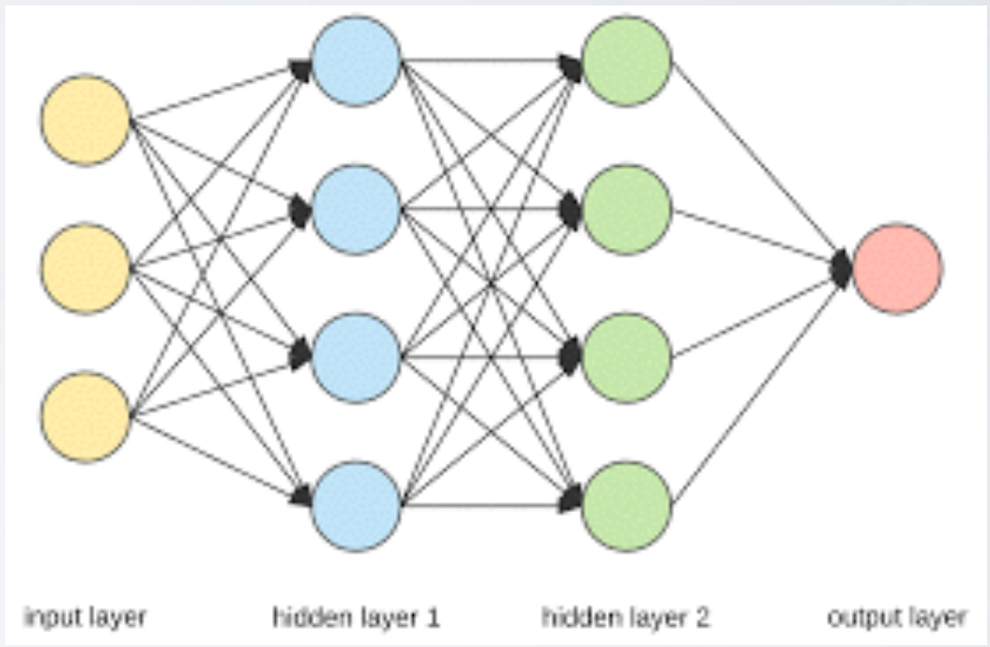
MACHINE LEARNING

THINGS I WANT YOU TO KNOW

- machine learning is just math
- neural nets are just math
- there are different types of neural net architectures and they generally do different things
- there are many ways to practice ML



ARTIFICIAL INTELLIGENCE (AI)

MACHINE LEARNING

WHAT IS MACHINE LEARNING USED FOR?

WHAT IS MACHINE LEARNING USED FOR?

speech recognition
computer vision, image recognition
language translation
detecting fraud
parsing language and text
search engines
games
optimizing systems (hospitals)
so many other things

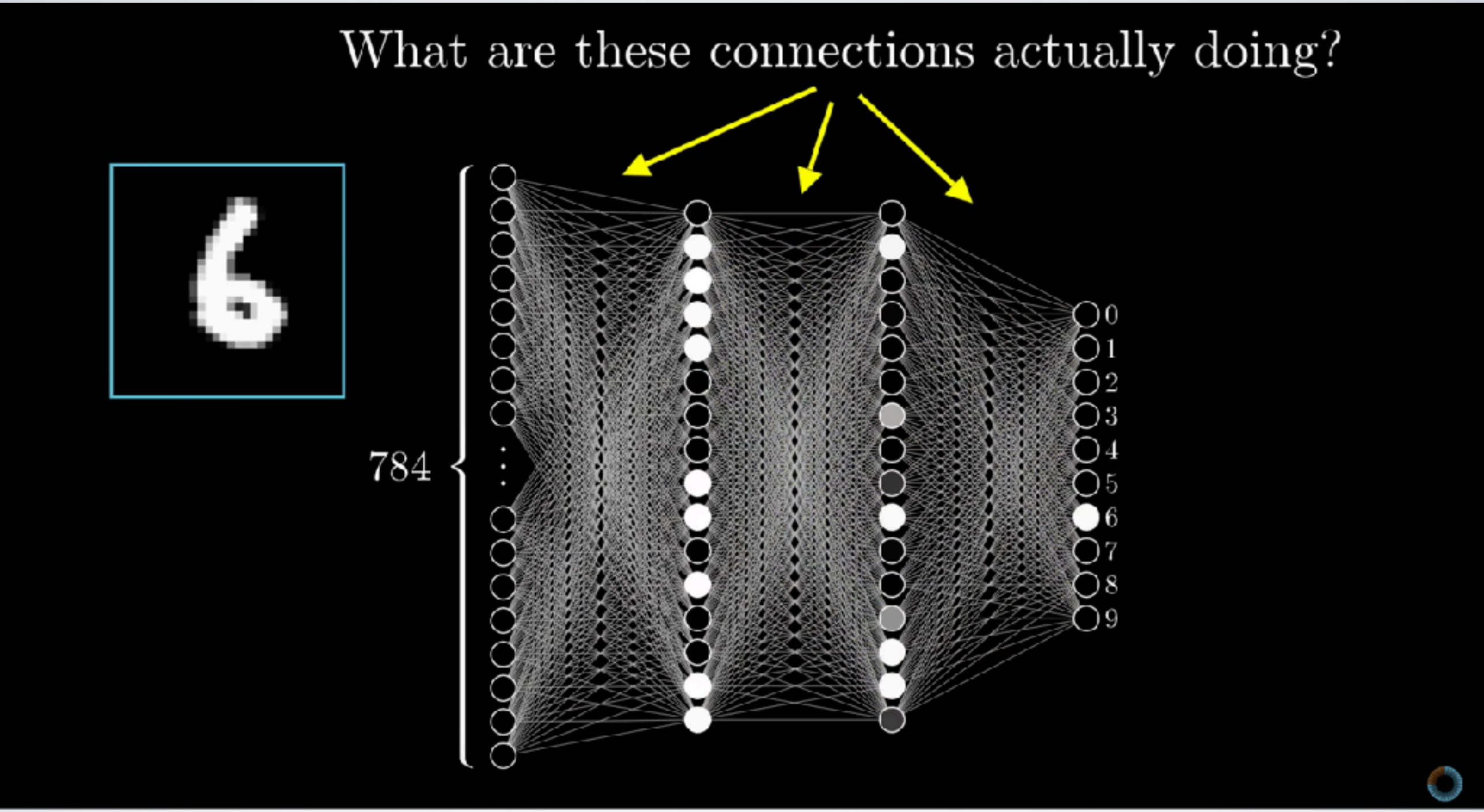
“Regular” Programming:

Input + Function = Output

Machine Learning:

Input + Output = Function

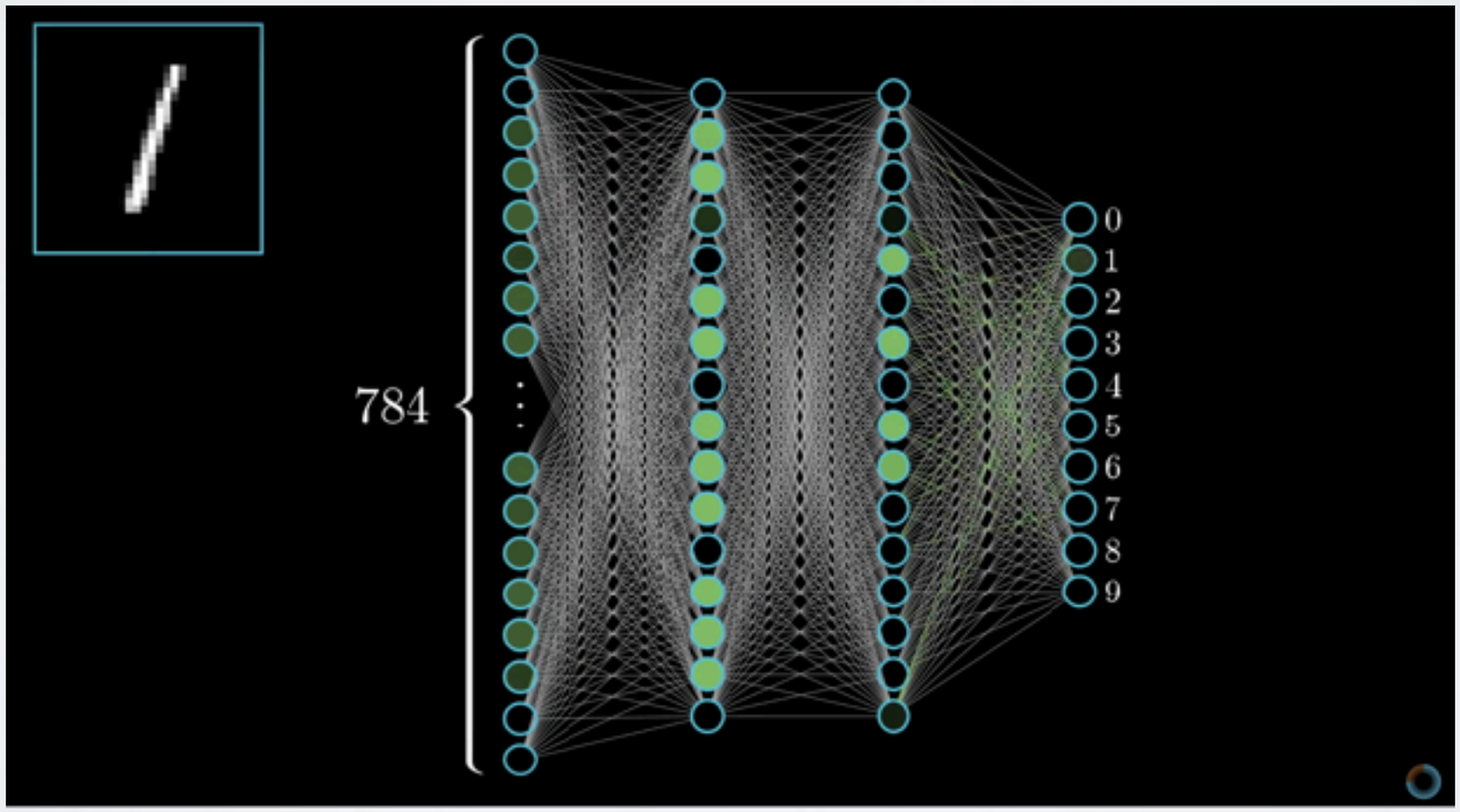
NEURAL NETWORK



https://www.youtube.com/watch?v=aircAruvnKk

IT'S OKAY IF
YOU DON'T UNDERSTAND
EVERYTHING YET

1. feed in features (“variables”)
2. assign a weight to each feature (initialized randomly)
3. you pass them all to the hidden layers
4. the hidden layers outputs are (usually) wrapped in an activation function (which squishes the data to some range)
5. the final layer outputs guesses
6. we compare those guesses to the actual labels with a cost function (often just mean squared error)



this is called a ‘forward pass’

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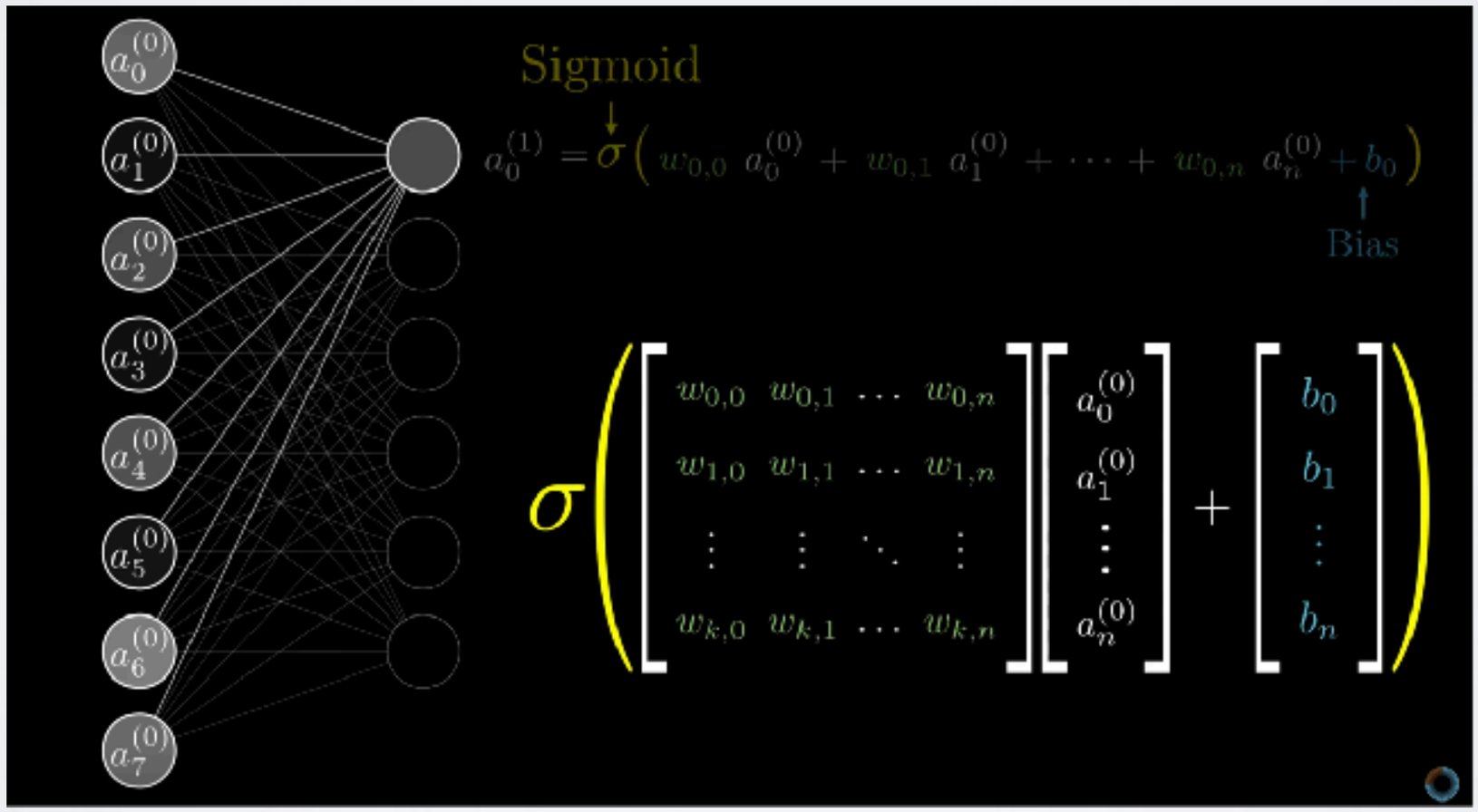

