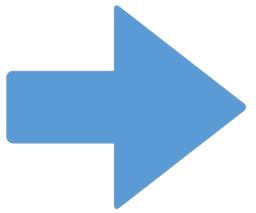




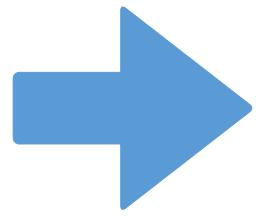


Source: Pouff - Grocery Trip

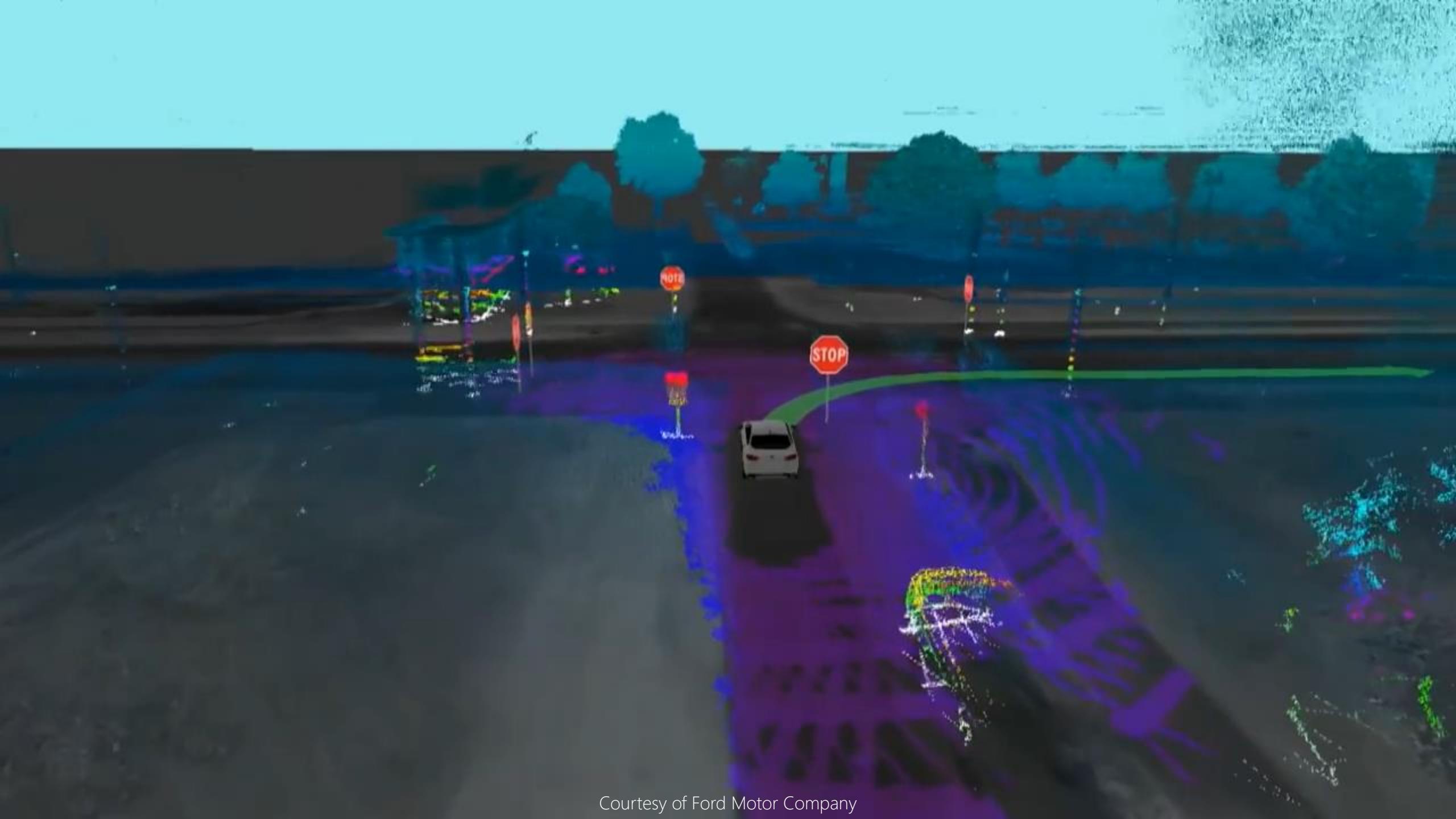
?



