presented in

Track 1 ▪ Track 2

Introduction to Deep Learning

What we will cover in this module

- The difference between AI, machine learning, and deep learning
- How machine learning works
- What is a neural network
- The challenges with machine & deep learning

Let’s get technical!

😵 Don’t stress.

🐣 If this is your first time engaging in the technical details, use this as a way to **familiarize** yourself with terms & concepts.

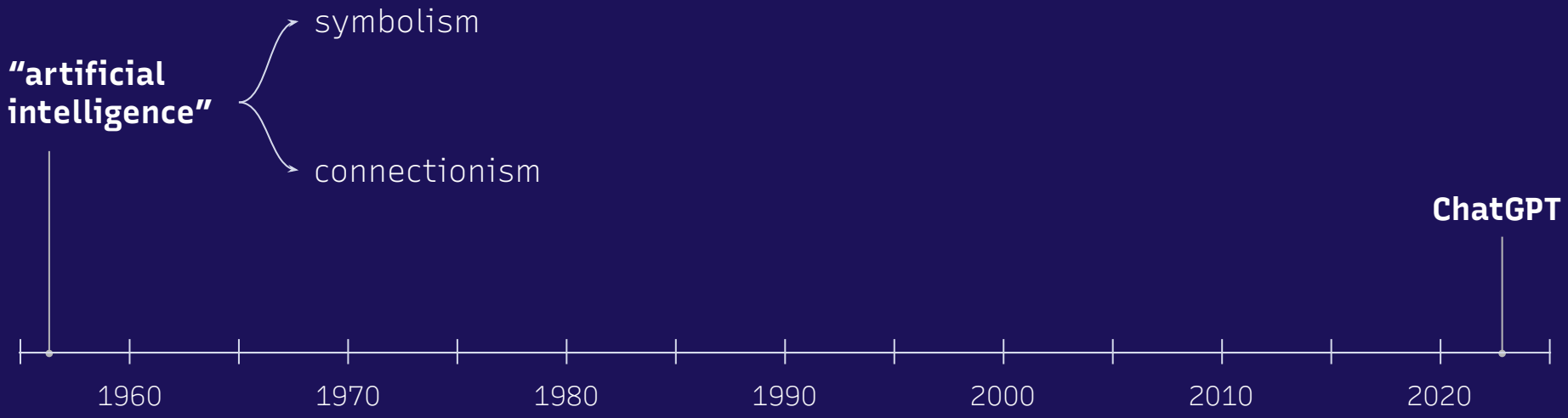
🐥 If you already know some of these details, use this as a way to **clarify** your understanding.

🔍 Treat this slide deck as a **resource**. Refer back to it as needed!

deep learning

VISION
Rule-based systems

VISION
Big data, big compute systems



The “symbolists”

THE THEORY

We’re smart because we have knowledge

THE PLAN

Build expert systems with databases of knowledge

The “connectionists”

THE THEORY

We’re smart because we can learn

THE PLAN

Build machine-learning software that can learn from data

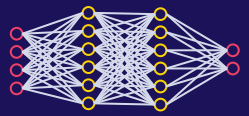
VISION
Rule-based systems

VISION
Big data, big compute systems

“artificial intelligence”

symbolism → expert systems

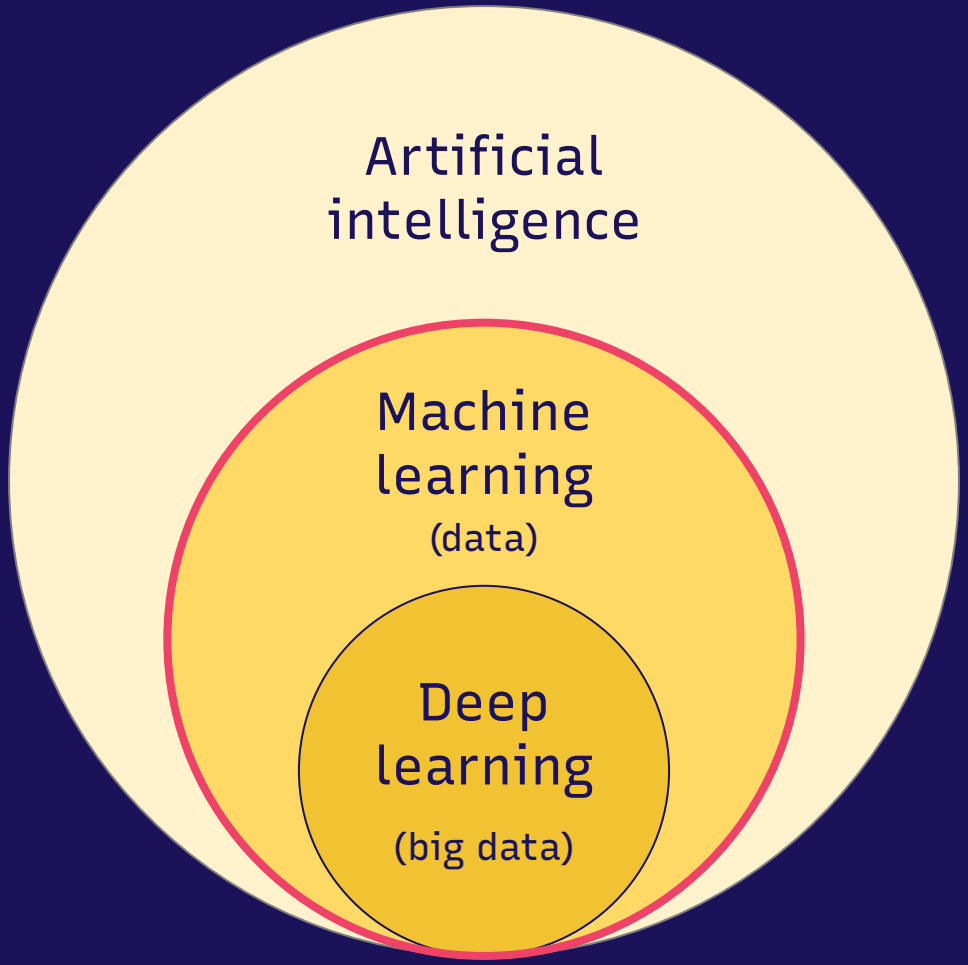
connectionism → machine learning → (deep) neural networks → **“deep learning”**