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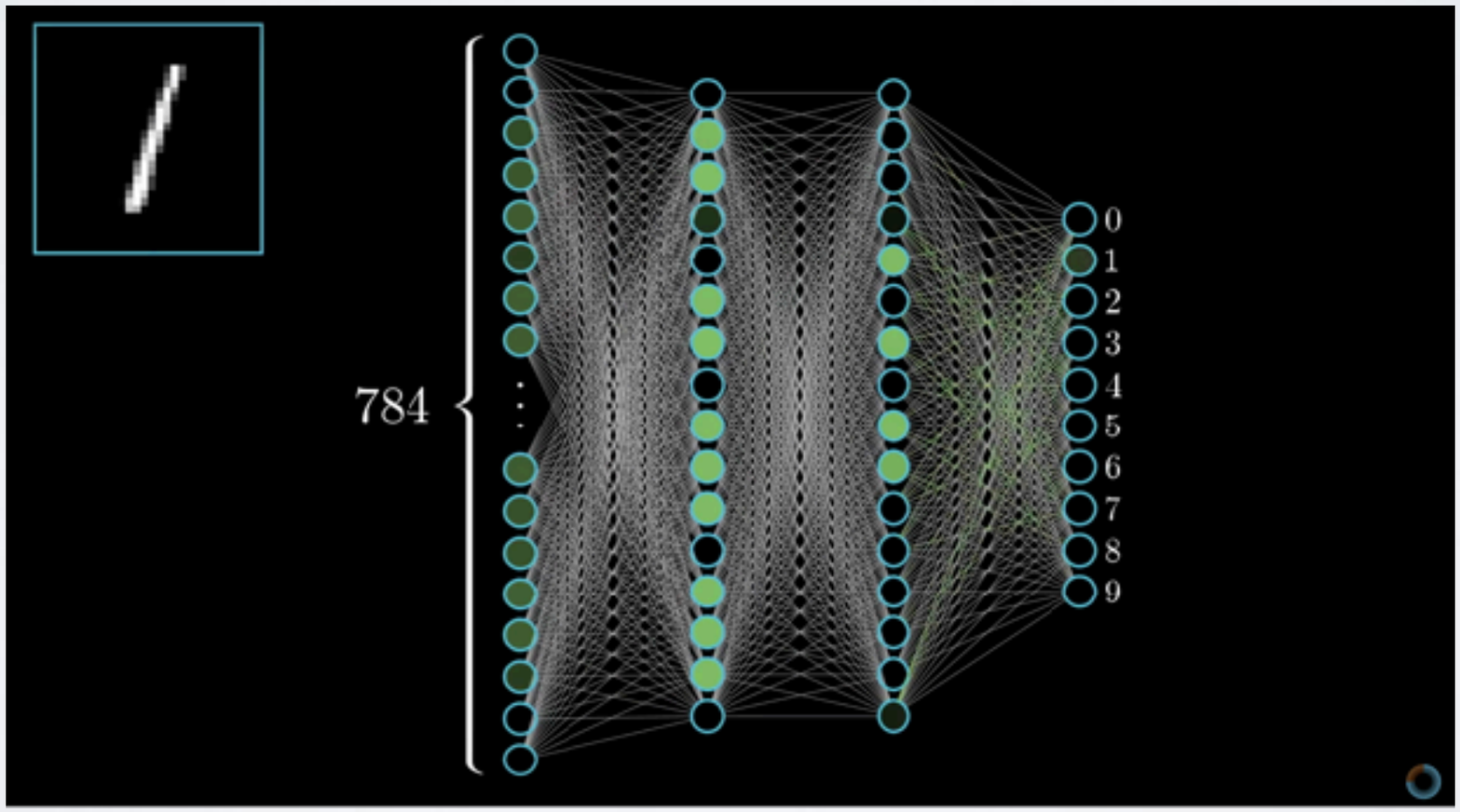
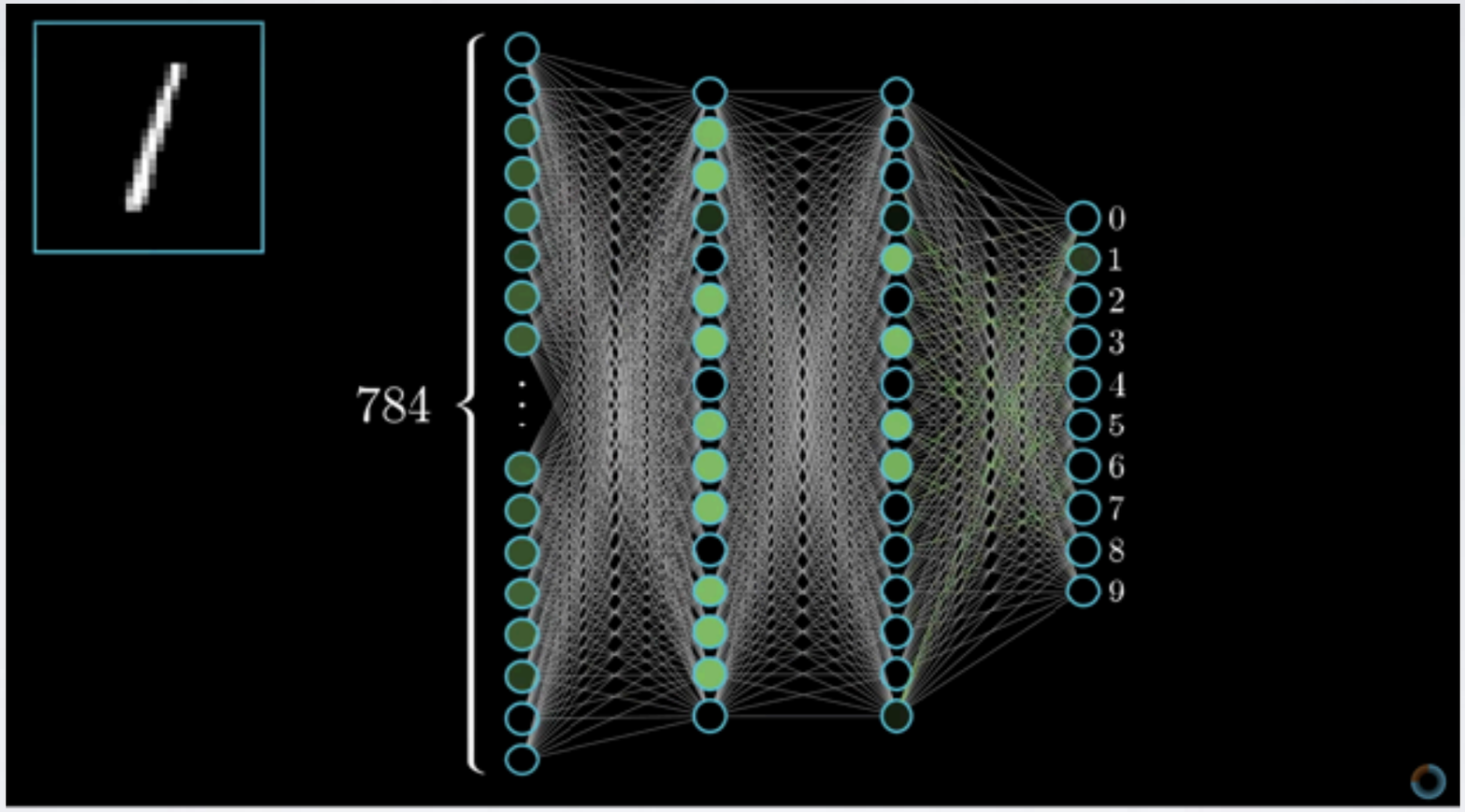


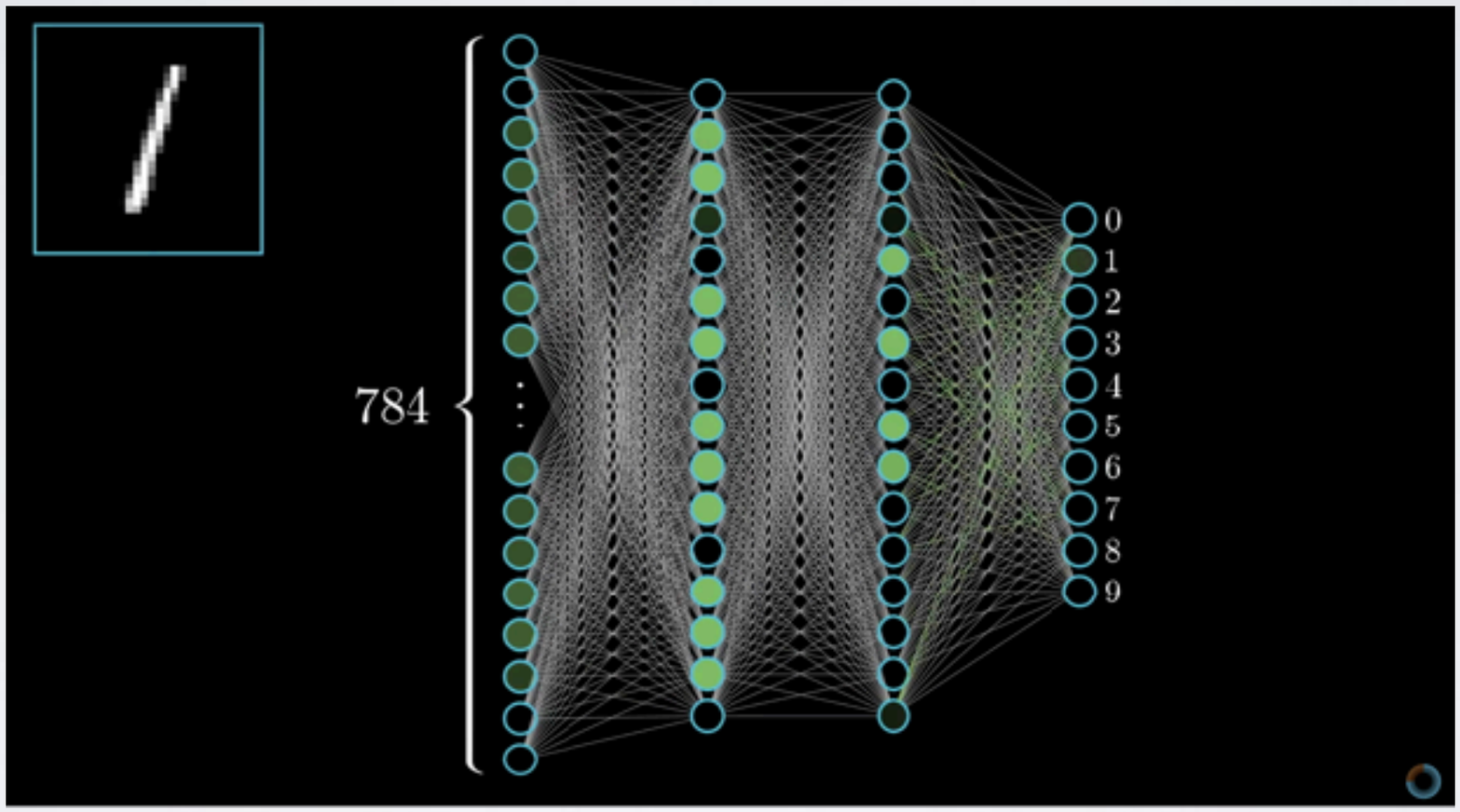
this is called a ‘forward pass’

what comes after the forward pass?



backpropagation
(the ‘backward pass’)

backpropagation



updates the weights and biases
once it knows the right answer
THIS IS HOW THE NEURAL NET "LEARNS"

GOOD NEWS:

frameworks do a lot of this work for you

PYTORCH

TENSORFLOW

KERAS

SCIKIT-LEARN

!! ML5.JS !!

