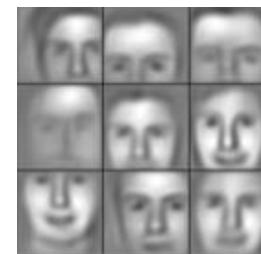
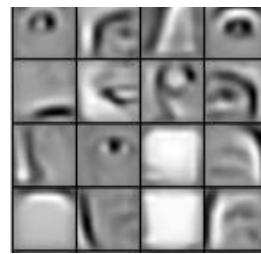
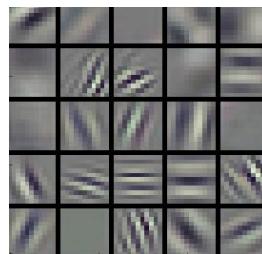
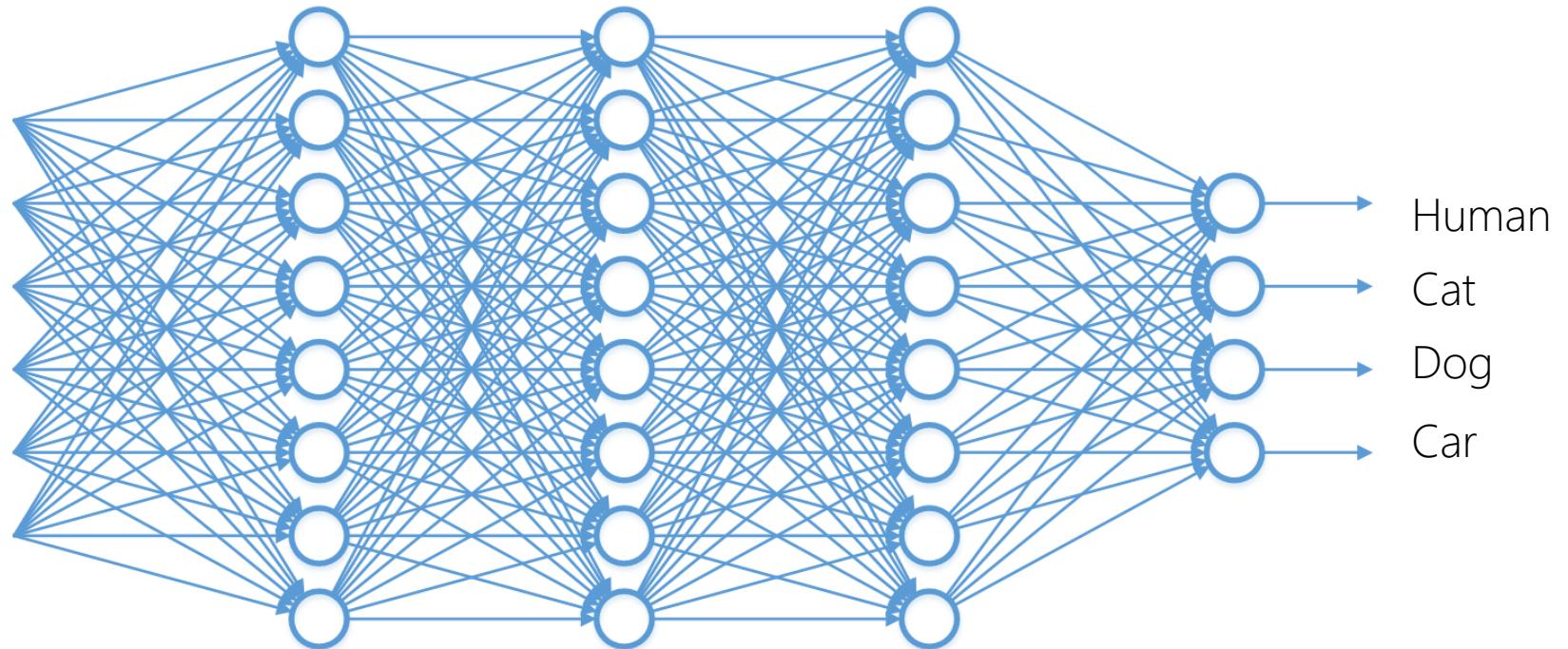


Deep Learning: The Future of AI

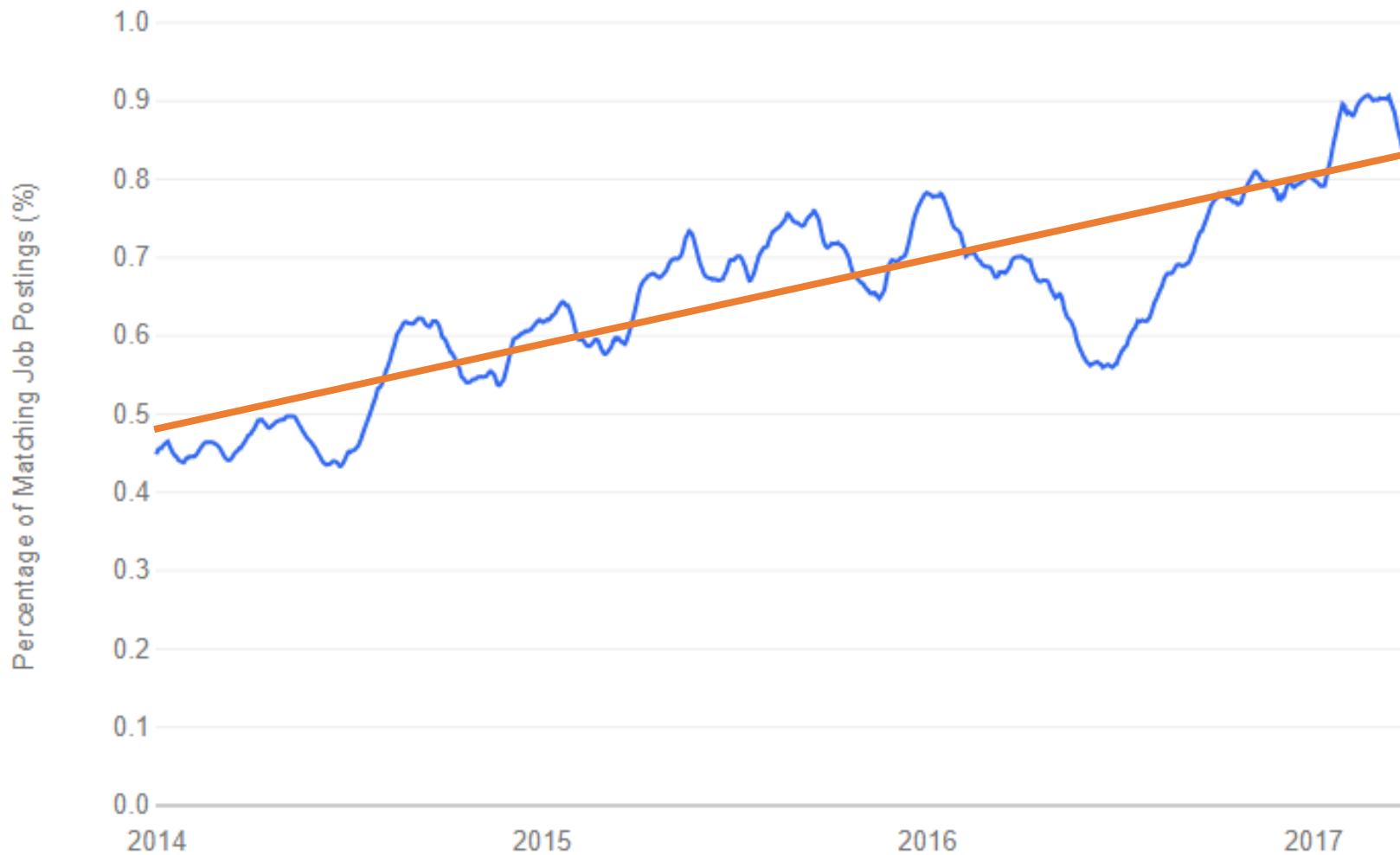
@MatthewRenze
#MicrosoftDevelopersUAE





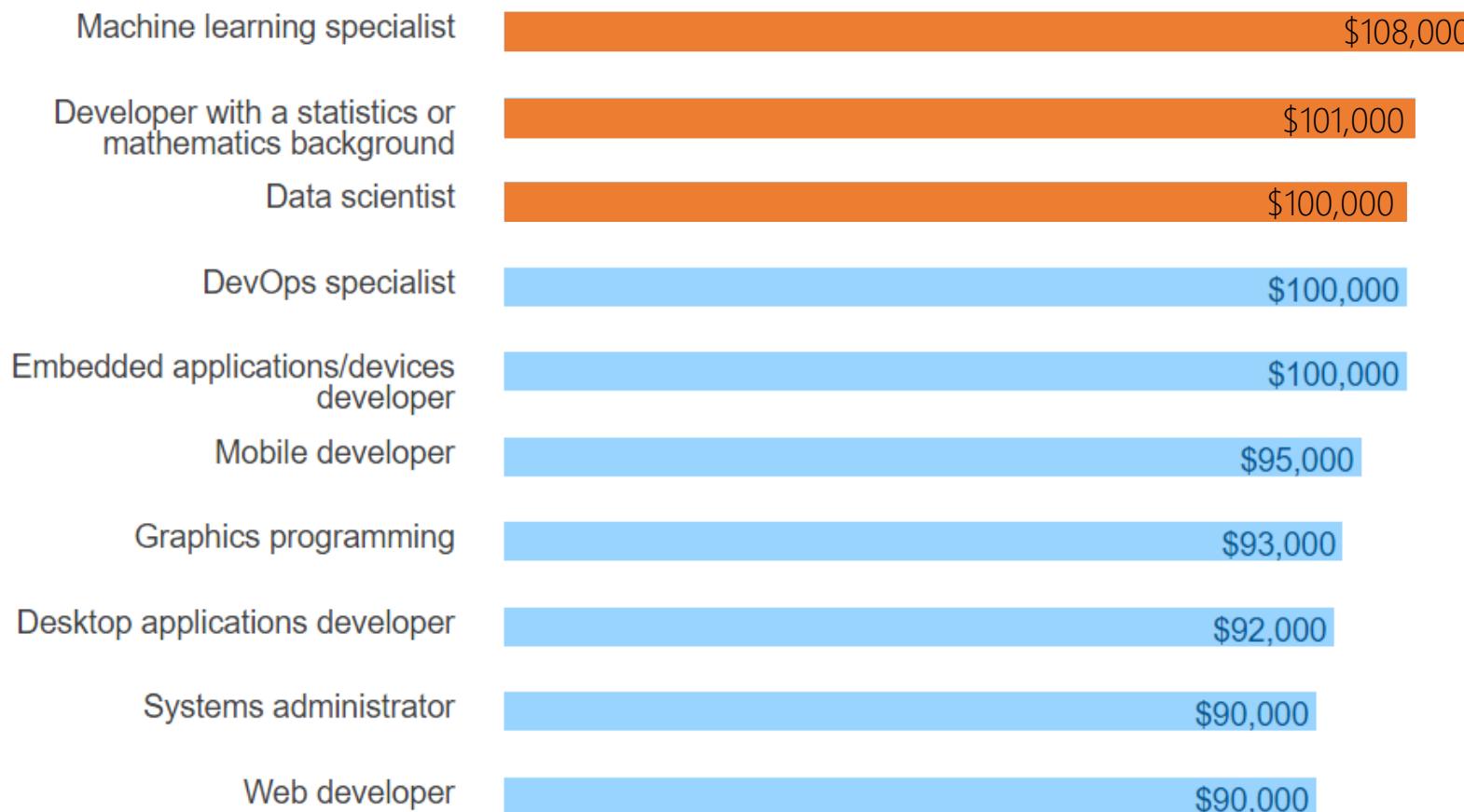


Job Postings for Machine Learning



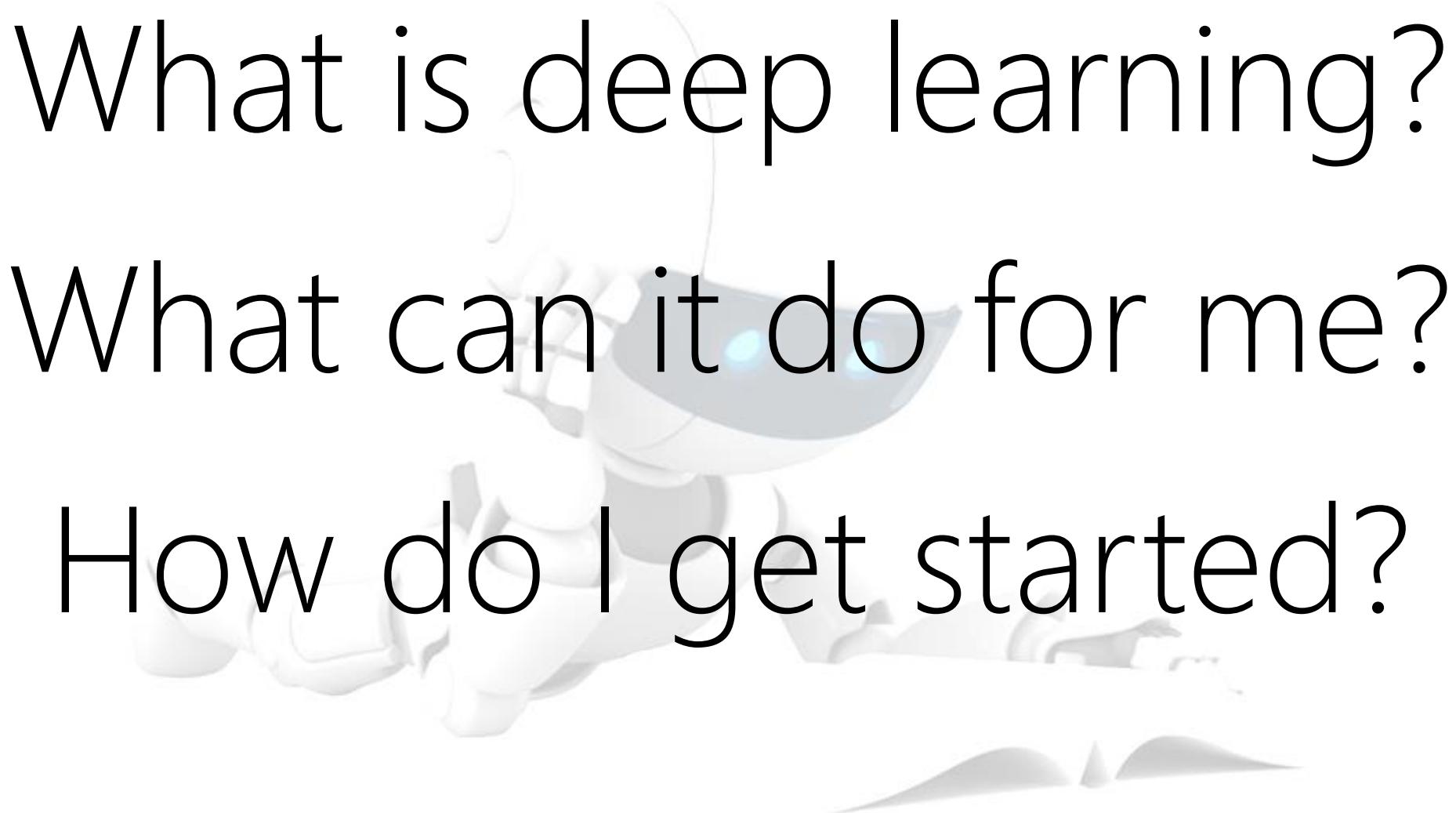
Source: Indeed.com

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 reaching out. A small yellow warning label with a red exclamation mark and the word 'Caution' is visible on its upper arm.

What is deep learning?

