Class 7: AI in Practice: Introduction to Artificial Intelligence

Agenda

- AI: Why now?
- Understanding AI
- Introduction to Machine Learning
- Introduction to Deep Learning
- Introduction to Transfer Learning
- Introduction to GAN
- Introduction to Data Science
- AI Tools on Cloud

AI : Why now?

Coined the term
artificial intelligence
in 1955

“the science and
engineering of making
intelligent machines."

John McCarthy
one of the "founding fathers" of AI

Source: Wikipedia

FRANKENSTEIN;

OR,

THE MODERN PROMETHEUS.

IN THREE VOLUMES.

Did I request thee, Maker, from my clay
To mould me man? Did I solicit thee
From darkness to promote me?——
PARADISE LOST.

VOL. I.

London:
PRINTED FOR
LACKINGTON, HUGHES, HARDING, MAVOR, & JONES,
FINSBURY SQUARE.

1818.

Start with 2 Types of AI Trends

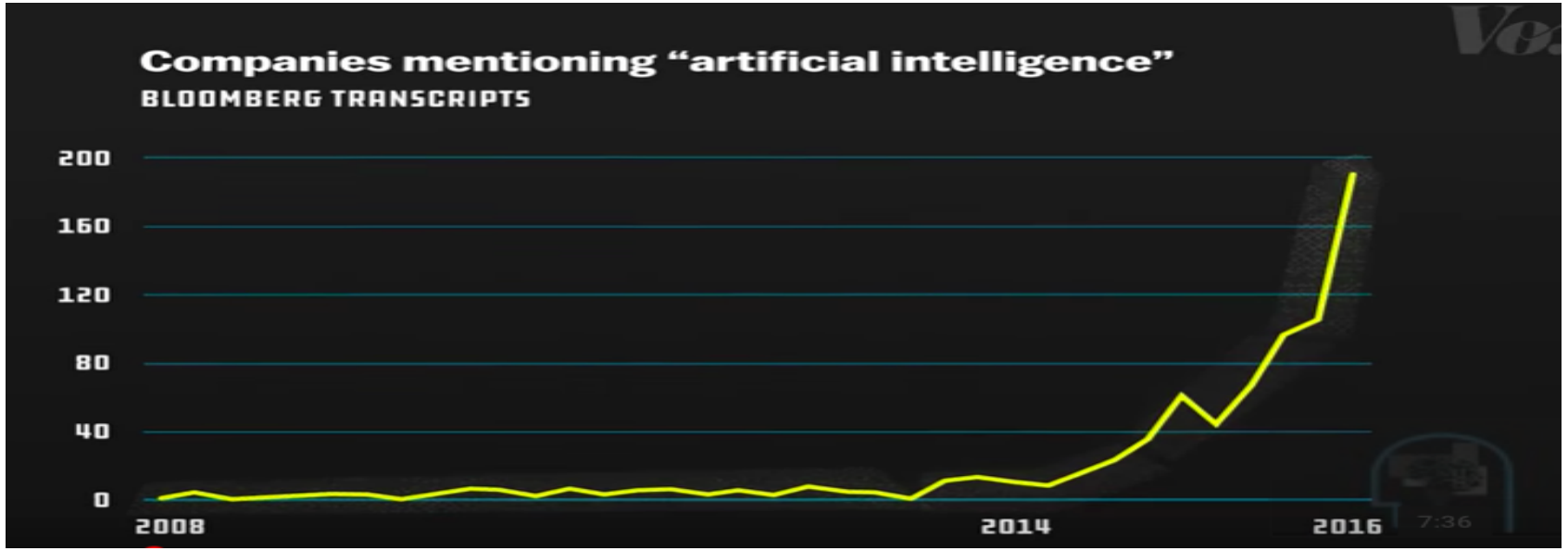
1. Expert Systems – Rule-Based
2. Neural Networks – Machine Learning from Data →Cold starts

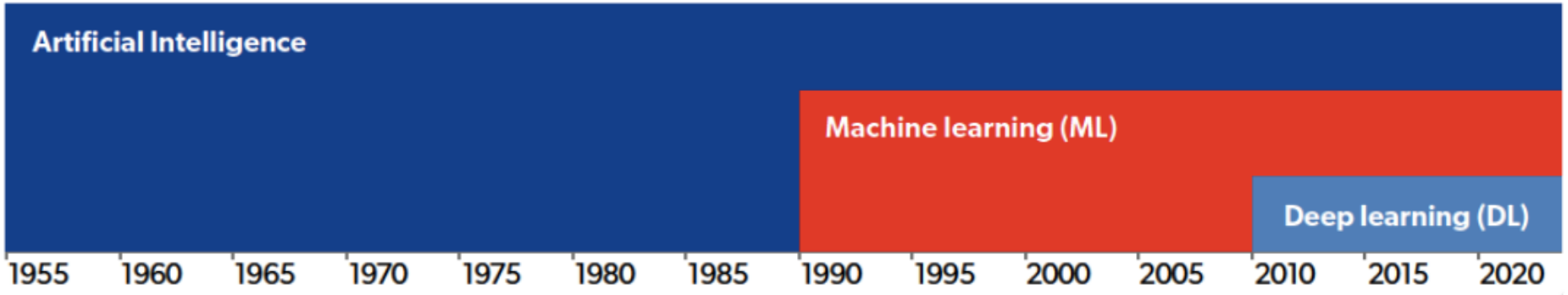
March 25, 1996

"the science and engineering of making intelligent machines."