ChatGPT

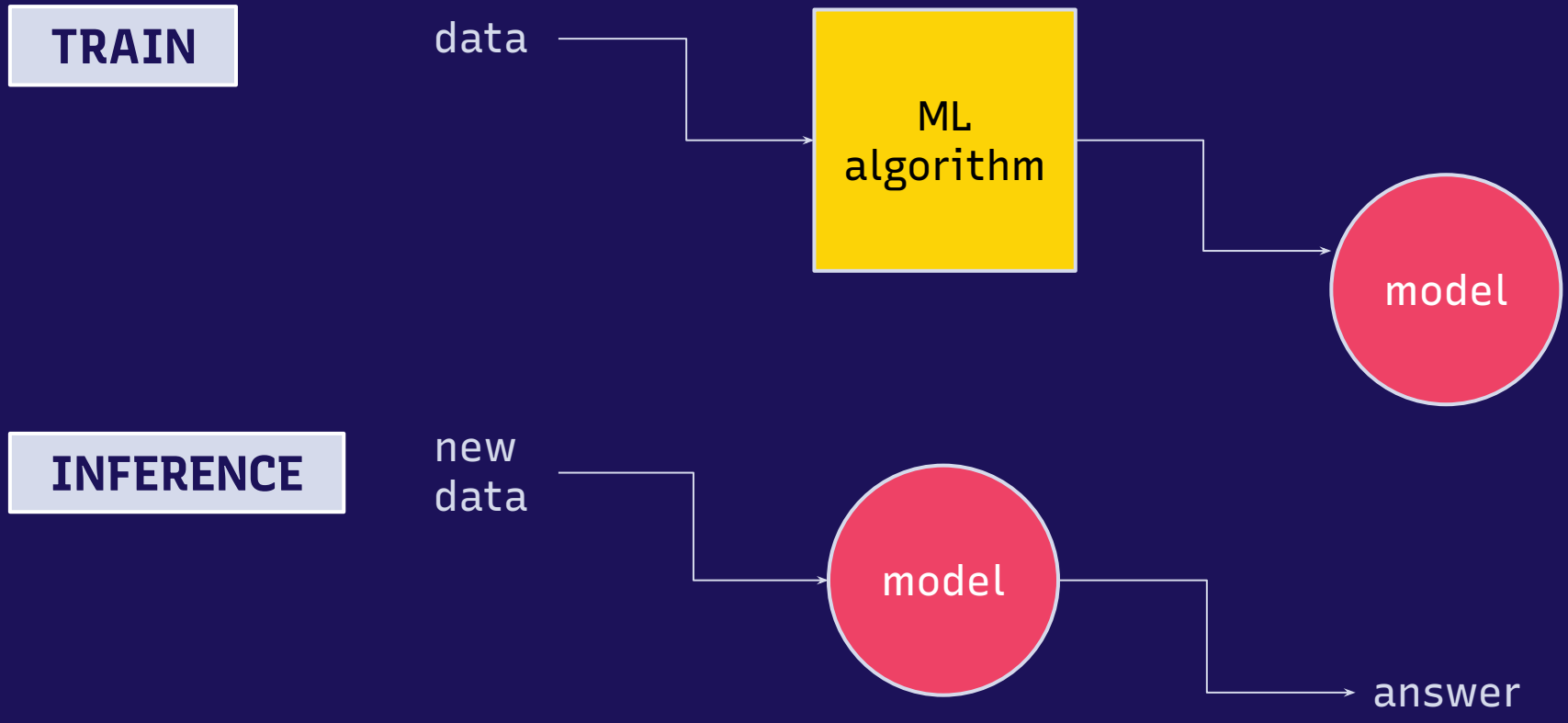
1960 1970 1980 1990 2000 2010 2020

AI Spotlight Series



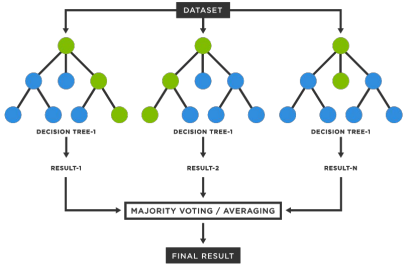
Machine learning vs. deep learning in the wild