Deep Learning



Deep Learning

Artificial intelligence

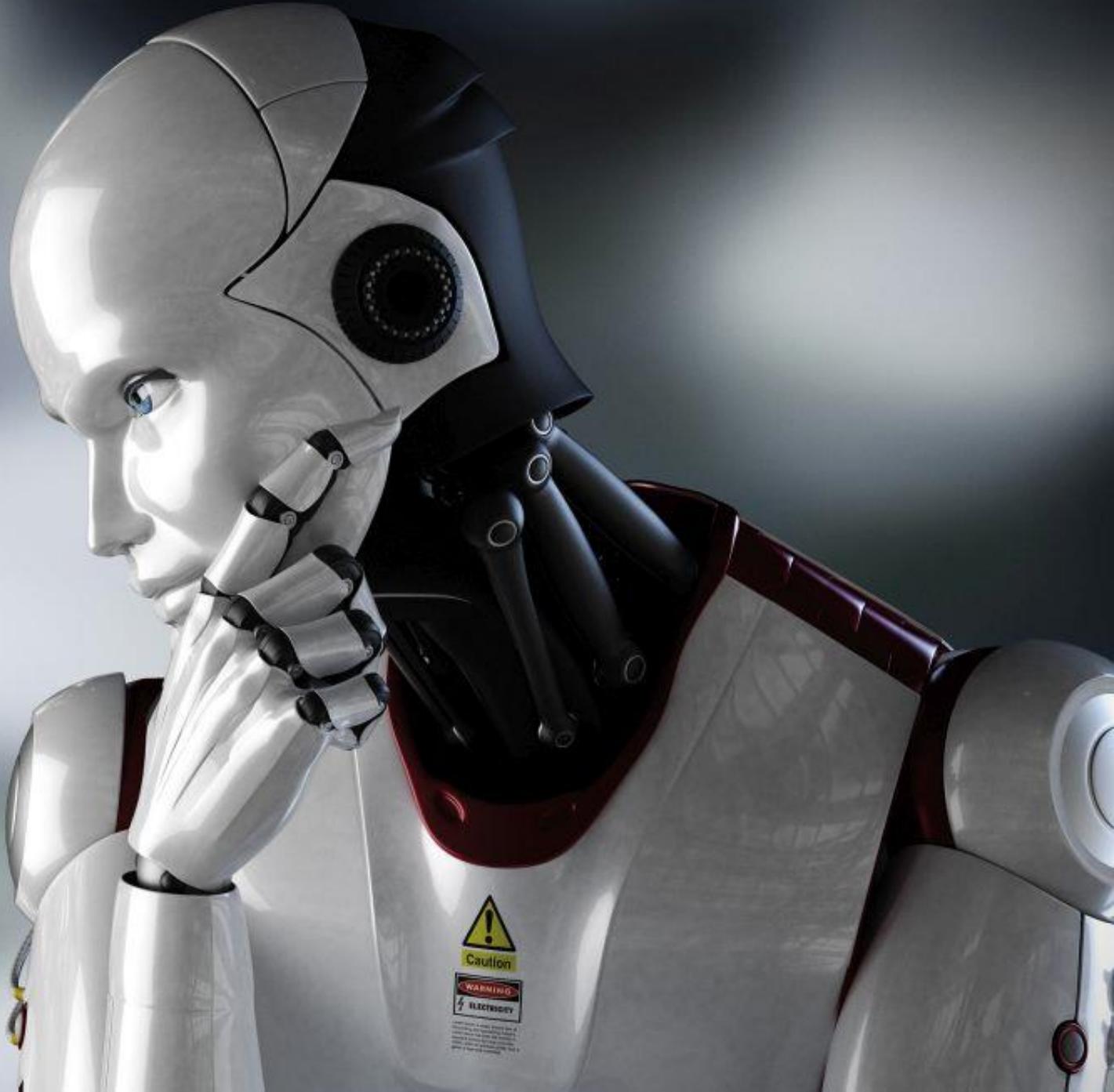
Machine learning

Neural network

Multiple hidden layers

Hierarchical representations

Makes predictions with data



Deep Learning

Artificial intelligence

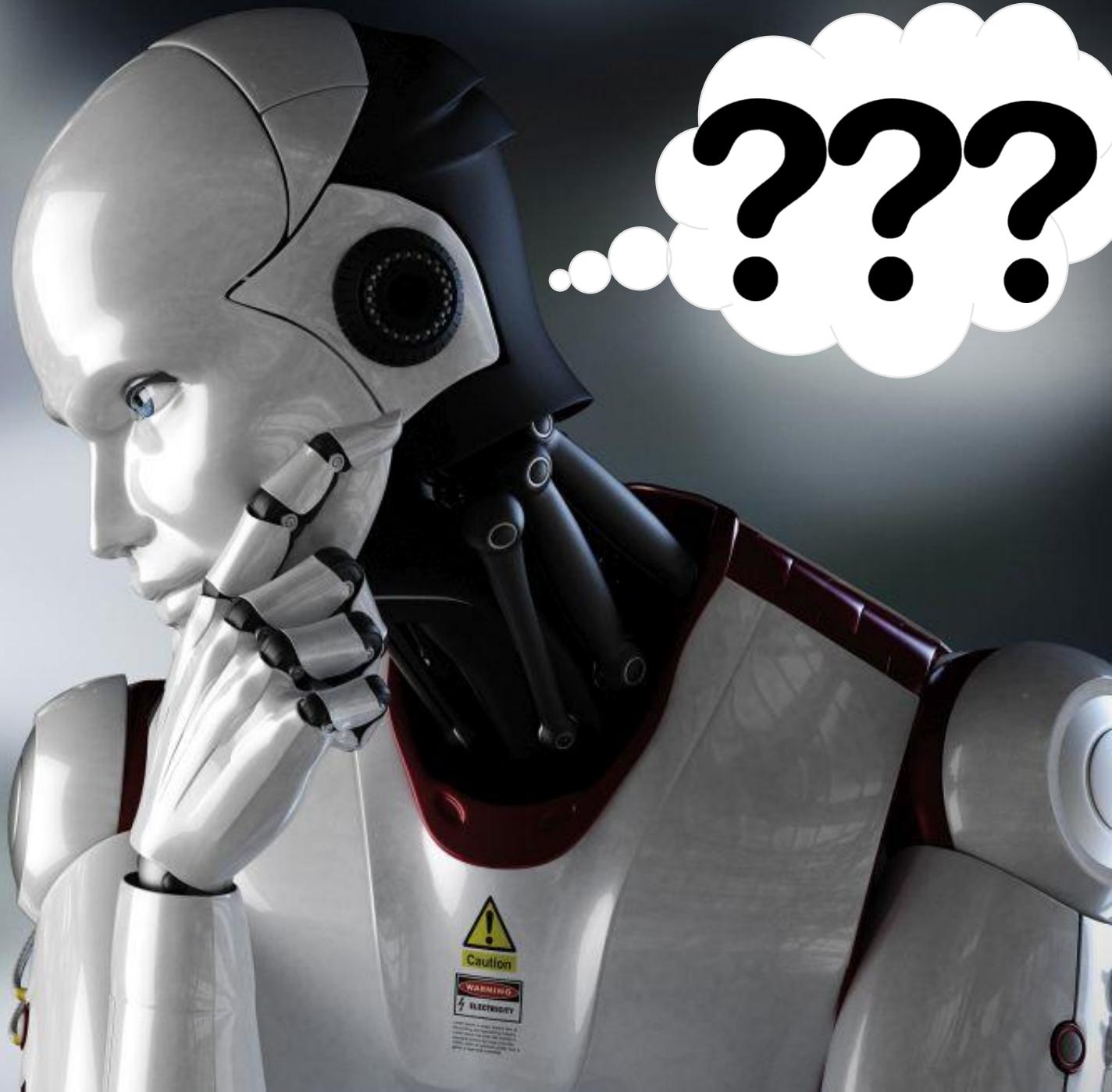
Machine learning

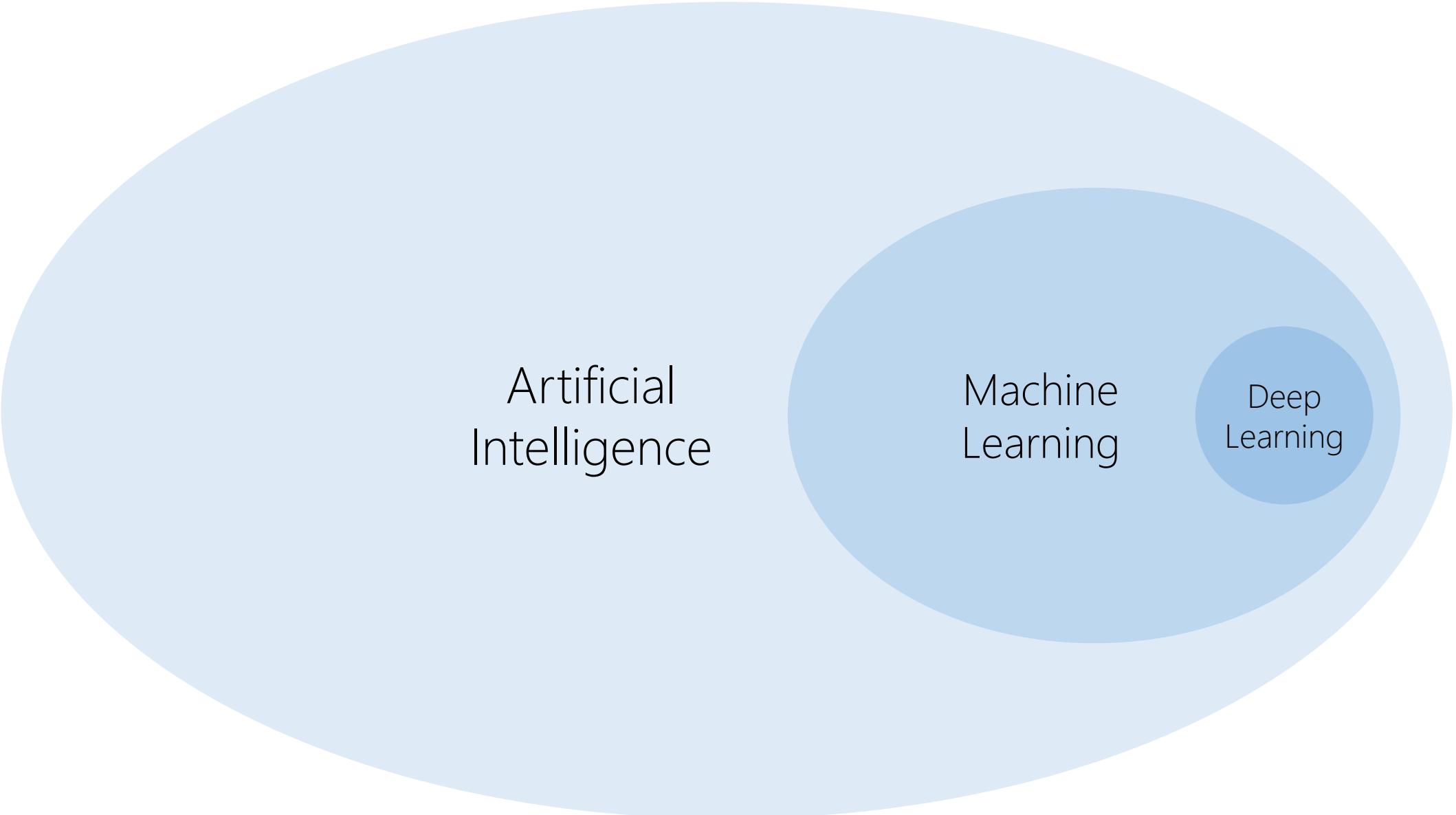
Neural network

Multiple hidden layers

Hierarchical representations

Makes predictions with data



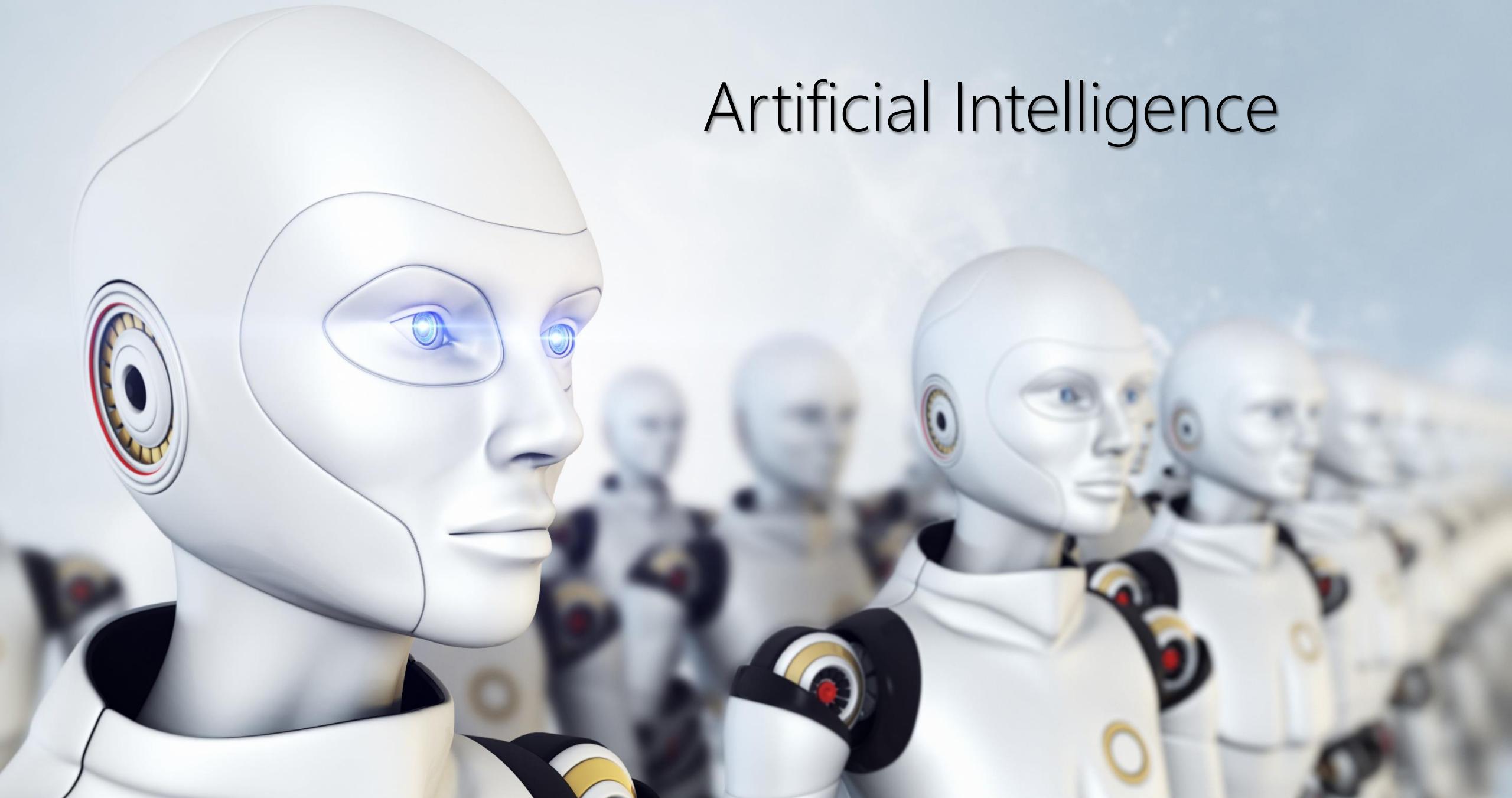


Artificial
Intelligence

Machine
Learning

Deep
Learning

Artificial Intelligence



Explicit programming





Explicit programming

Encoding domain knowledge



Explicit programming

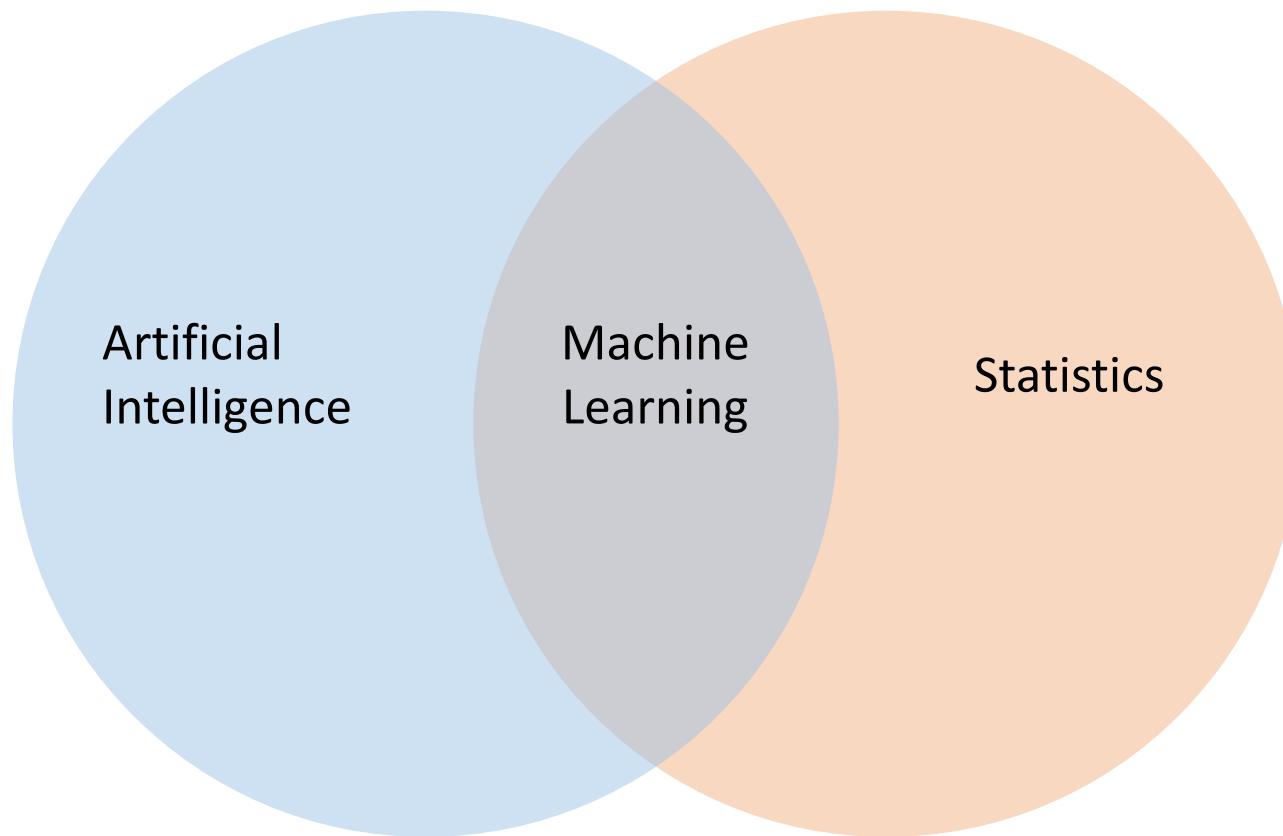
Encoding domain knowledge

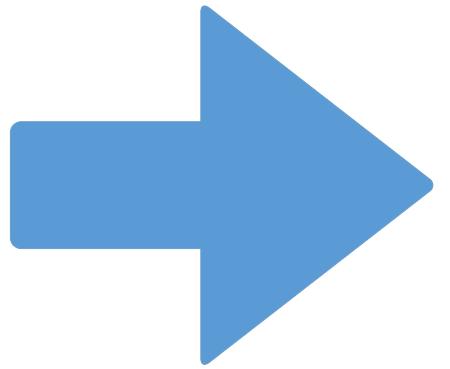
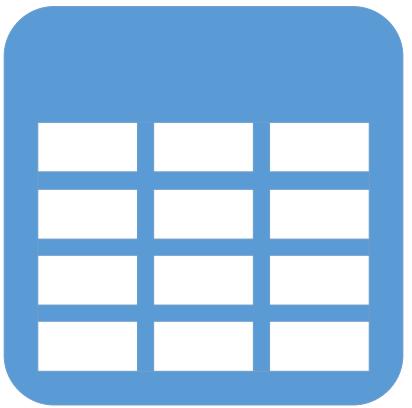
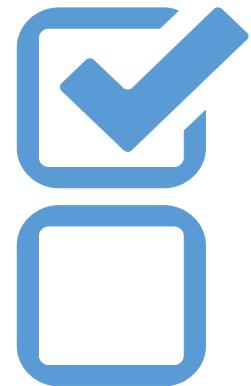
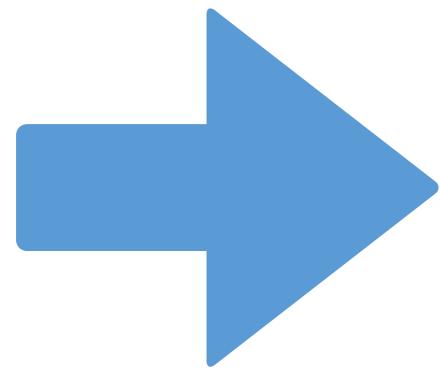
Statistical patterns detection

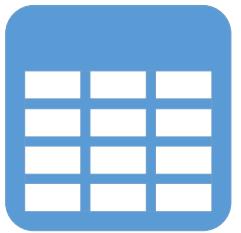


Machine Learning

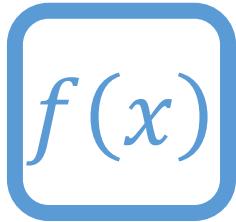
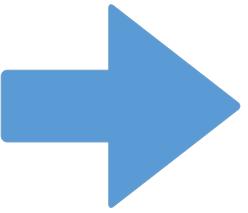
Machine Learning



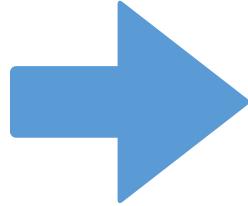
 $f(x)$ 



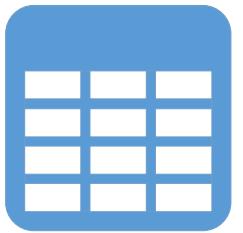
Data



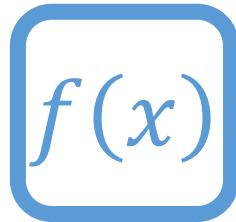
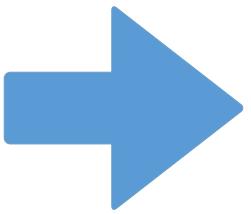
Function



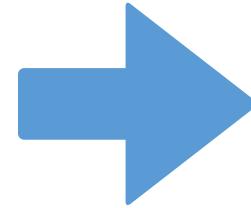
Prediction



Data



Function



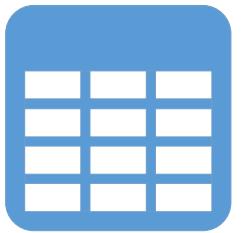
Prediction



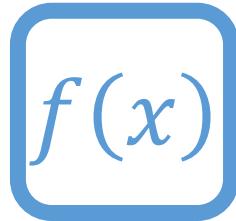
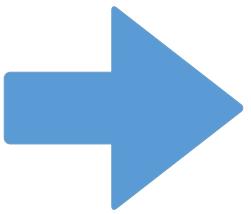
Cat



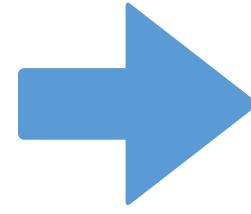
Dog



Data



Function



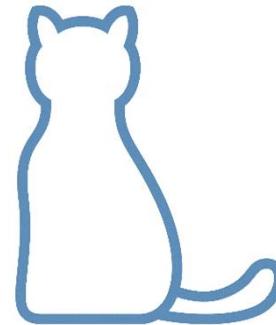
Prediction



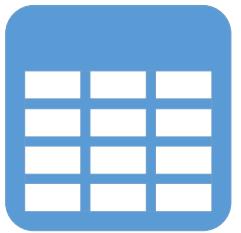
Cat



Dog



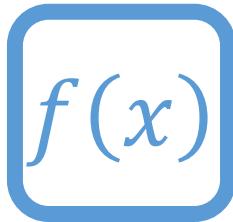
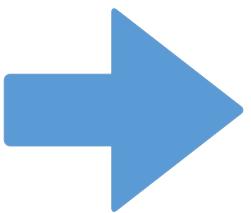
Is cat?



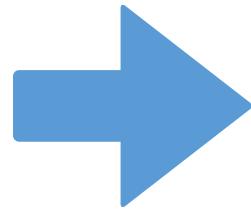
Data



Cat



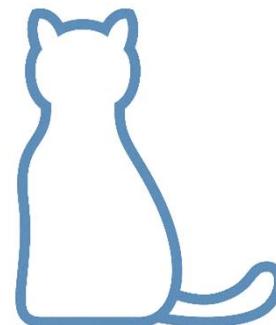
Function



Prediction



Dog



Is cat?