$f(x)$

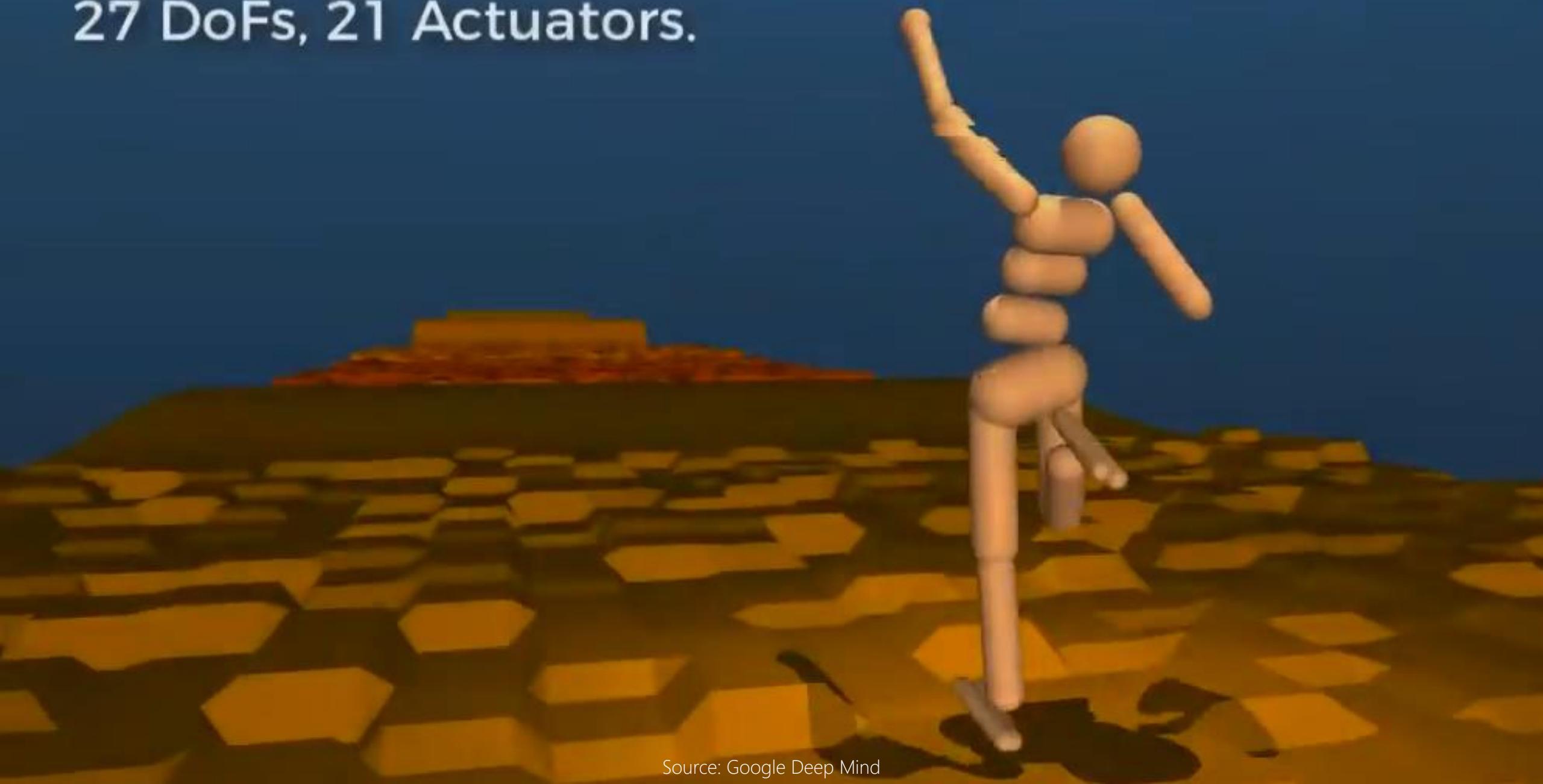


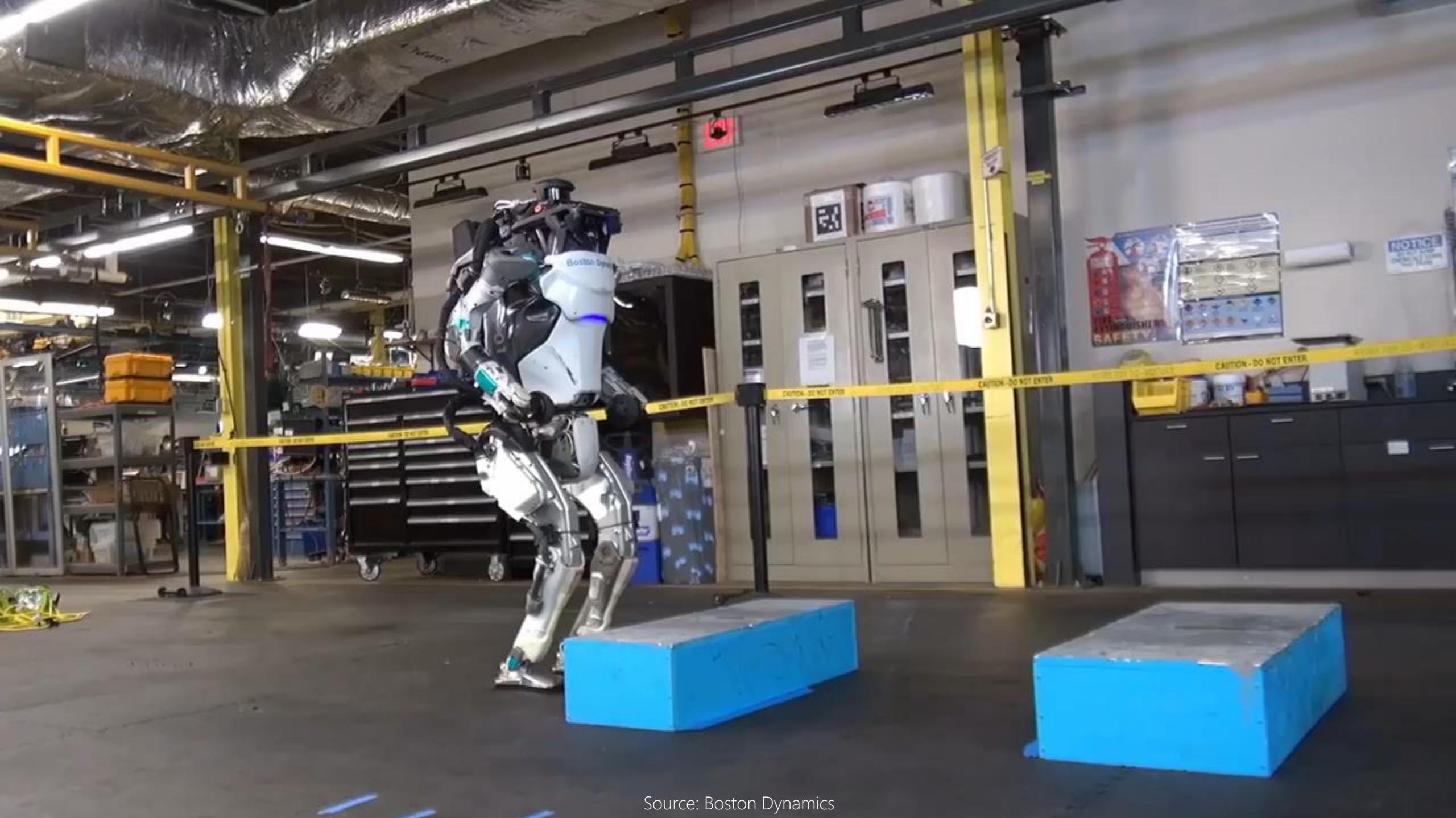
?



Courtesy of Ford Motor Company

Humanoid:
27 DoFs, 21 Actuators.





Source: Boston Dynamics

FUN GAME

Dog or Mop?



DOG!



MOP!

CAUTION



CUIDADO



CAUTION



DOG!



MOP!