Source: Drive Digital Transformation using AI, AWS summit

The (60+ years) rise of AI





Kasparov vs Deep Blue, 1997

จุดเปลี่ยนของ AI →DeepMind (Deep Learning) จาก Alpha GO ของ Google


AllphaGO vs. Lee Sedol
4 - 1
AlphaGo
Lee Sedol

AlphaGo Zero

AI vs AI


AlphaGO Zero vs. AlhpaGo
100 - 0
AlphaGo Zero vs AlphaGo Lee Game 1
日時 2017-10-01
コミ 7.5
手数 16
アゲハマ 0
AlphaGo Zero
時間 02:00:00
アゲハマ 0
AlphaGo Lee
時間 02:00:00
予測勝率
50.0%
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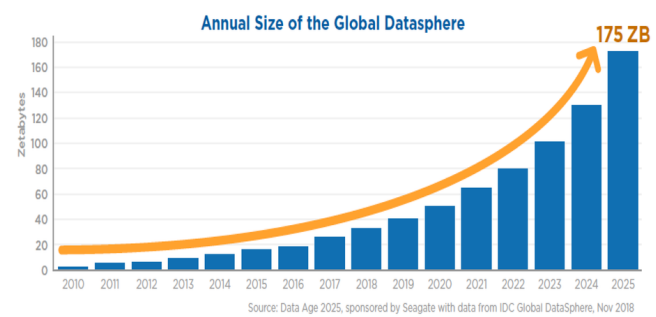
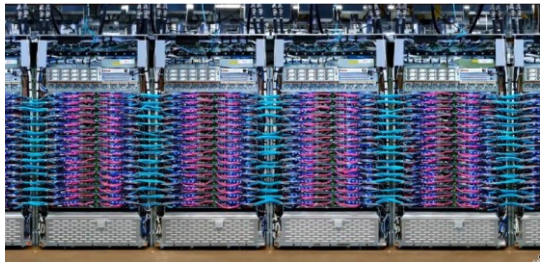
B+4.8

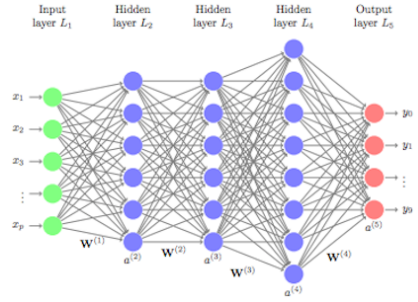
AI: Why now?