Yes

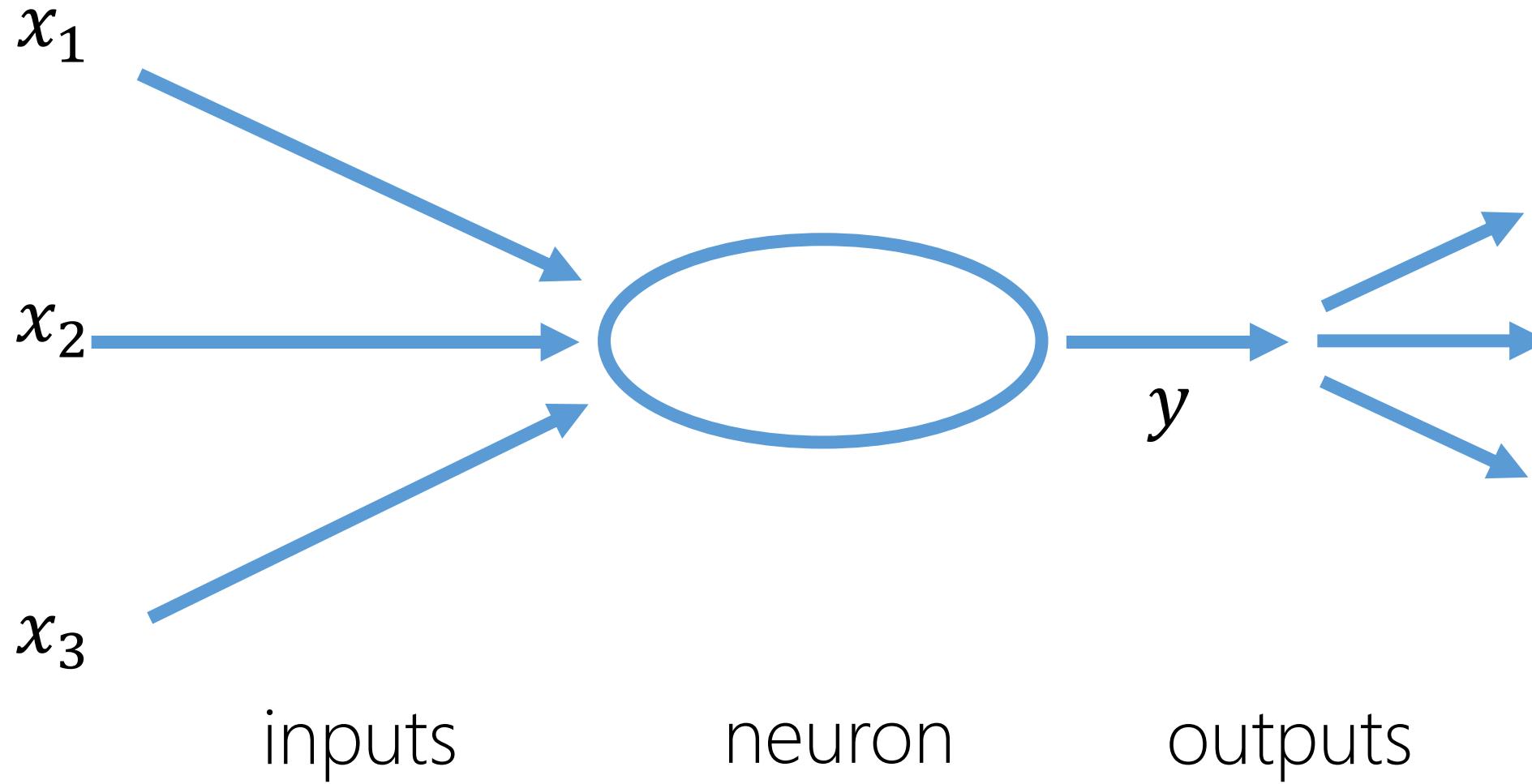




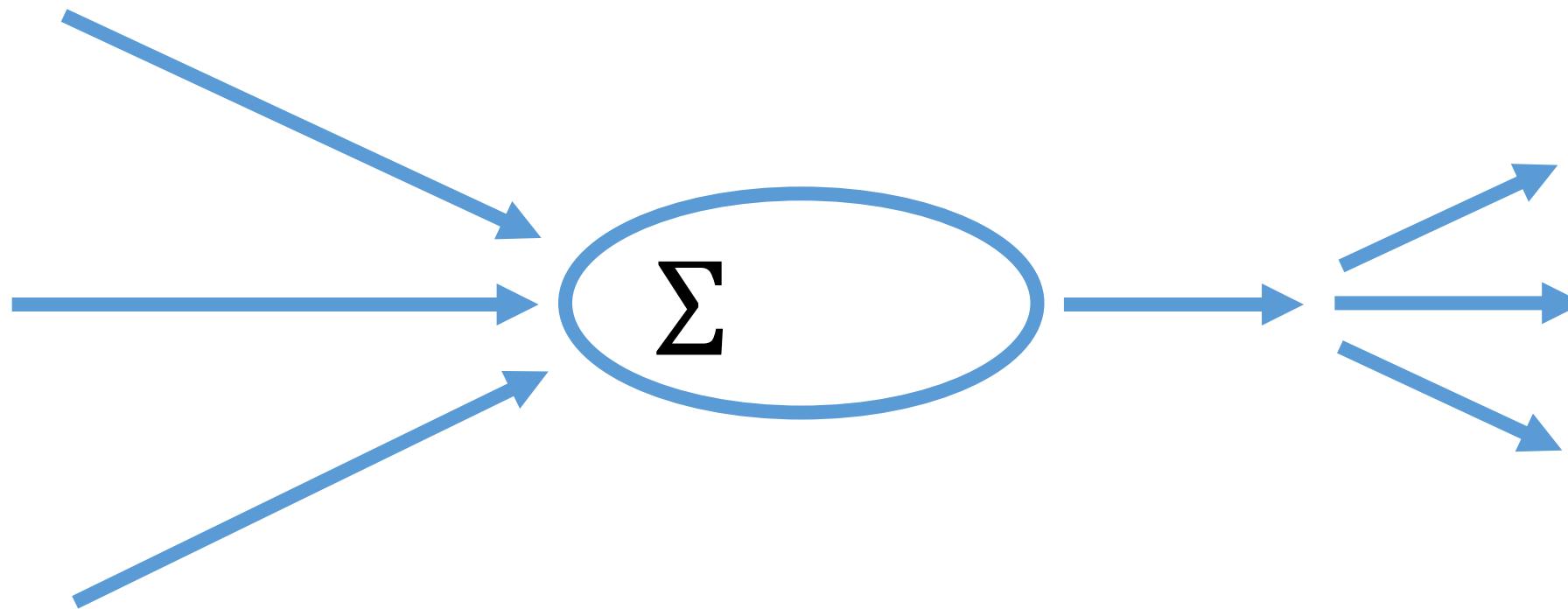




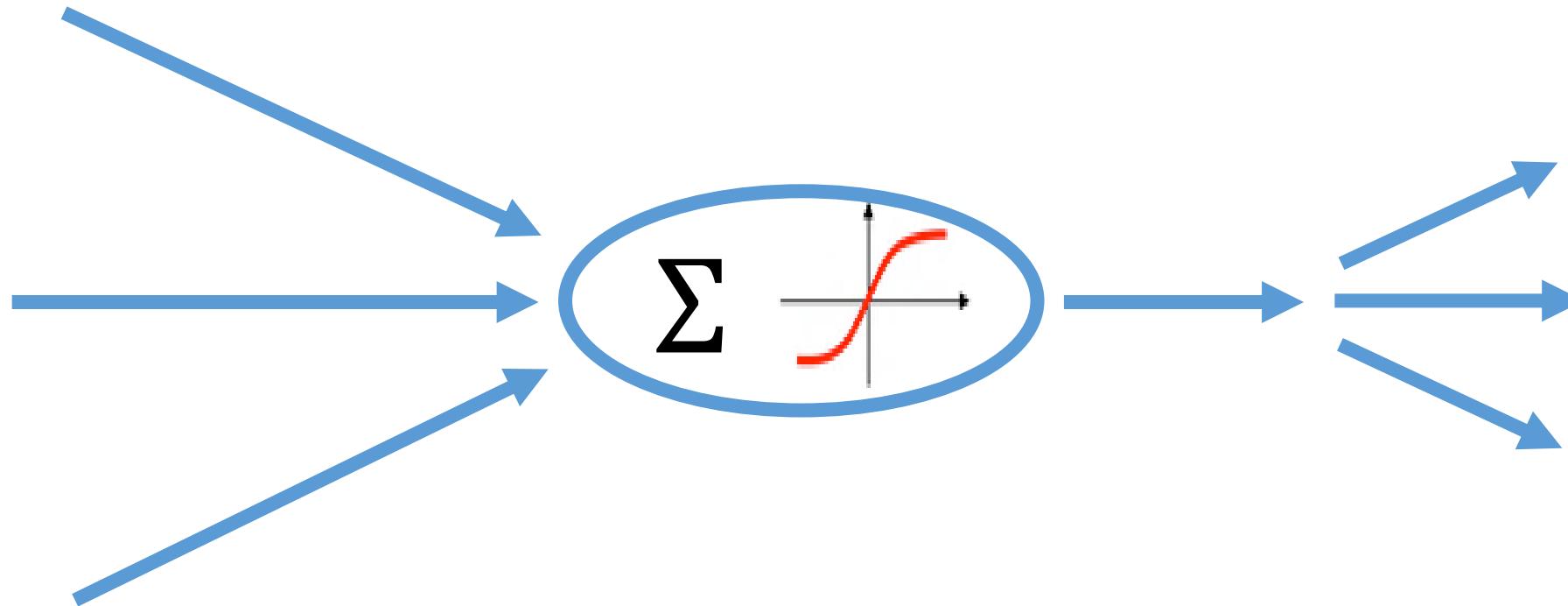
Artificial Neuron



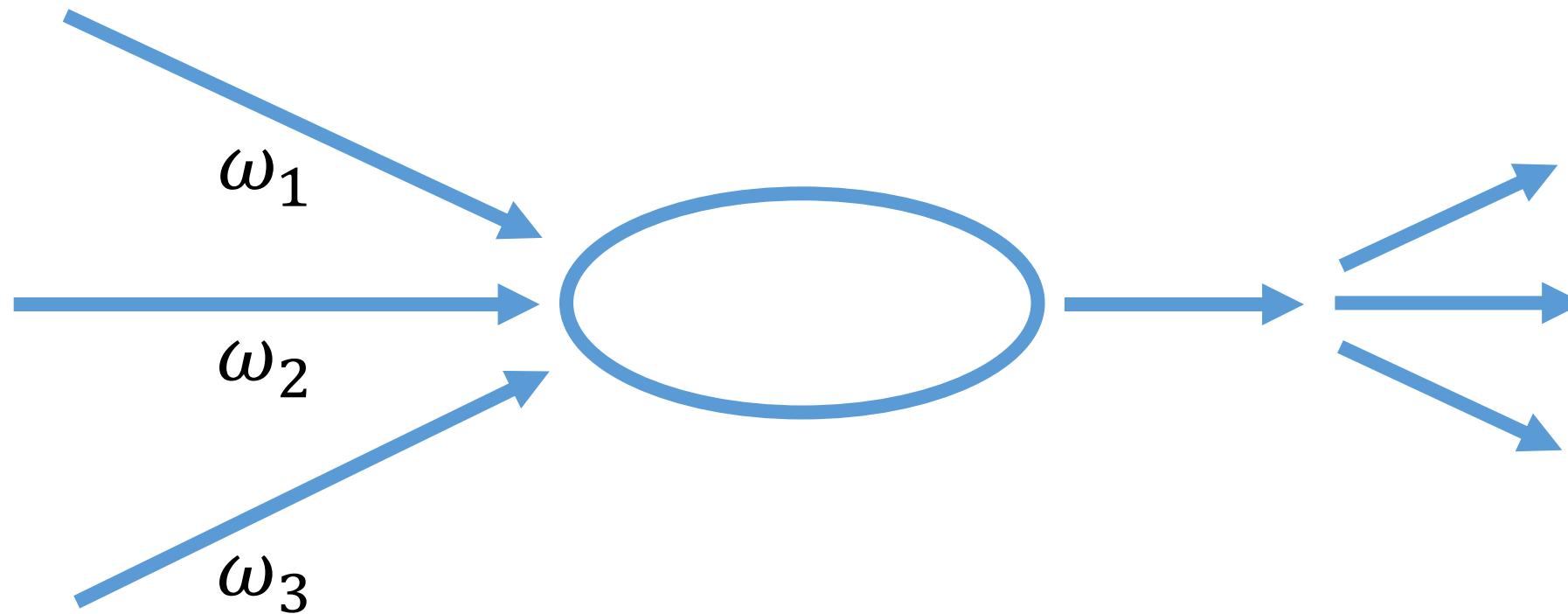
Artificial Neuron



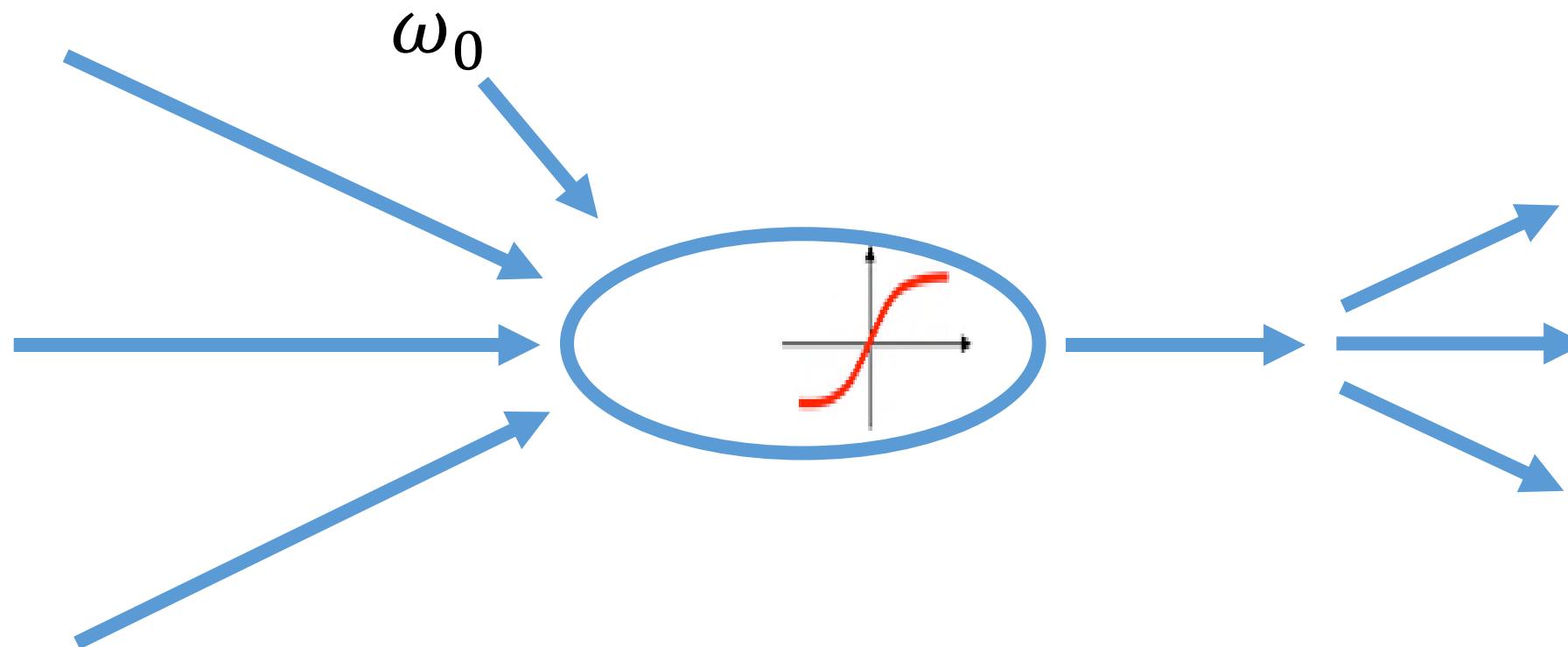
Artificial Neuron



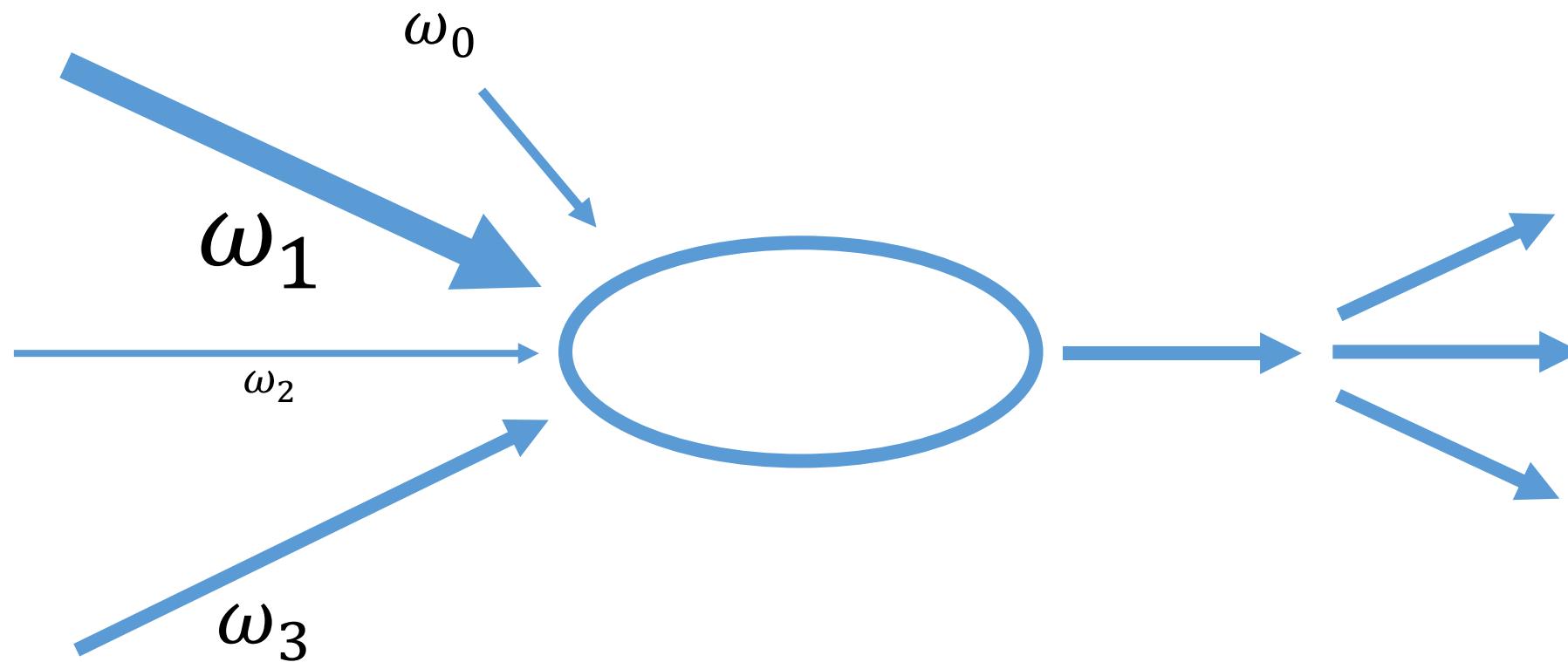
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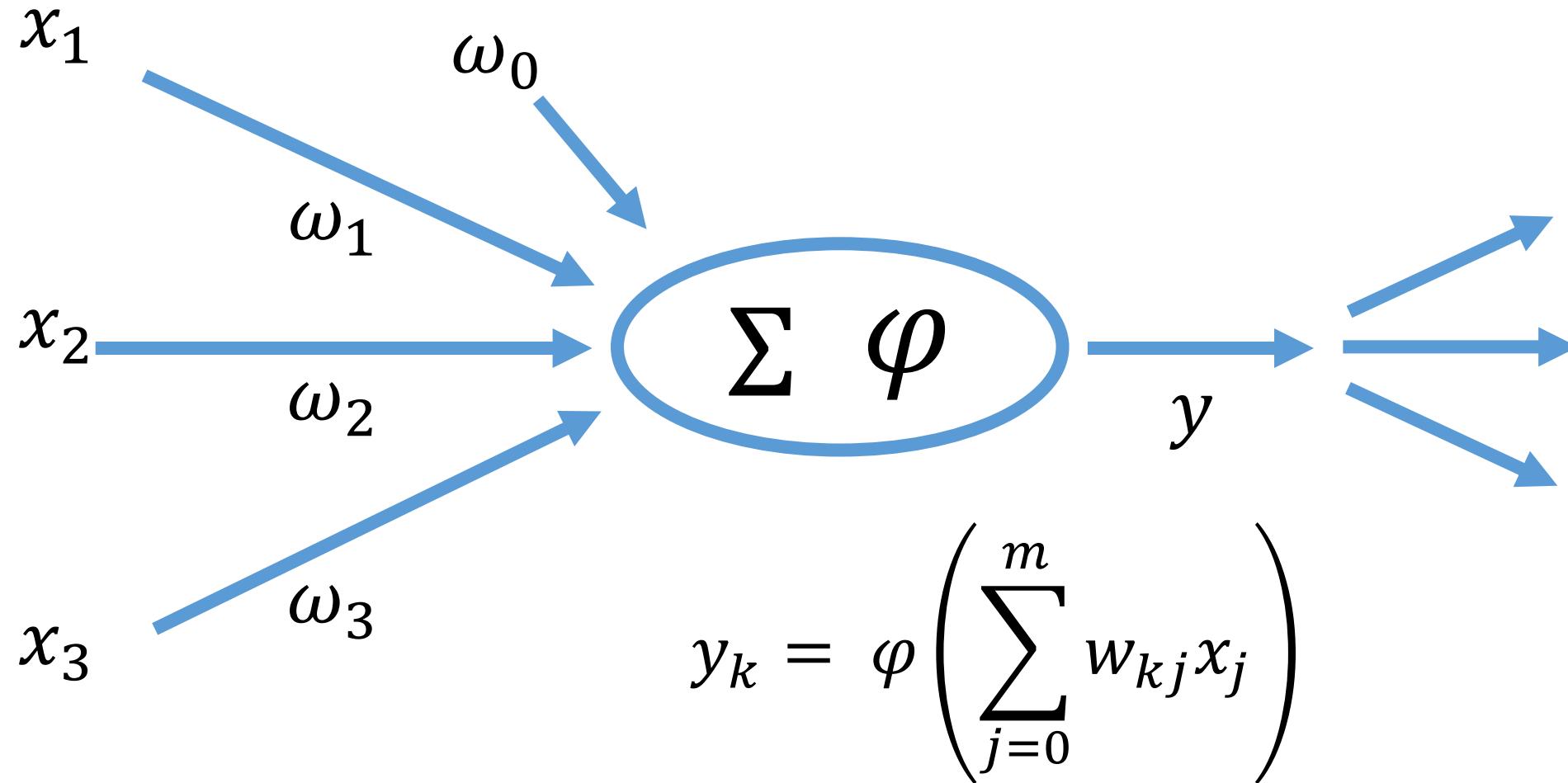
Artificial Neuron



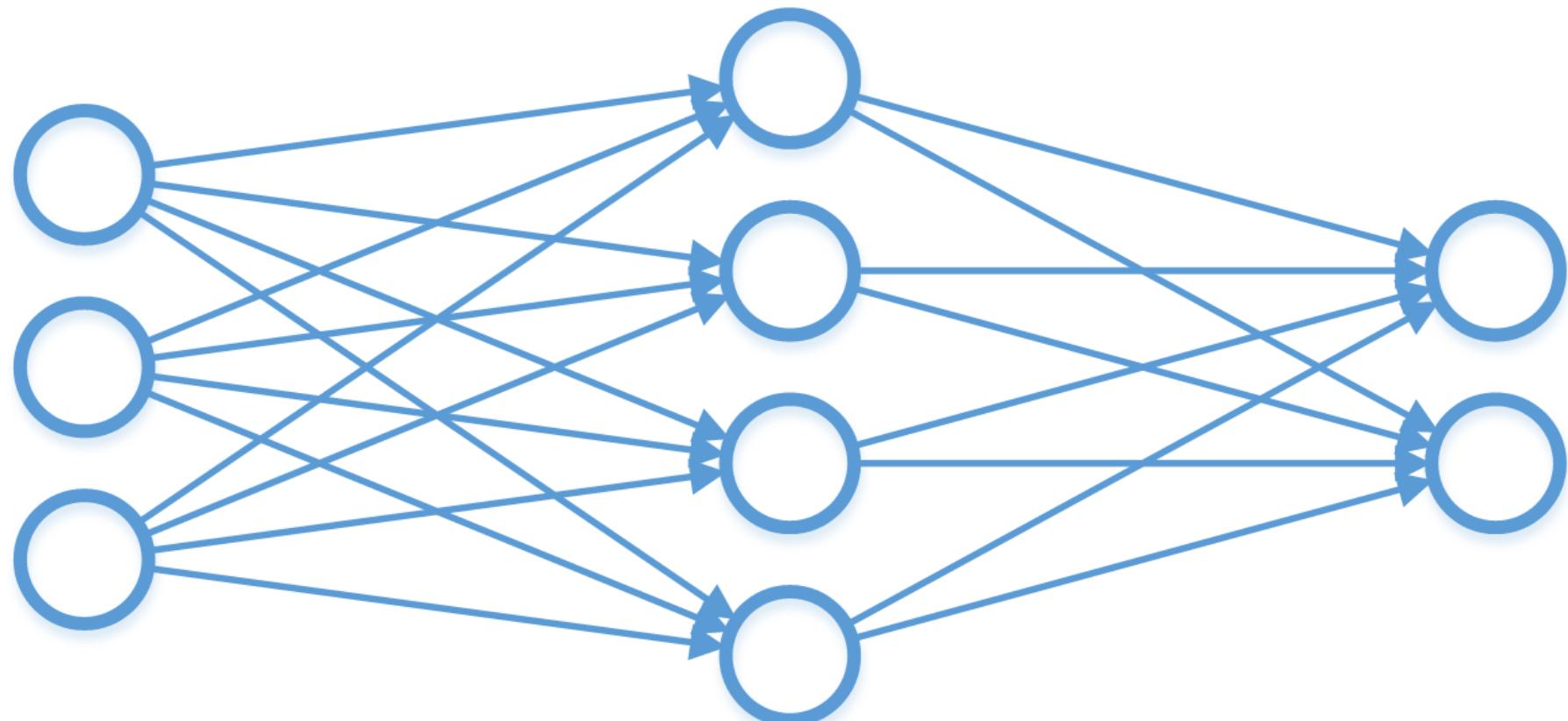
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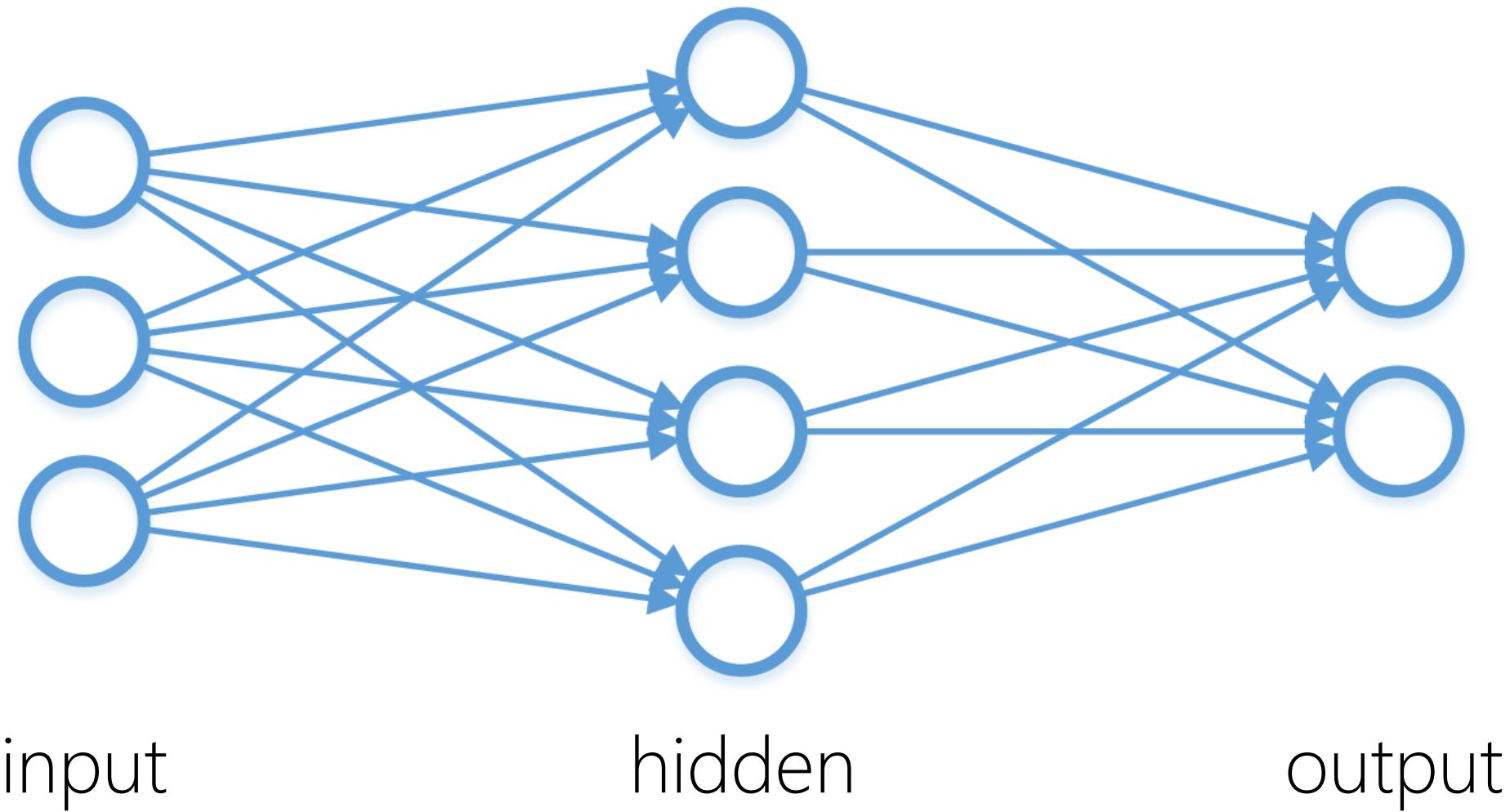
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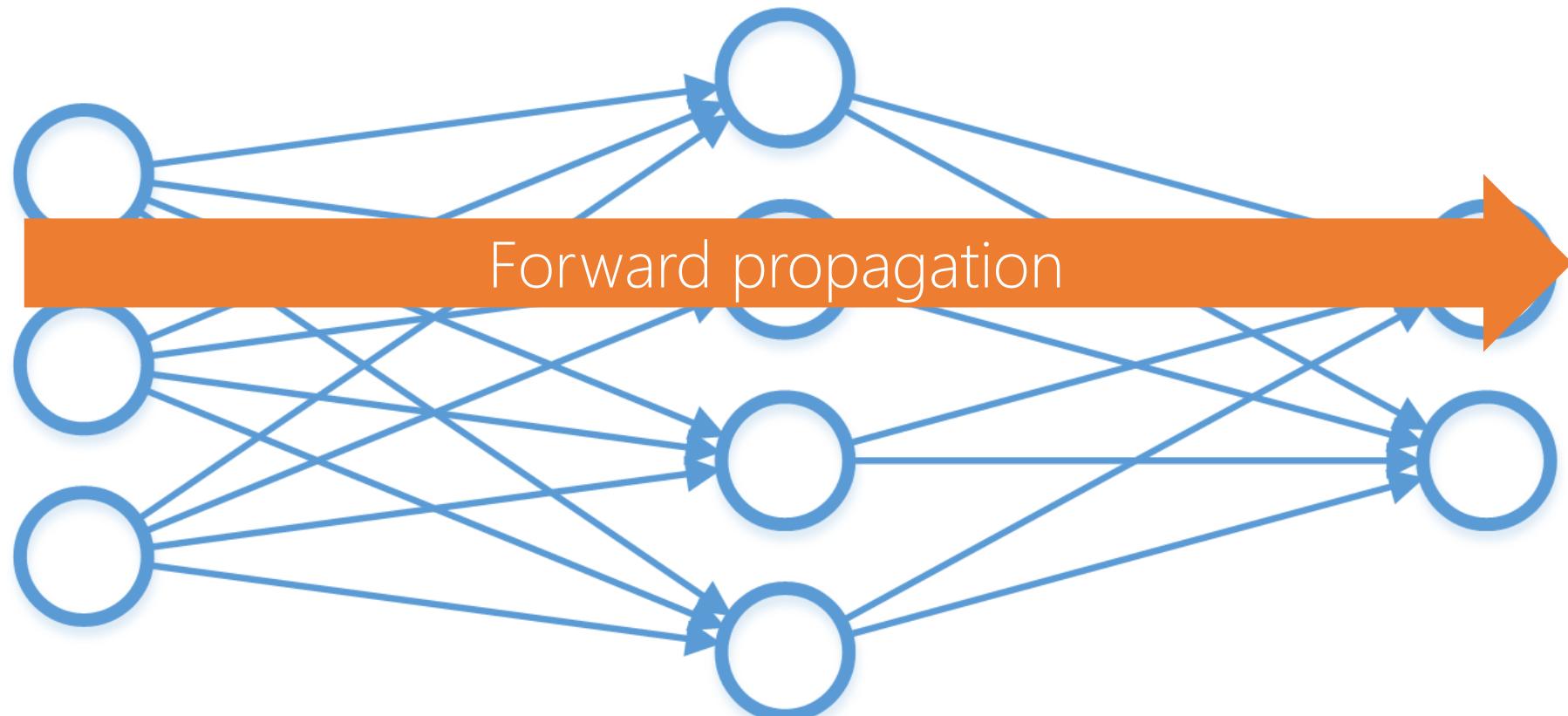