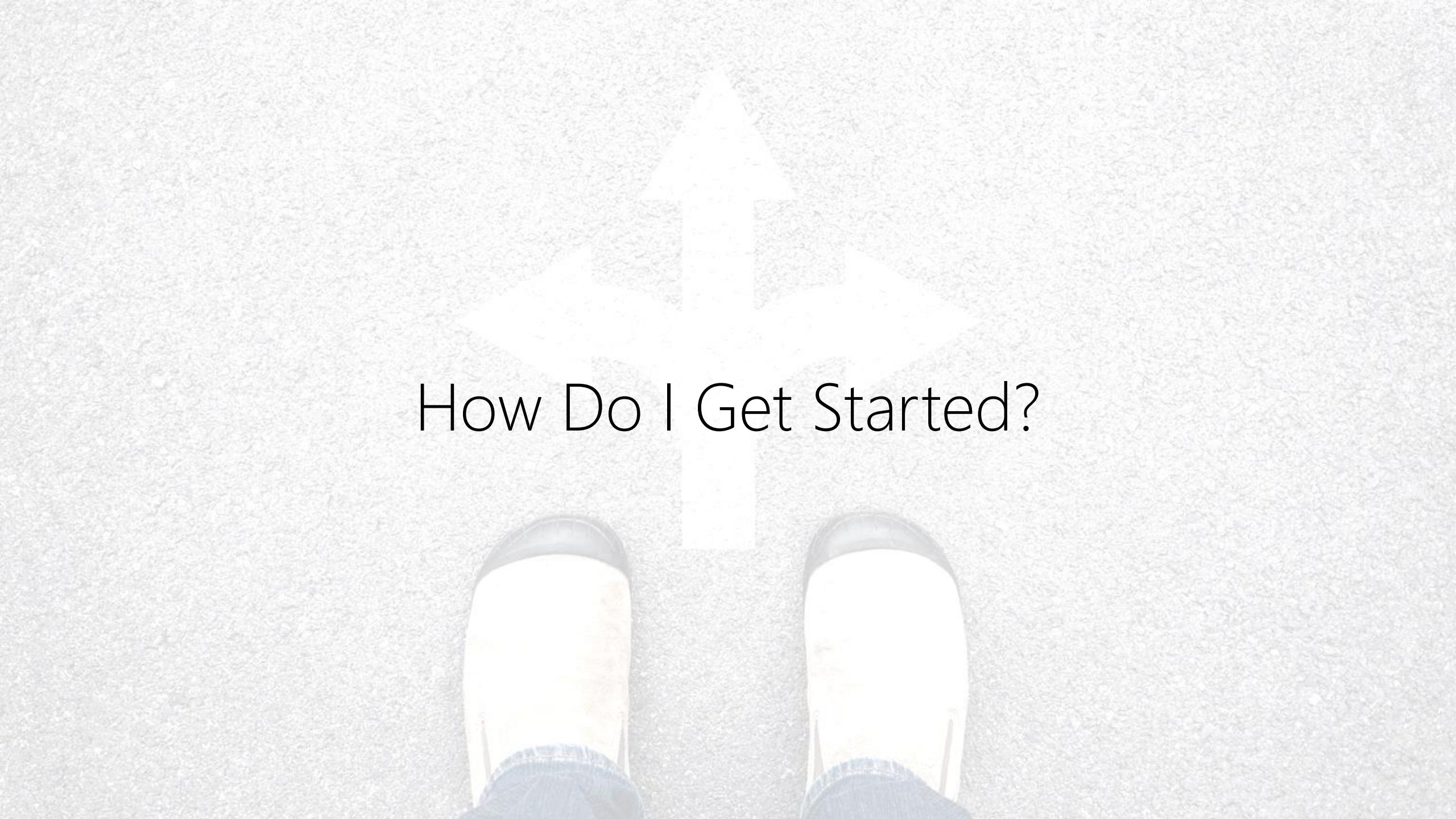
MOP!



DOG!





A grayscale photograph showing a person's lower legs and feet from a top-down perspective. The person is wearing light-colored sneakers and dark blue jeans. The background is a textured, light-colored floor.

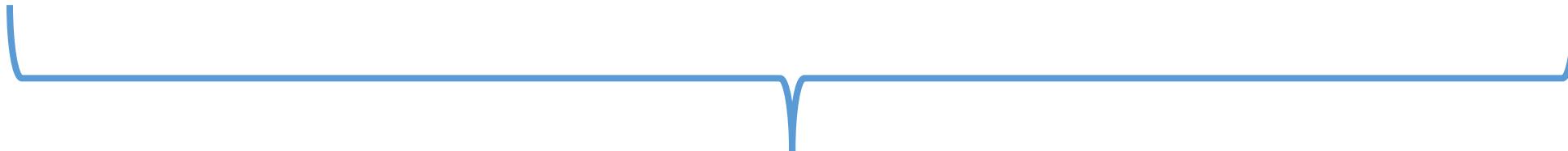
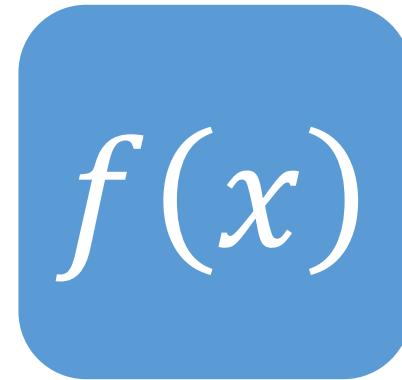
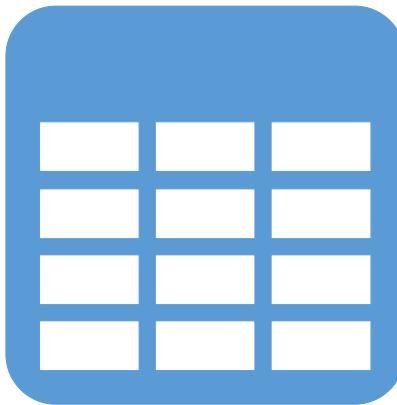
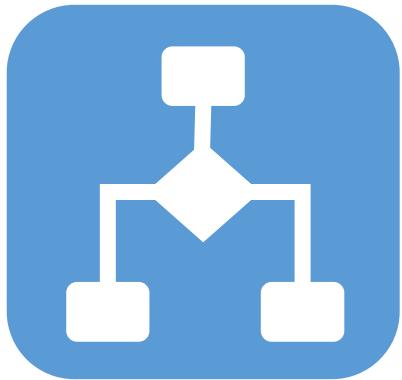
How Do I Get Started?