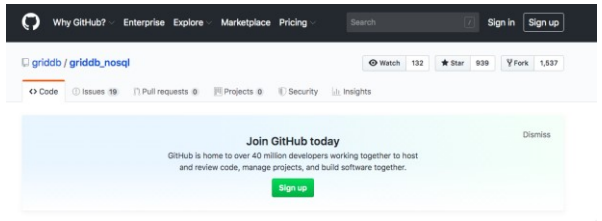
Data



Hardware



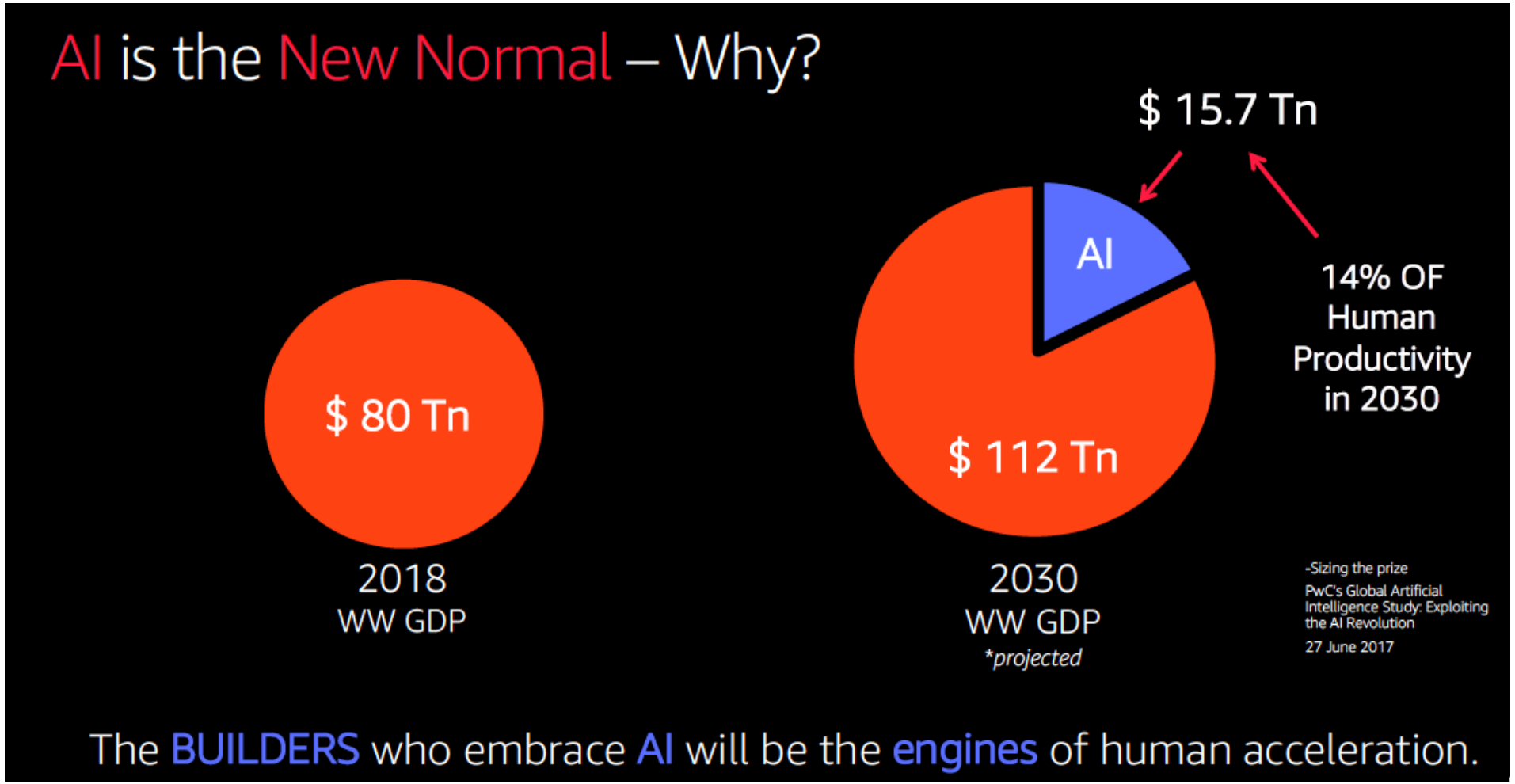
Algorithms



Community

Tools

Investment

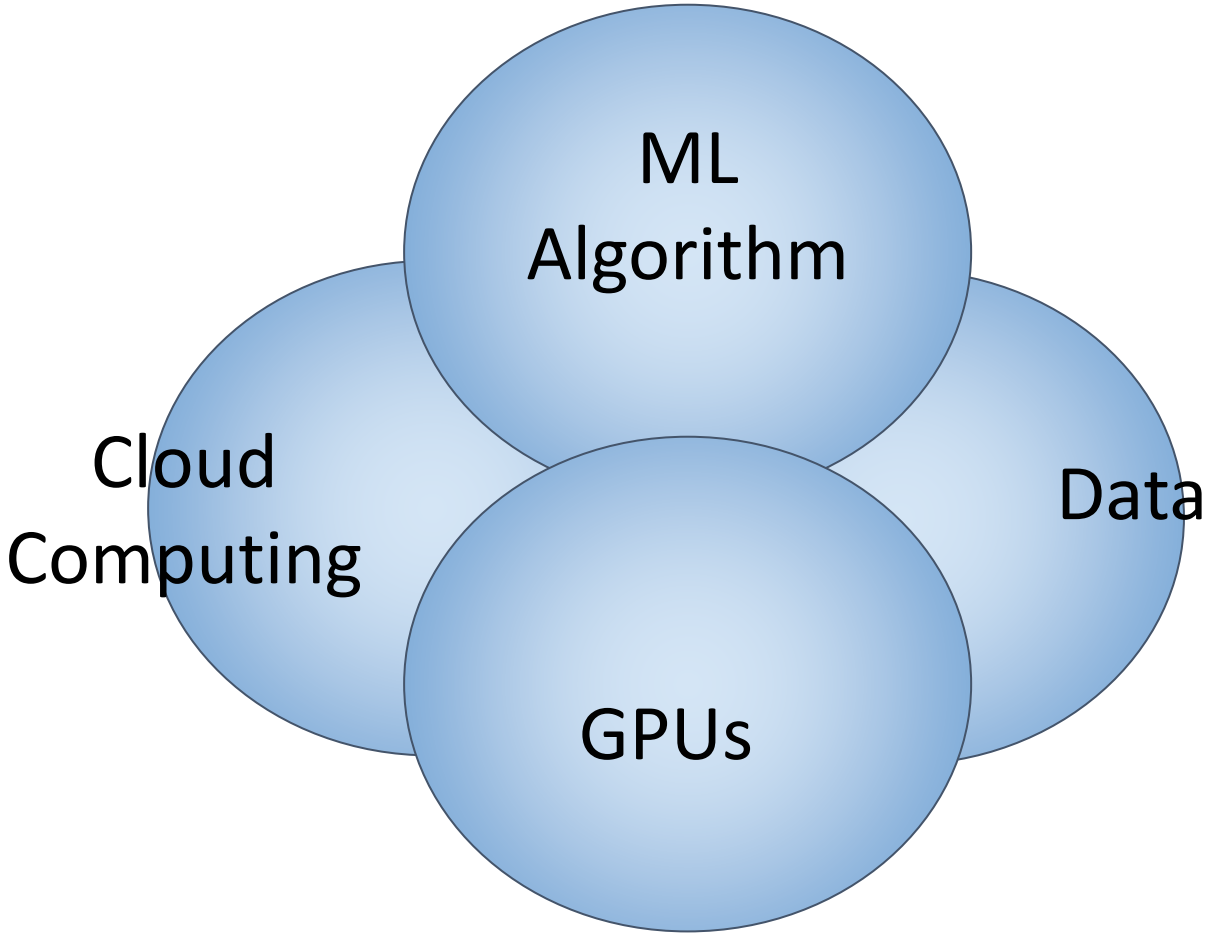


Source: Drive Digital Transformation using AI, AWS summit