MACHINE LEARNING

VS.

DEEP MACHINE LEARNING

ARTIFICIAL INTELLIGENCE (AI)

↓

MACHINE LEARNING

↓

DEEP MACHINE LEARNING

ARTIFICIAL INTELLIGENCE (AI)

↓

MACHINE LEARNING

↓

DEEP MACHINE LEARNING

ARTIFICIAL INTELLIGENCE (AI)

↓

MACHINE LEARNING

↓

DEEP MACHINE LEARNING

non-neural network machine learning algorithms

K-NEAREST NEIGHBORS
DECISION TREES
NAIVE BAYES

A NON-NEURAL NETWORK ML ALGORITHM: DECISION TREES

http://www.r2d3.us/visual-intro-to-machine-learning-part-1/

TYPES OF MACHINE LEARNING

SUPERVISED LEARNING

UNSUPERVISED LEARNING

REINFORCEMENT LEARNING

SUPERVISED LEARNING

SUPERVISED LEARNING

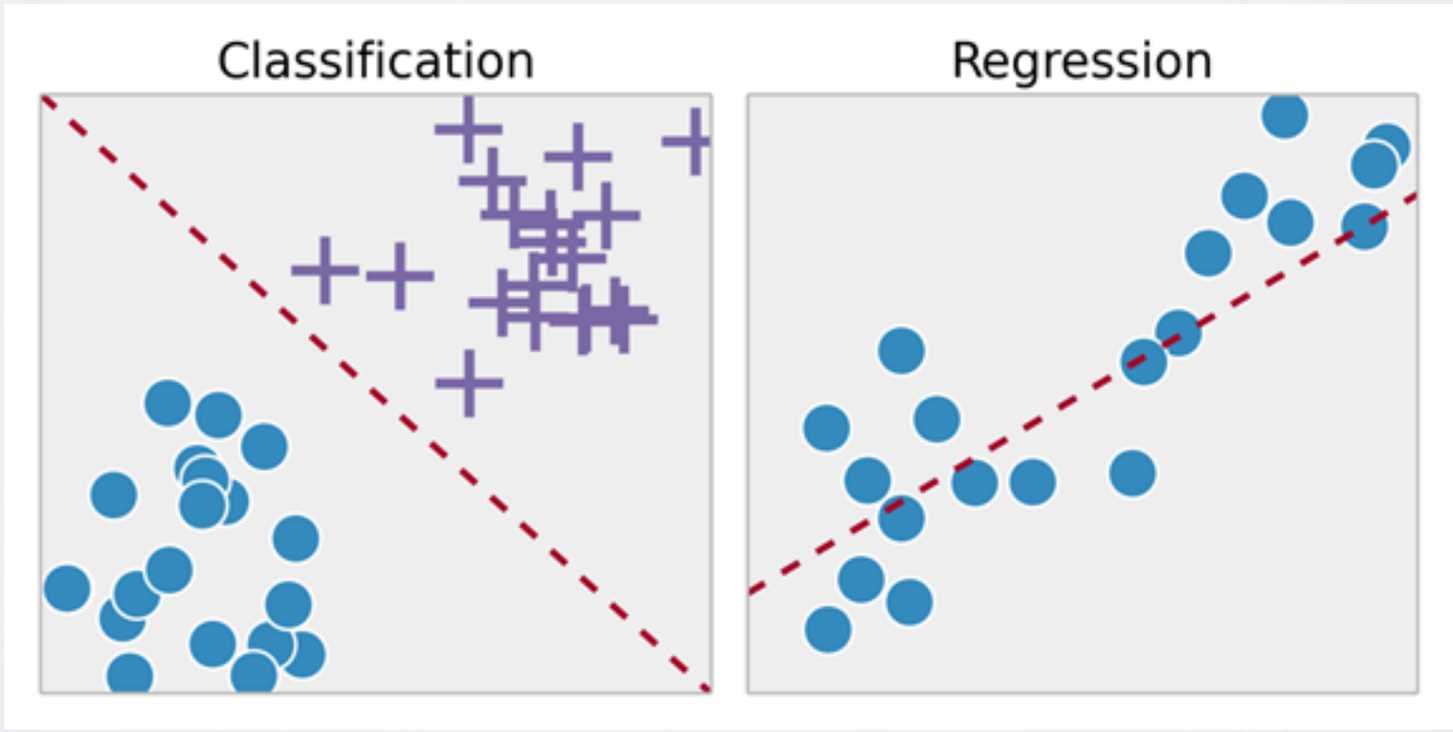
CLASSIFICATION

REGRESSION

SUPERVISED LEARNING

CLASSIFICATION

REGRESSION



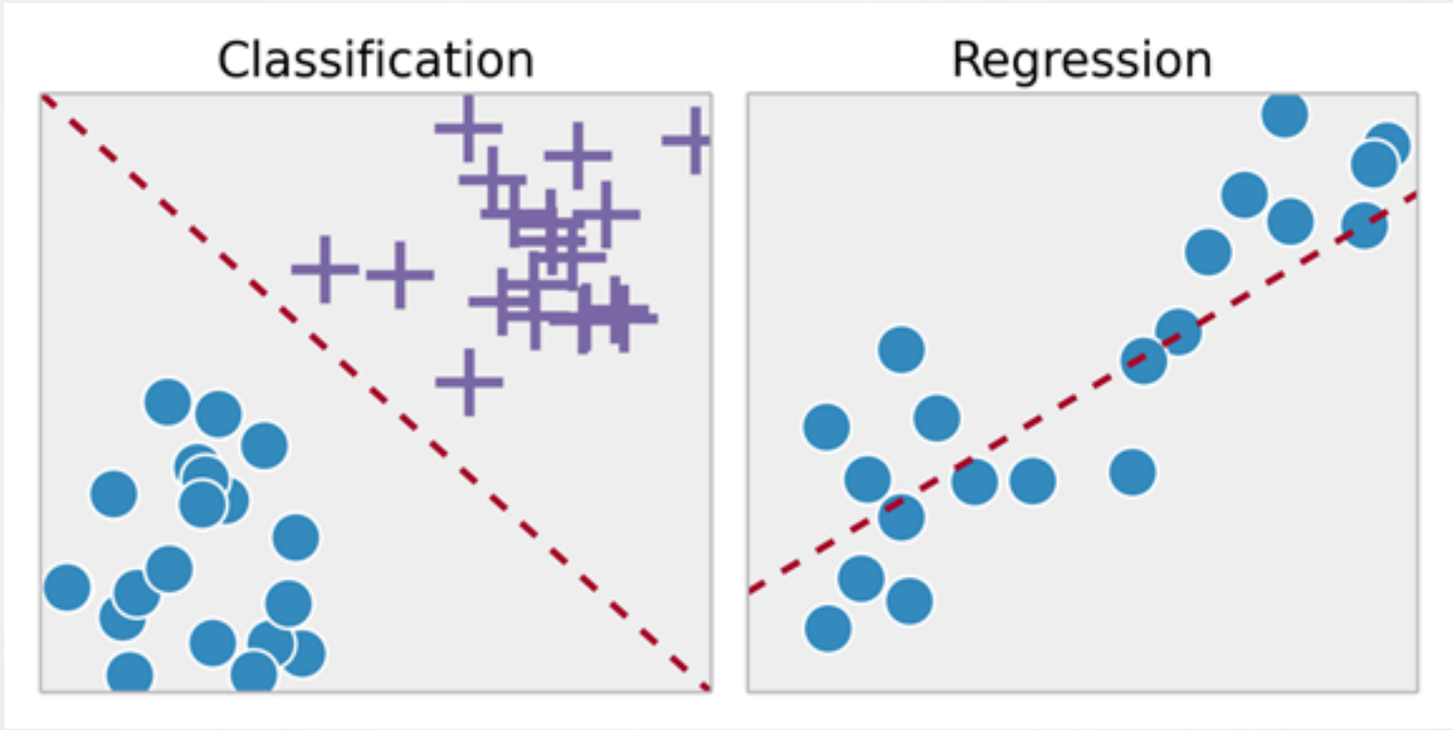
SUPERVISED LEARNING

CLASSIFICATION

what kind of cat do you have?

REGRESSION

how many seconds will your cat let you pet him?



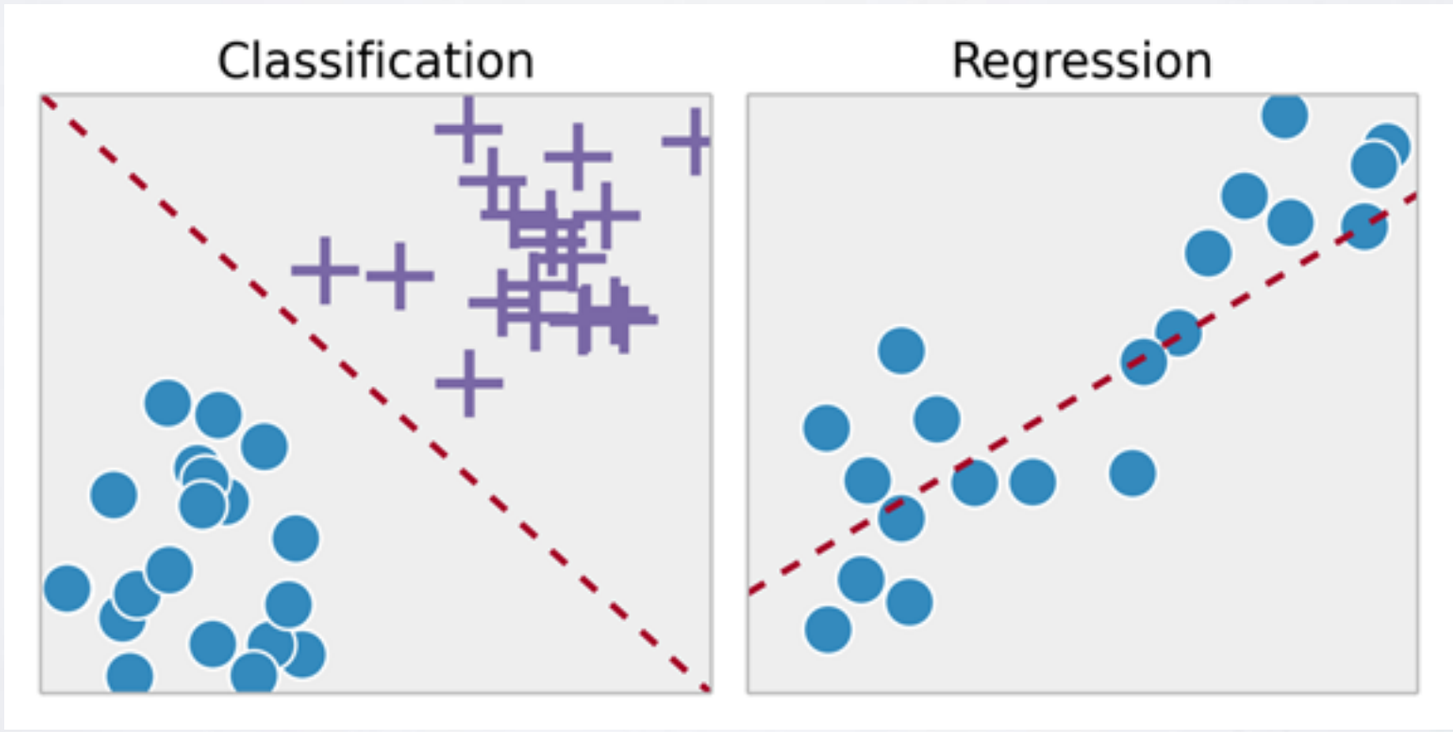
SUPERVISED LEARNING

CLASSIFICATION

will I rent this apartment?

REGRESSION

how much should this apartment's rent be?