Option 1:

Deep Learning as a Service

Deep Learning as a Service



They provide

Deep Learning Services

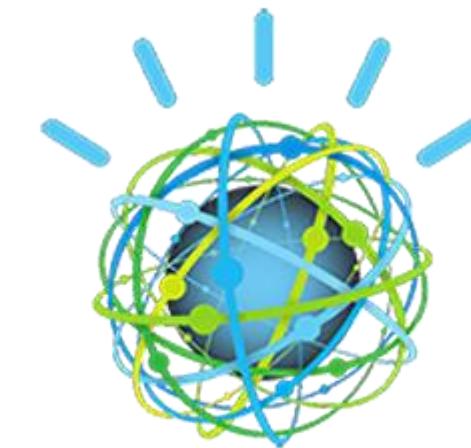


Google
Cloud Platform



Microsoft

Cognitive Services



IBM Watson

Pros/Cons

Pros

Simple

Quick

Inexpensive

Pros/Cons

Pros

Simple

Quick

Inexpensive

Cons

Narrow

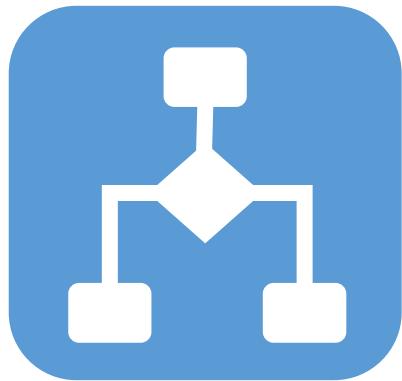
Remote

Pay-per-use

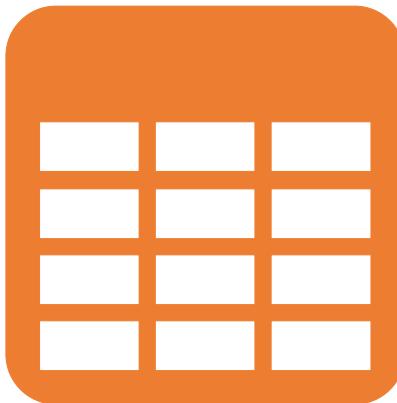
Option 2:

Deep Learning as a Platform

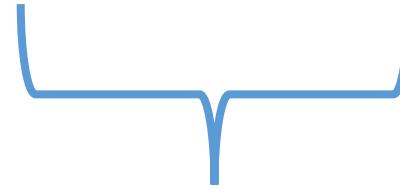
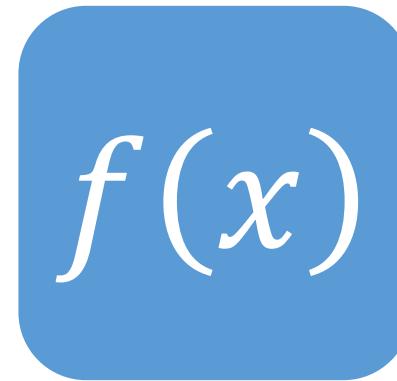
Deep Learning as a Platform



They provide



You provide



They host

Deep Learning Platforms



Pros/Cons

Pros

Simple

Quick

Inexpensive

Pros/Cons

Pros

Simple

Quick

Inexpensive

Cons

Training

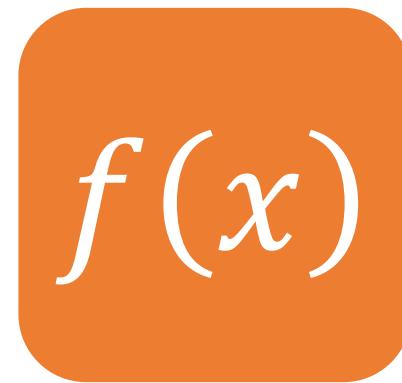
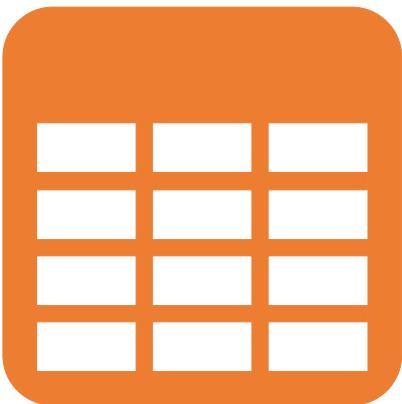
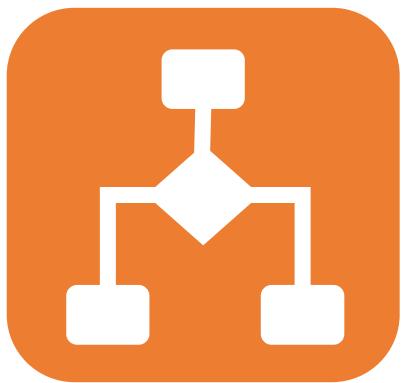
Remote