- A lot of government algorithms will be **machine learning**, e.g. predictive policing, benefits distribution.
- A lot of Big Tech products and services will be **deep learning**, e.g. ad targeting, recommendation.
- A lot of AI software built using multimedia data (images, audio, video) will also be **deep learning**, e.g. face and speech recognition.

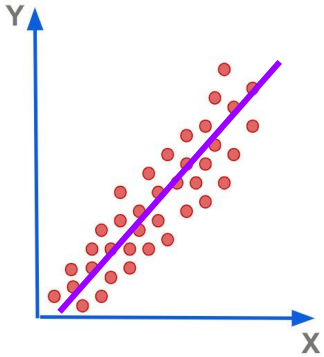


Other types of machine learning

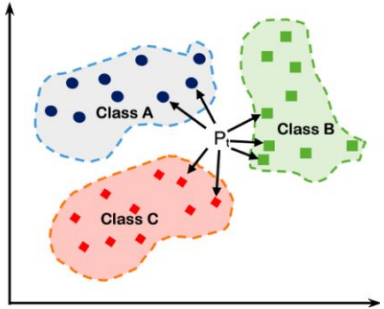
Deep learning



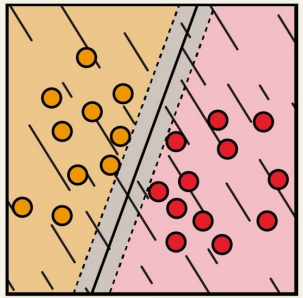
Random forest



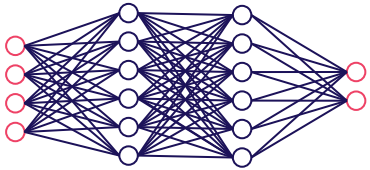
Linear regression



K nearest neighbor



Support vector machines



Neural networks