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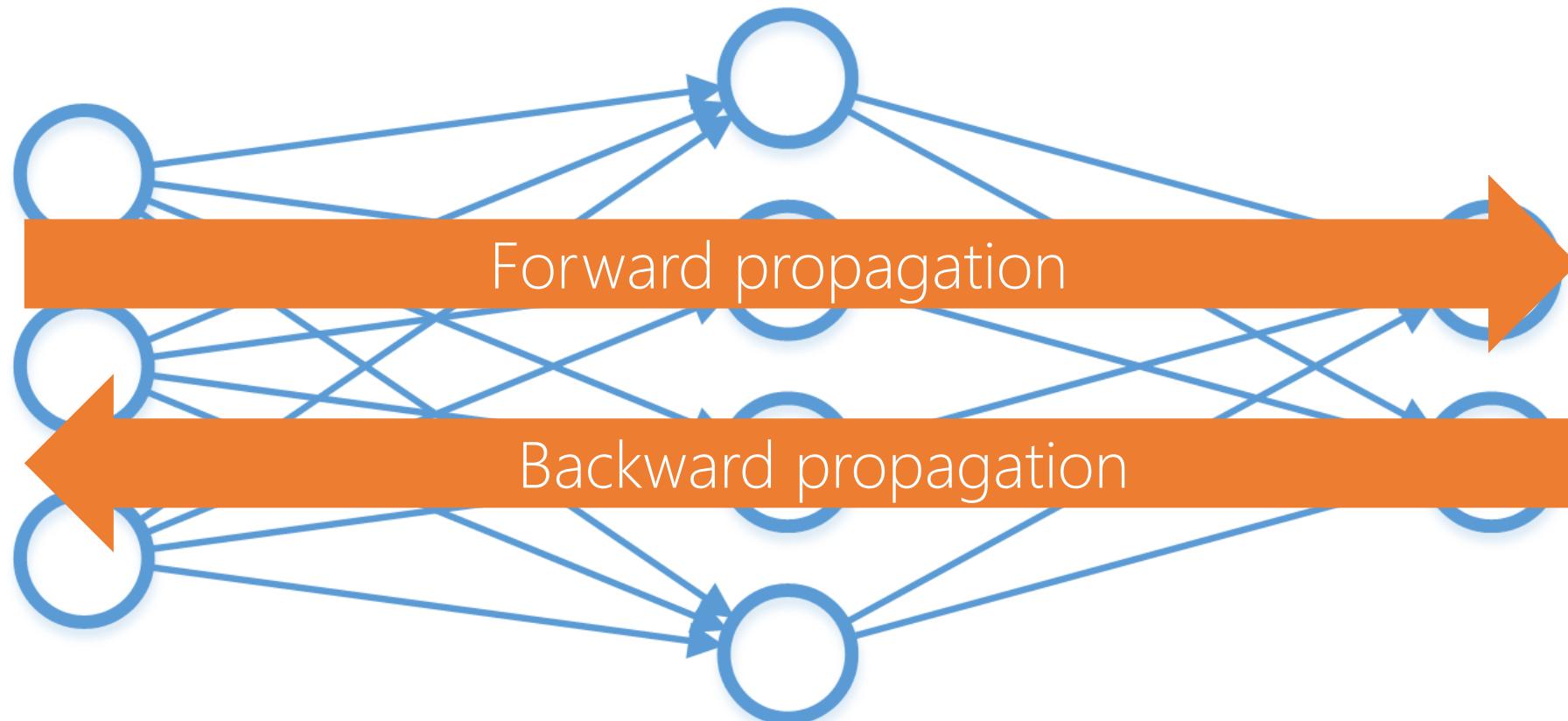
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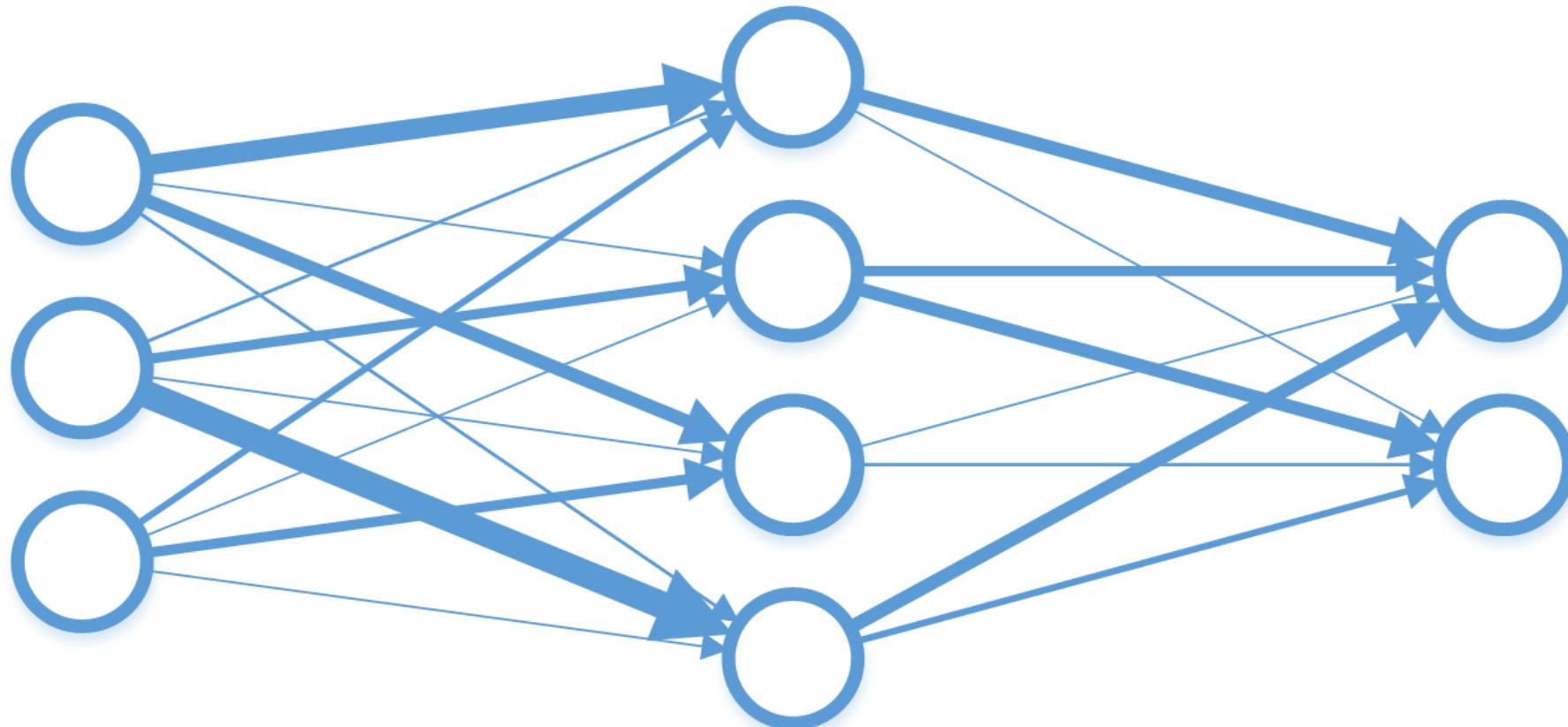
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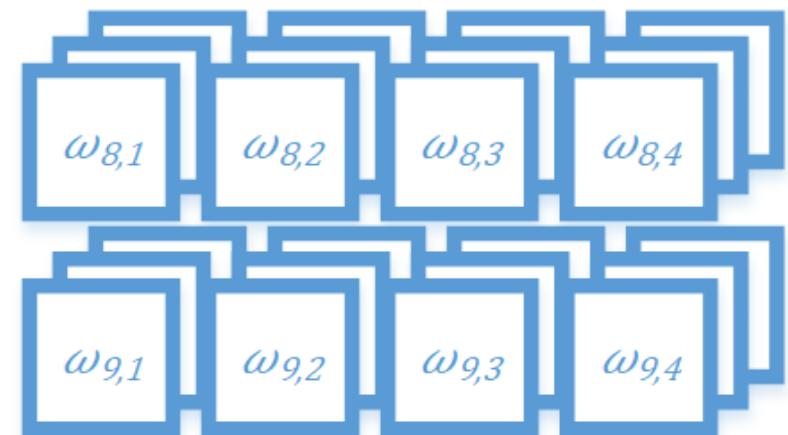
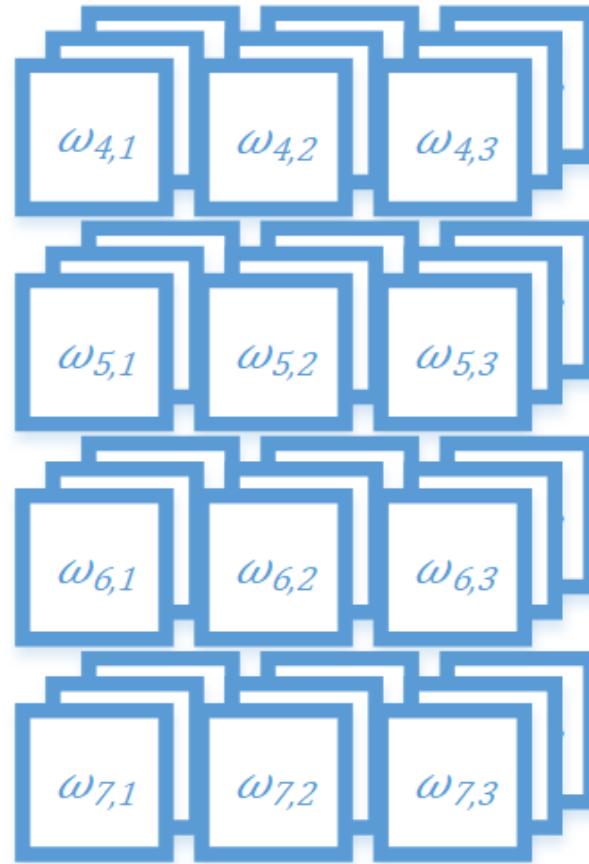
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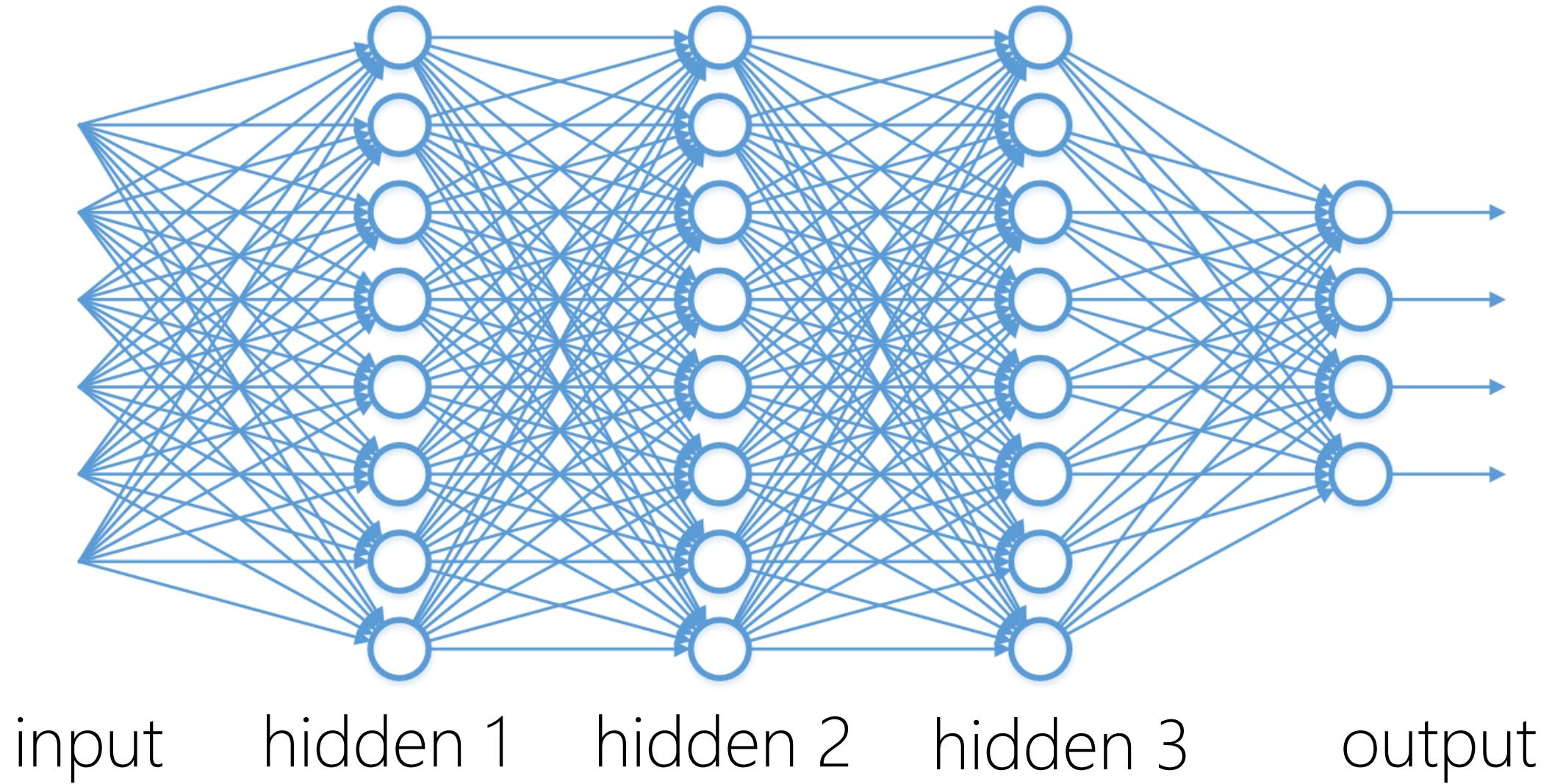
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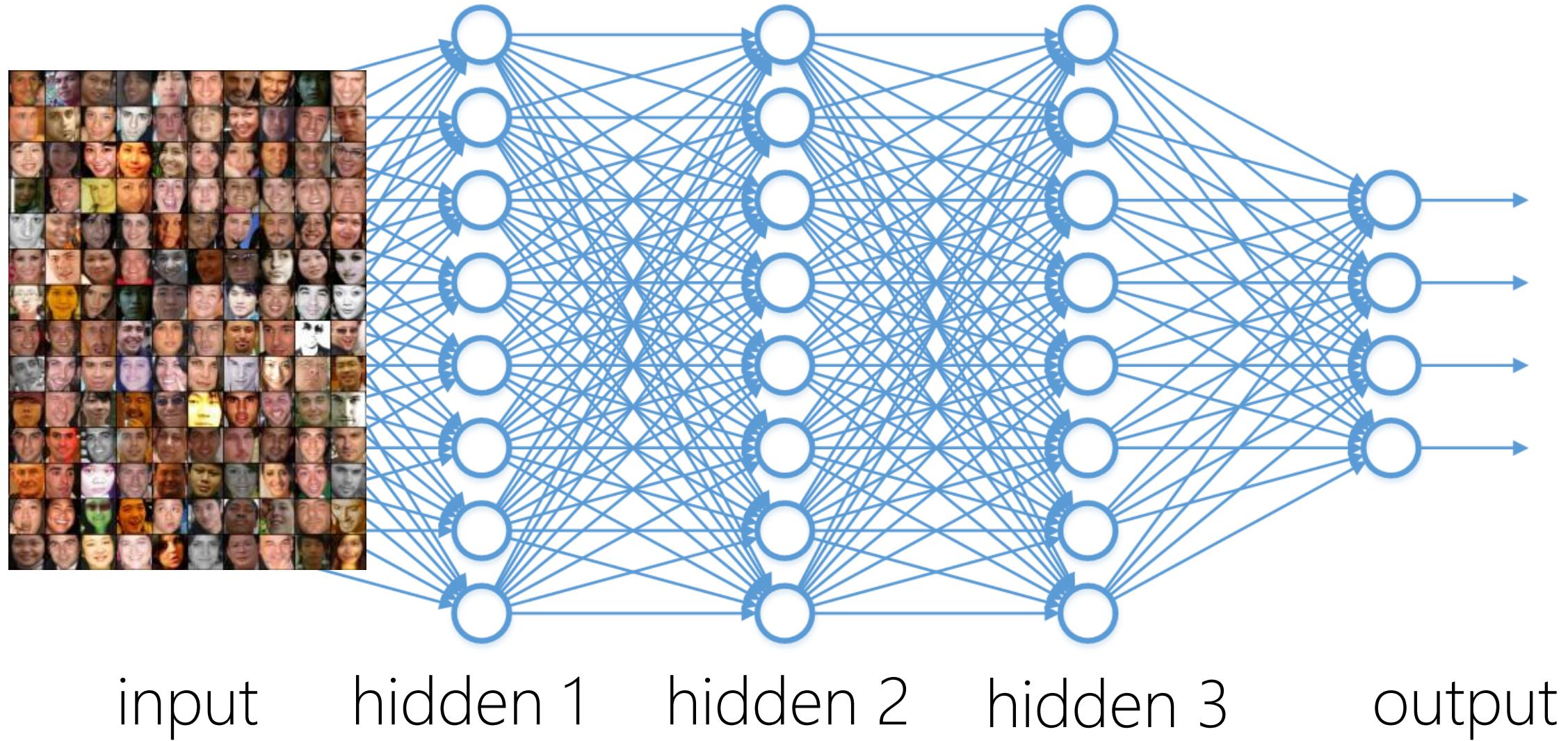
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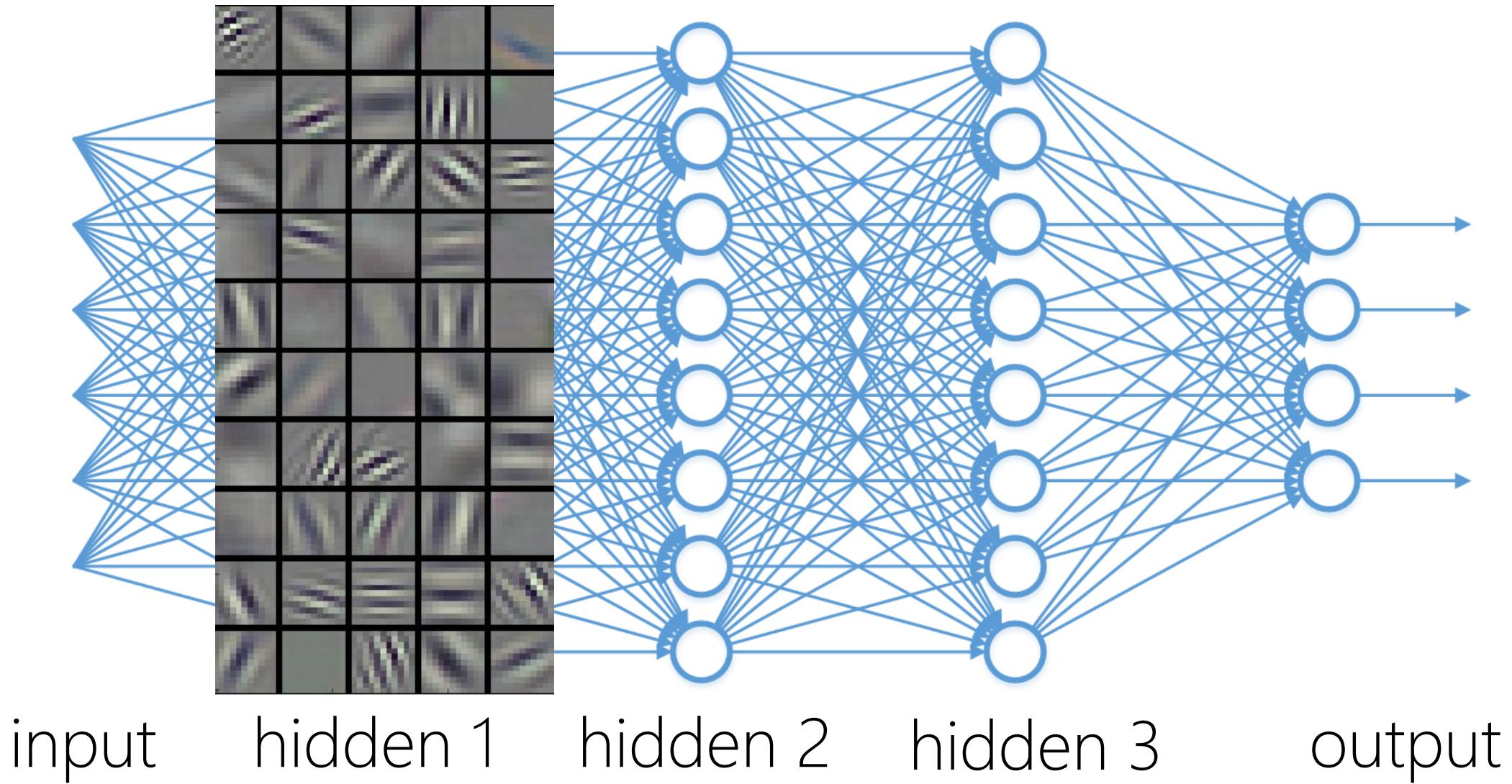
Deep Neural Network