Pay-per-use

Option 3

Do It Yourself

Do It Yourself

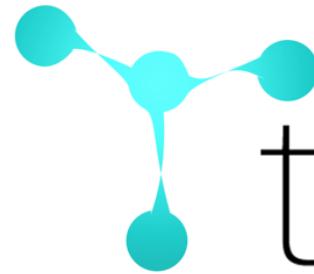


You provide

Open Source Frameworks



TensorFlow



torch



CNTK

theano

Pros/Cons

Pros

Custom

Local

Private

Pros/Cons

Pros

Custom

Local

Private

Cons

Complex

Labor

Expensive

Recommendation

Use traditional ML techniques first

Recommendation

Use traditional ML techniques first

Use Option 1 for narrow use cases

Recommendations

Use traditional ML techniques first

Use Option 1 for narrow use cases

Use Option 2 for custom use cases

Recommendations

Use traditional ML techniques first

Use Option 1 for narrow use cases

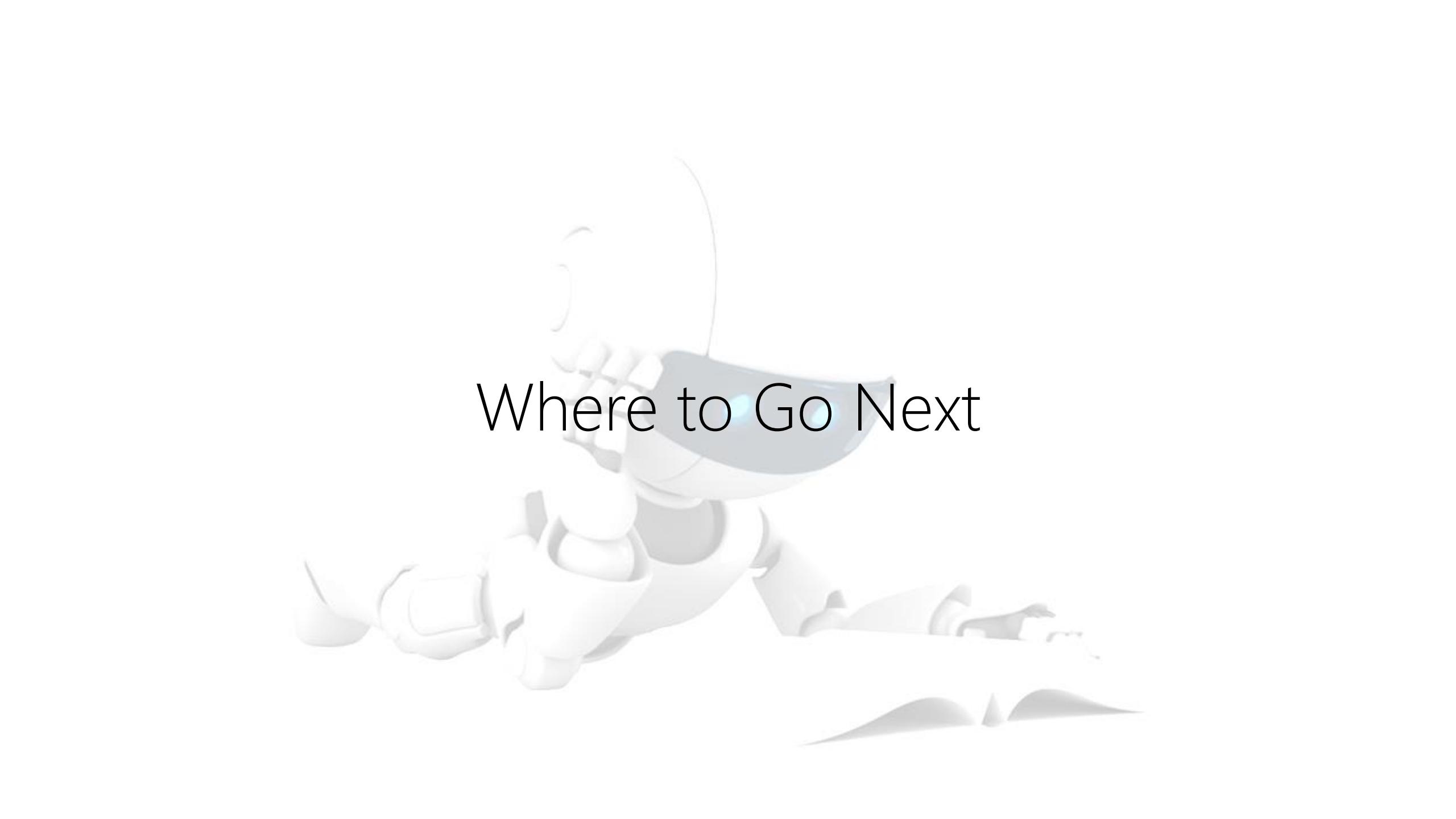
Use Option 2 for custom use cases

Use Option 3 if option 1 or 2 fails

Code Demo

[TODO: ADD ETHICS SECTION?]

Note: I'm currently right at 50 minutes without the Ethics section.



Where to Go Next

Where to Go Next

Data Camp: <https://www.datacamp.com>

Pluralsight: <https://www.pluralsight.com>

Coursera: <https://www.coursera.org>

Pluralsight Courses

Deep Learning: The Big Picture

Data Science: The Big Picture

Data Science with R

Exploratory Data Analysis with R

Data Visualization with R (3-part)



<https://www.pluralsight.com/authors/matthew-renze>

News

2017-08-25 - Invitation to Speak at Devoxx Morocco

Very excited to announce that I've been invited to give a keynote in Casablanca at [Devoxx Morocco](#) in November. My keynote presentation will be on [Artificial Intelligence](#).



2017-08-16 - Invitation to Speak at Microsoft Ignite

I've been invited to speak at [Microsoft Ignite](#) in Orlando, Florida in September. This will be my first time speaking at Ignite. Talks will include both Data Science and Machine Learning with R.

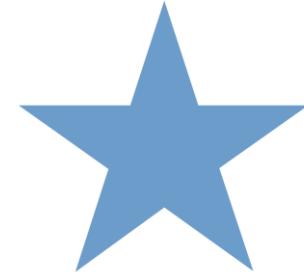


Matthew is a data science consultant, author for [Pluralsight](#), international public speaker, a [Microsoft MVP](#), [ASPIInsider](#), and open-source software contributor.