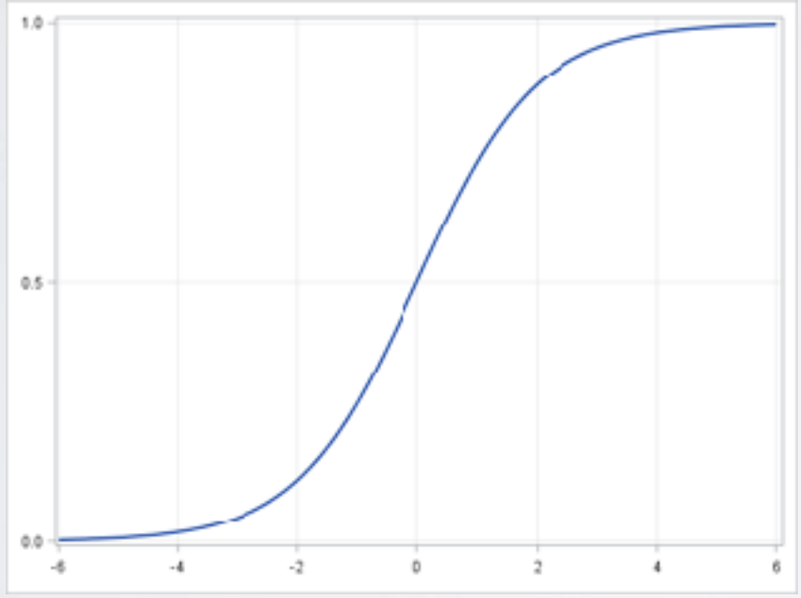


SUPERVISED LEARNING

CLASSIFICATION

↓

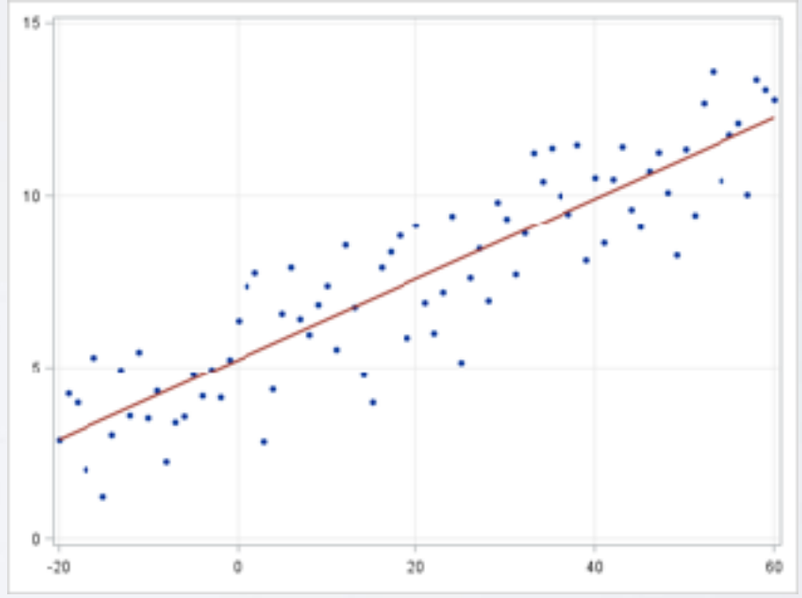
logistic regression*



REGRESSION

↓

linear regression



*annoying note

SUPERVISED LEARNING

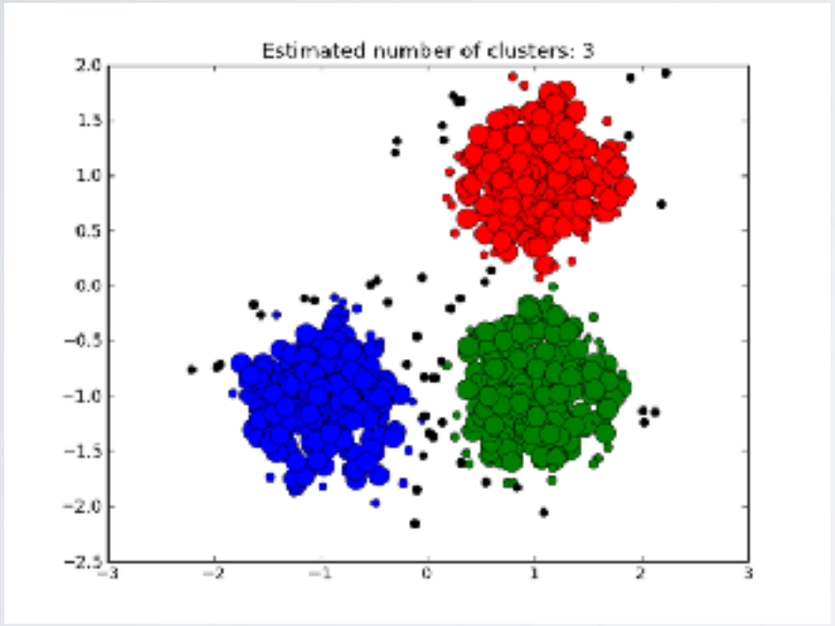
UNSUPERVISED LEARNING

REINFORCEMENT LEARNING

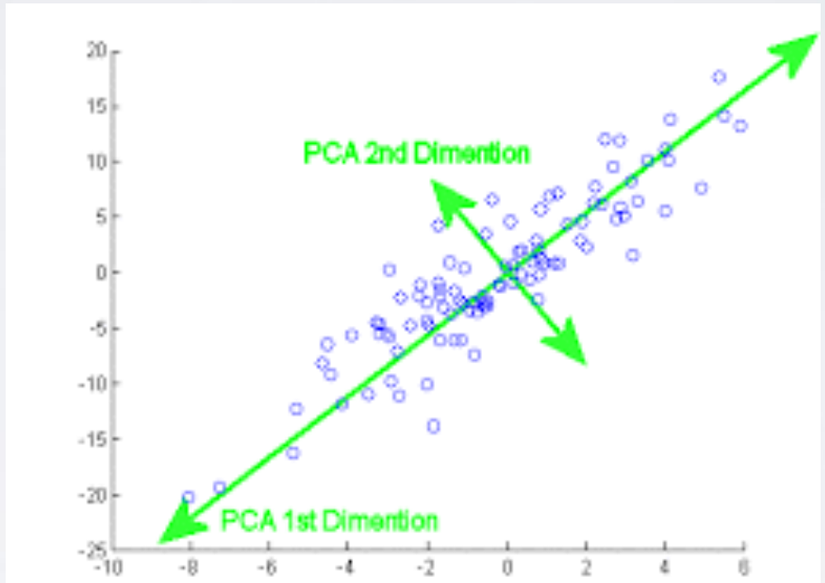
UNSUPERVISED LEARNING

UNSUPERVISED LEARNING

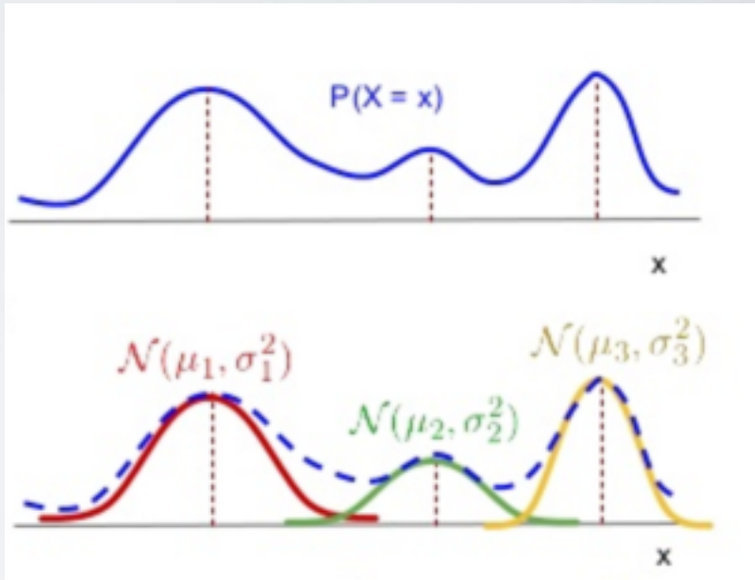
CLUSTERING



DIMENSION REDUCTION

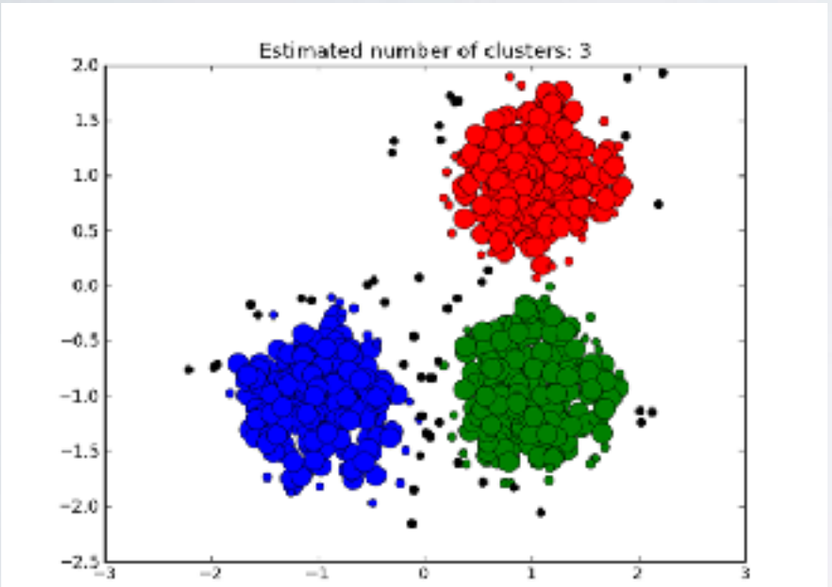


GENERATIVE MODELS



UNSUPERVISED LEARNING

CLUSTERING



1, 3, 7

19, 4, 6

2, 4, 8

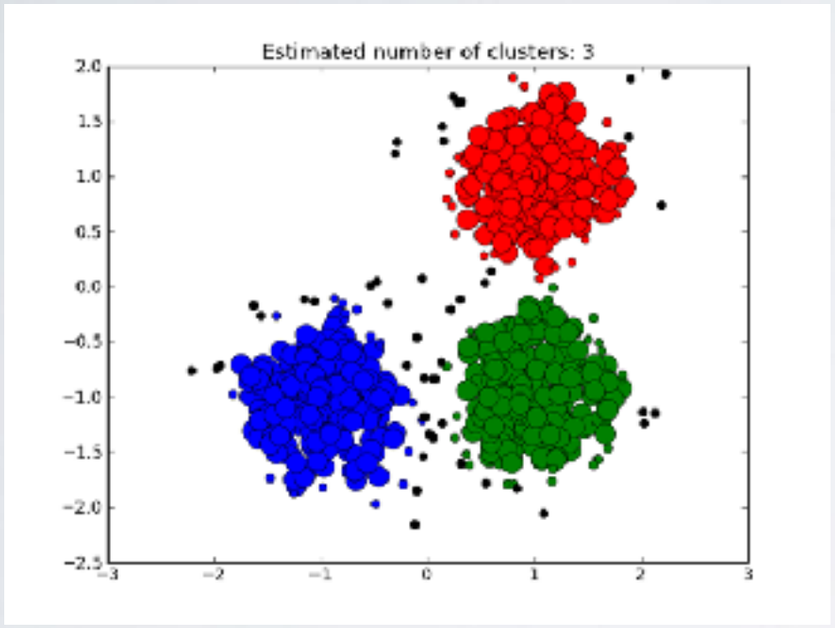
2, 12, 8

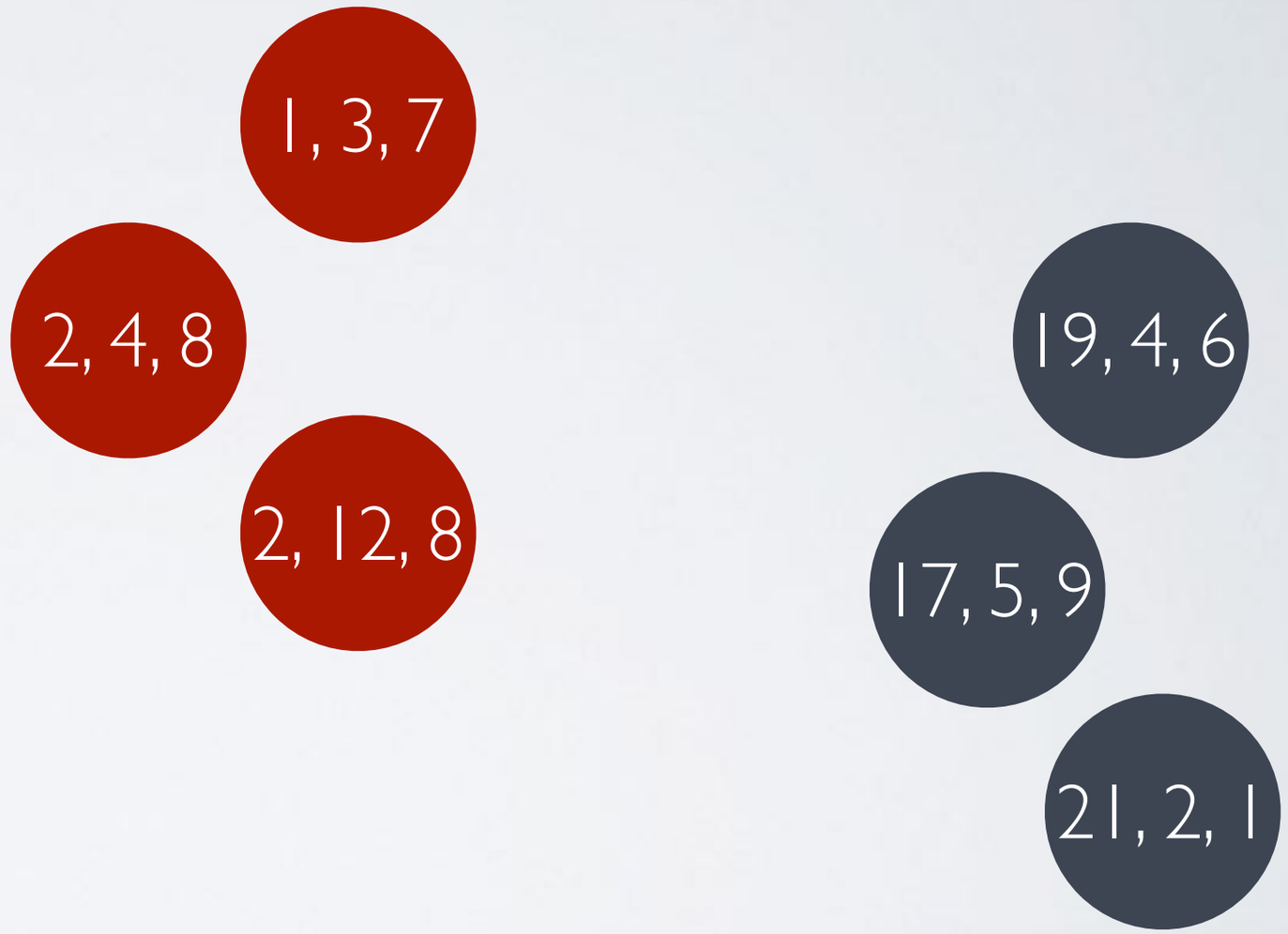