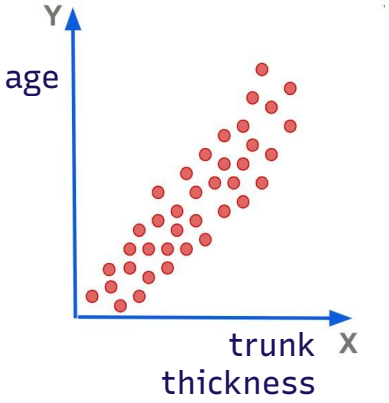
Less fancy statistics

More fancy statistics

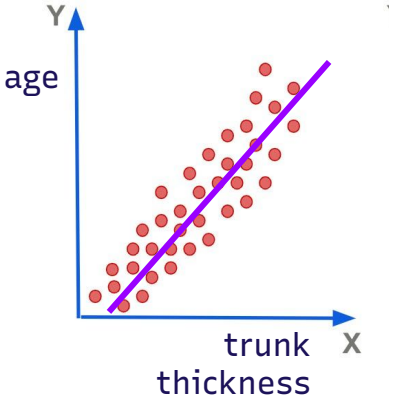
AI Spotlight Series

TRAIN

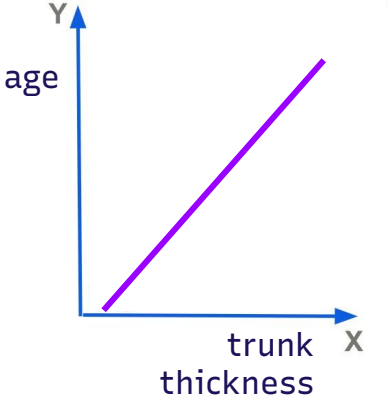
Data



ML algorithm

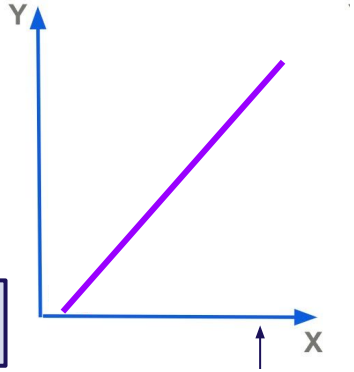


Model

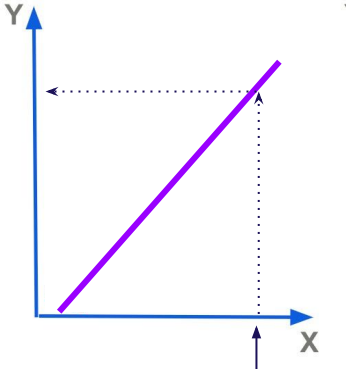


INFERENCE

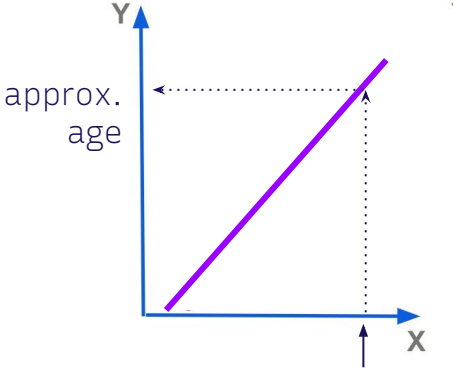
New data

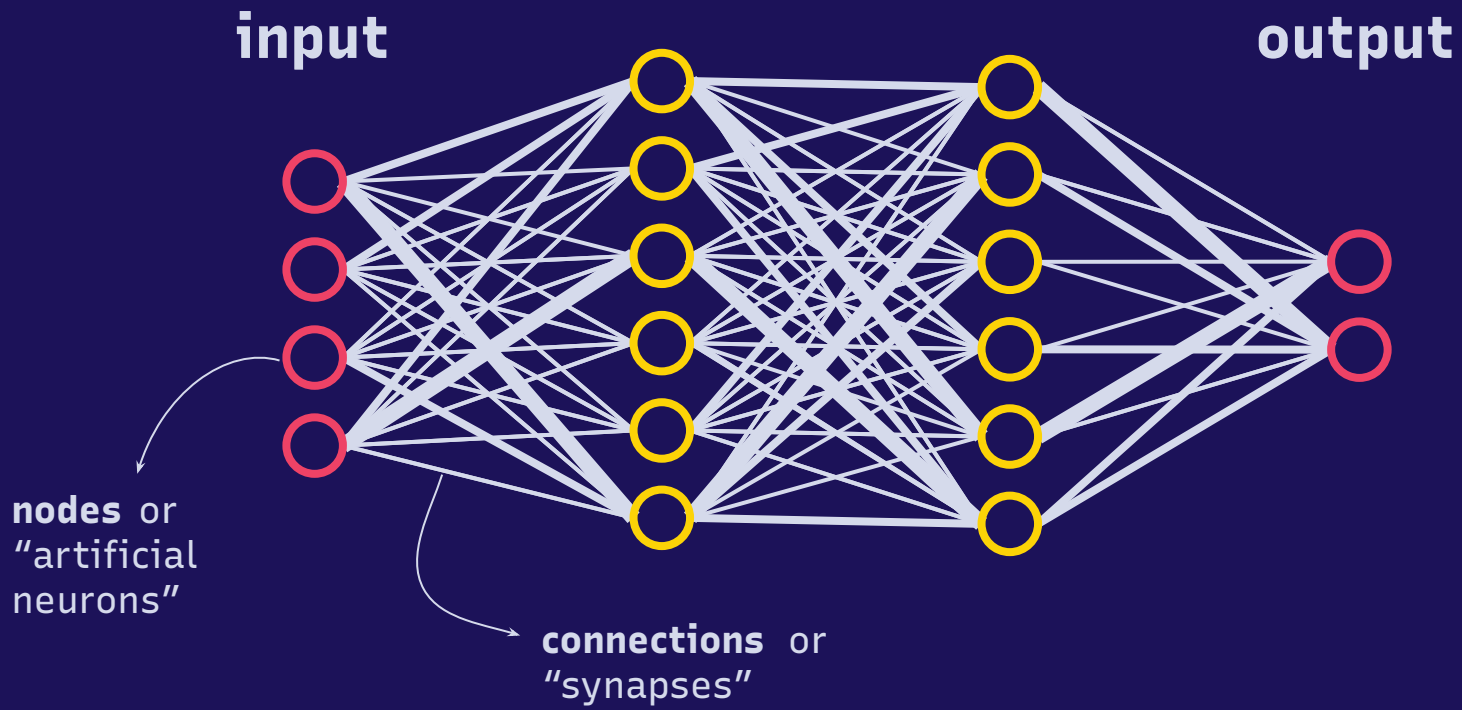


Model



Answer





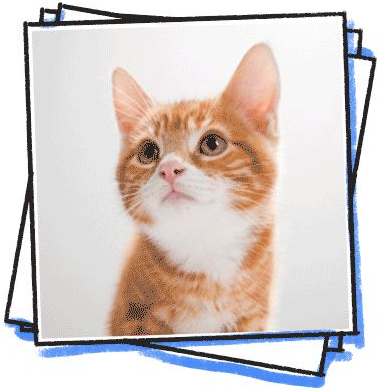
AI Spotlight Series

Data

ML algorithm

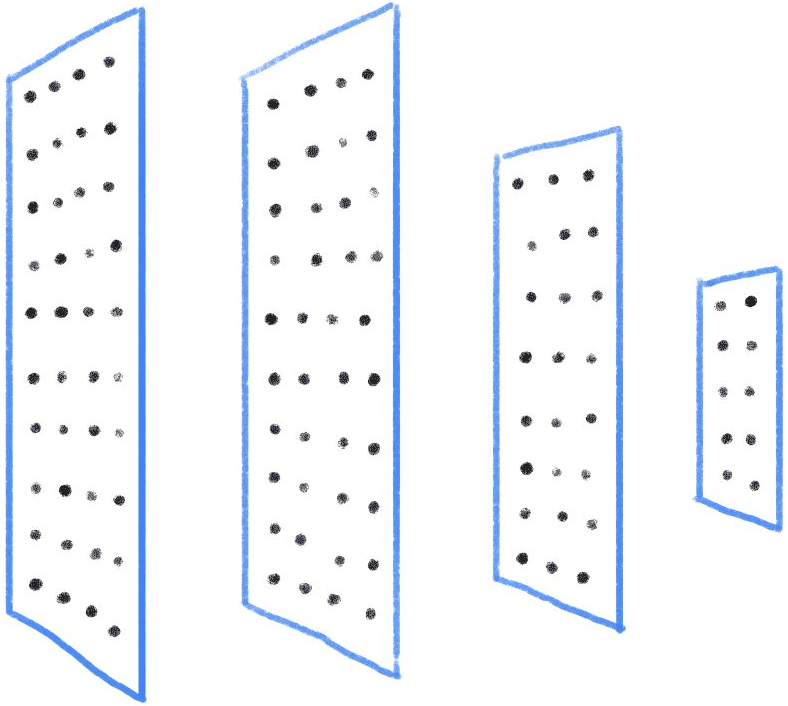
Model

CAT



(LABELED PHOTOS)

DOG



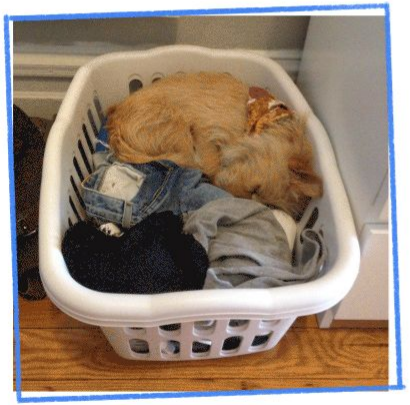
OUTPUT

TRAIN

Credit: Selman Design

New data

IS THIS A
CAT or DOG?