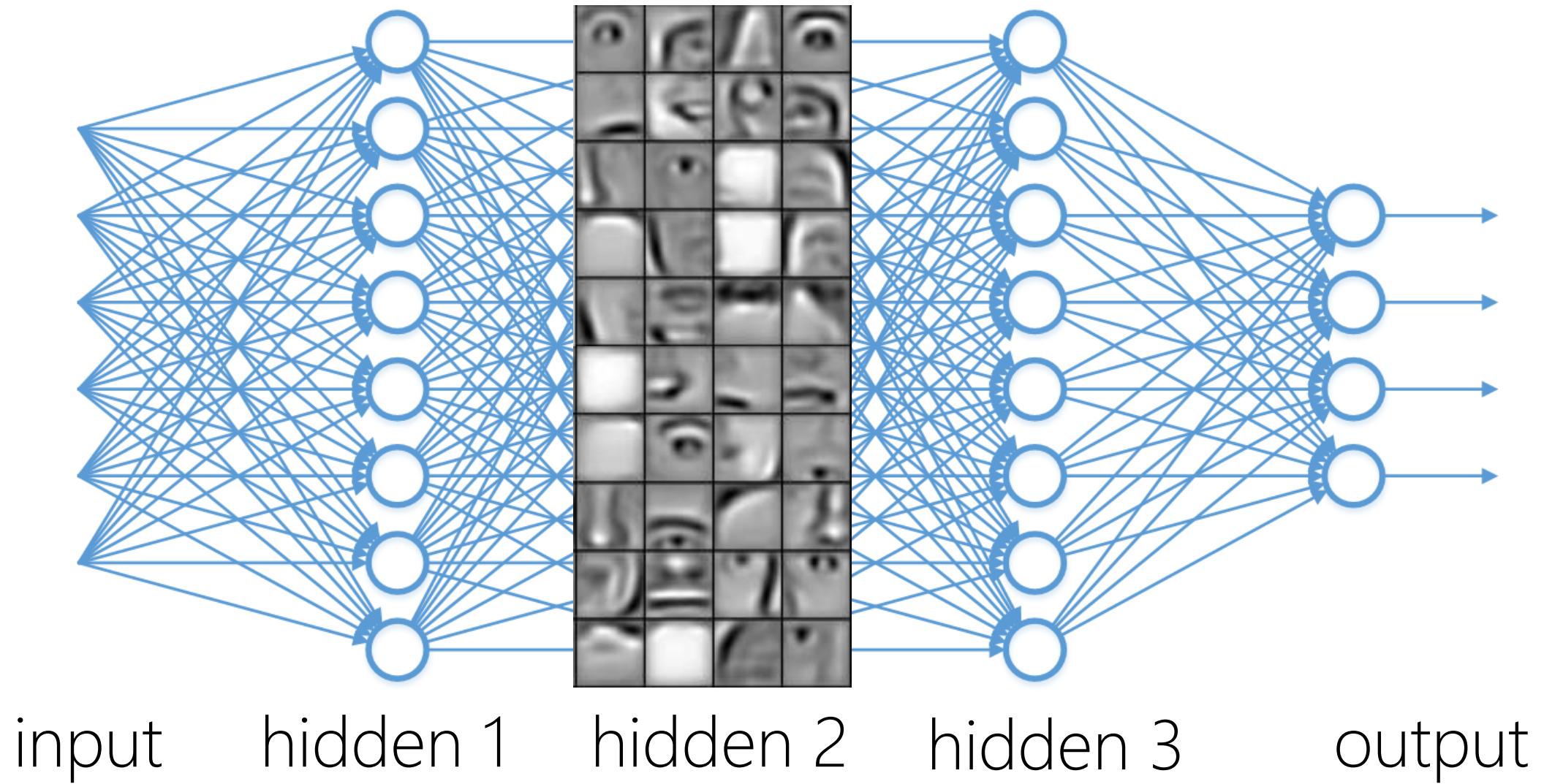
Deep Neural Network



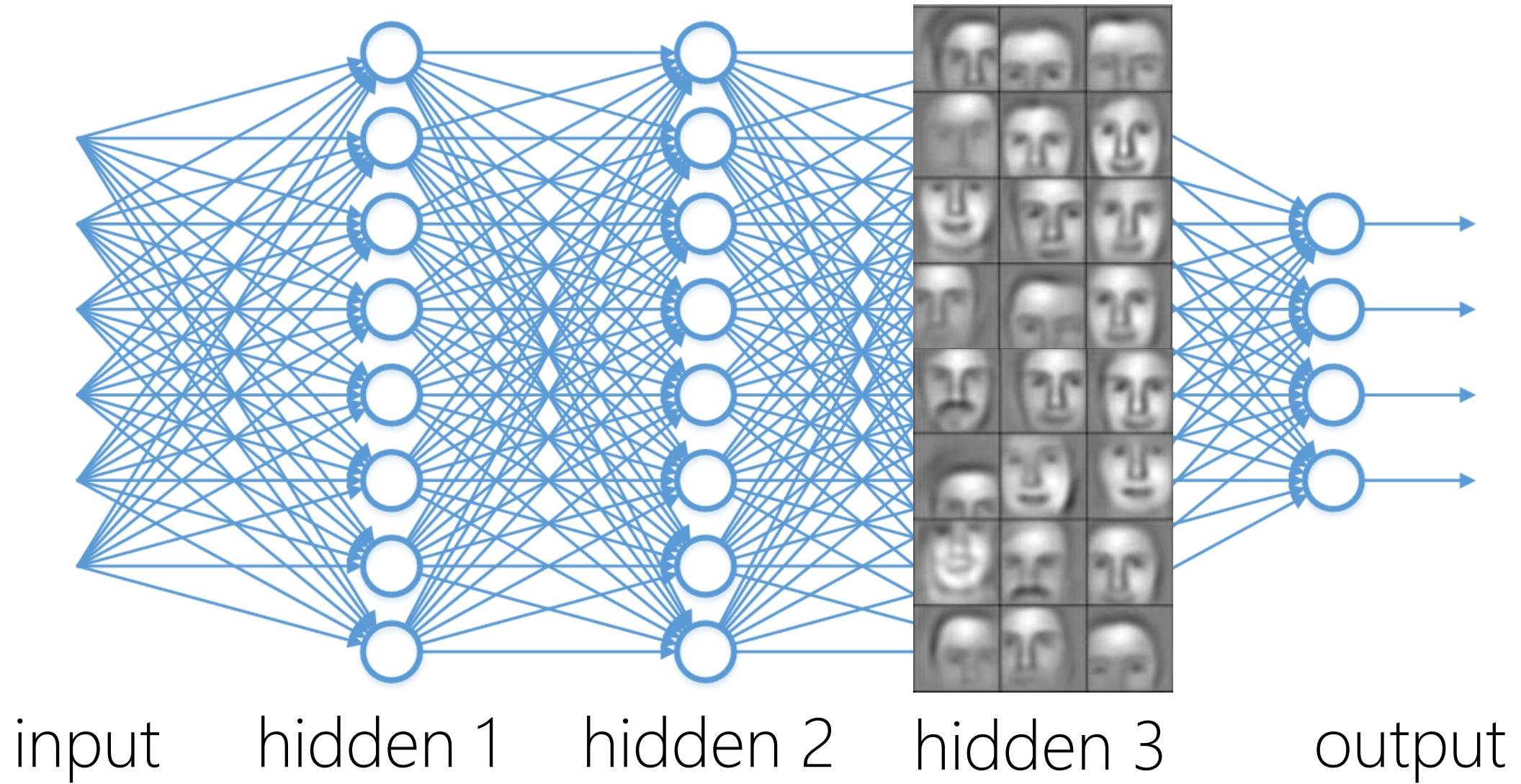
Deep Neural Network



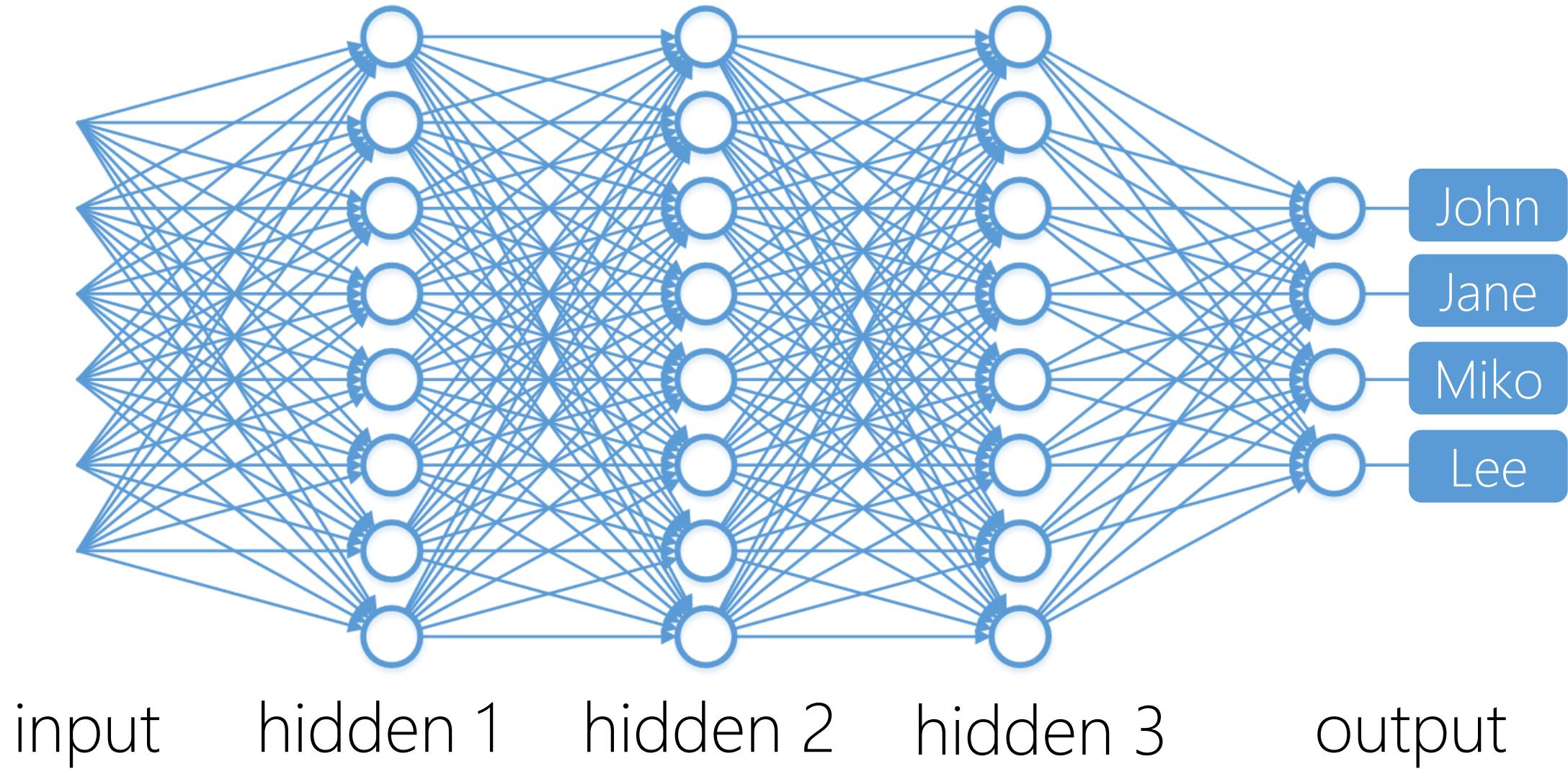
Deep Neural Network



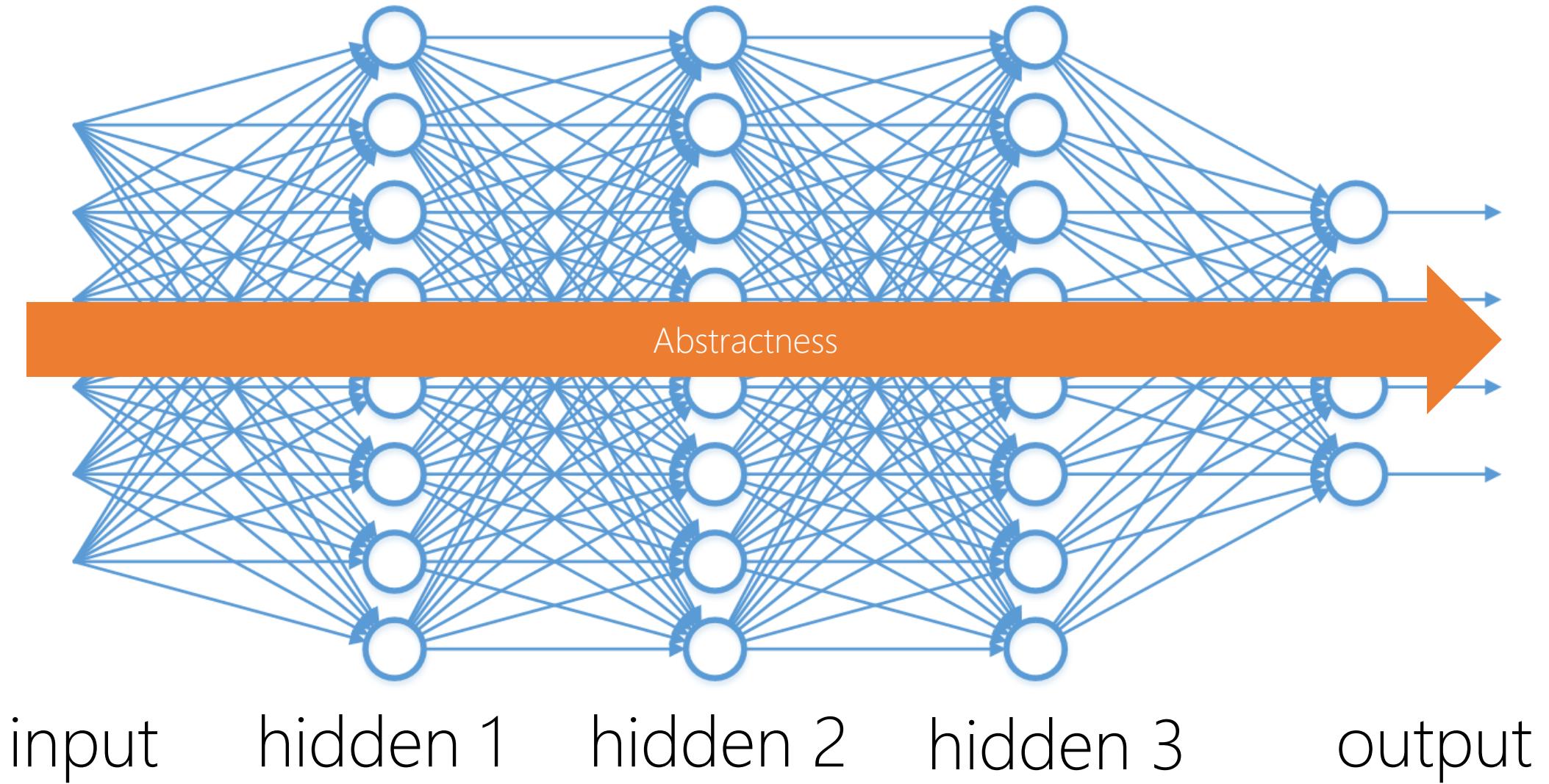
Deep Neural Network



Deep Neural Network



Deep Neural Network



Deep Learning

Artificial intelligence

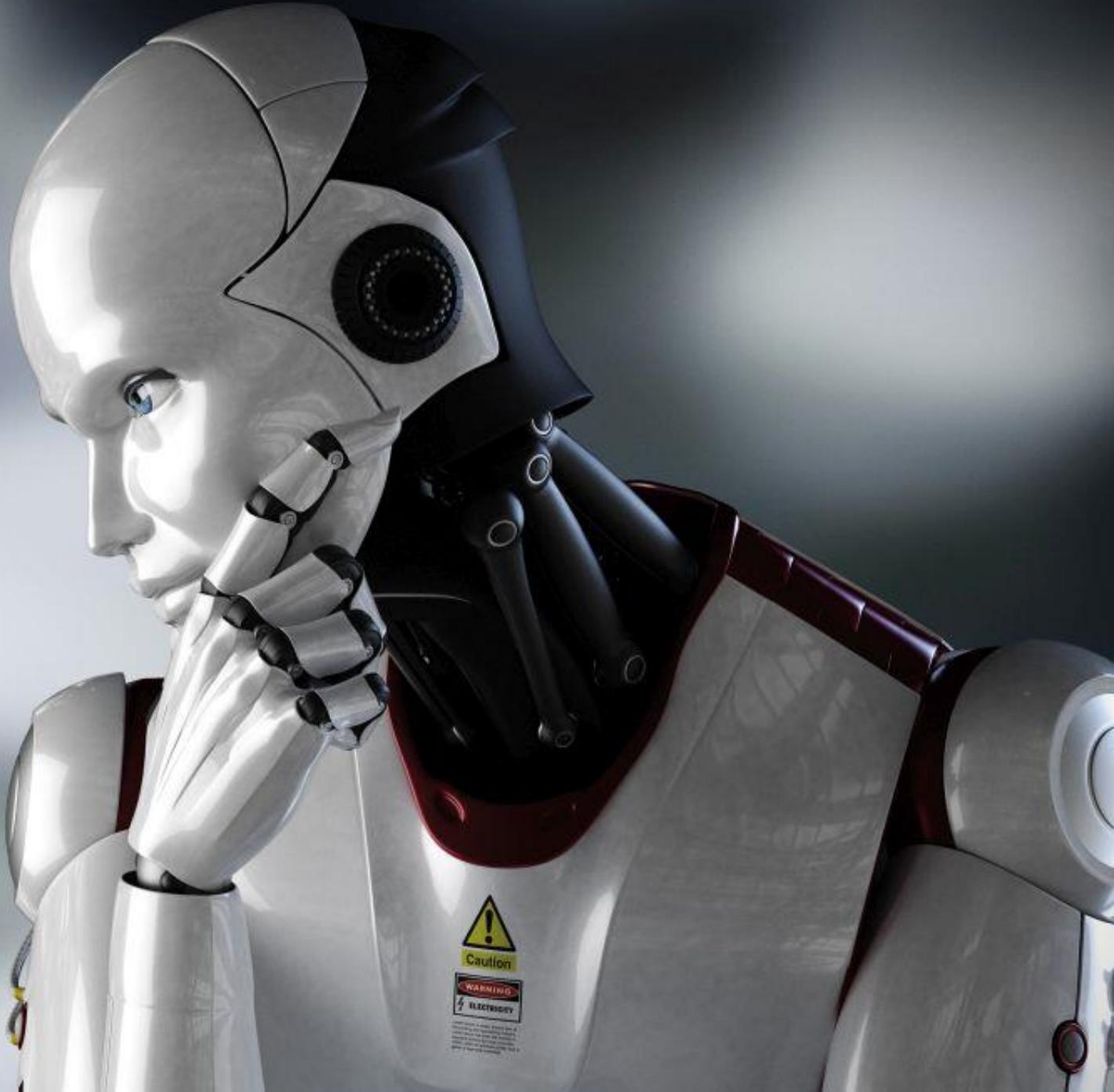
Machine learning

Neural network

Multiple hidden layers

Hierarchical representations

Makes predictions with data

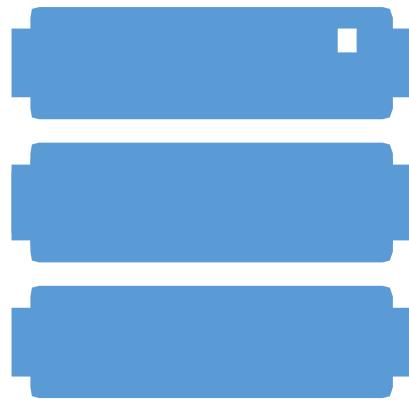
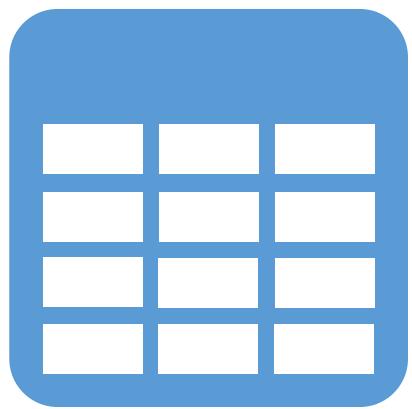


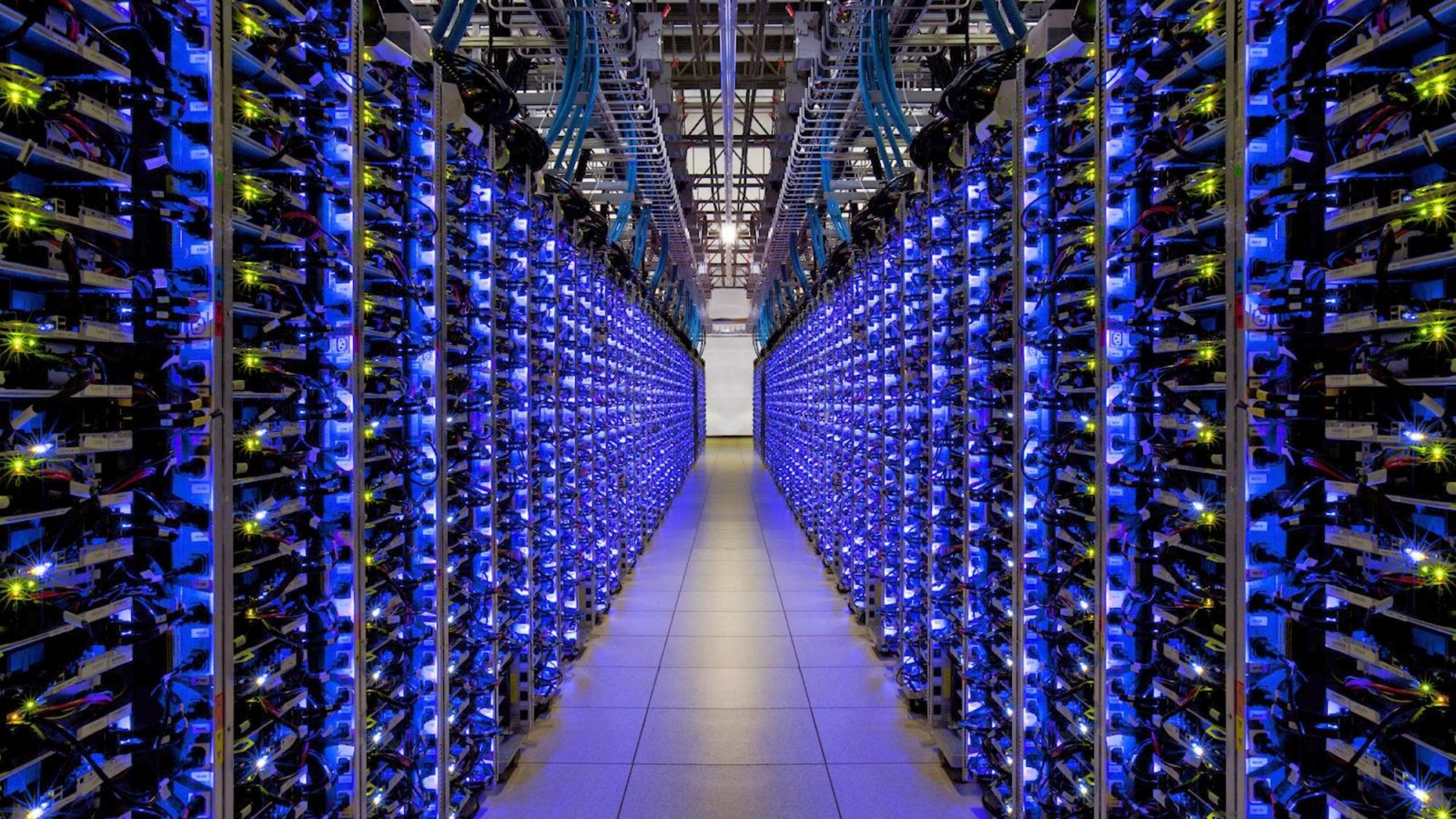


MARK 7

PERCEPTION

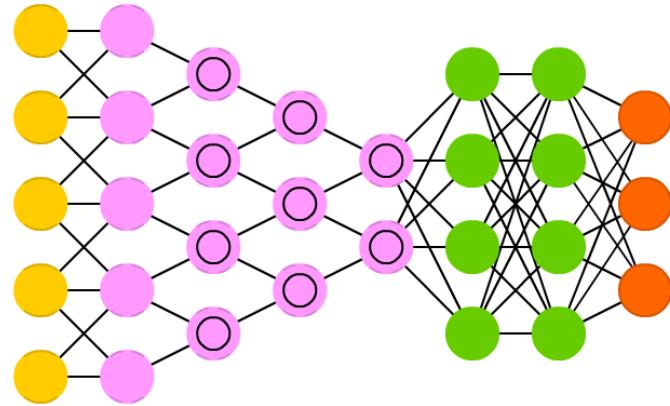
What Changed?

 $f(x)$

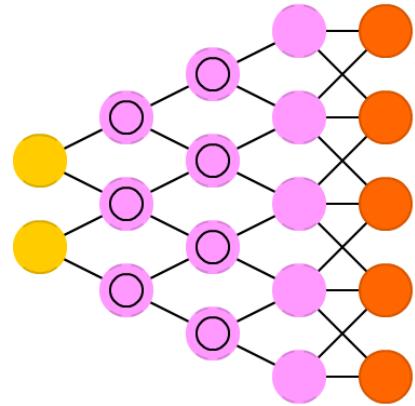




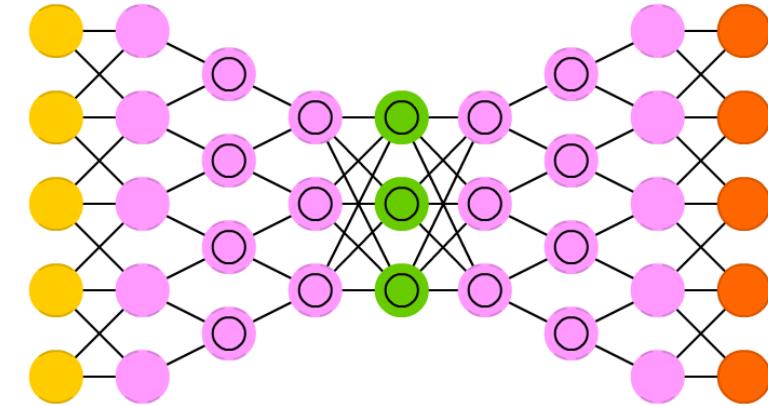
Deep Convolutional Network (DCN)



Deconvolutional Network (DN)

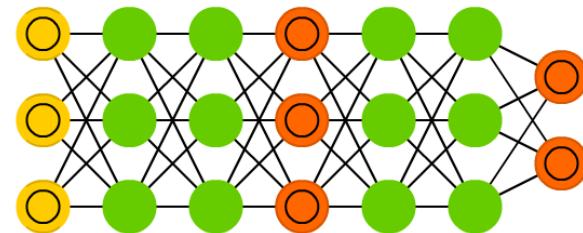


Deep Convolutional Inverse Graphics Network (DCIGN)

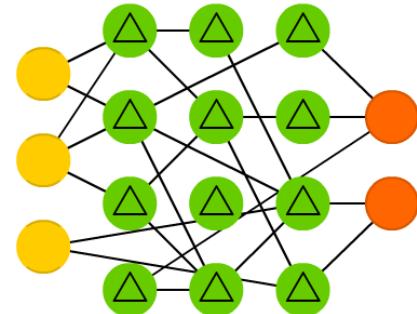


- Backfed Input Cell
- Input Cell
- △ Noisy Input Cell
- Hidden Cell
- Probabilistic Hidden Cell
- Spiking Hidden Cell
- Output Cell
- Match Input Output Cell
- Recurrent Cell
- Memory Cell
- △ Different Memory Cell
- Kernel
- Convolution or Pool

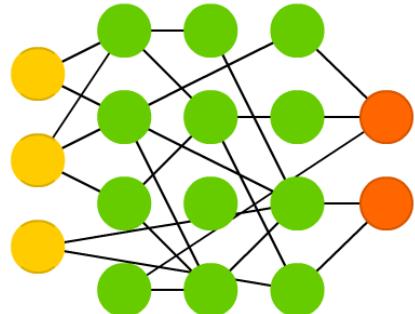
Generative Adversarial Network (GAN)



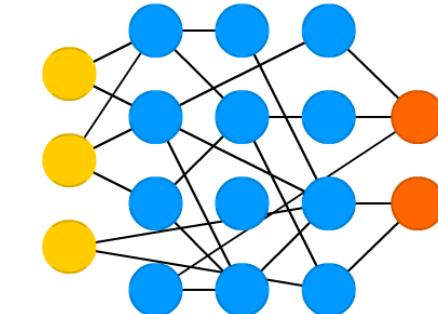
Liquid State Machine (LSM)



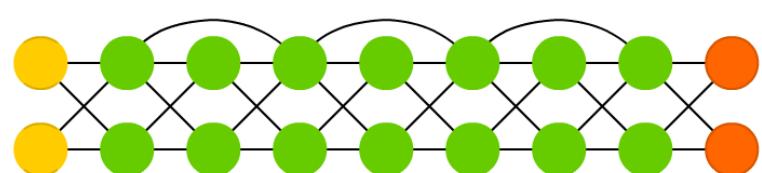
Extreme Learning Machine (ELM)



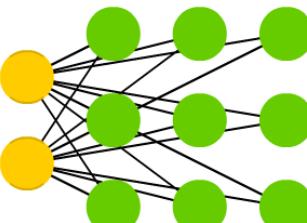
Echo State Network (ESN)



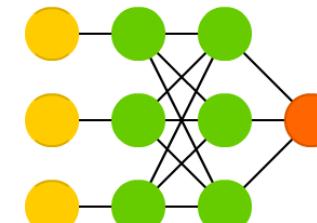
Deep Residual Network (DRN)



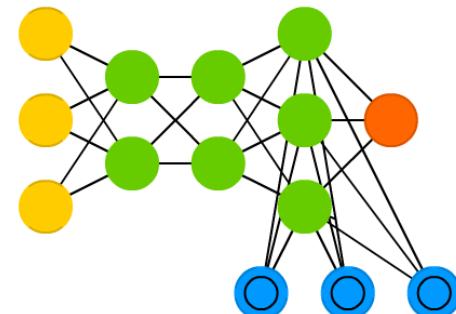
Kohonen Network (KN)



Support Vector Machine (SVM)

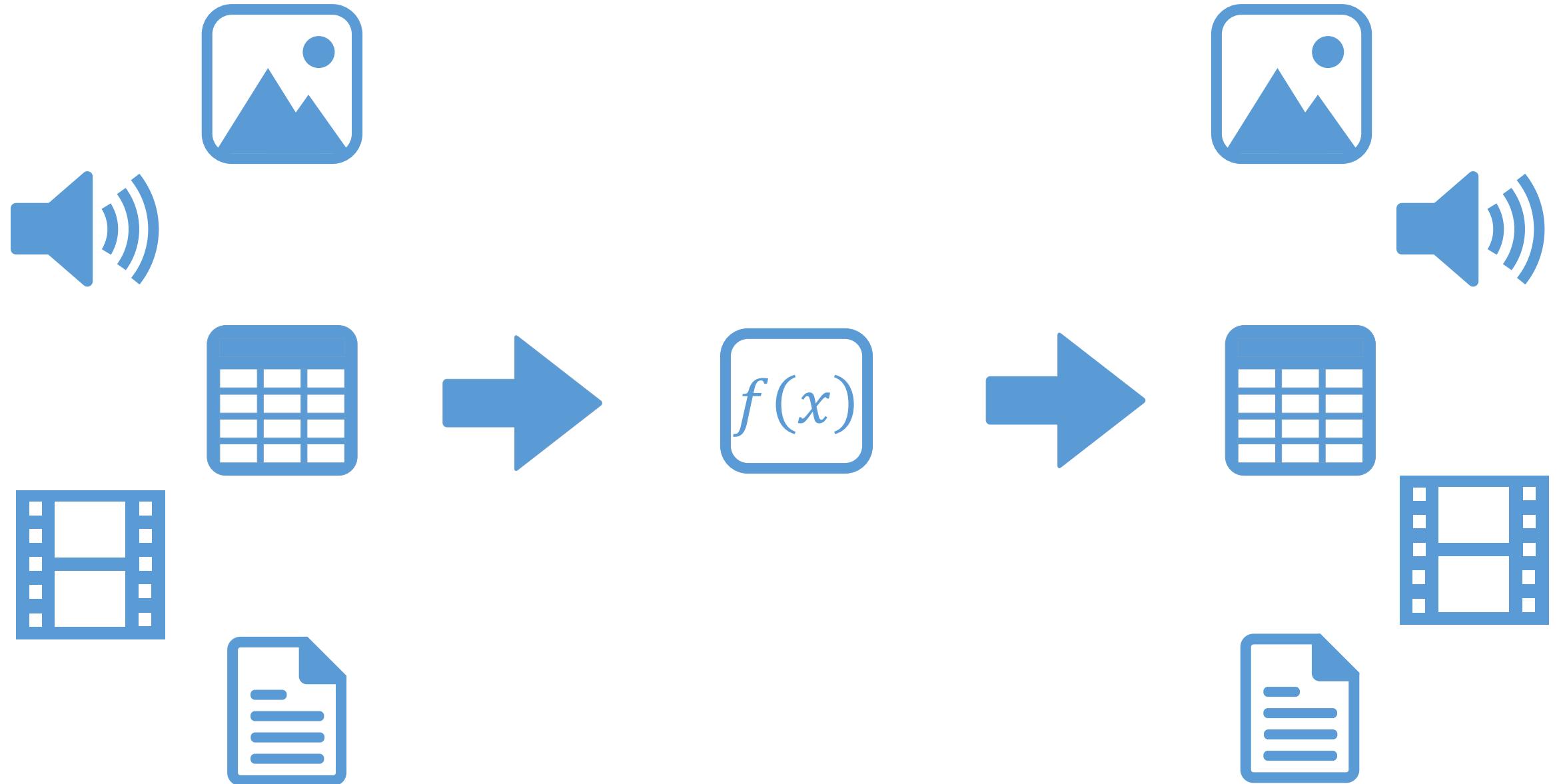


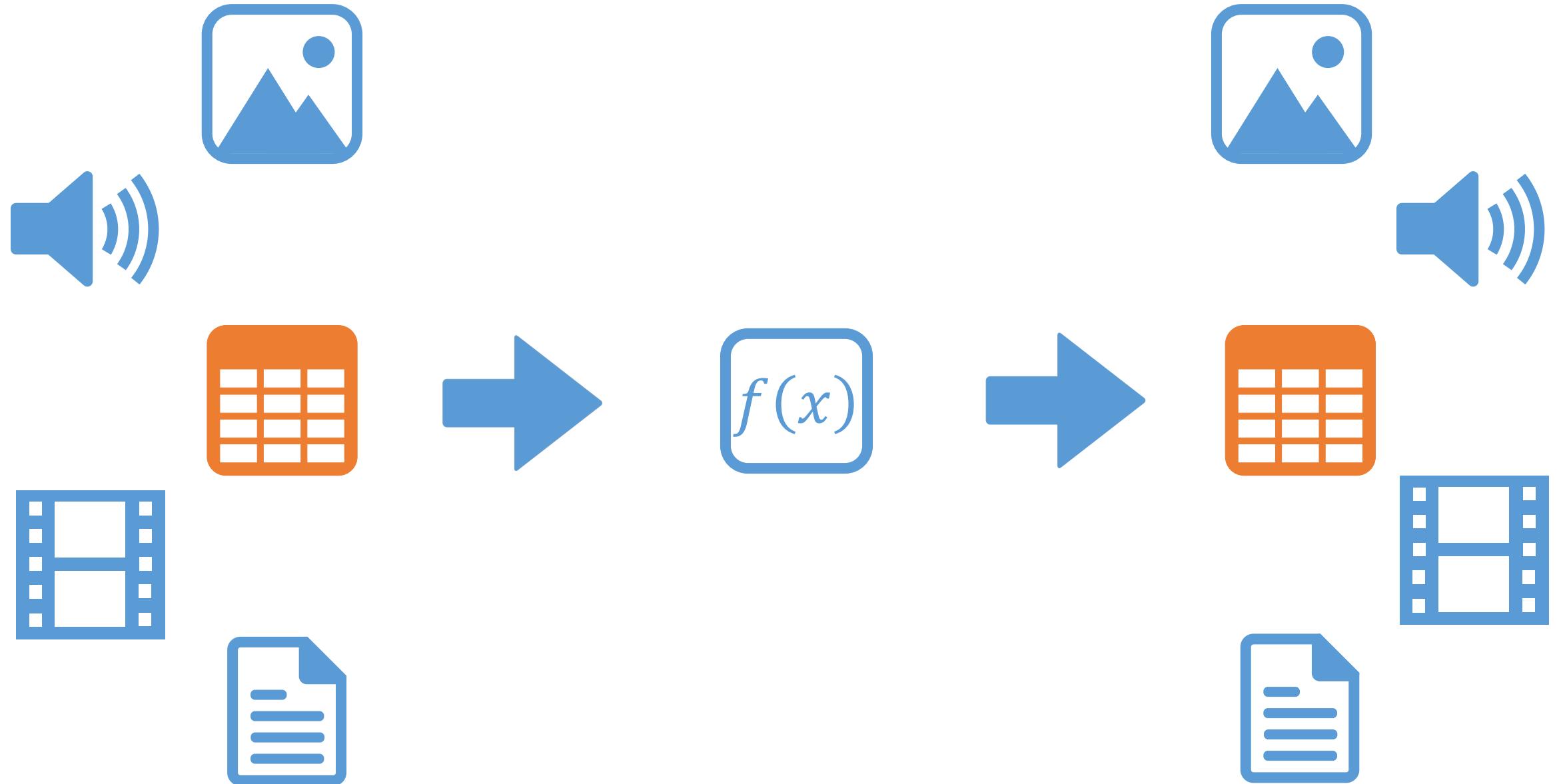
Neural Turing Machine (NTM)