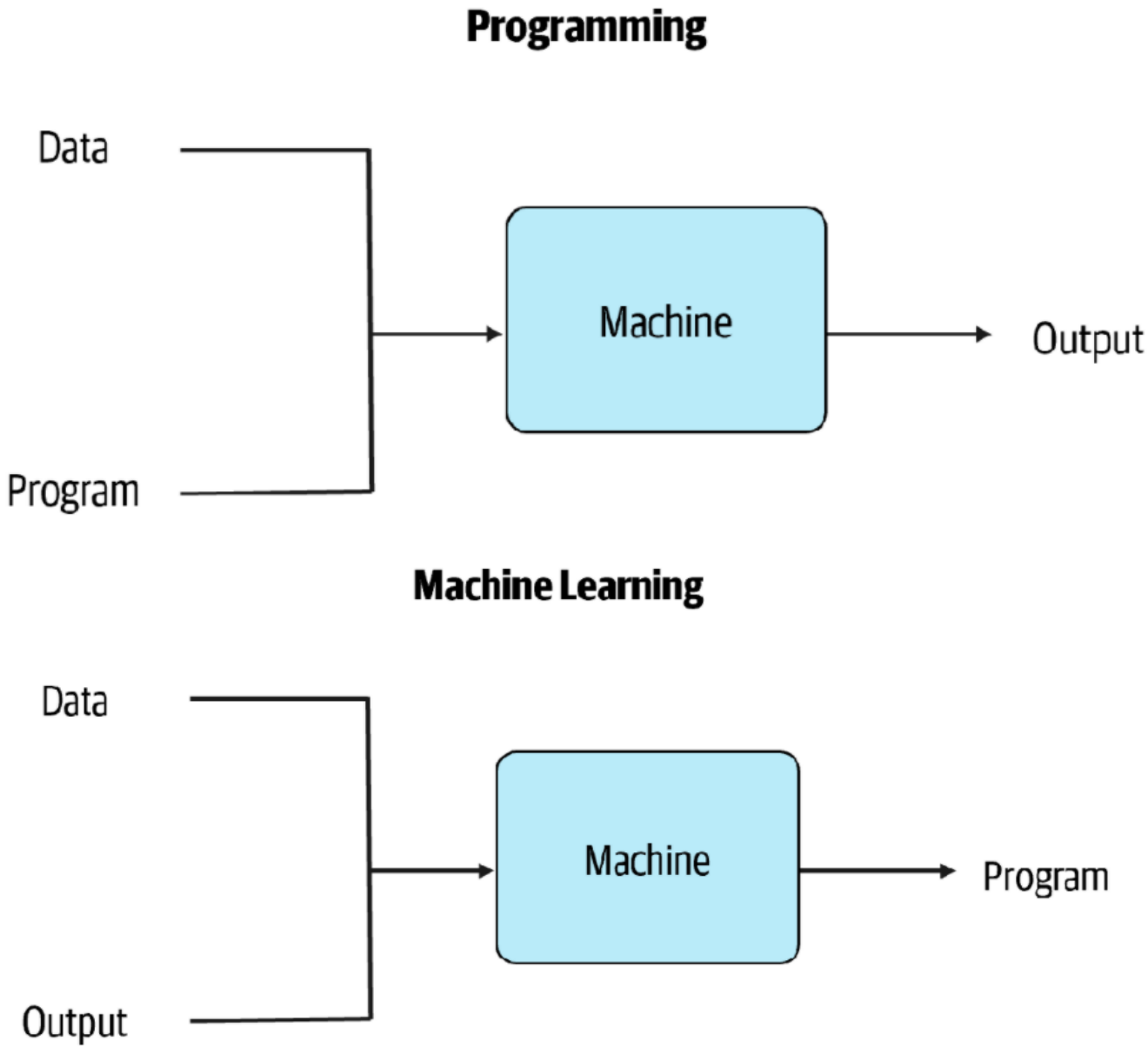
ประชุมเอไอโลก : แจ็ค หม่า ประธานบริหารอาลีบาบากรุ๊ป ขึ้นเวทีแสดงสุนทรพจน์ในการประชุมเอไอโลก ที่นครเซี่ยงไฮ้ของจีน วานนี้ (17 ก.ย.) ระบุ ผู้ผลิตที่ประสบความสำเร็จในอนาคตต้องเชี่ยวชาญเทคโนโลยีเอไอ ใครไม่รู้จะล้มเหลวทุกด้าน