CAT DOG

Answer

OUTPUT LAYER

ACTIVATED NEURONS

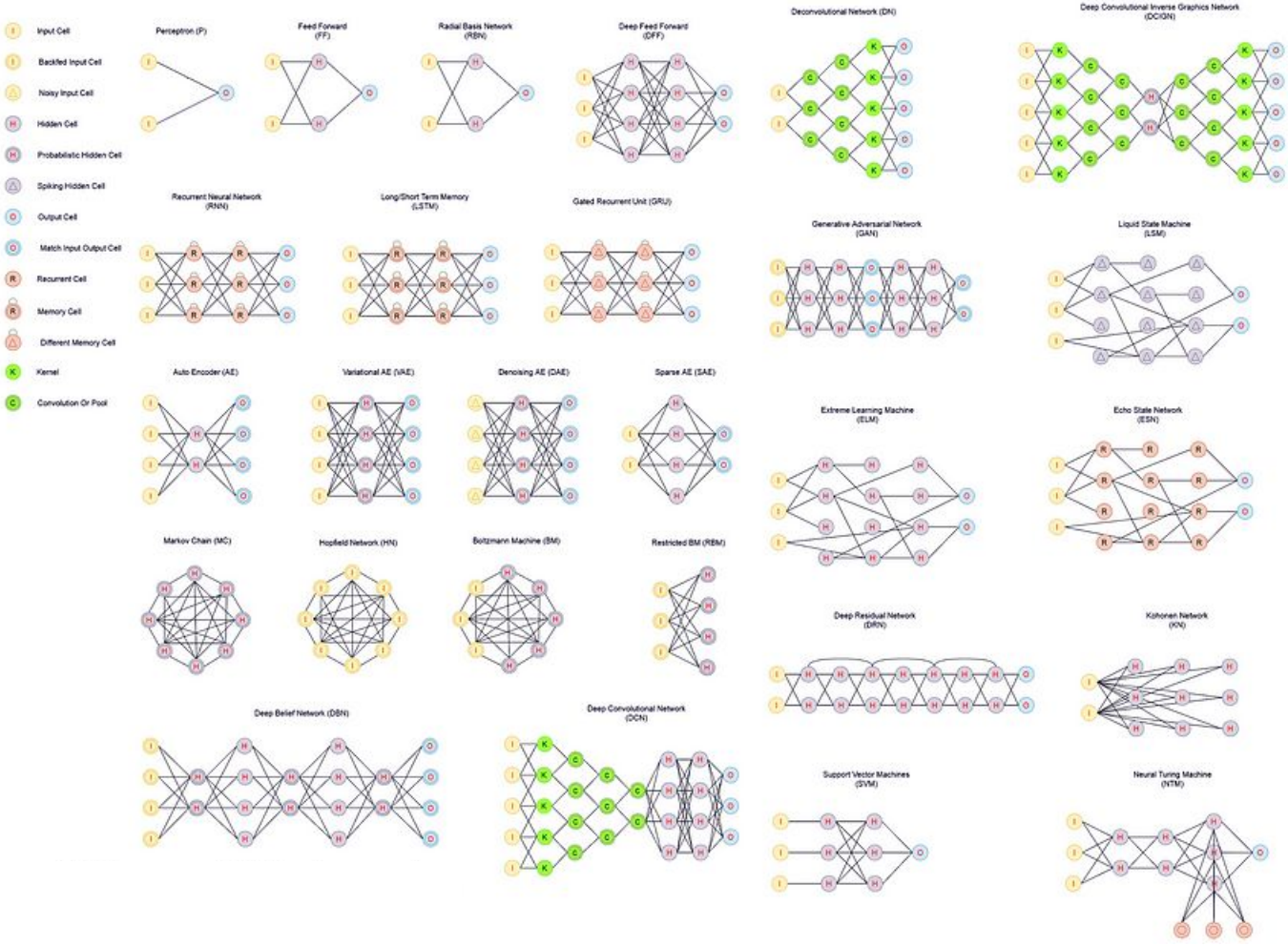
INPUT LAYER

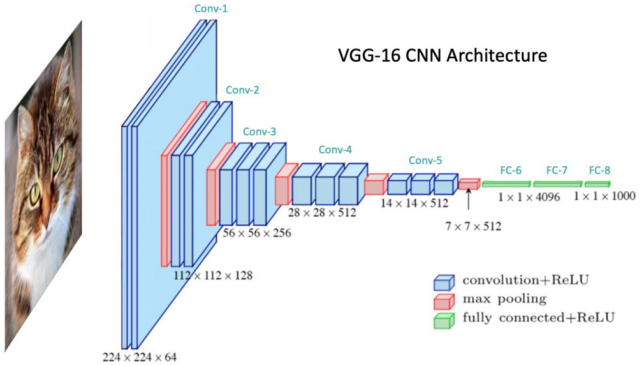
Model

DEEP neural NETWORK

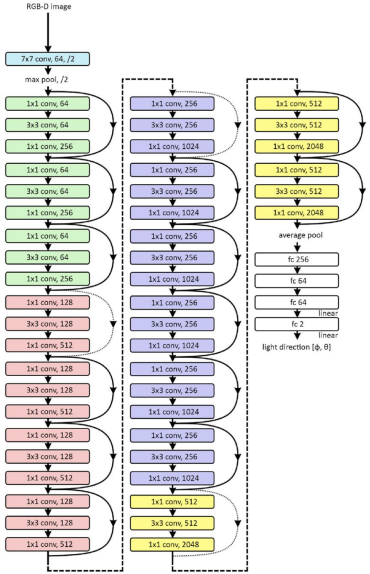
INFERENCE

Credit: Selman Design

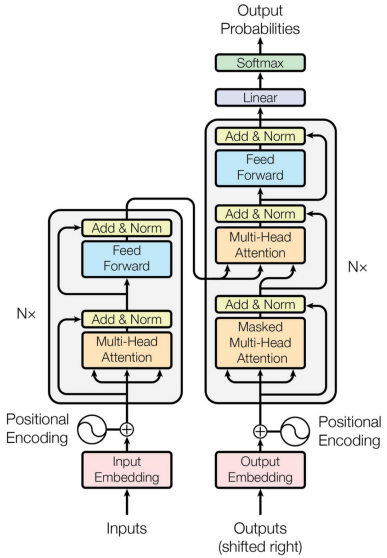

Input Cell
Backfed Input Cell
Noisy Input Cell
Hidden Cell
Probabilistic Hidden Cell
Spiking Hidden Cell
Output Cell
Match Input Output Cell
Recurrent Cell
Memory Cell
Different Memory Cell
Kernel
Convolution Or Pool
Perceptron (P)
Feed Forward (FF)
Radial Basis Network (RBN)
Deep Feed Forward (DFF)
Deconvolutional Network (DN)
Deep Convolutional Inverse Graphics Network (DCIGN)
Recurrent Neural Network (RNN)
Long/Short Term Memory (LSTM)
Gated Recurrent Unit (GRU)
Generative Adversarial Network (GAN)
Liquid State Machine (LSM)
Auto Encoder (AE)
Variational AE (VAE)
Denoising AE (DAE)
Sparse AE (SAE)
Extreme Learning Machine (ELM)
Echo State Network (ESN)
Markov Chain (MC)
Hopfield Network (HN)
Boltzmann Machine (BM)
Restricted BM (RBM)
Deep Residual Network (DRN)
Kohonen Network (KN)
Deep Belief Network (DBN)
Deep Convolutional Network (DCN)
Support Vector Machines (SVM)
Neural Turing Machine (NTM)