17, 5, 9

21, 2, 1

UNSUPERVISED LEARNING

CLUSTERING





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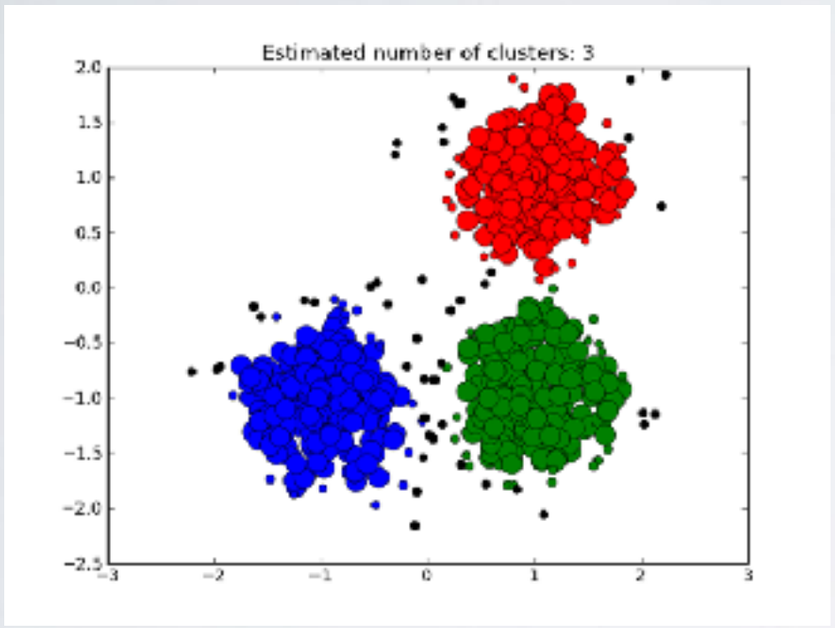

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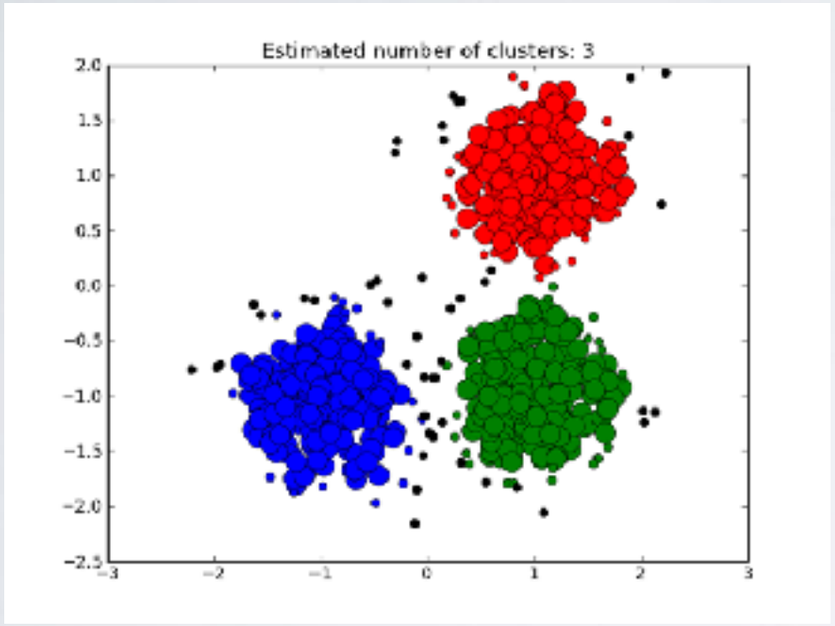

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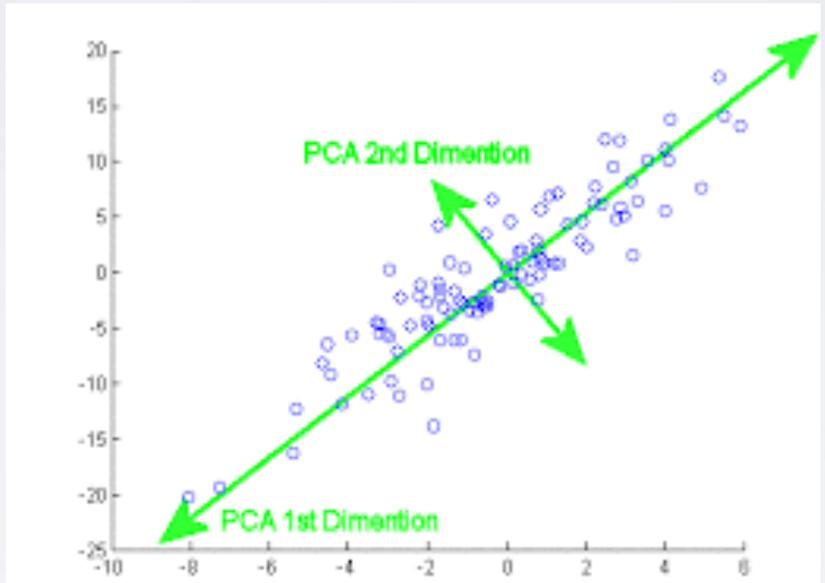

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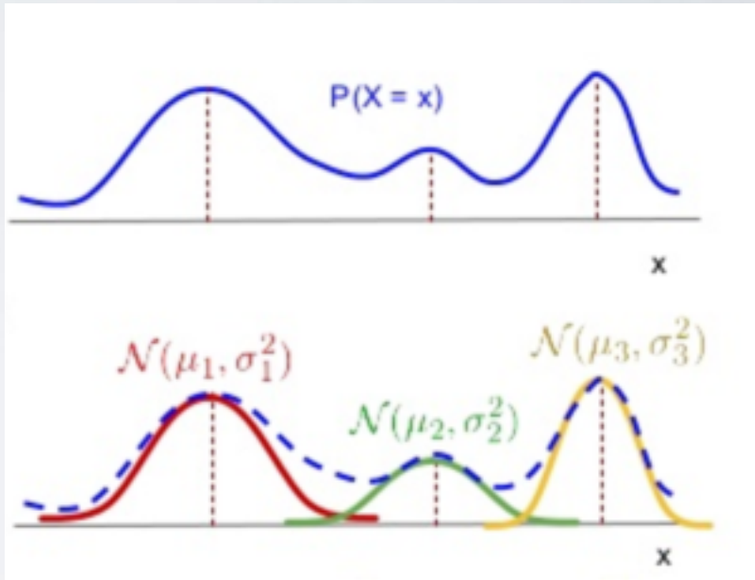

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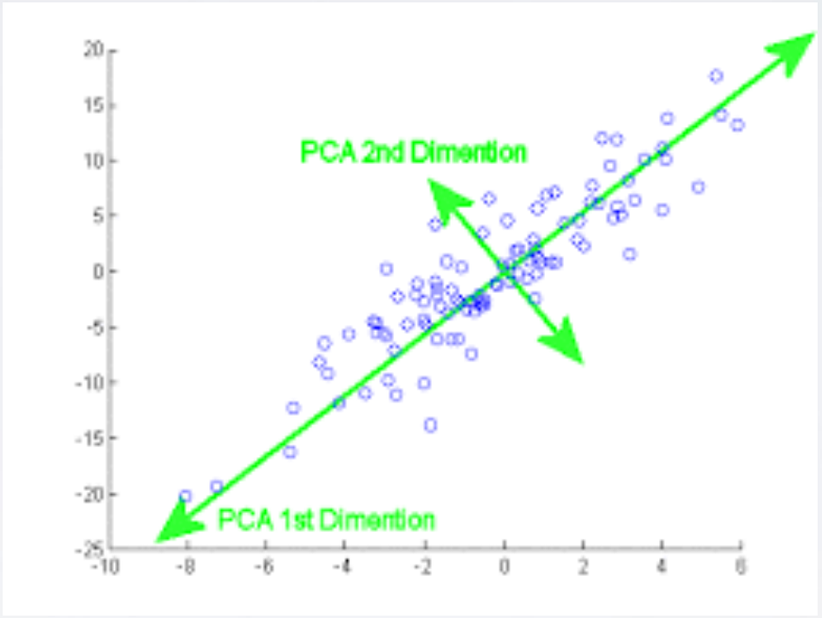

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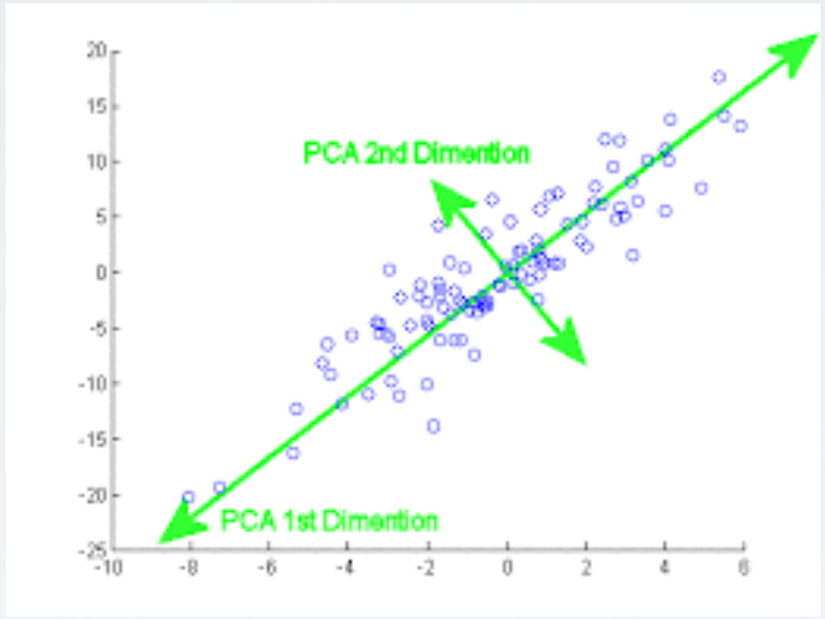
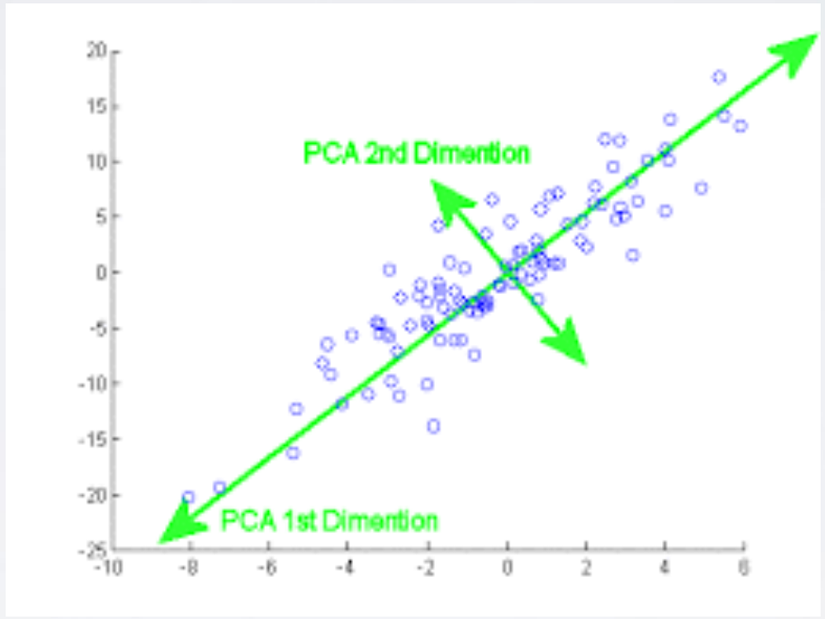