Source: กรุงเทพธุรกิจ 18 ก.ย. 2561

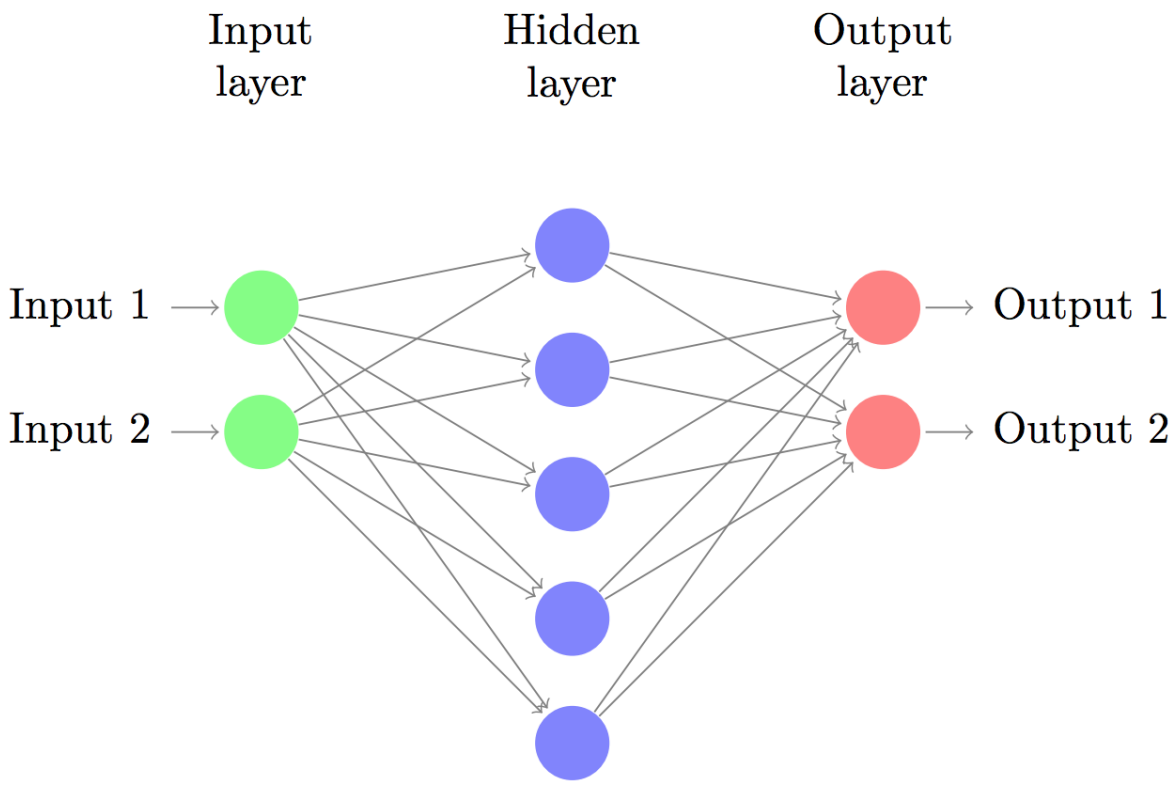
Factors impacting AI



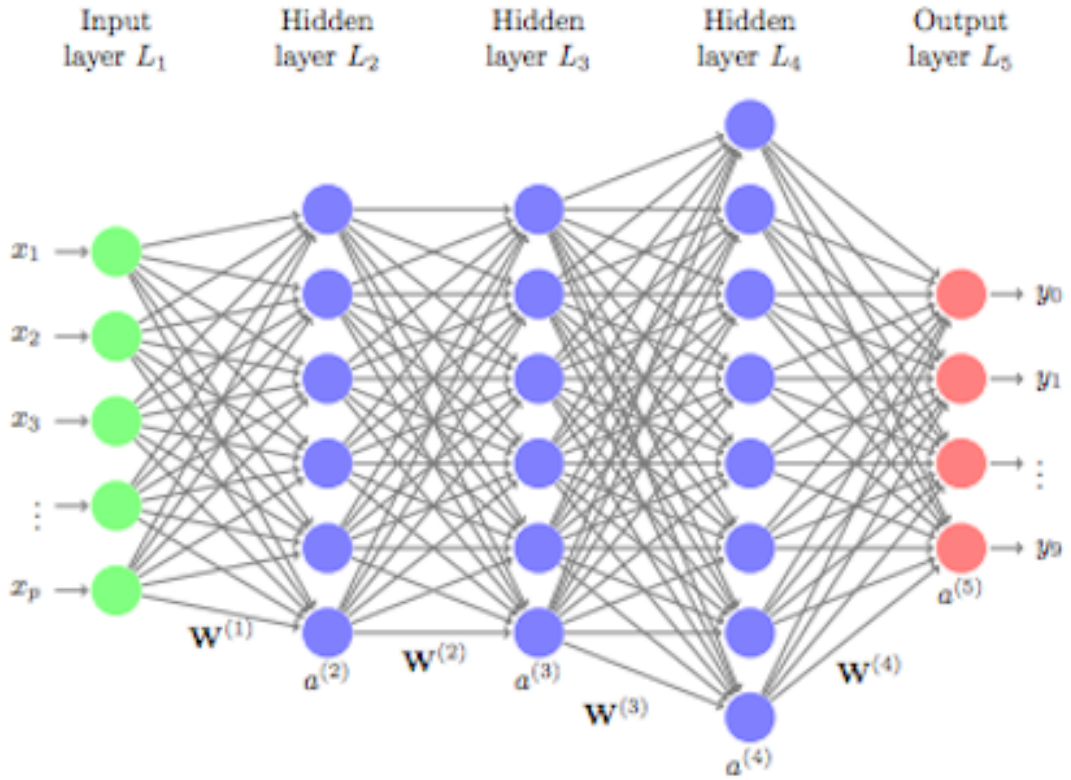
How to make machine intelligent?


Programming
Data
Program
Machine
Output
Machine Learning
Data
Output
Machine
Program