Convolutional neural network (CNN)



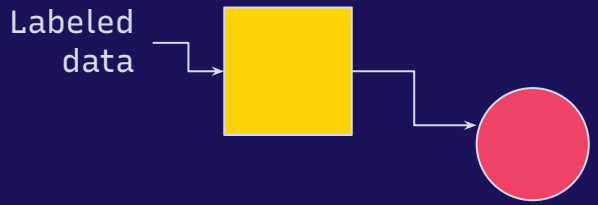
Recurrent neural network (RNN)



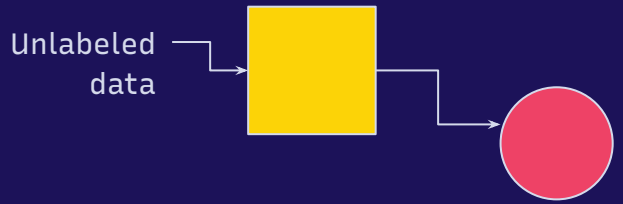
Transformer

Deep
Supervised learning

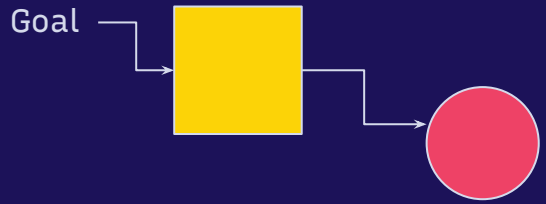
(semi-supervised)