Visualization

UNSUPERVISED LEARNING

DIMENSION REDUCTION

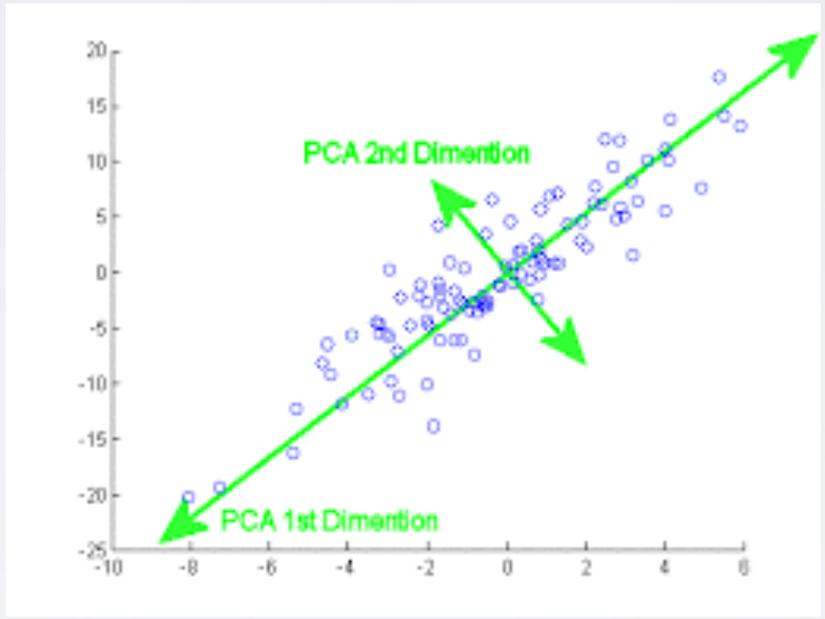


Visualization

t-SNE

UNSUPERVISED LEARNING

DIMENSION REDUCTION

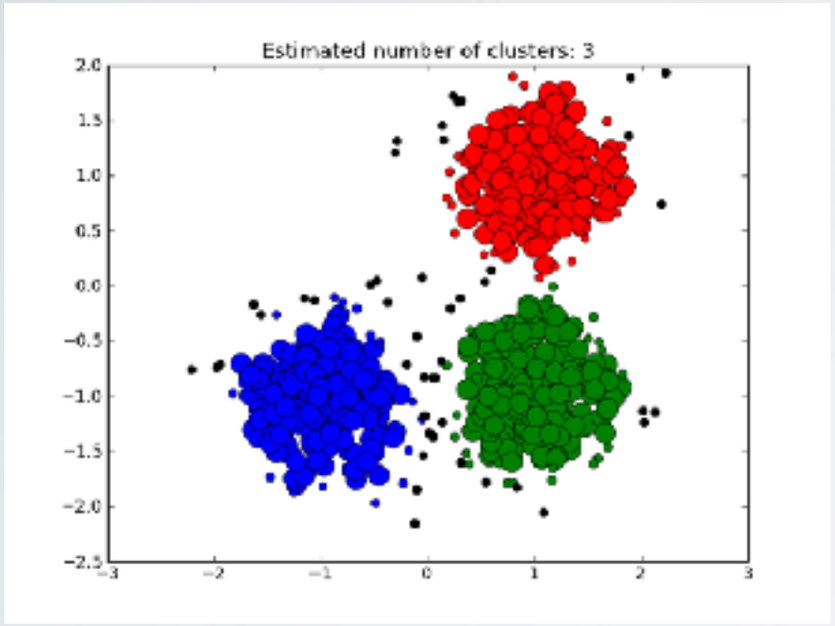


Visualization

t-SNE*

UNSUPERVISED LEARNING

CLUSTERING



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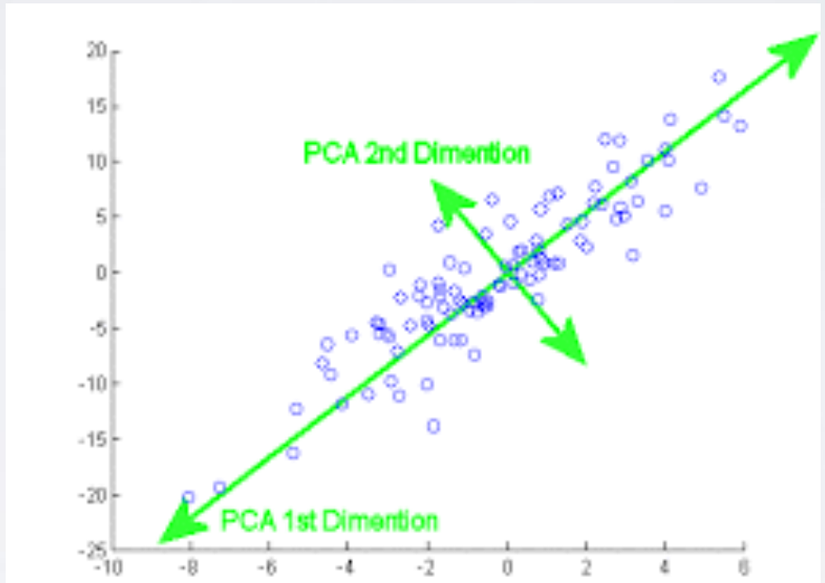

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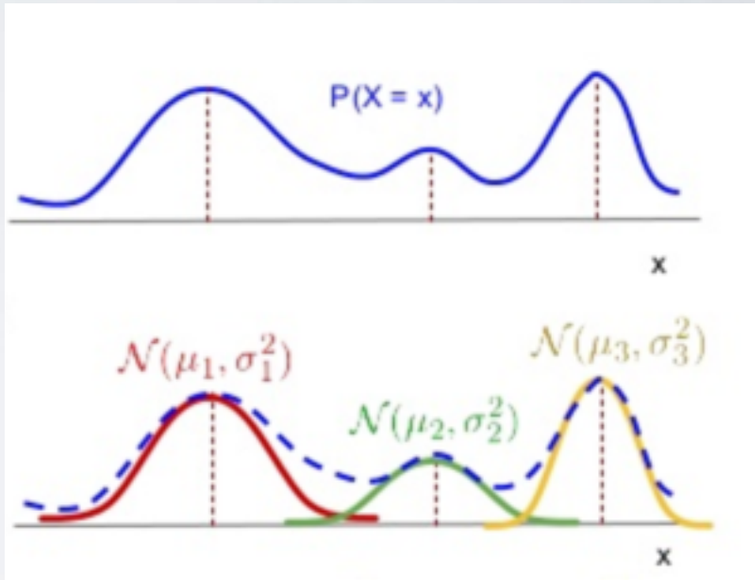

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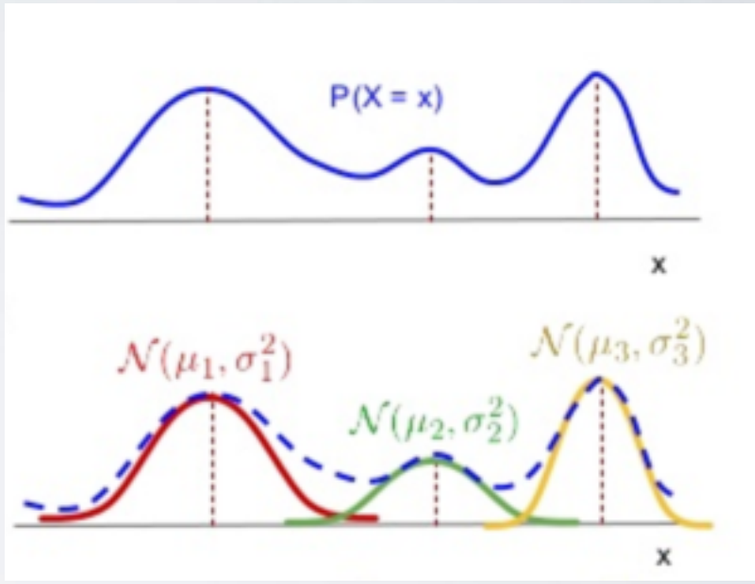


SUPERVISED LEARNING

UNSUPERVISED LEARNING

REINFORCEMENT LEARNING

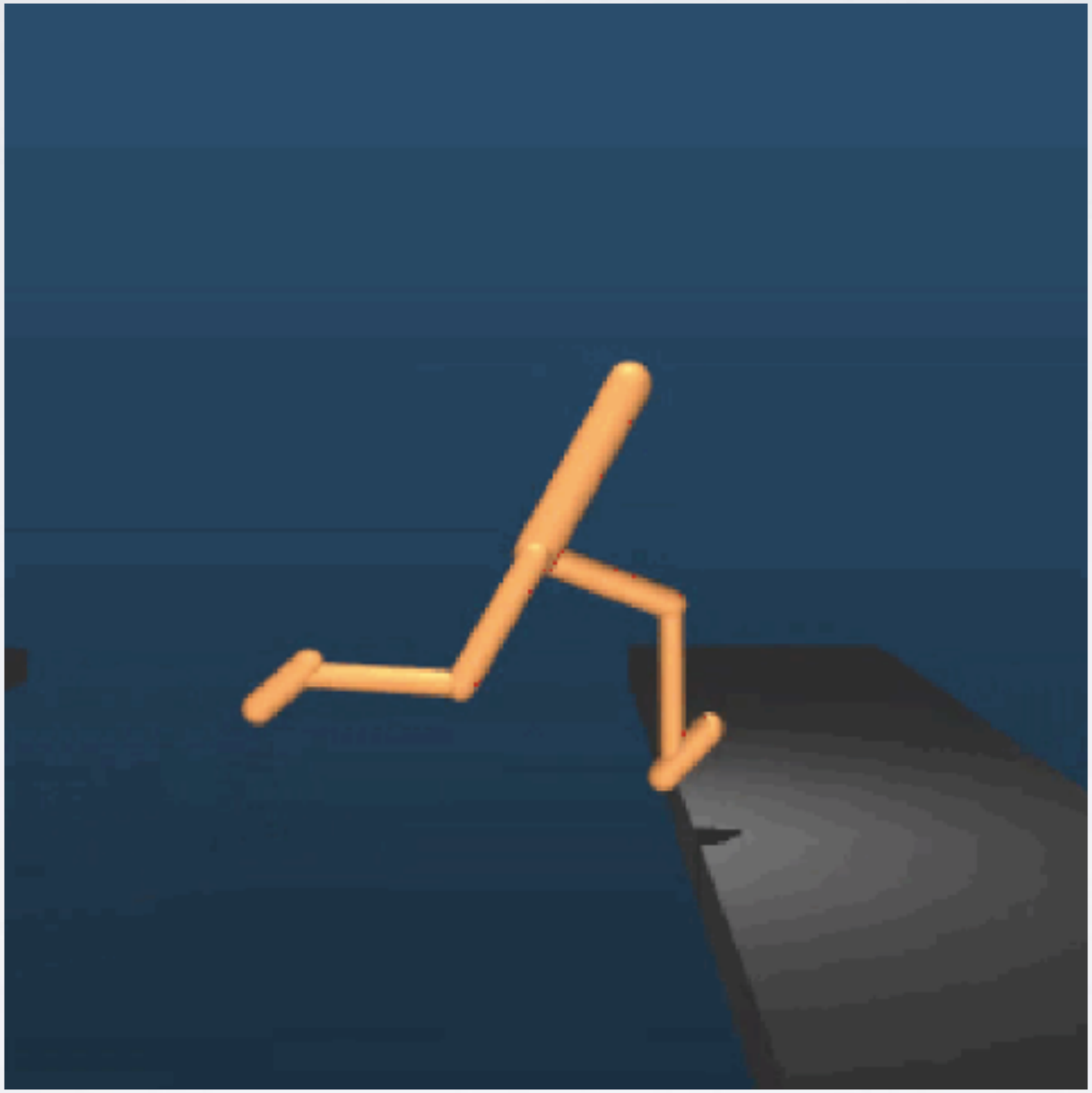
REINFORCEMENT LEARNING

REINFORCEMENT LEARNING

SUPERVISED

UNSUPERVISED

REINFORCEMENT LEARNING



TYPES OF ALGORITHMS/ ARCHITECTURES

CONVOLUTIONAL NEURAL NETWORKS

RECURRENT NEURAL NETWORKS/
LONG TERM SHORT MEMORY (LSTM)

GENERATIVE ADVERSARIAL NETWORKS

VARIATIONAL AUTOENCODERS

CONVOLUTIONAL NEURAL NETWORKS (CNNS)

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use:
images,
image recognition,
audio (treating waveform as an image)
style transfer