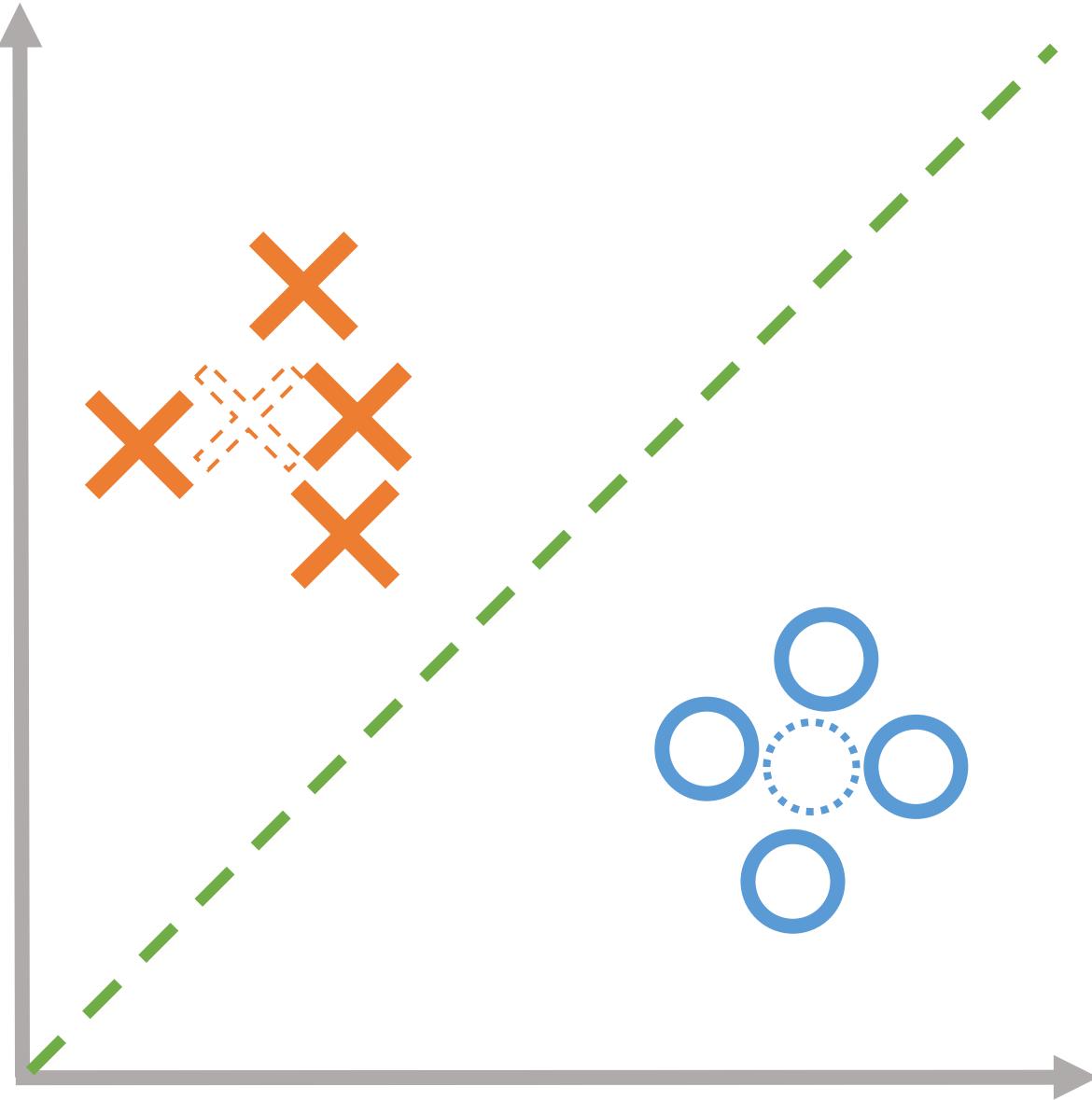


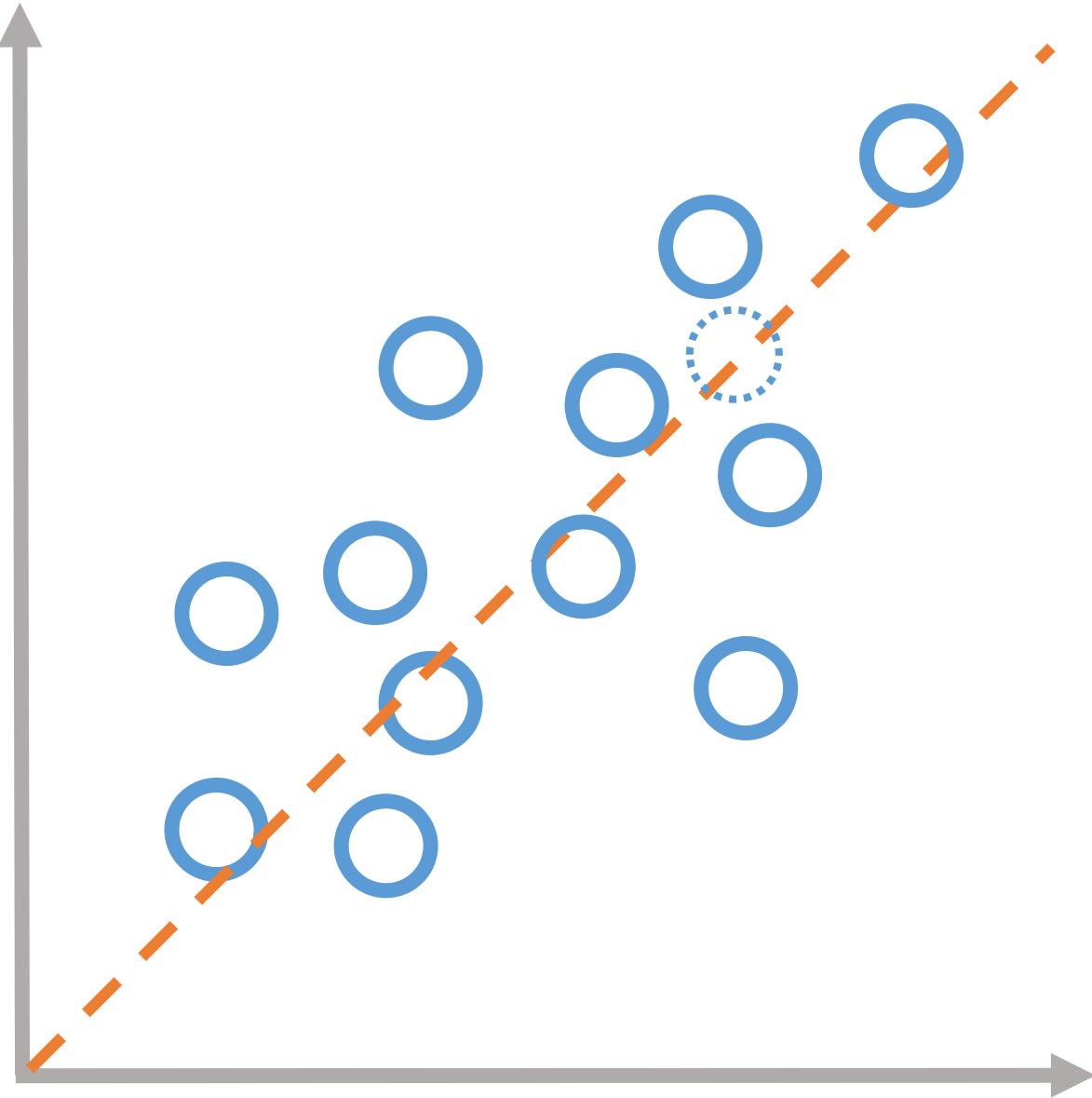
What can deep learning do?

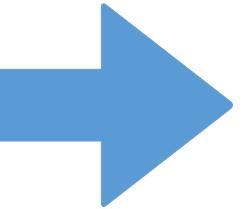
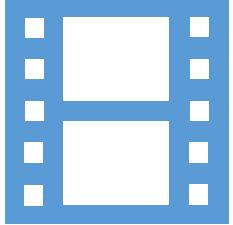
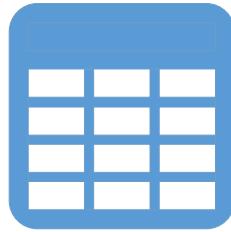
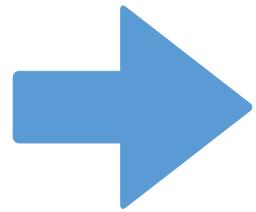


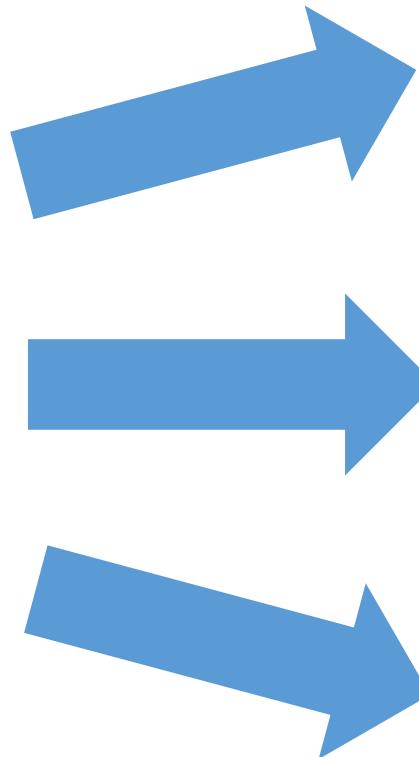








 $f(x)$ 



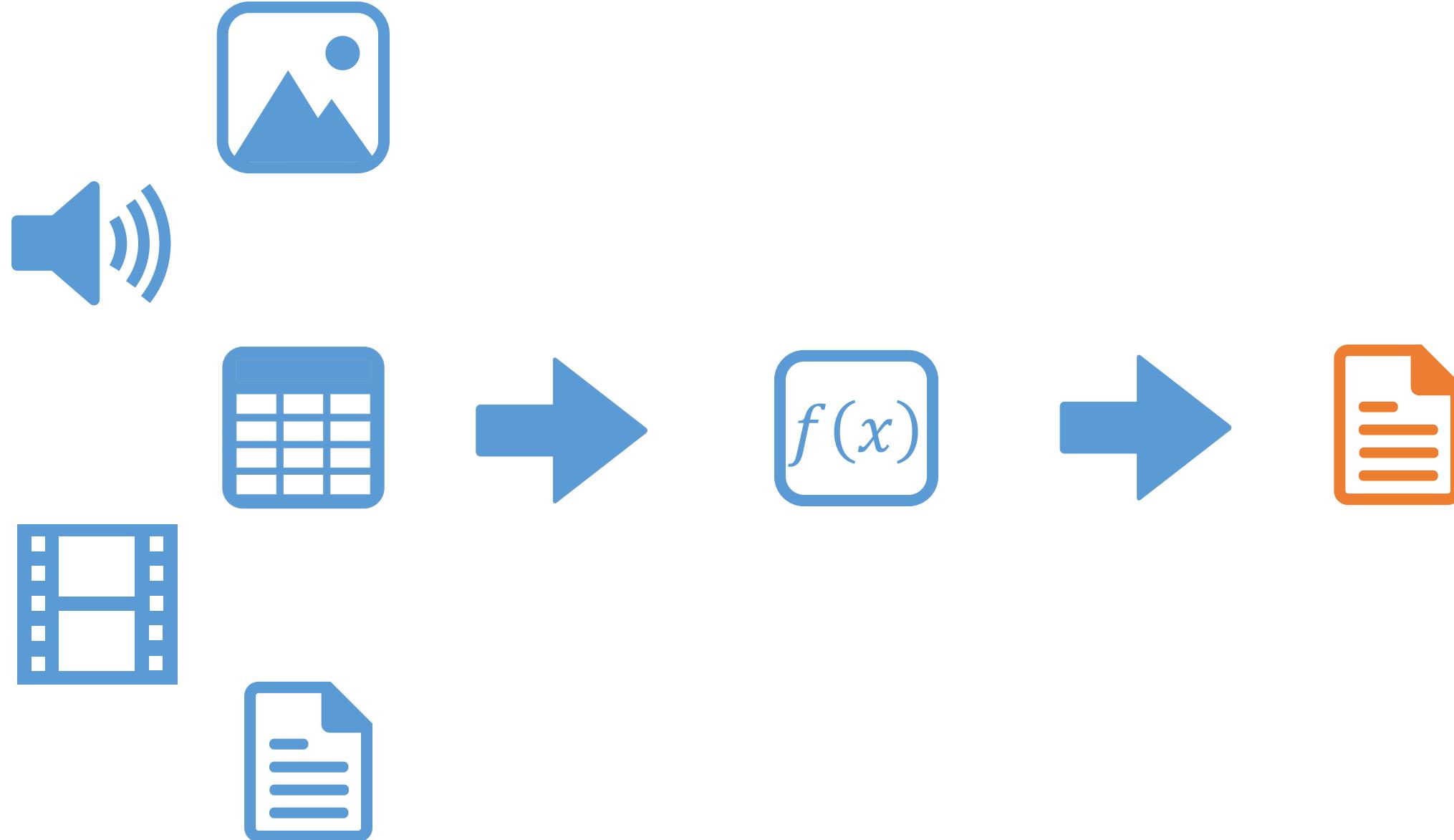
Technology



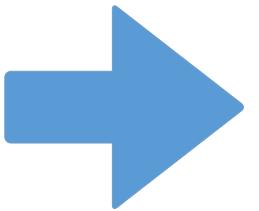
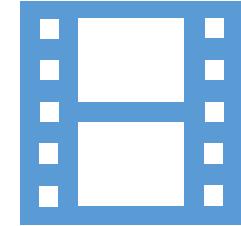
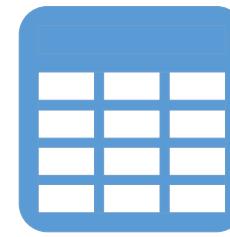
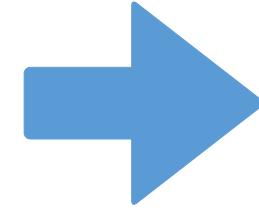
Sports

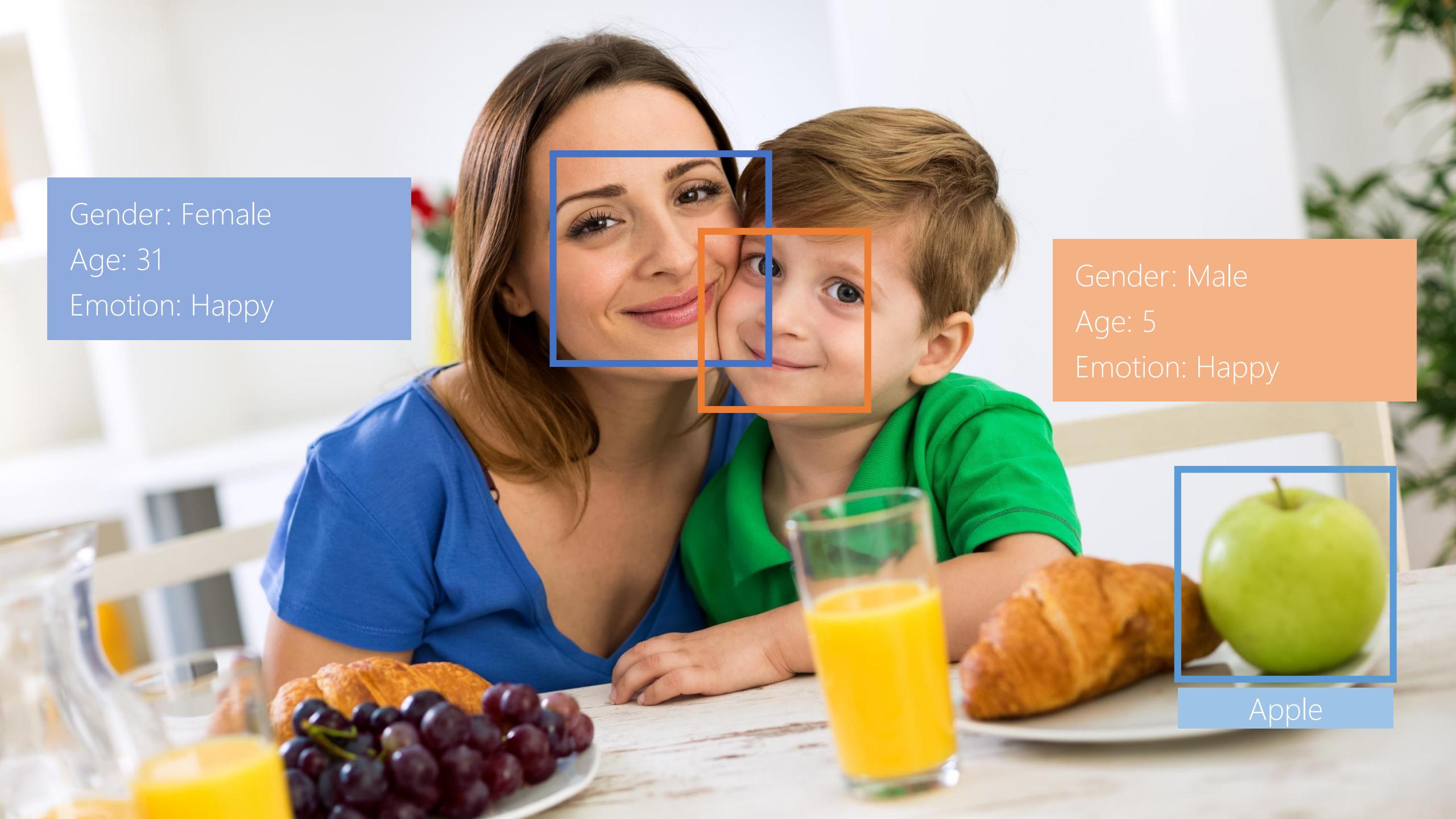


Entertainment



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



Source: <https://blog.deepomatic.com/ai-for-everyone-d687522934af>

Describes without errors



A person riding a motorcycle on a dirt road.



A group of young people playing a game of frisbee.

Describes with minor errors



Two dogs play in the grass.



Two hockey players are fighting over the puck.

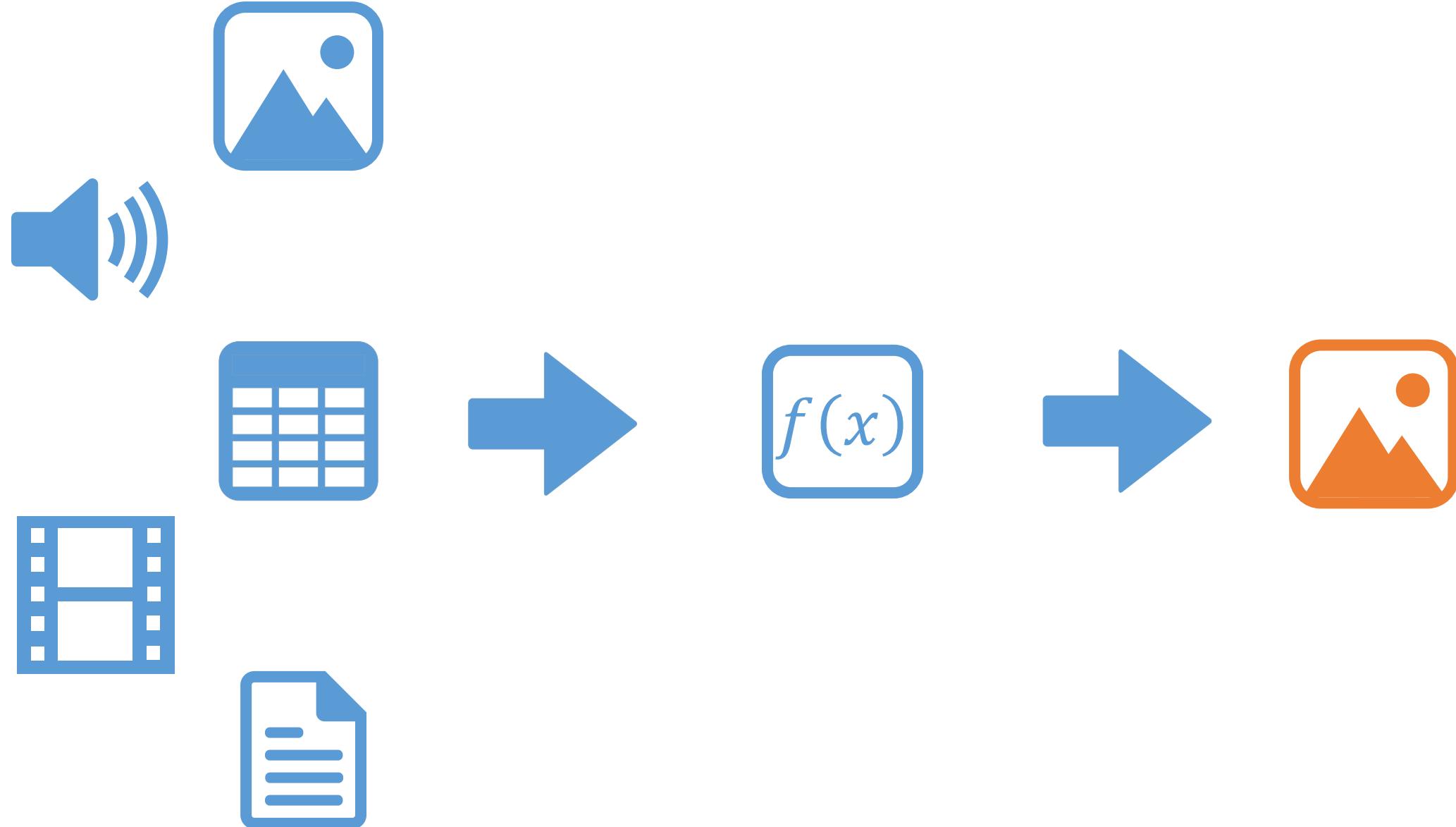
Somewhat related to the image

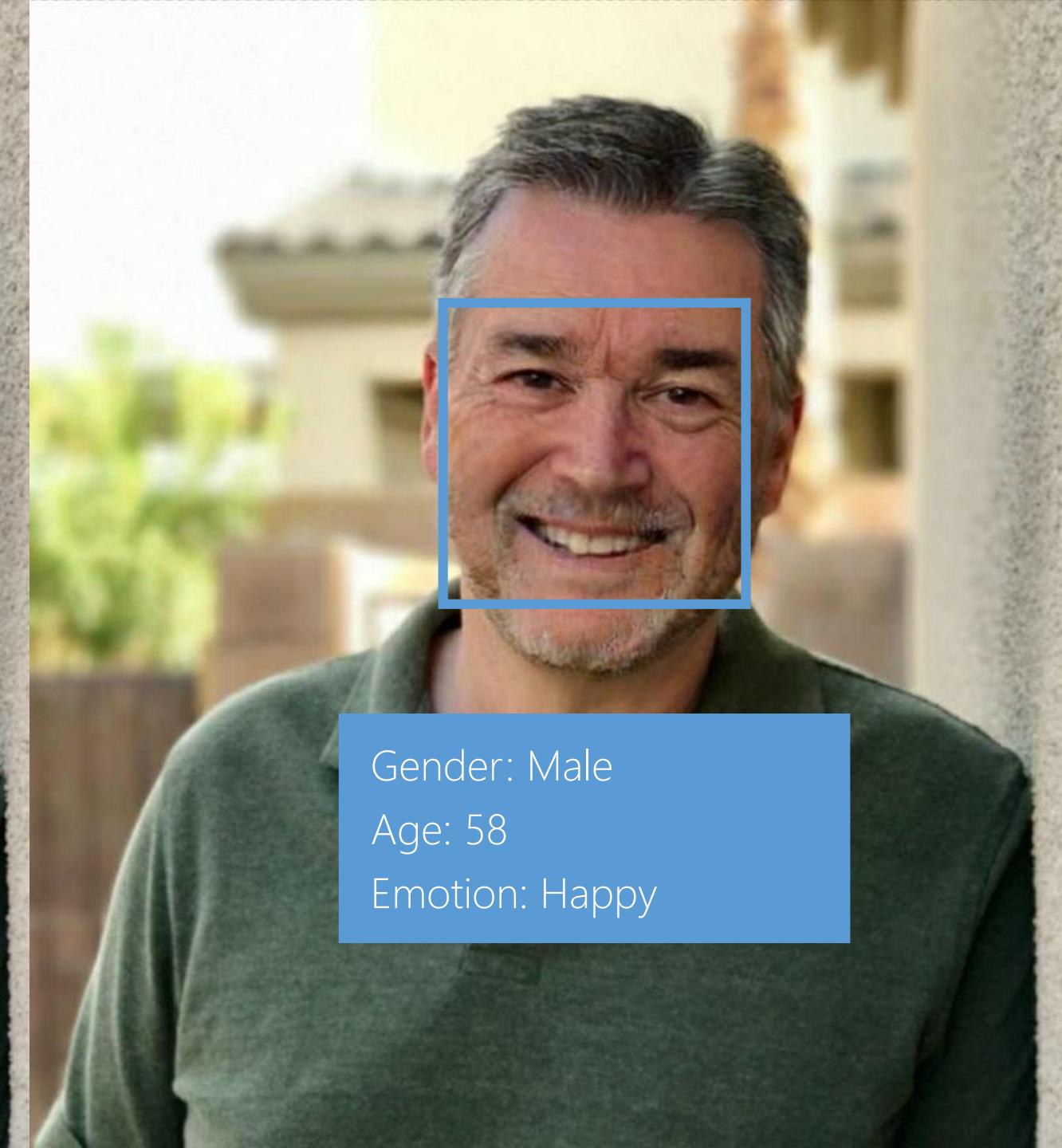


A skateboarder does a trick on a ramp.



A little girl in a pink hat is blowing bubbles.





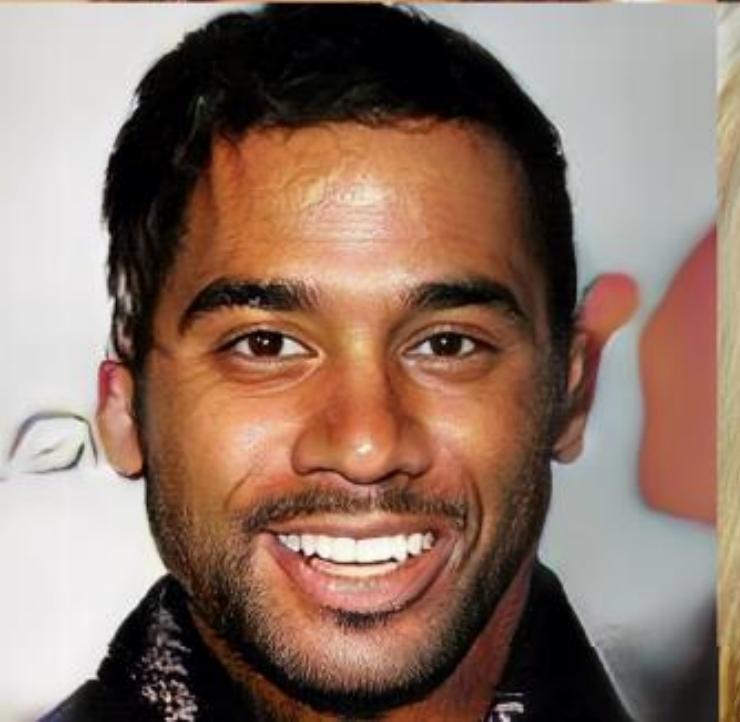
Gender: Male

Age: 58

Emotion: Happy



Source: Microsoft



Source: Nvidia

Text to Image with GANs

this small bird has a pink breast and crown, and black primaries and secondaries.



this magnificent fellow is almost all black with a red crest, and white cheek patch.



the flower has petals that are bright pinkish purple with white stigma



this white and yellow flower have thin white petals and a round yellow stamen



(Reed et al 2016)

(Goodfellow 2016)

Vector Space Arithmetic

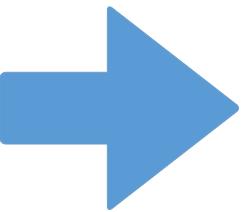
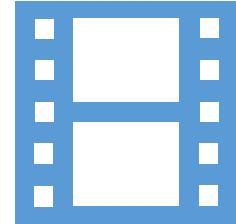
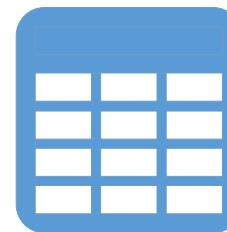
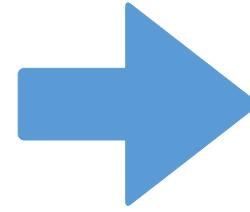


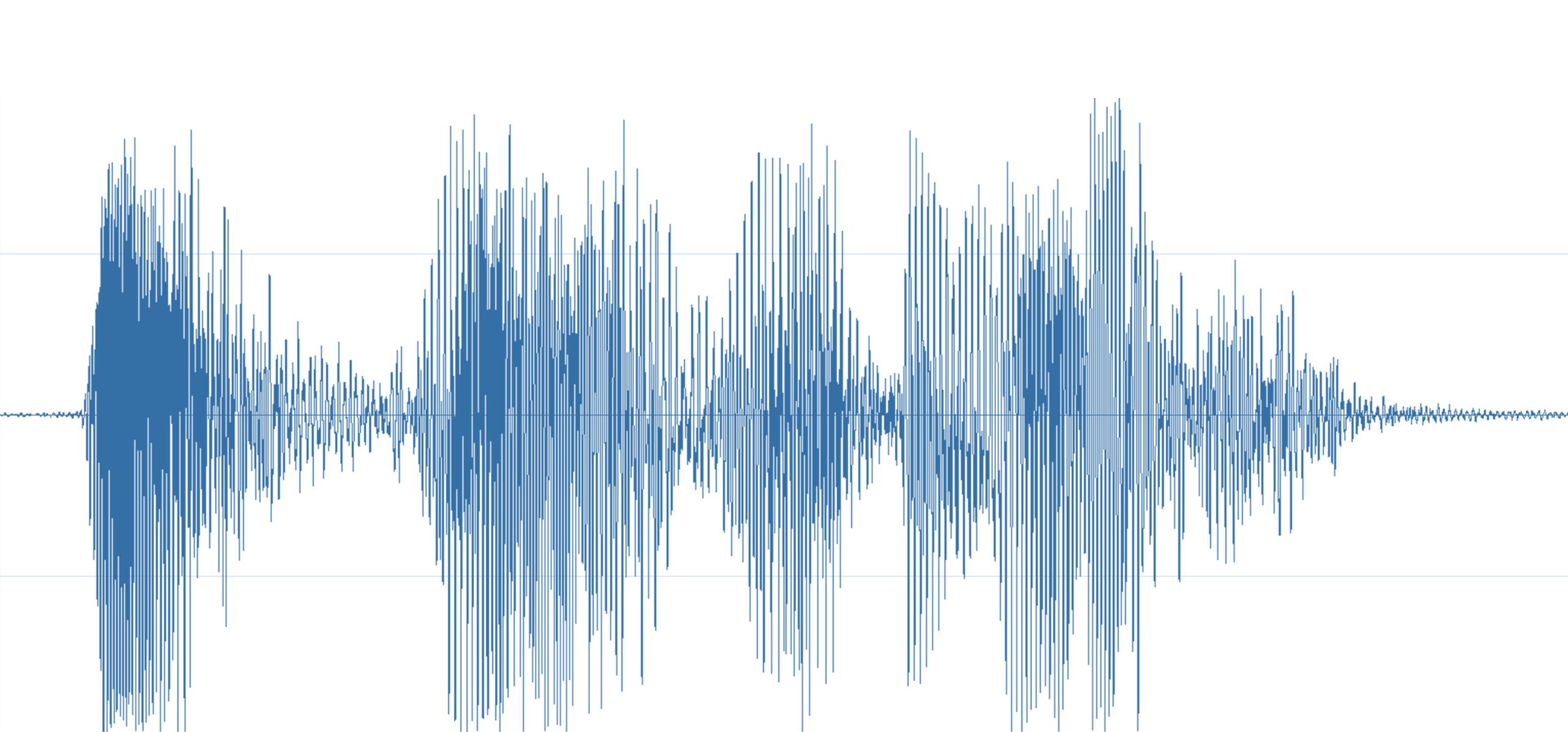
Man Man Woman
with glasses



Woman with Glasses

(Goodfellow 2016)