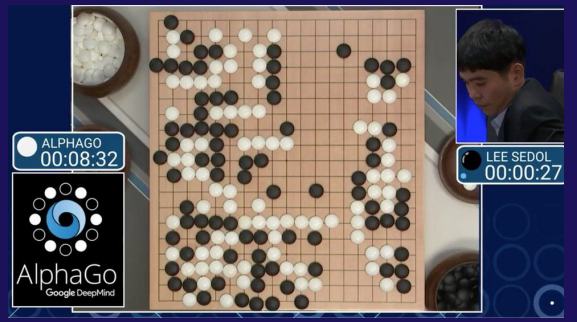


Deep
Unsupervised learning



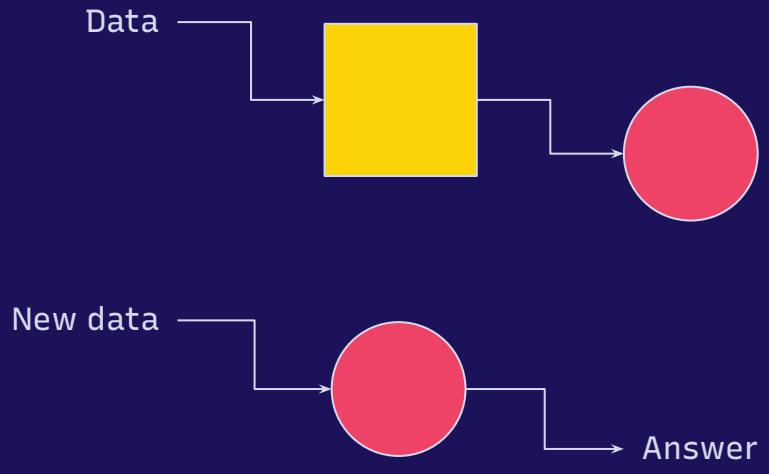
Deep
Reinforcement learning



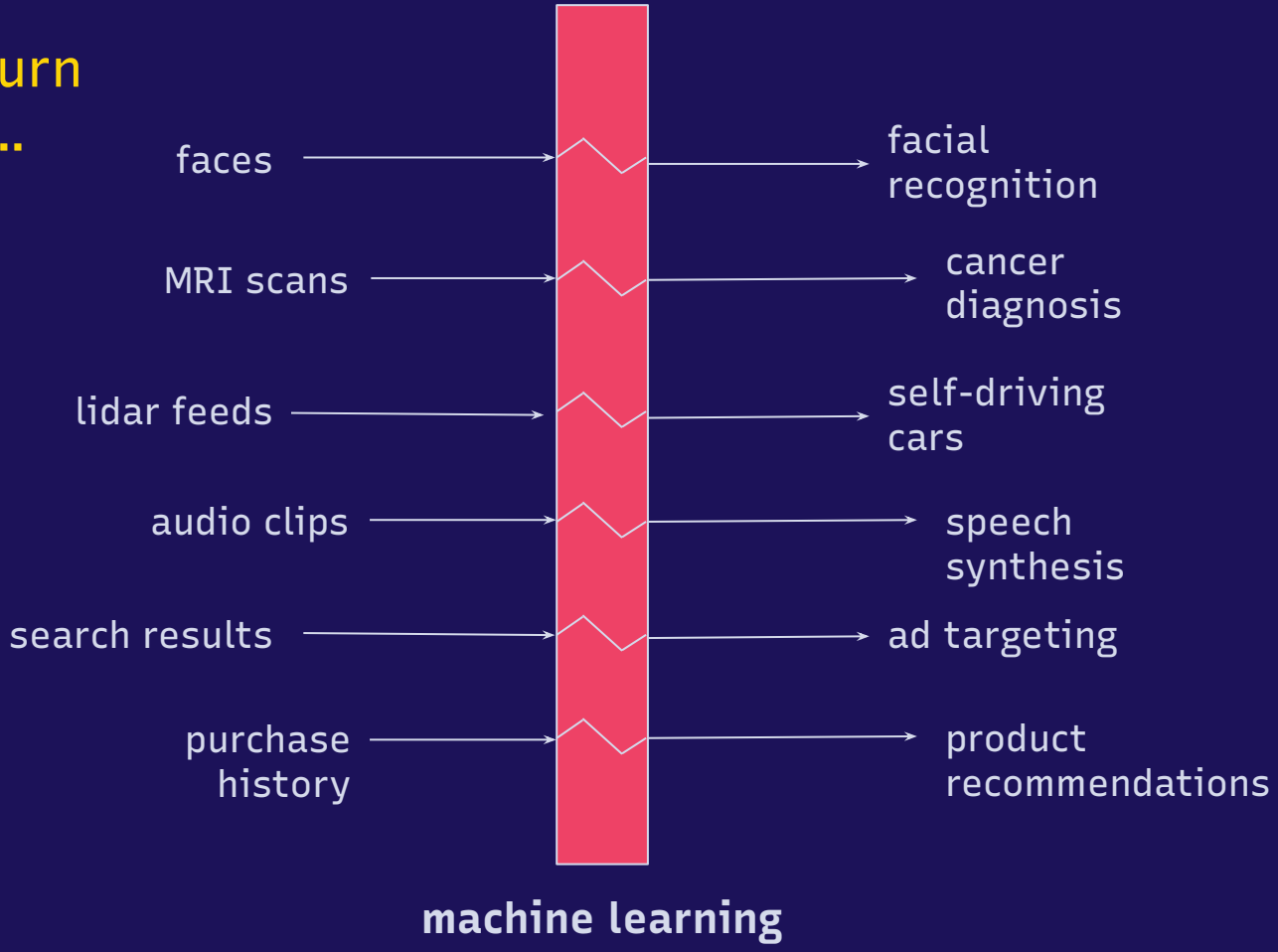


AI Spotlight Series

The simplicity of machine learning is what makes it so powerful.

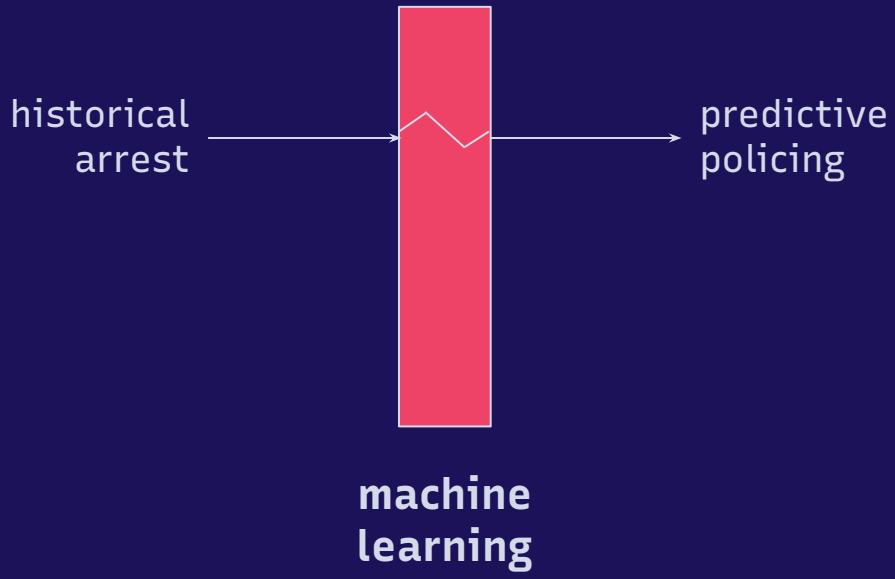


You can turn any data...



...into a model

It’s also the root of a lot of problems.



This gets more difficult with neural networks.

The New York Times

Self-Driving Uber Car Kills Pedestrian in Arizona, Where Robots Roam

A woman crossing Mill Avenue at its intersection with Curry Road in Tempe, Ariz., on Monday. A pedestrian was struck and killed by a self-driving Uber vehicle at the intersection a night earlier. Caitlin O'Hara for The New York Times

By Daisuke Wakabayashi

March 19, 2018

AI Spotlight Series

The AI Accountability Network

Pulitzer Center