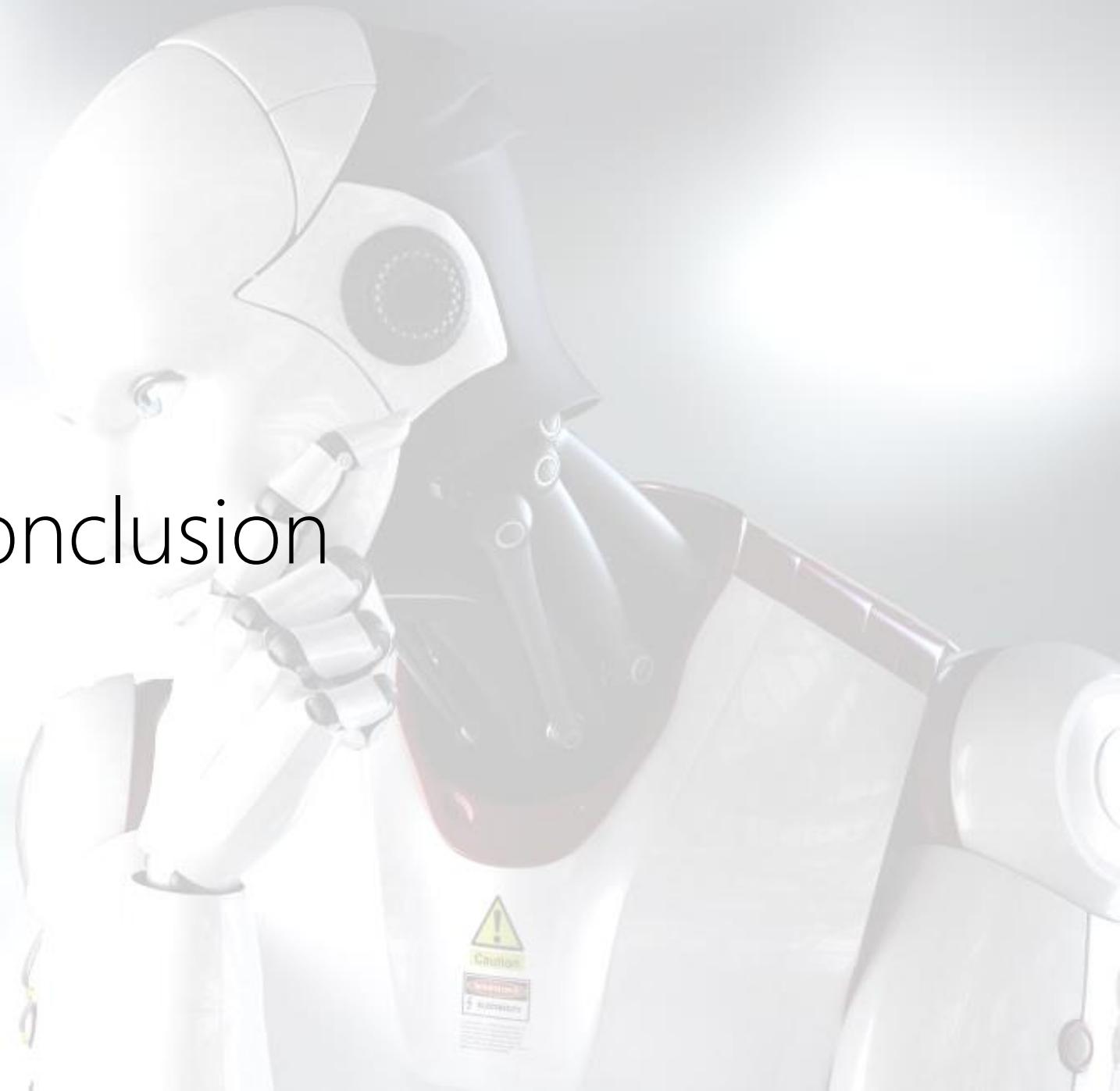
2017-08-14 - Dev on Fire Interview

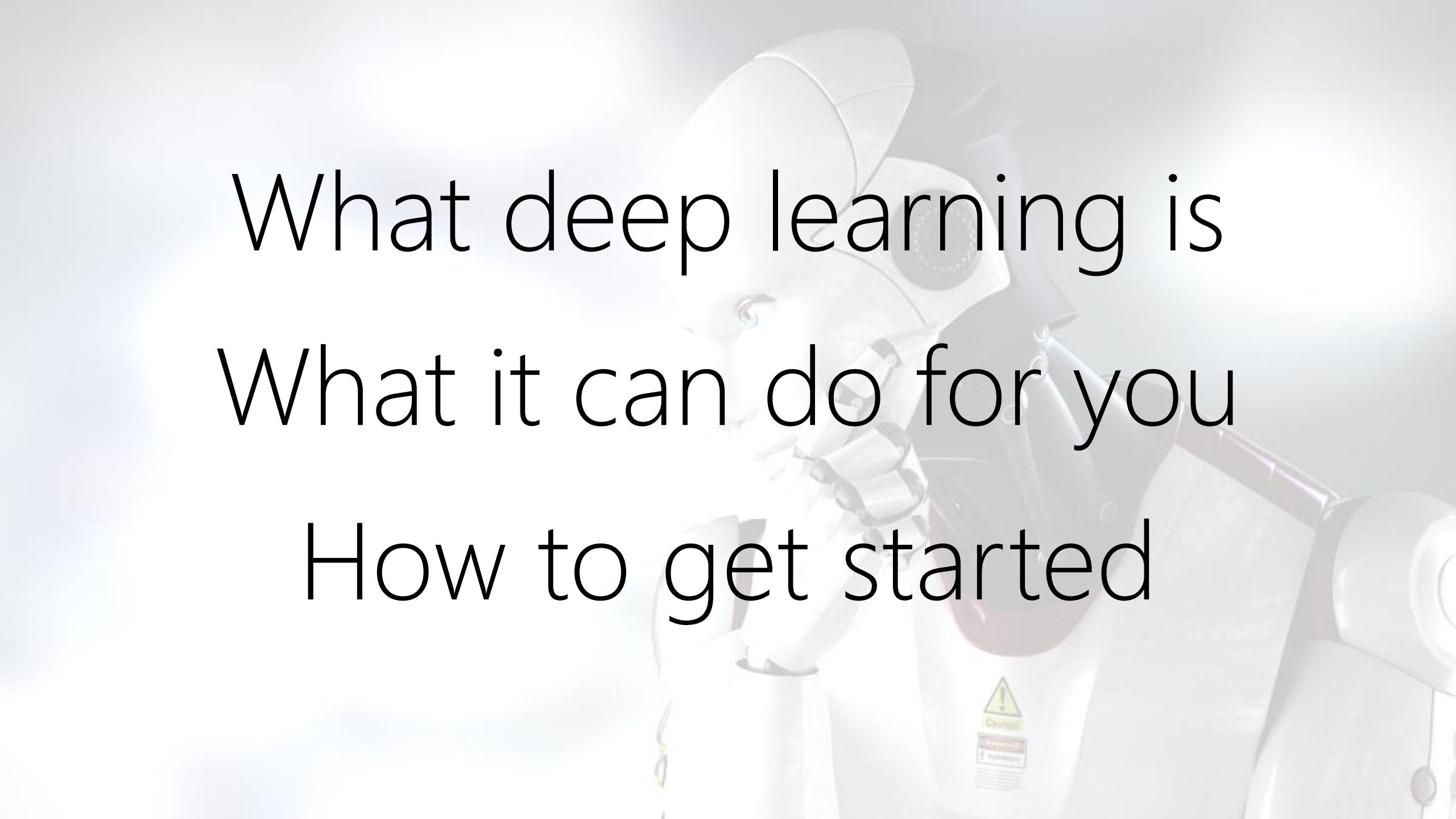
Feedback

Very important to me!
What did you like?
What could I improve?