Neural Network



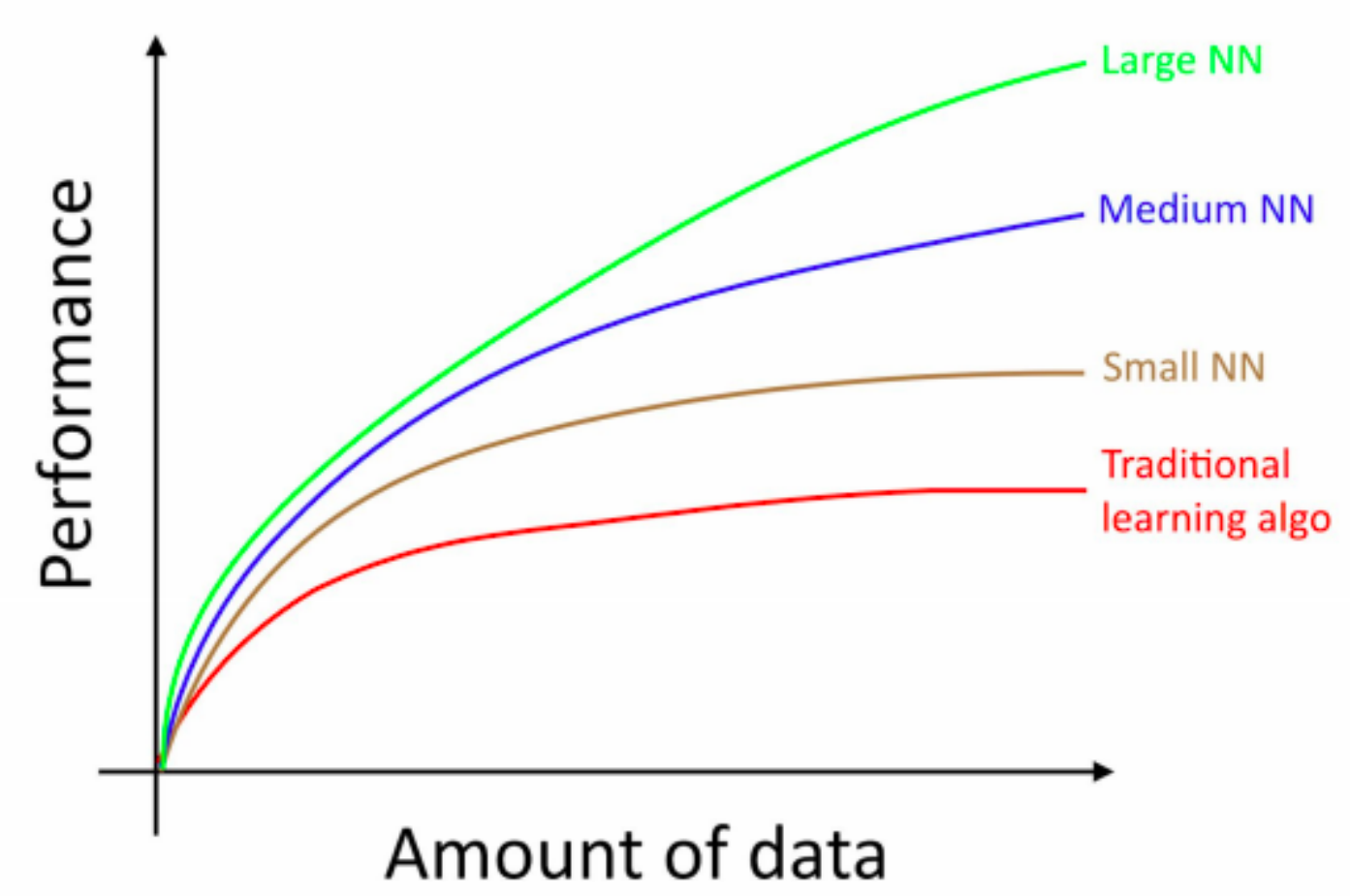
Deep Learning



Lion

or

Elephant



Source:Machine Learning, Andrew Ng.

Facial Recognition Technology

MEGAPIXELS

DATASETS ABOUT RESEARCH

Microsoft Celeb Dataset (MS Celeb)

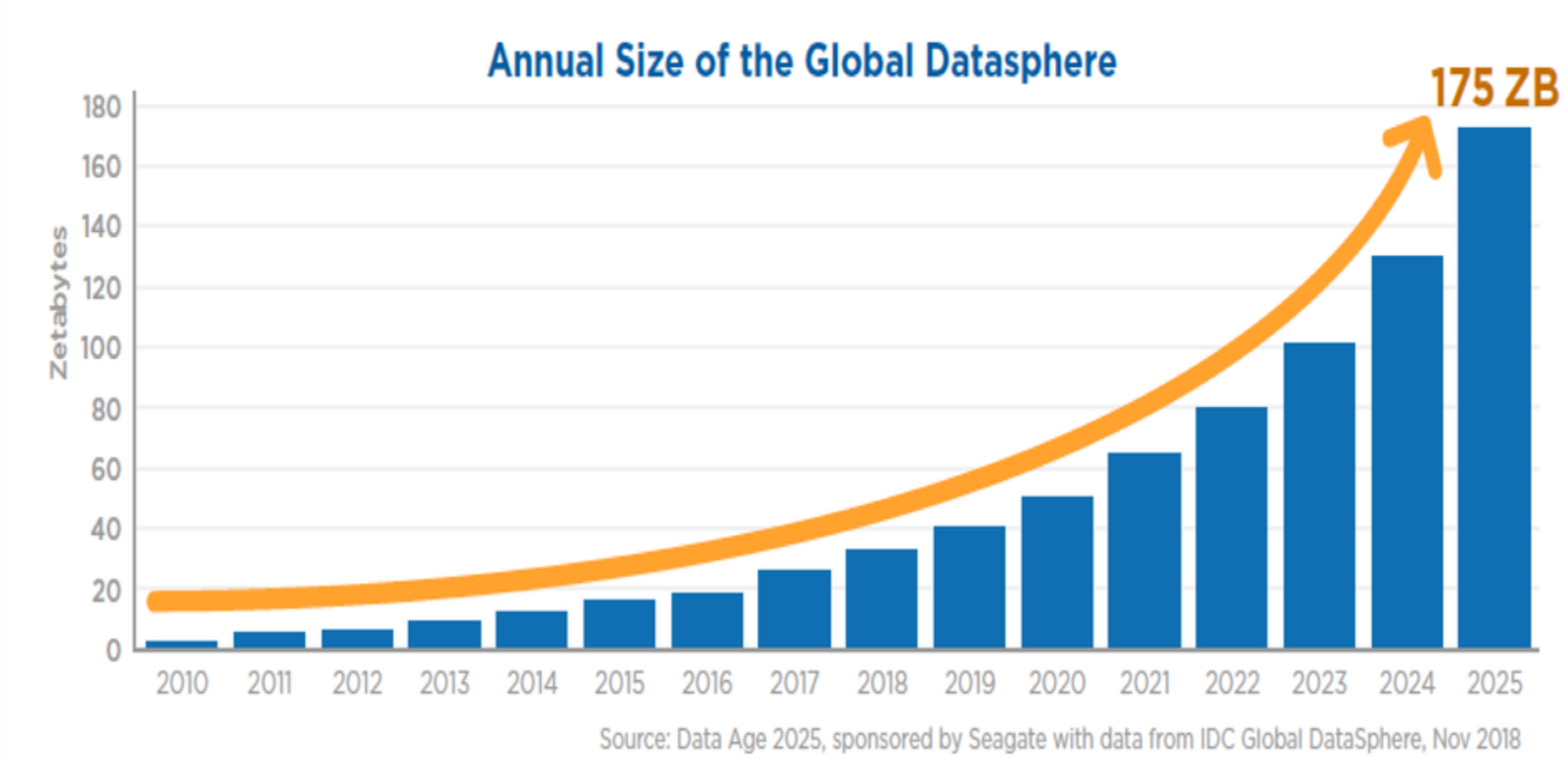
Microsoft Celeb (MS-Celeb-1M) is a dataset of 10 million face images harvested from the Internet for the purpose of developing face recognition technologies. According to Microsoft Research, who created and published the dataset in 2016, MS Celeb is the largest publicly available face recognition dataset in the world, containing over 10 million images of nearly 100,000 individuals. Microsoft's goal in building this dataset was to distribute an initial training dataset of 100,000 individuals' biometric data to accelerate research