 $f(x)$ 

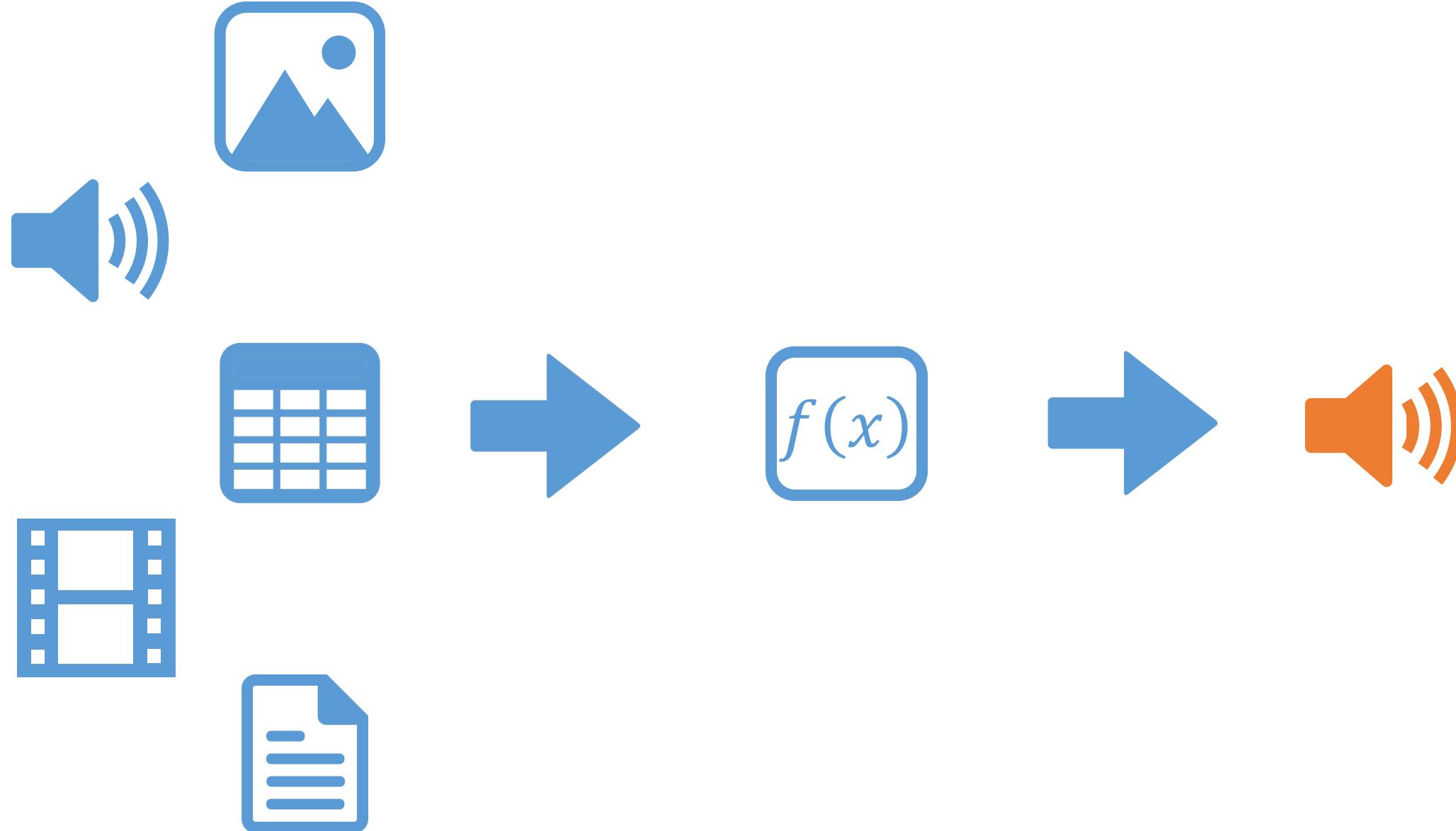


Hi

my name is

Matthew

Renze





Source: <https://deepmind.com/blog/wavenet-generative-model-raw-audio/>

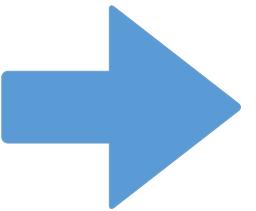
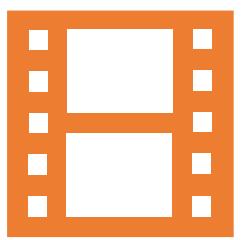
Open Project a0007 reset

0

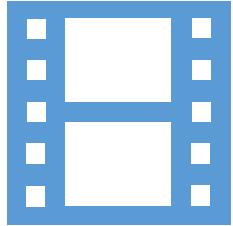
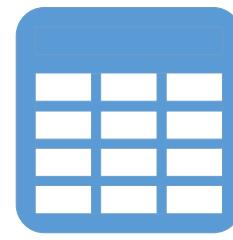
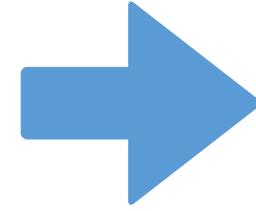
AND UR

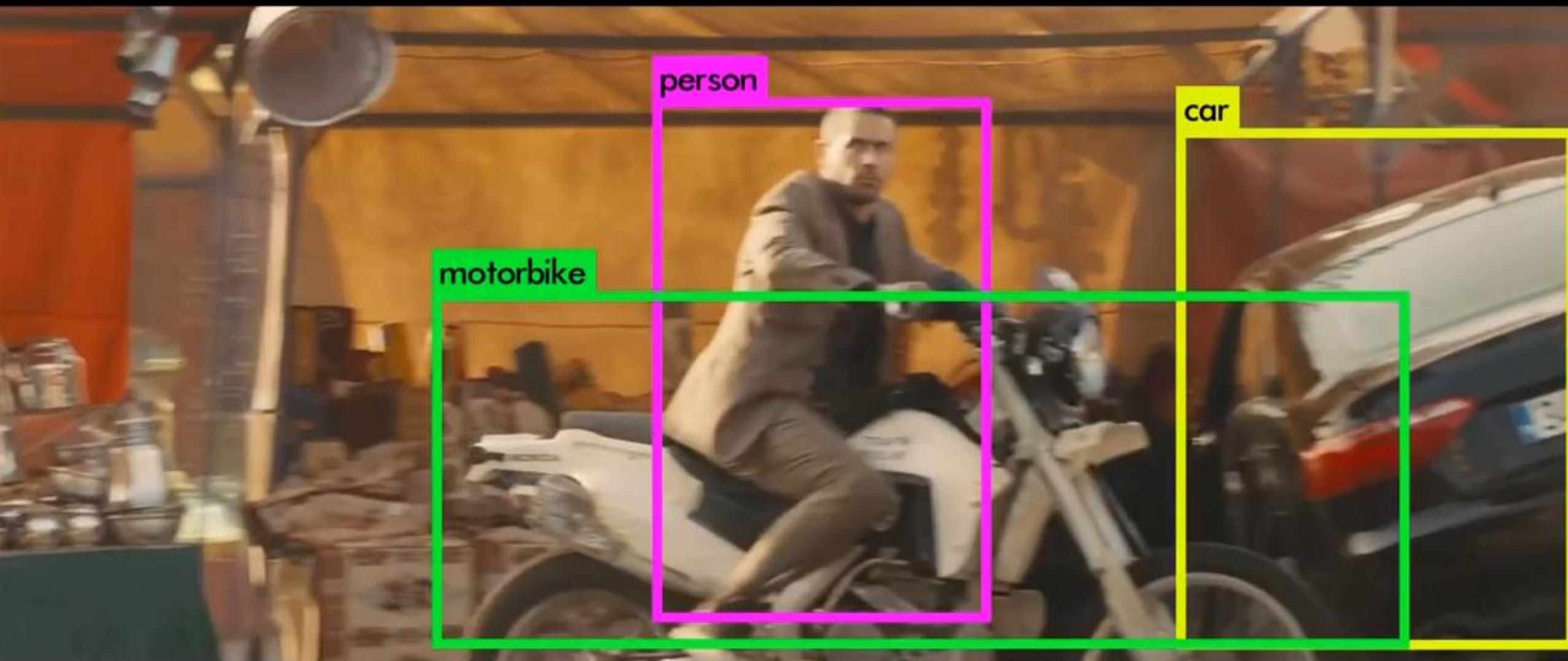
And ur I kissed my dogs and my wife

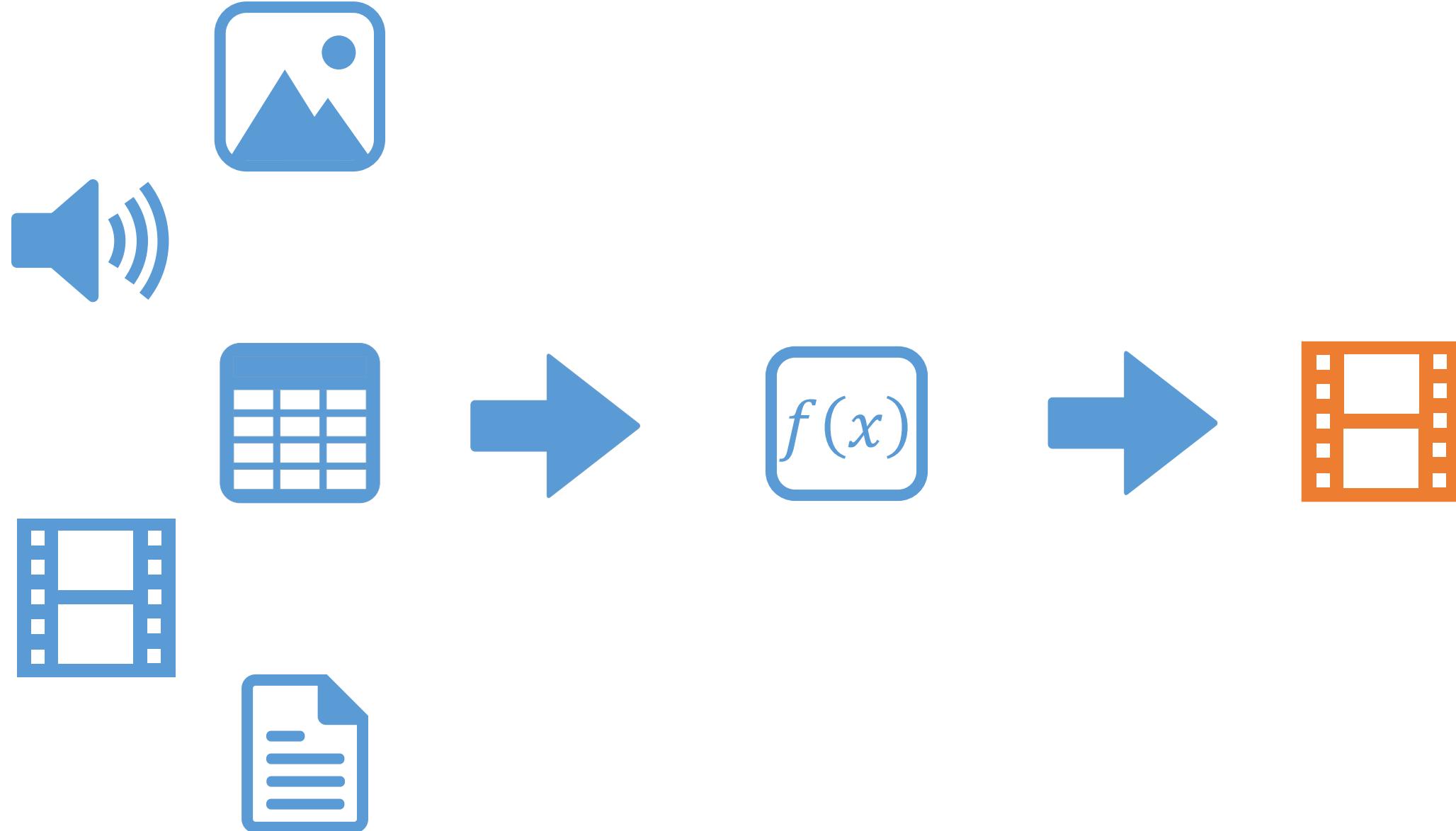
play WIFE



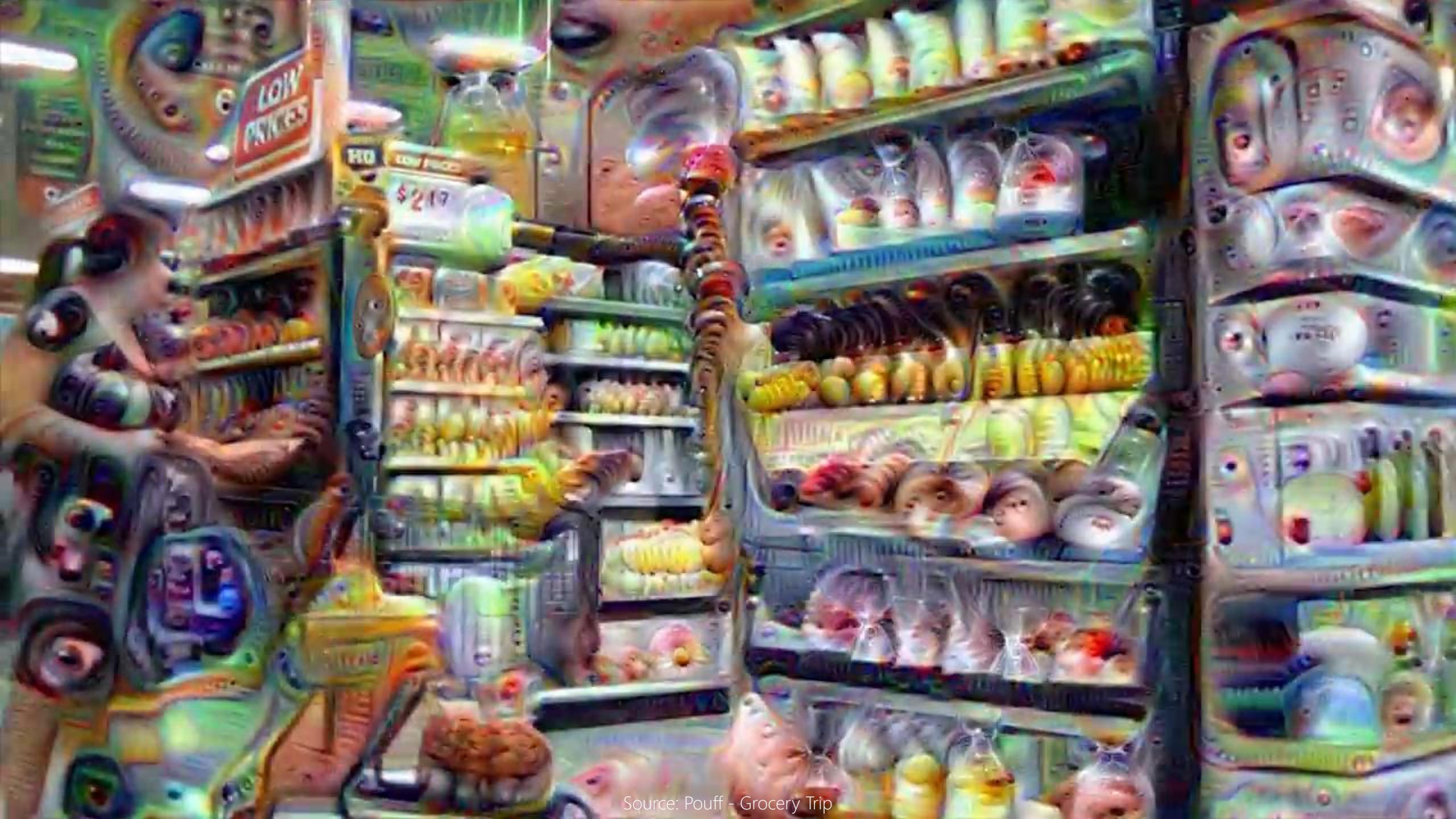
$$f(x)$$





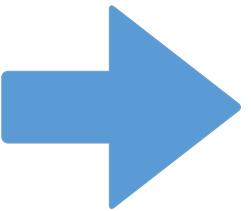




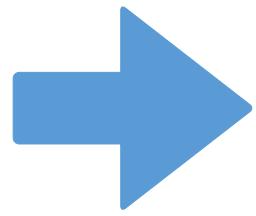


Source: Pouff - Grocery Trip

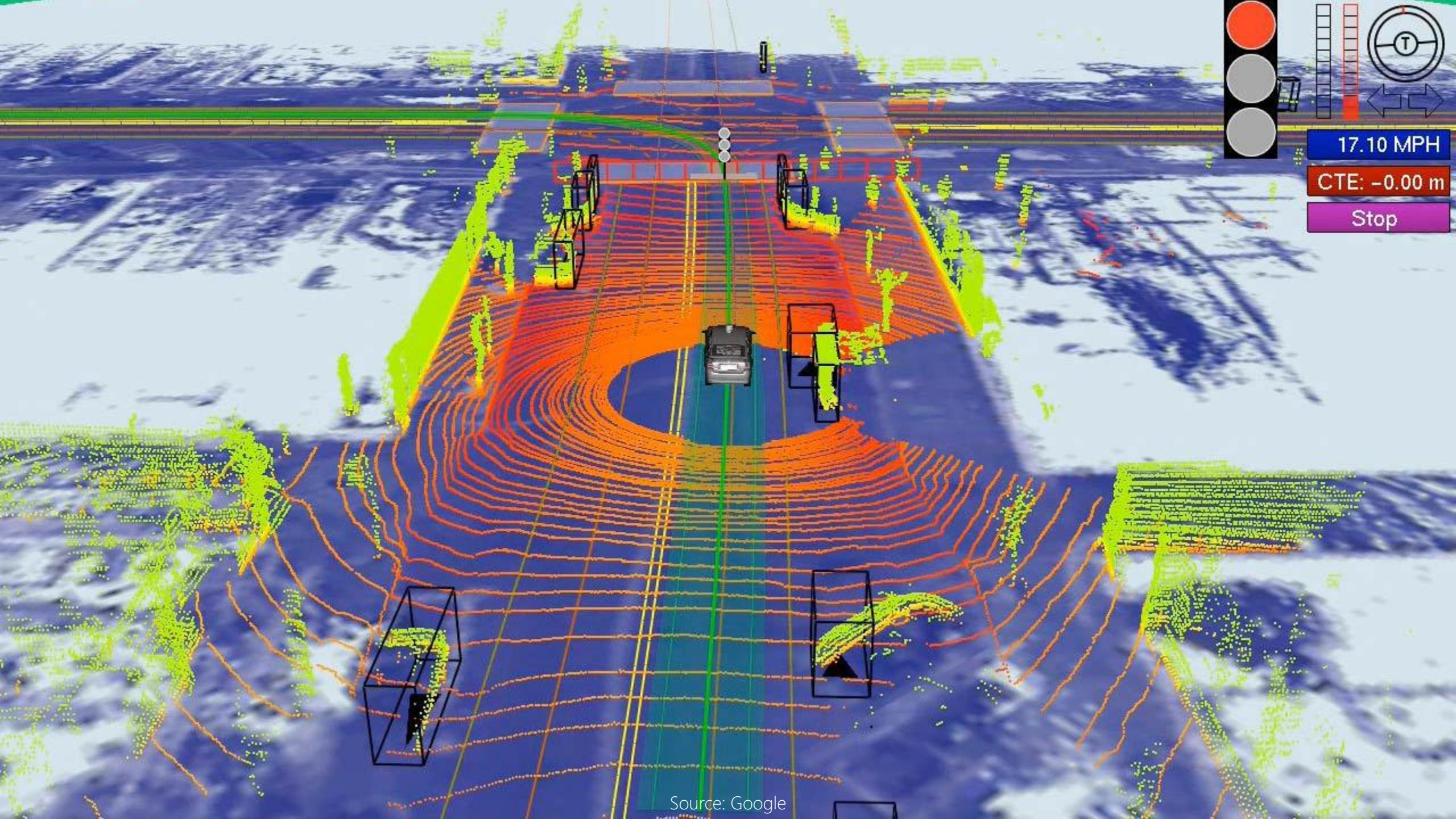
?



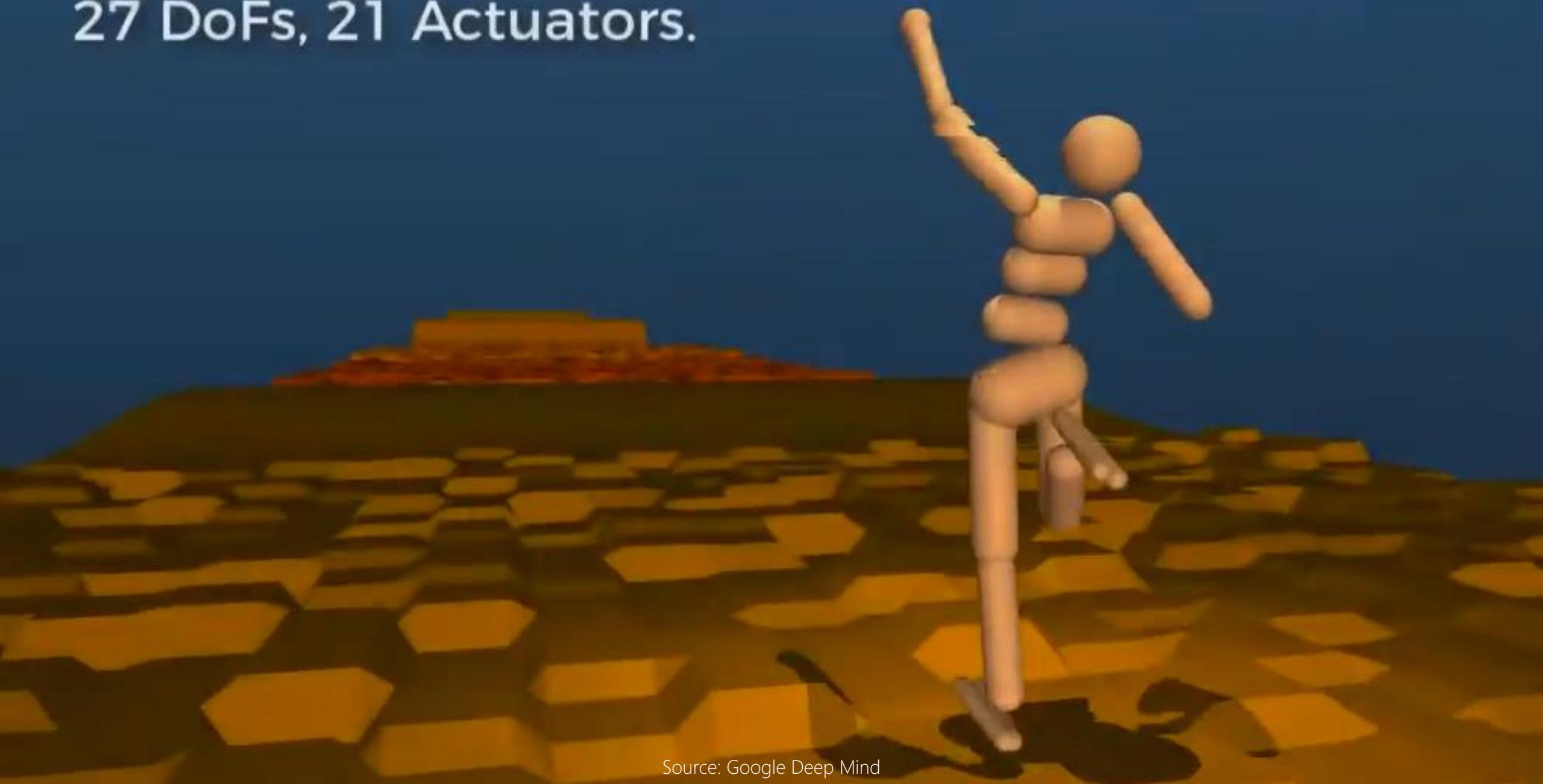
$f(x)$

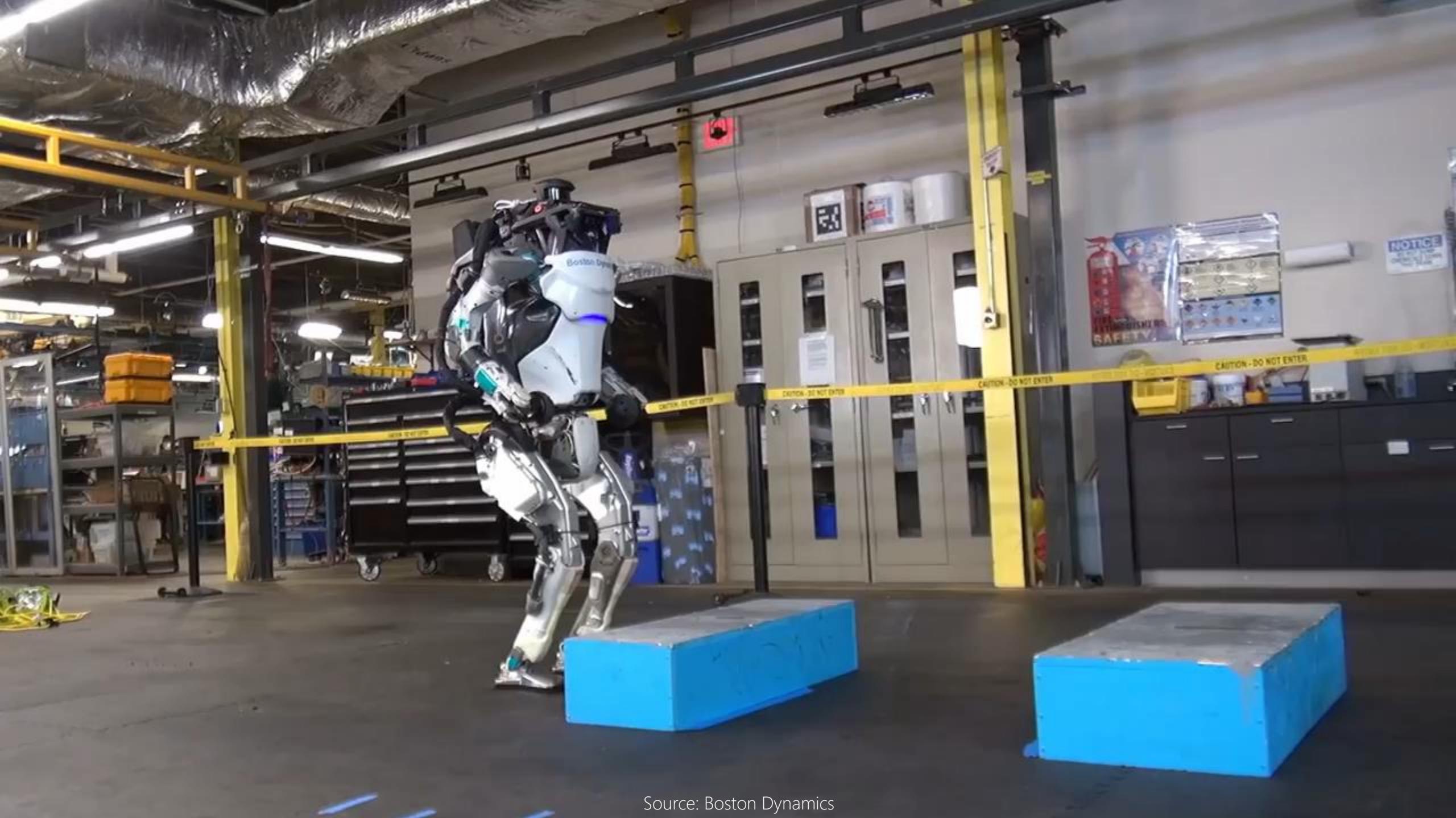


?