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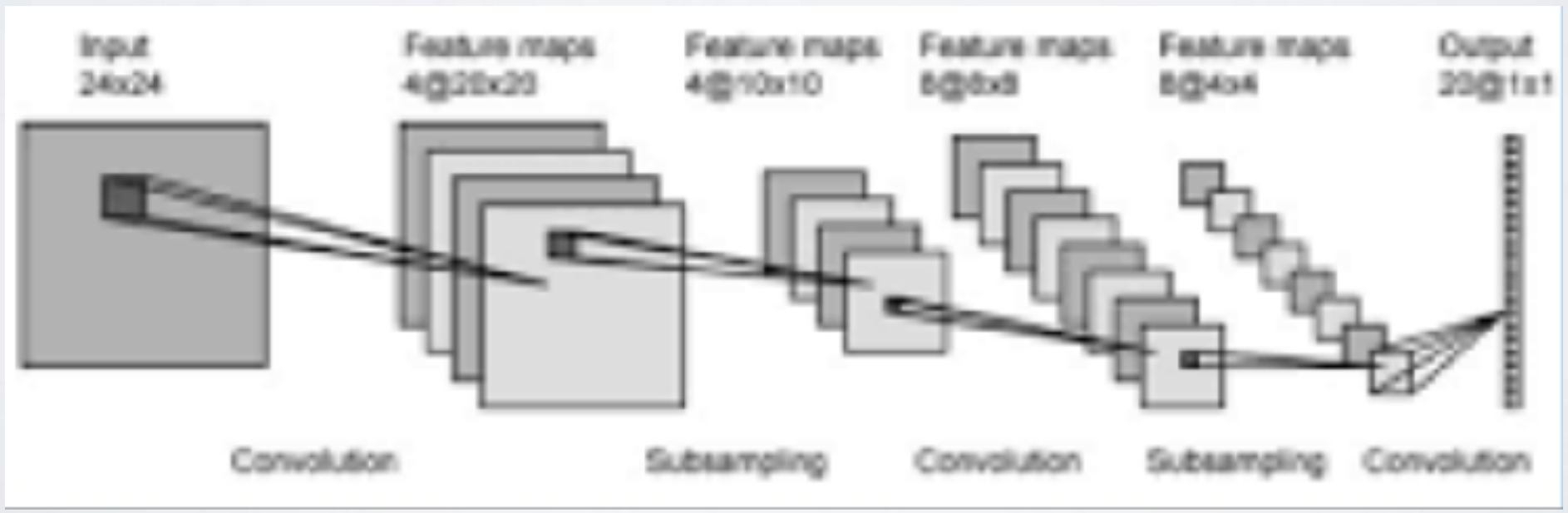

RECURRENT NEURAL NETWORKS (RNNS)

text,
language translation,
long-term structure,
music,
sequential data

RECURRENT NEURAL NETWORKS (RNNS)

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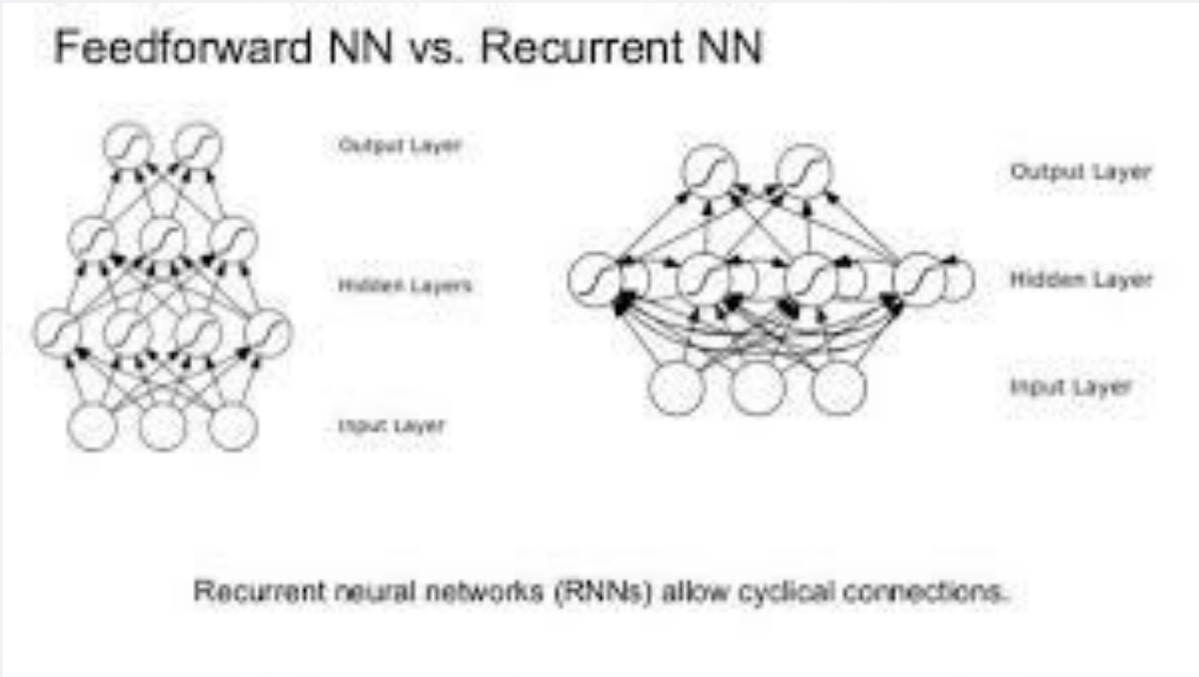
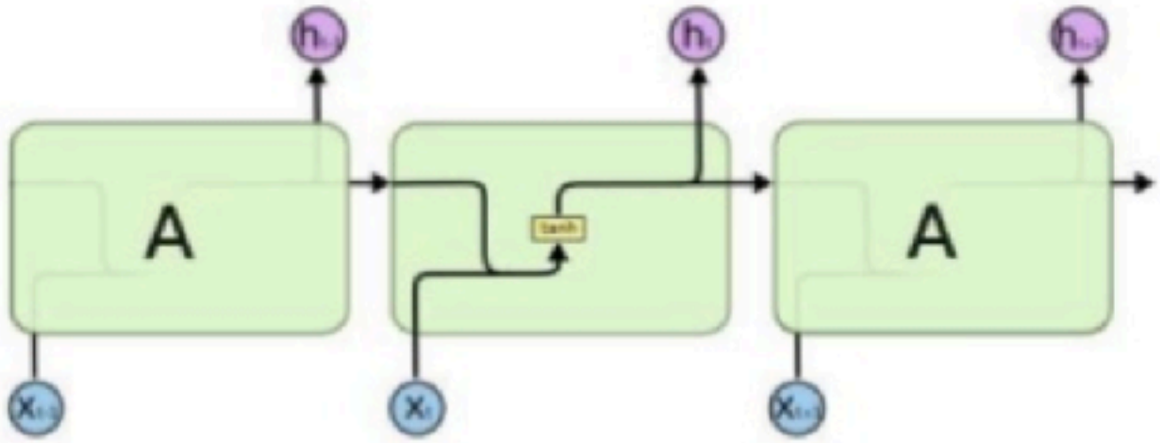
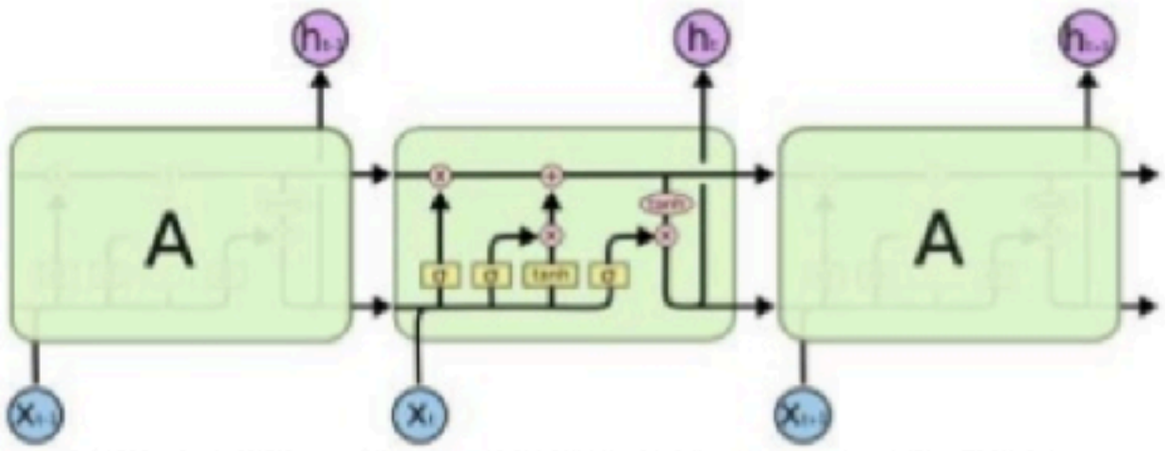


RECURRENT NEURAL NETWORKS (RNNS) LONG-TERM SHORT MEMORY (LSTMS)

- **Differences of LSTM and Vanilla RNN**



The repeating module in a standard RNN contains a single layer.



The repeating module in an LSTM contains four interacting layers.

GENERATIVE ADVERSARIAL NETWORKS (GANS)

generative images
realistic generated data
upscaling images

GENERATIVE ADVERSARIAL NETWORKS (GANS)

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realistic generated data
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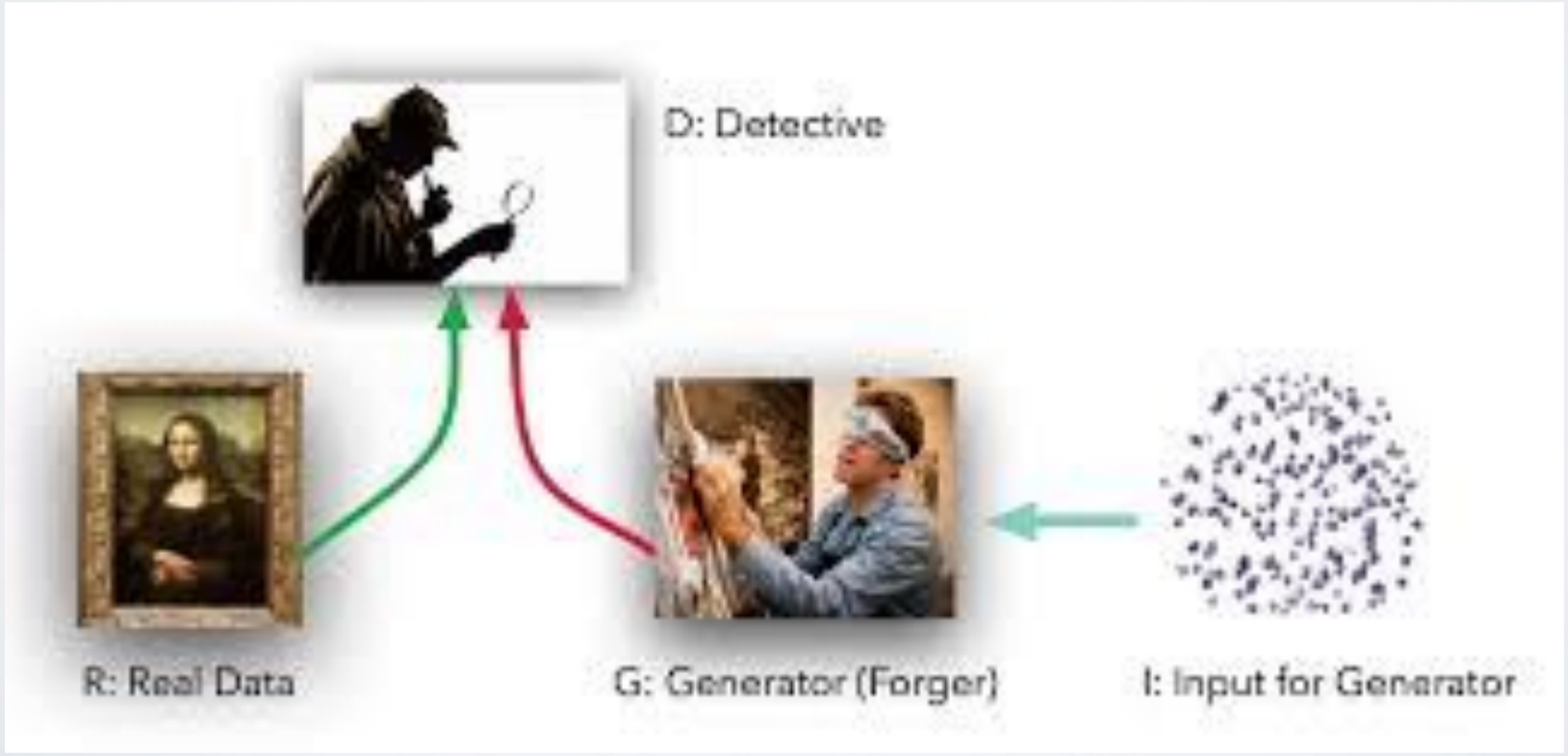