Conclusion

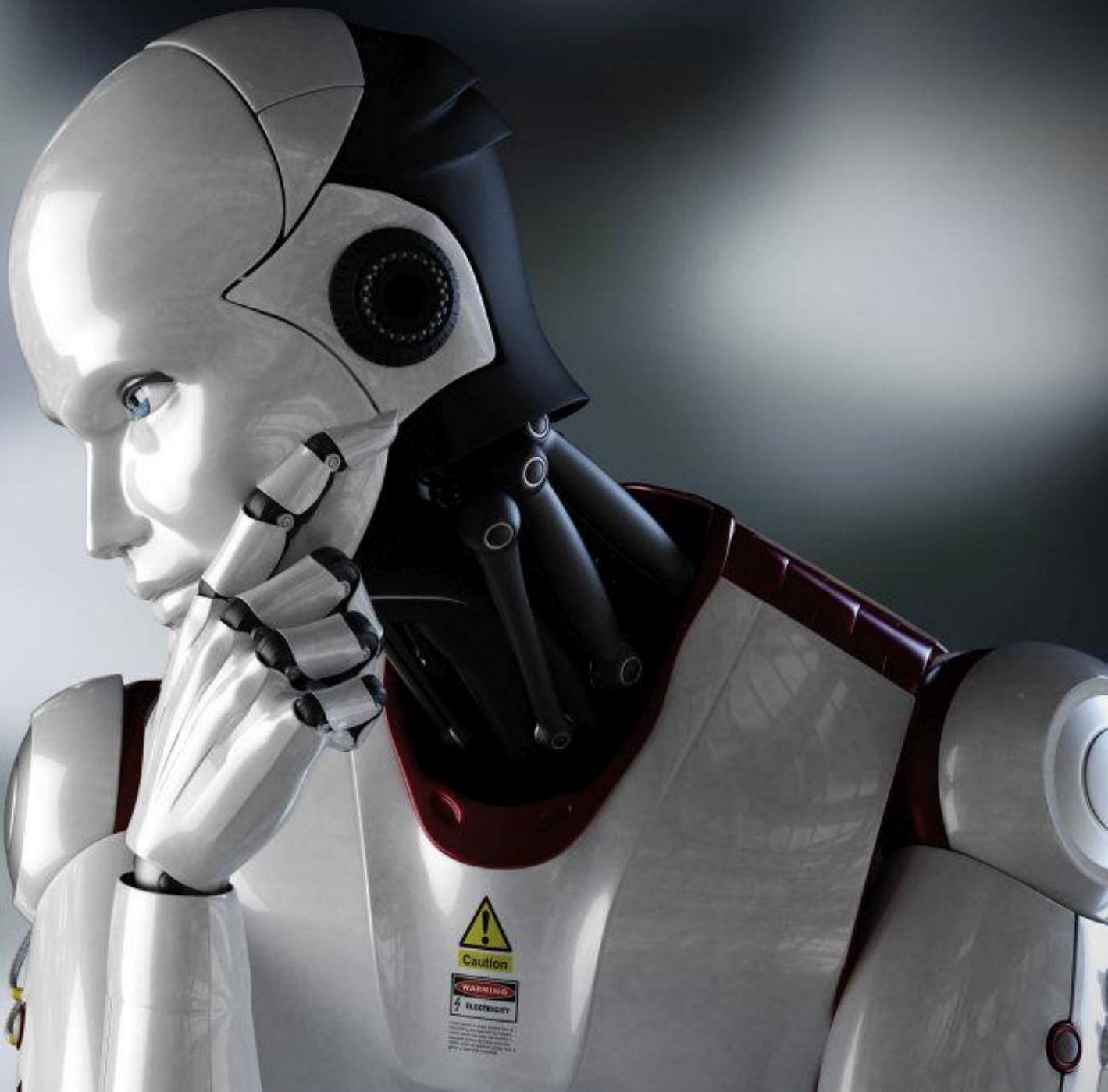


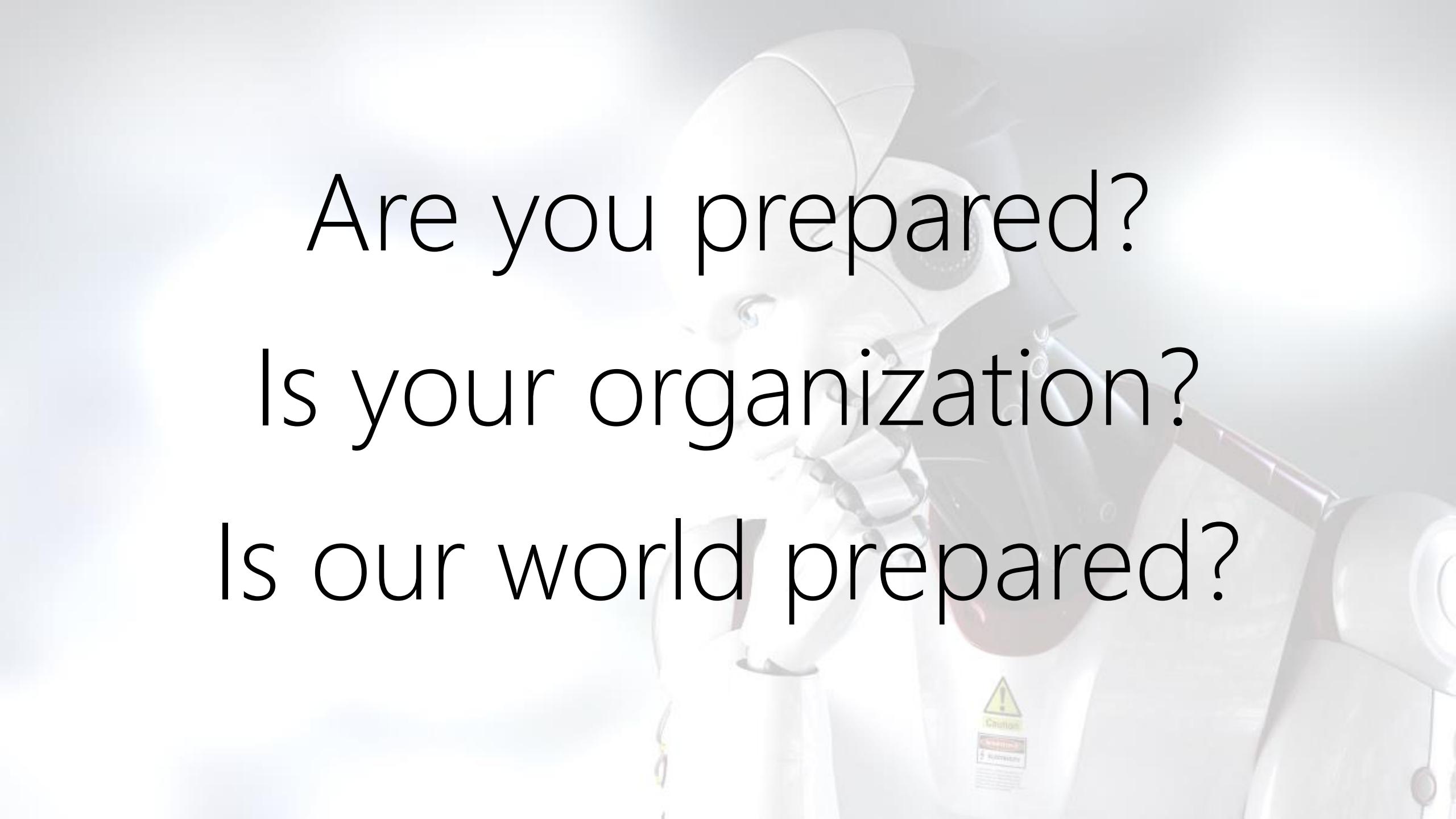


What deep learning is

What it can do for you

How to get started

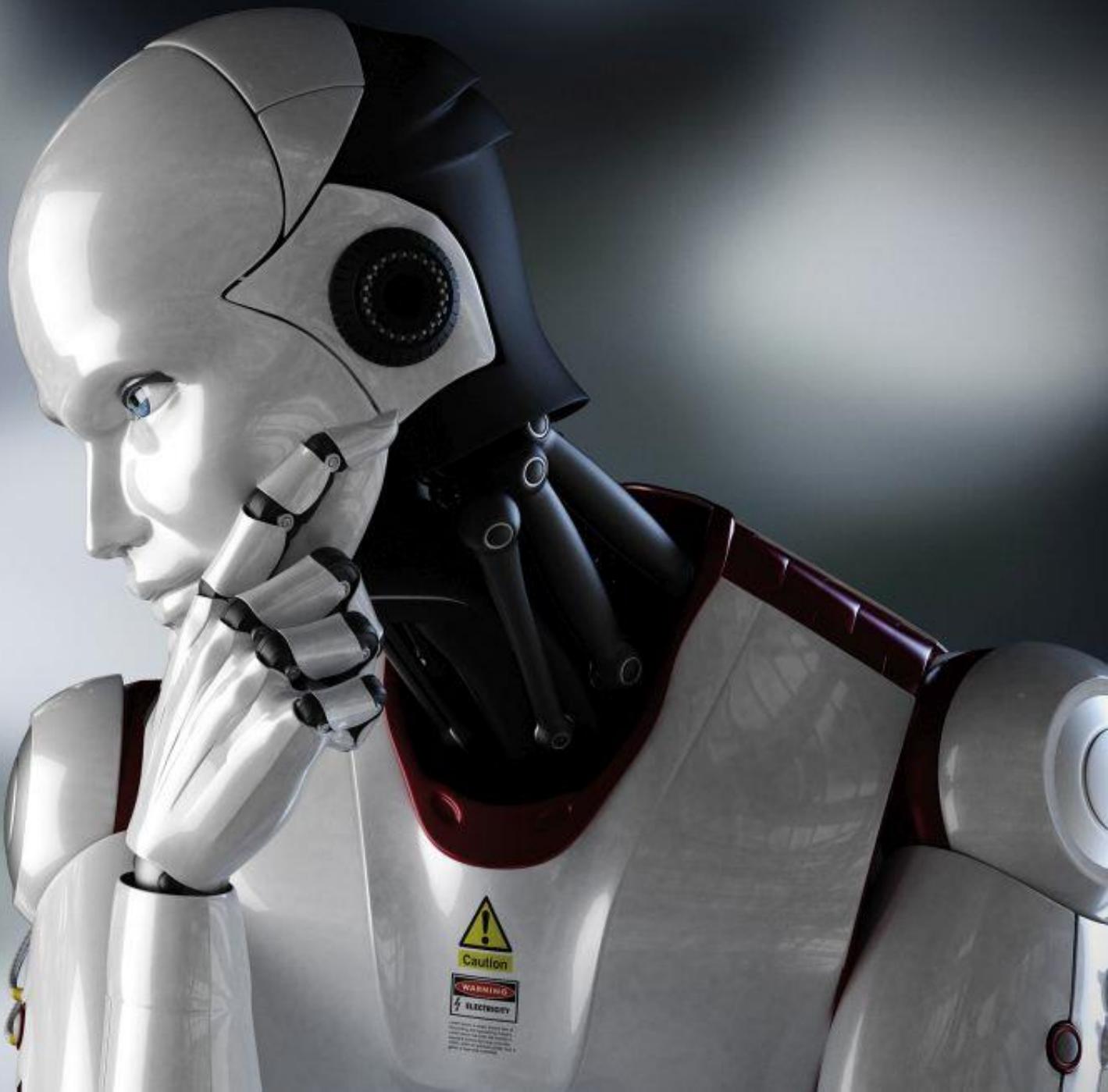


A man wearing a white protective suit and a respirator mask is shown from the waist up, working on a large industrial drum. He is wearing gloves and appears to be handling a tool or piece of equipment. The background is slightly blurred, focusing on the man and the drum.

Are you prepared?

Is your organization?

Is our world prepared?



Thank You!

Matthew Renze

Data Science Consultant
Renze Consulting

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Email: info@matthewrenze.com

Website: www.matthewrenze.com