Humanoid:
27 DoFs, 21 Actuators.





Source: Boston Dynamics

FUN GAME

Dog or Mop?



DOG!



MOP!

CAUTION



CUIDADO



CAUTION



DOG!



MOP!

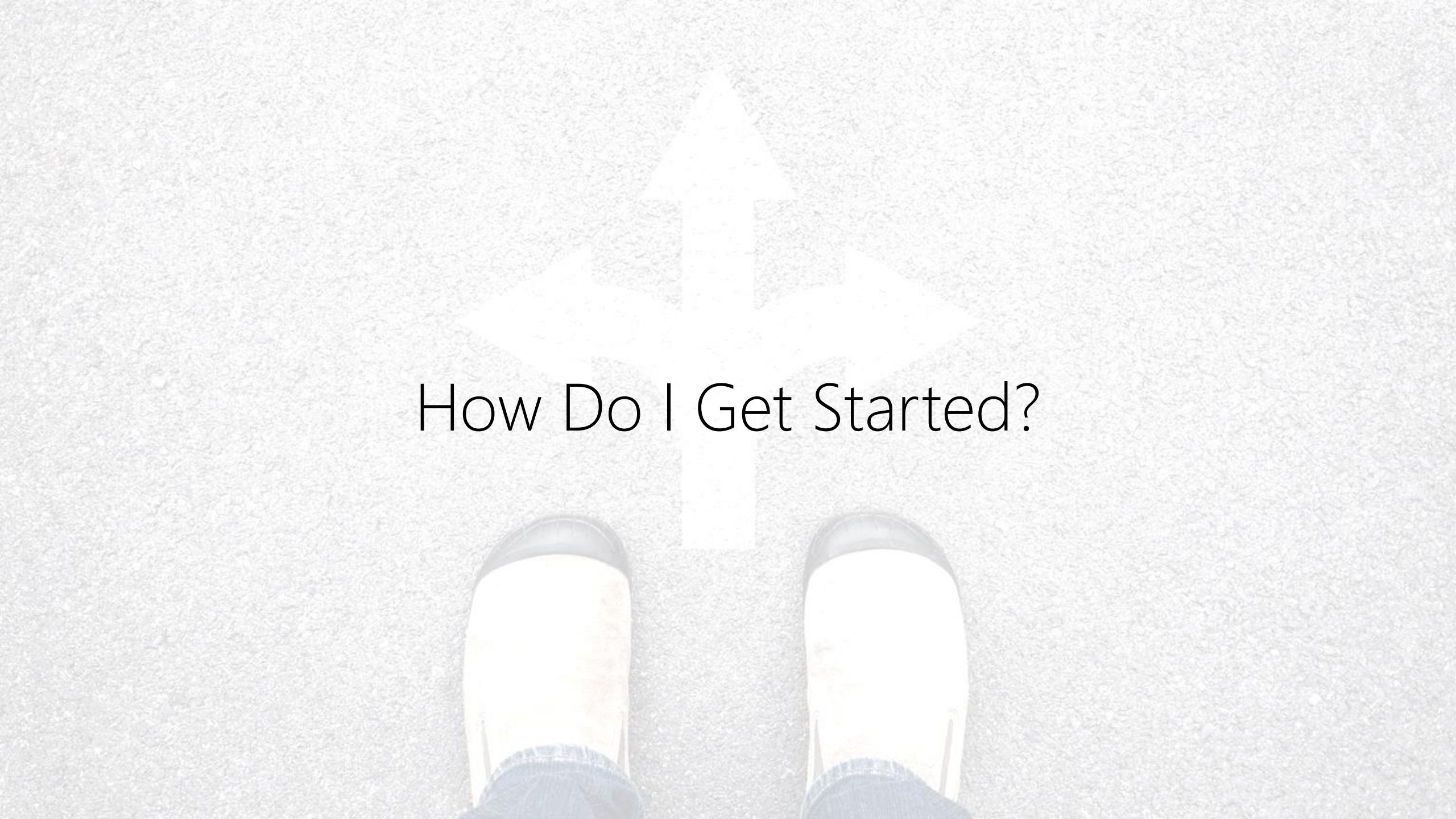
MOP!



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.

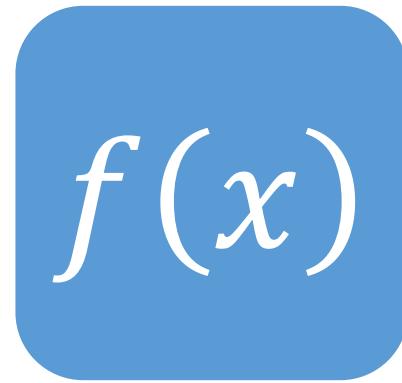
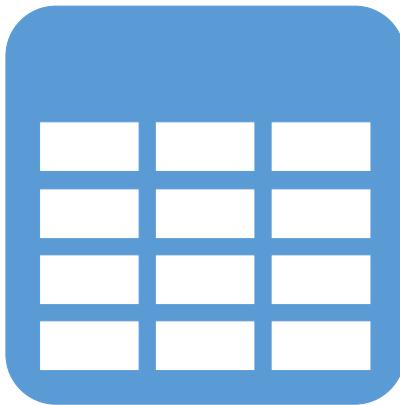
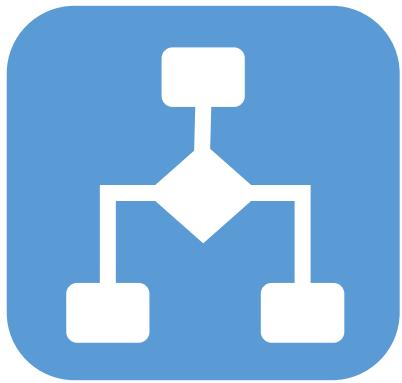
How Do I Get Started?



Option 1:

Deep Learning as a Service

Deep Learning as a Service



They provide

Deep Learning Services



Google
Cloud Platform



Microsoft
Cognitive Services



Pros/Cons

Pros

Simple

Quick

Inexpensive

Pros/Cons

Pros

Simple

Quick

Inexpensive

Cons

Narrow

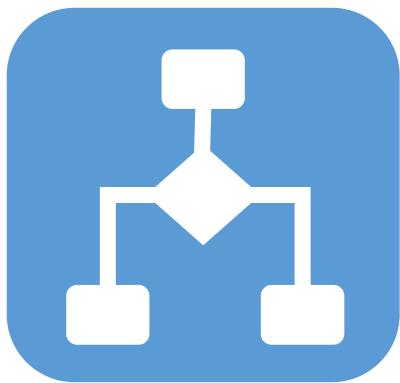
Remote

Pay-per-use

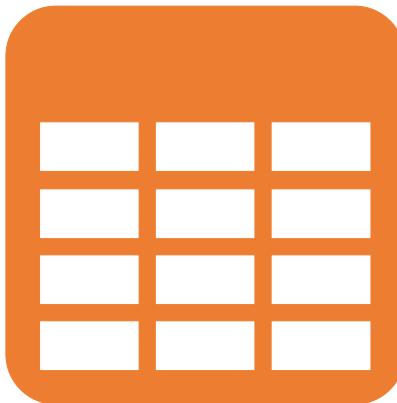
Option 2:

Deep Learning as a Platform

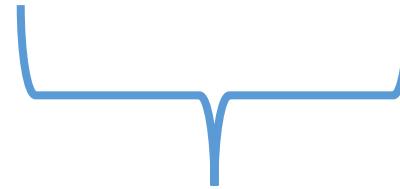
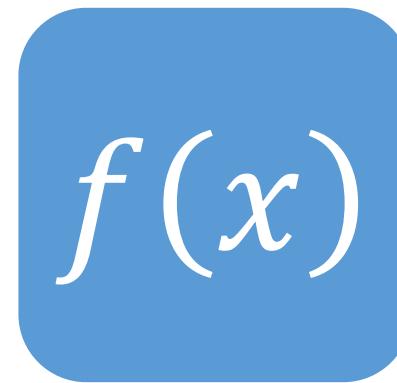
Deep Learning as a Platform



They provide



You provide



They host

Deep Learning Platforms



Pros/Cons

Pros

Simple

Quick

Inexpensive

Pros/Cons

Pros

Simple

Quick

Inexpensive

Cons

Training

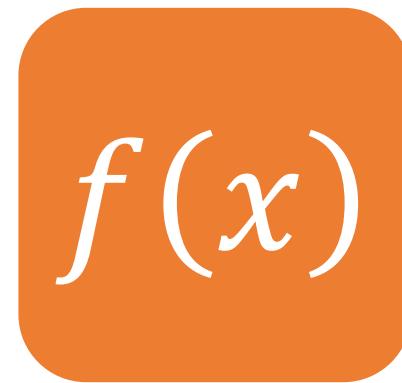
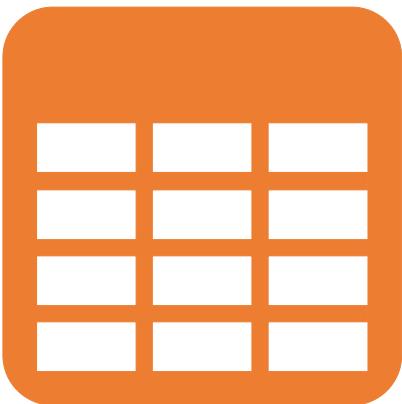
Remote

Pay-per-use

Option 3

Do It Yourself

Do It Yourself

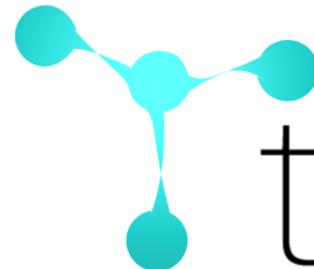


You provide

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 Option 1 for narrow use cases

Recommendations

Use Option 1 for narrow use cases

Use Option 2 for custom use cases

Recommendations

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



Where to Go Next

Where to Go Next

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

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

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

Pluralsight Courses

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.

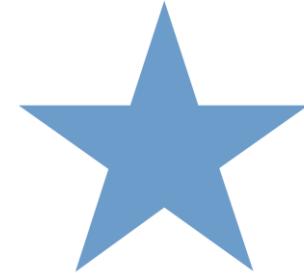


Matthew is a data science consultant, author for [Pluralsight](#), international public speaker, a [Microsoft MVP](#), [ASPIInsider](#), and open-source software contributor.

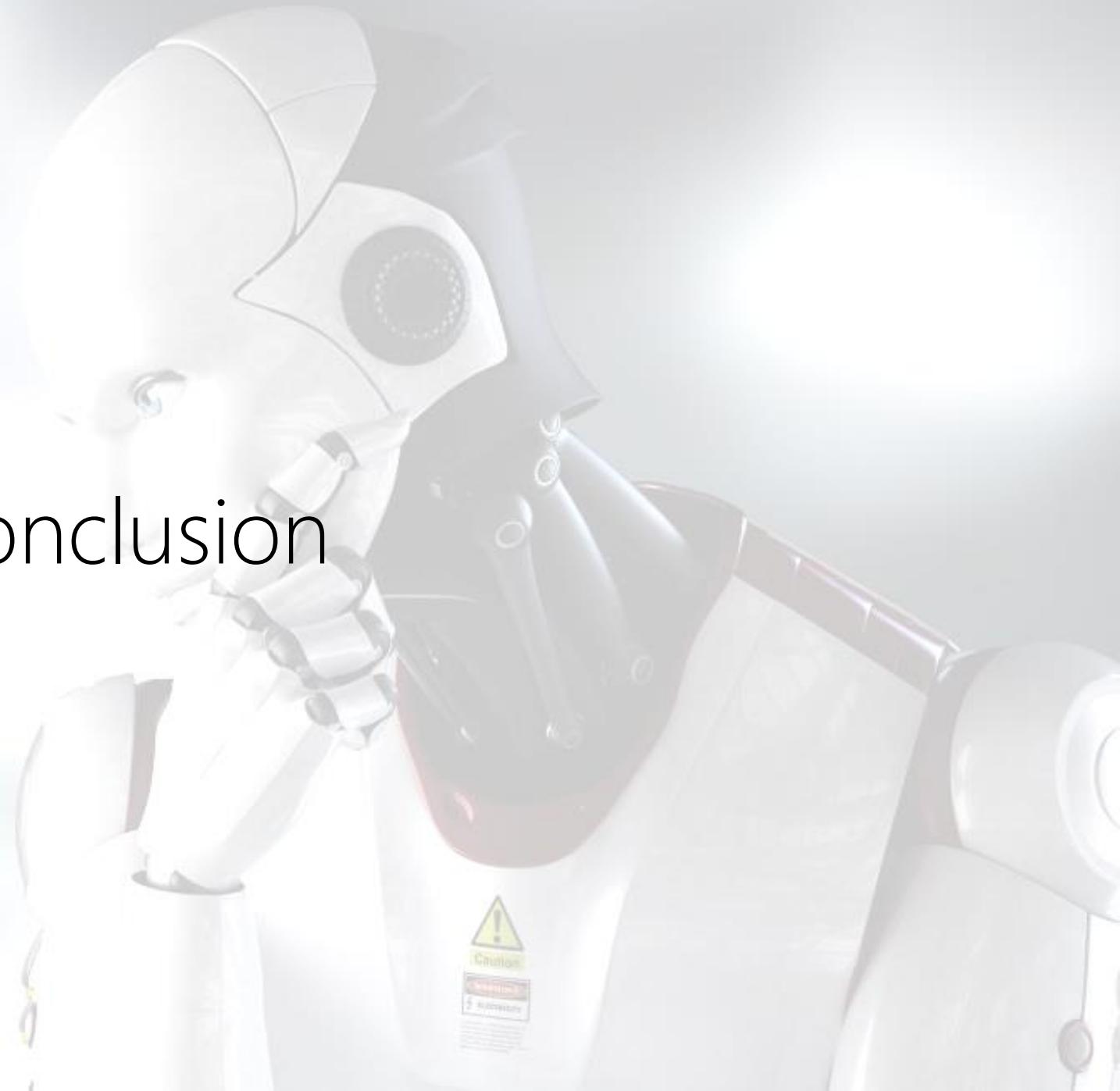
2017-08-14 - Dev on Fire Interview

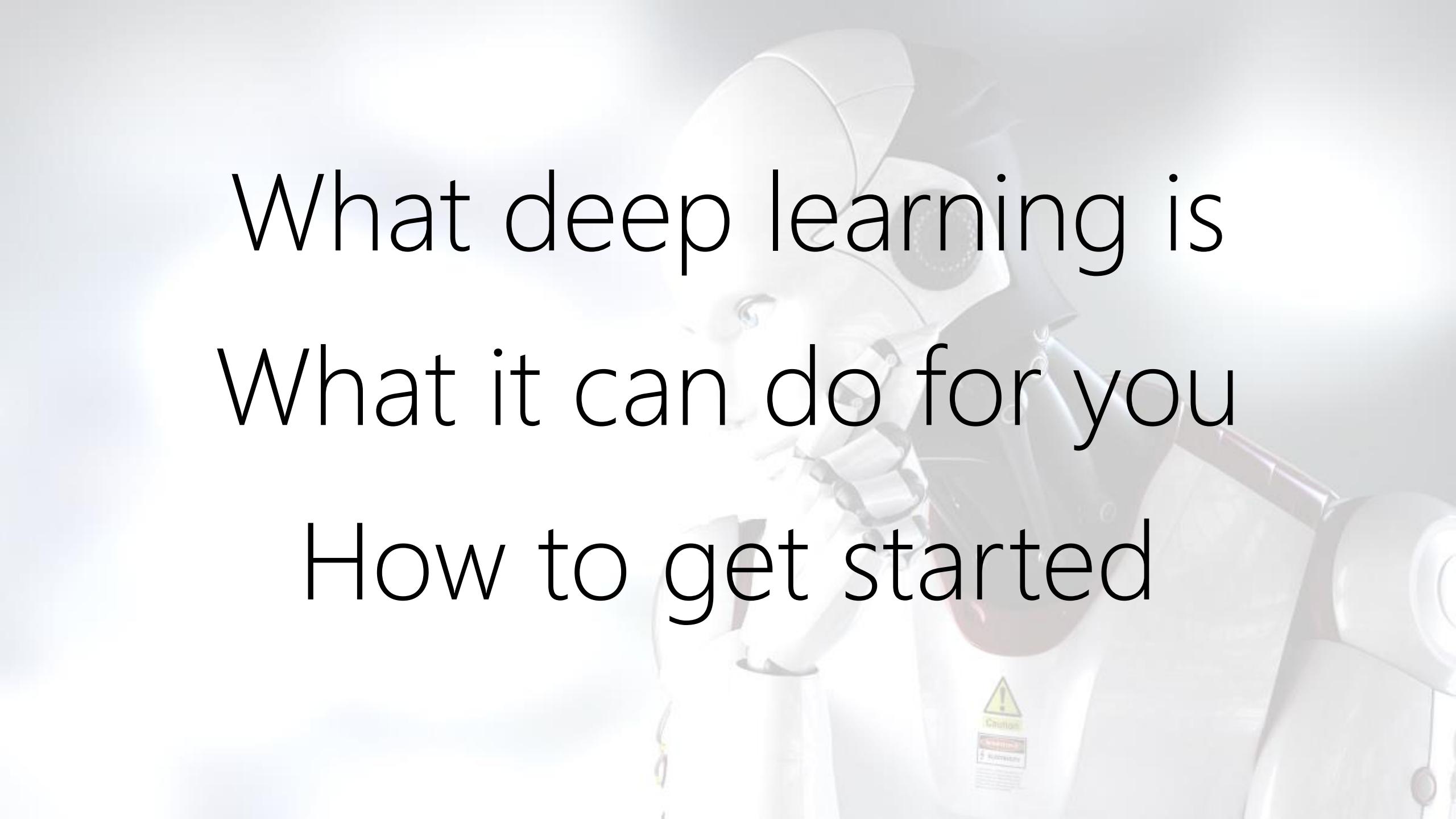
Feedback

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

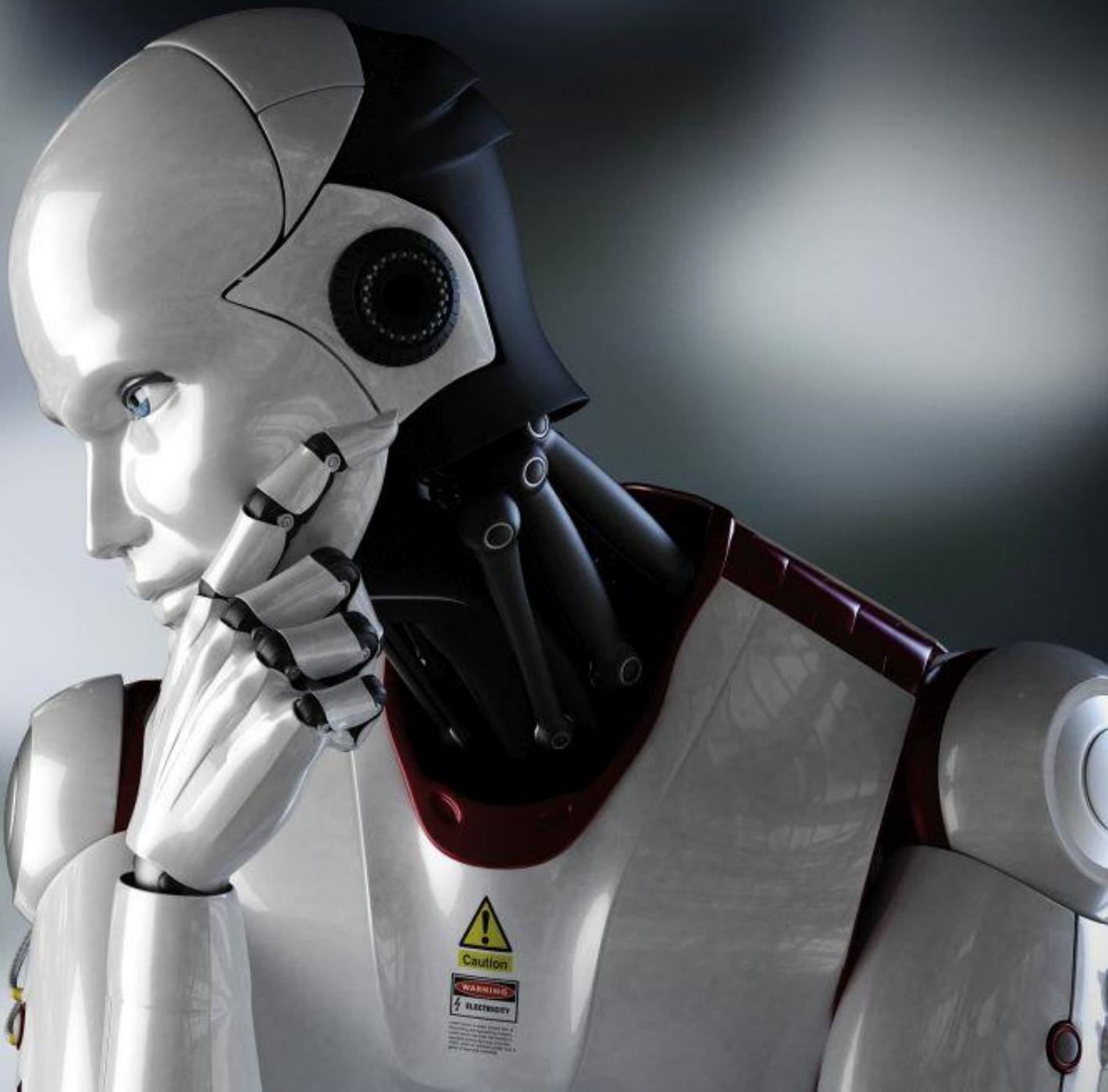


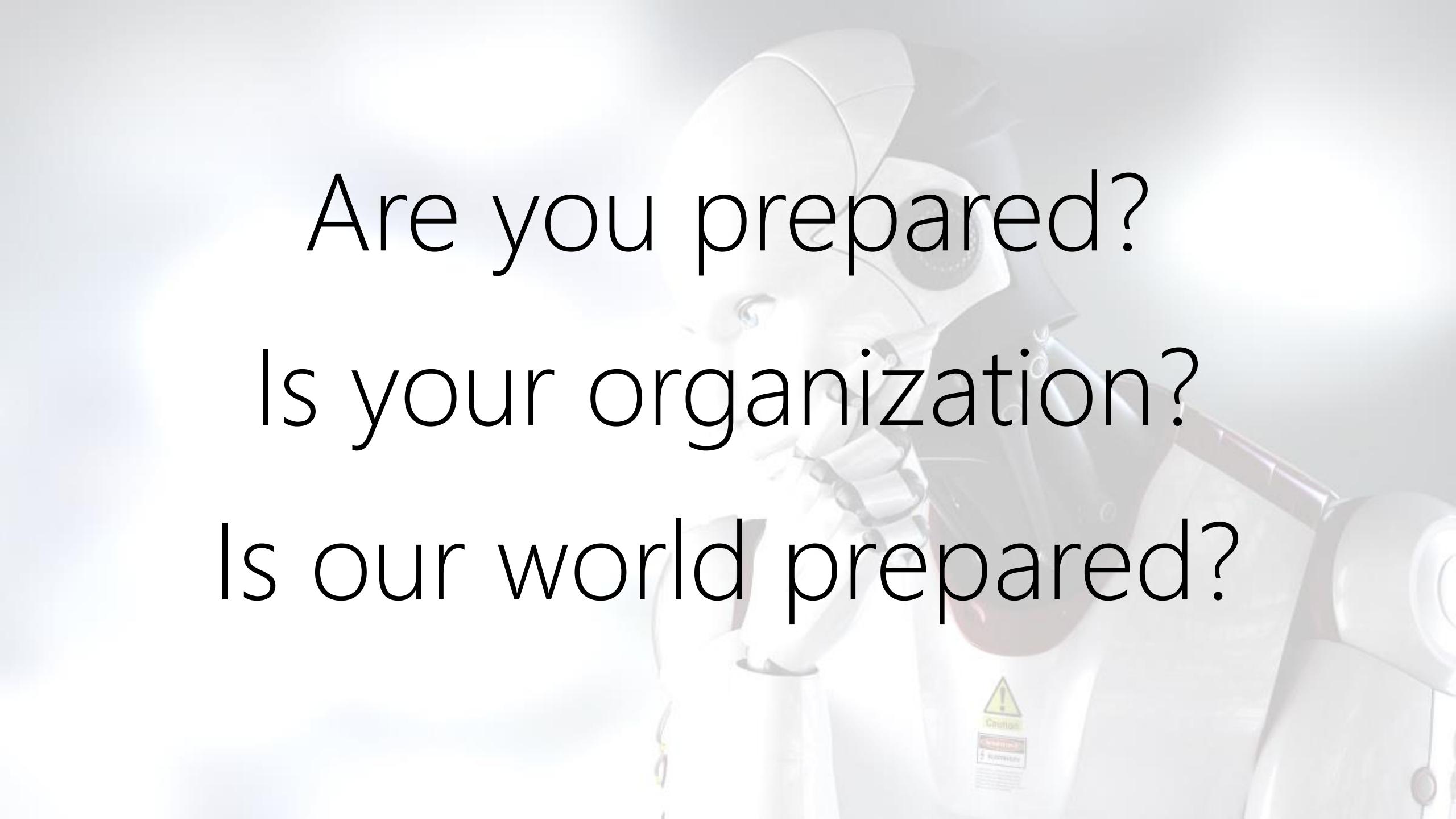
Conclusion





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 appears to be performing maintenance or cleaning. The background is a plain, light color.

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