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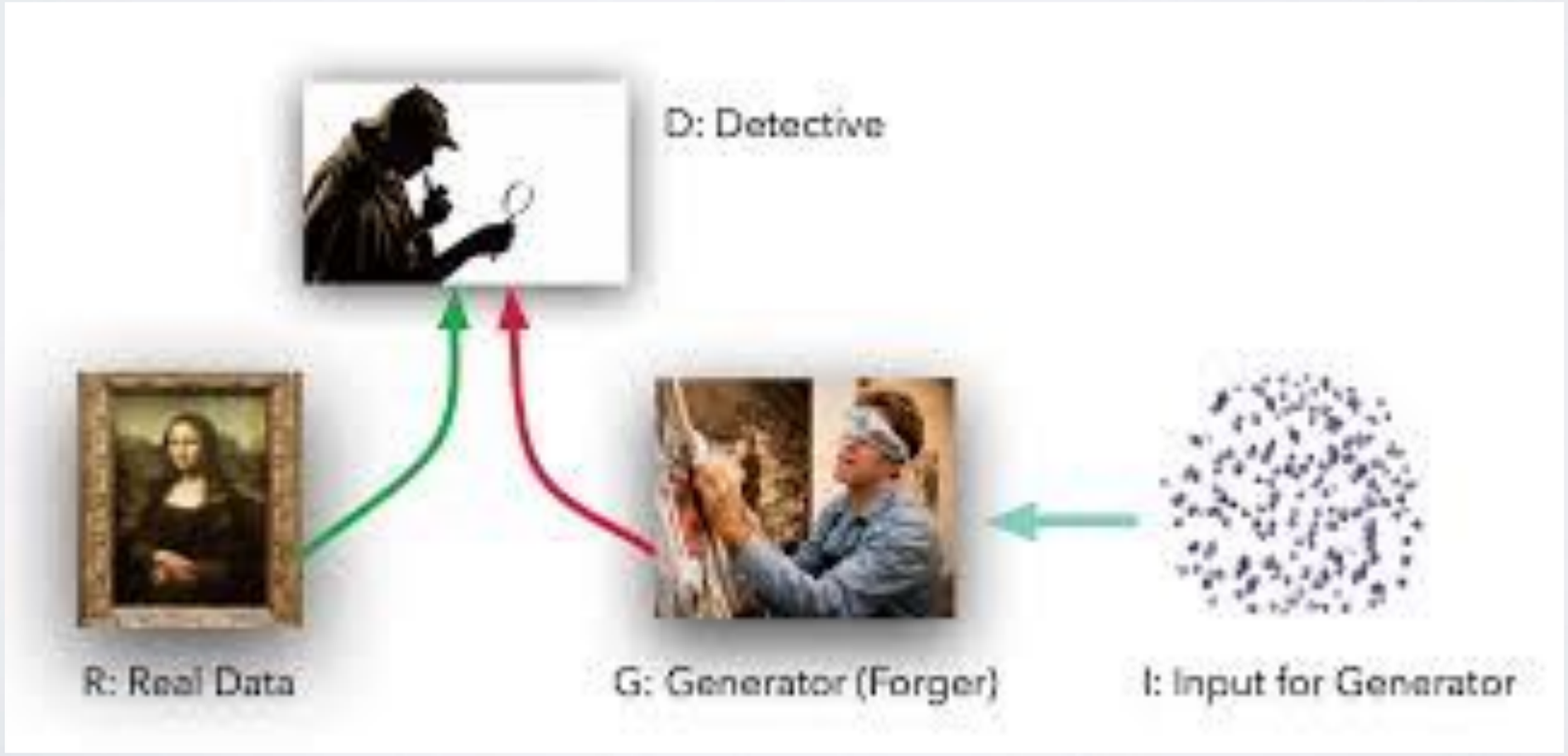

VARIATIONAL AUTOENCODERS (VAES)

create latent space
generate new images, music

VARIATIONAL AUTOENCODERS (VAES)

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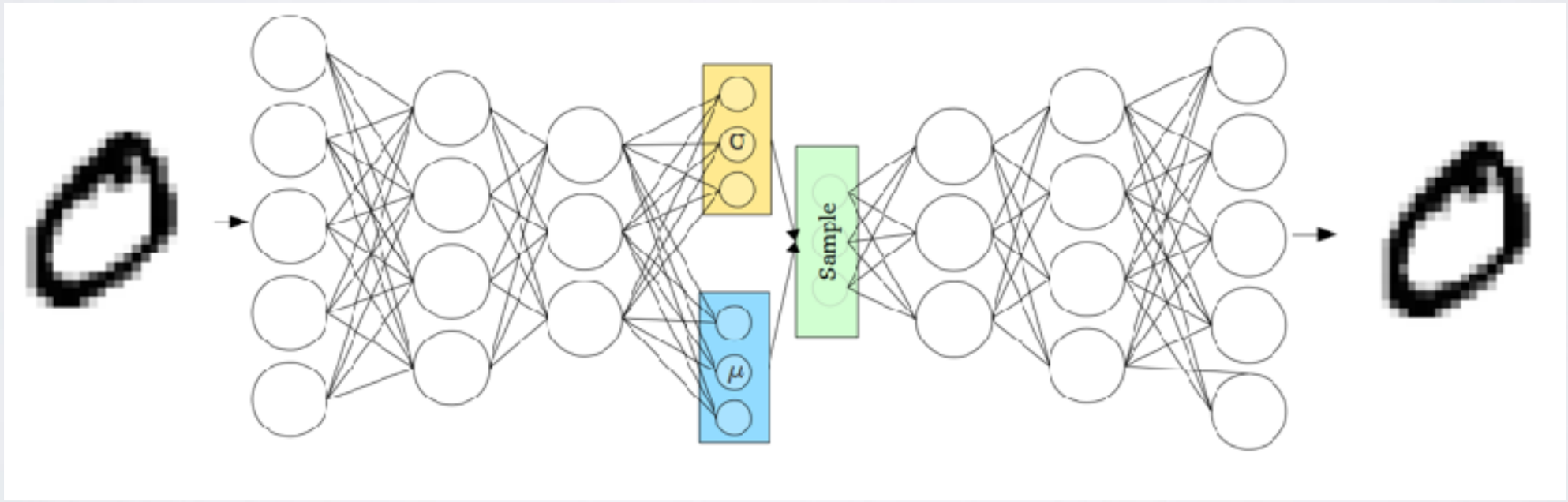
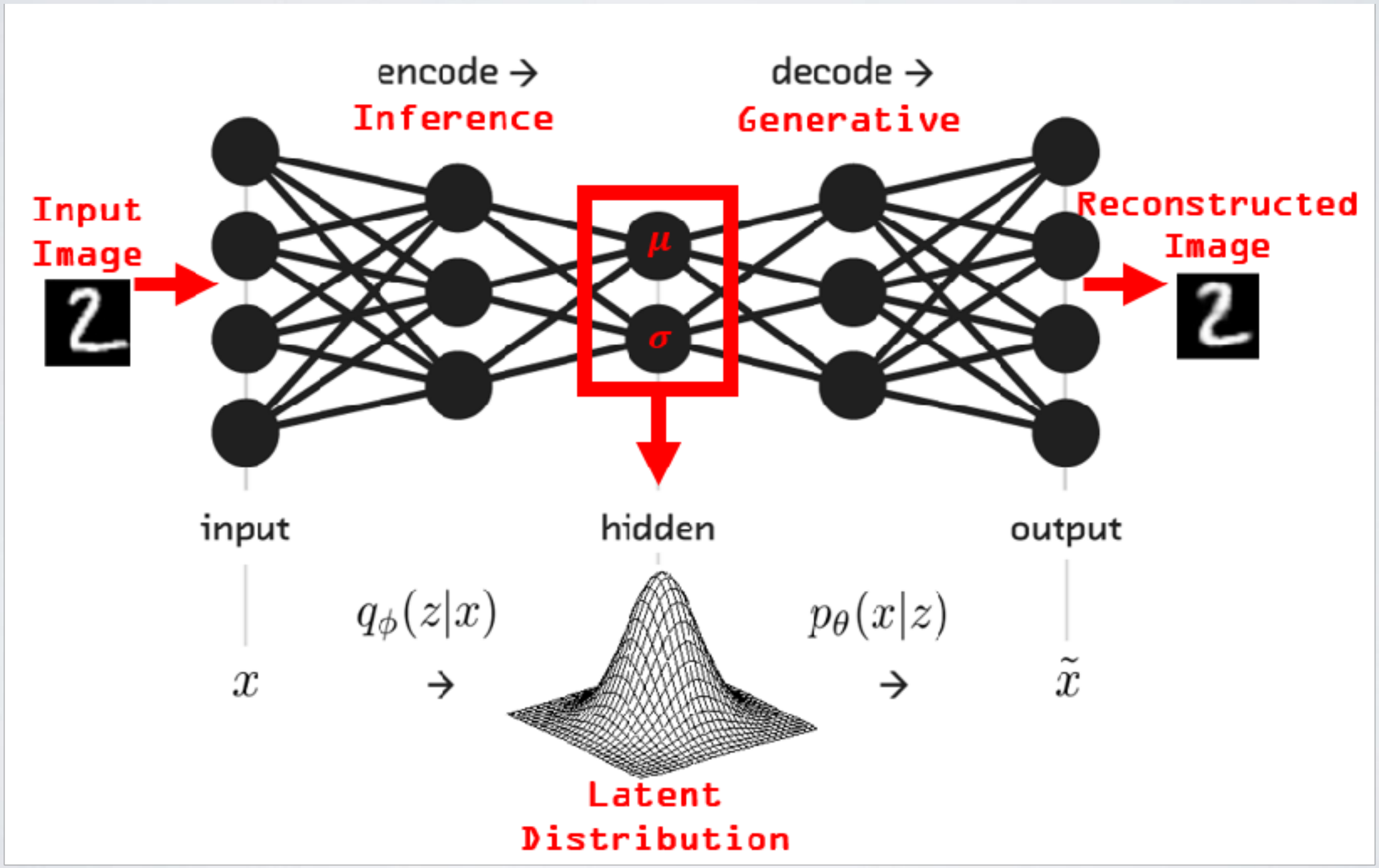
generate new images, music



VARIATIONAL AUTOENCODERS (VAES)



IT'S OKAY IF
YOU DON'T UNDERSTAND
EVERYTHING YET

Takeaway: there are different kind of models that do different things, and there are usually hints about what they do in their names

PIPELINES & WORKFLOWS

COMMON QUESTIONS

ML practitioners

Working with models

Hyperparameters/
"what are the kinds of things that can be modified to play around with?"

Hyperparameters/
"what are the kinds of things that can be modified to play around with?"

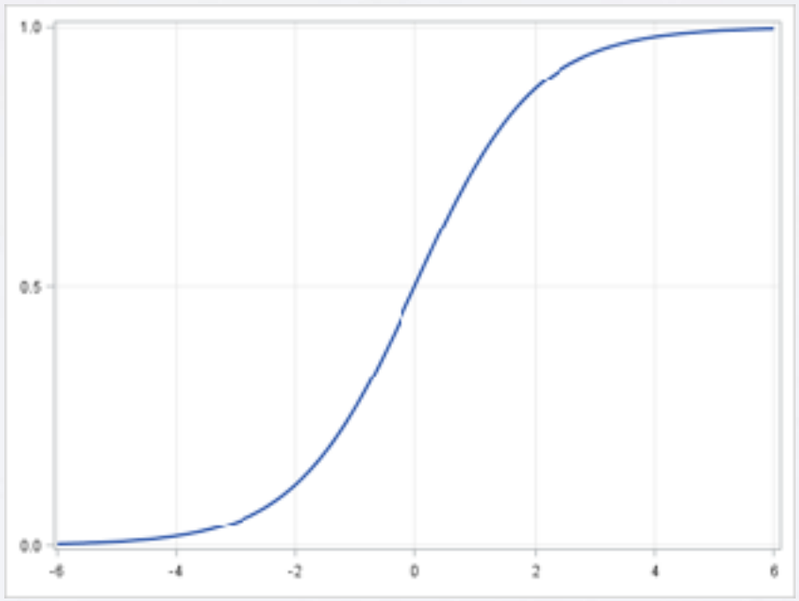
learning rate
number of layers
change loss function
change activation function
number of iterations
(not a hyperparameter: clean your data!!)
make your own dataset!

Is machine learning a fancy term for techniques for calculating probability as accurate as possible? People use the word "machine learning" as if it is something that you press a red button and the machine somehow magically learns things, but isn't it that we write a program with rules to interpret big amounts of data to calculate sets of probabilities to "guess" the future sequences of things?

Is machine learning a fancy term for techniques for calculating probability as accurate as possible? People use the word "machine learning" as if it is something that you press a red button and the machine somehow magically learns things, but isn't it that we write a program with rules* to interpret big amounts of data to calculate sets of probabilities to "guess" the future sequences of things?

“why don't more people avoid the weird "AI" expectations and hype that come from saying they used a machine learning in their thing by just saying they just designed something based on data they could find?”

RESOURCES

ml5.js!
fast.ai course online
Tariq Rashid, “Make your own Neural Network”
kaggle
ml4a

IN SHORT