PUBLISHED
2016

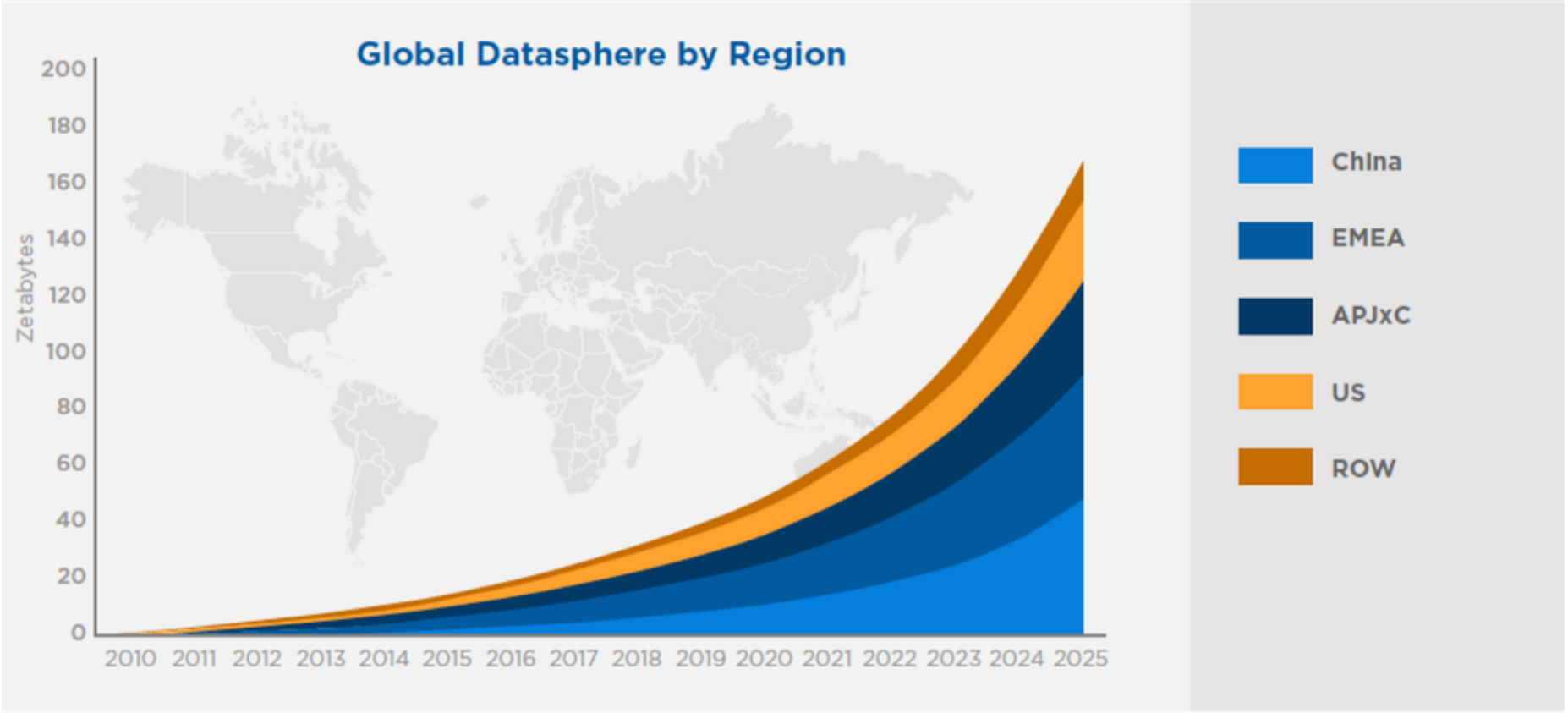
IMAGES
8,200,000

IDENTITIES
100,000

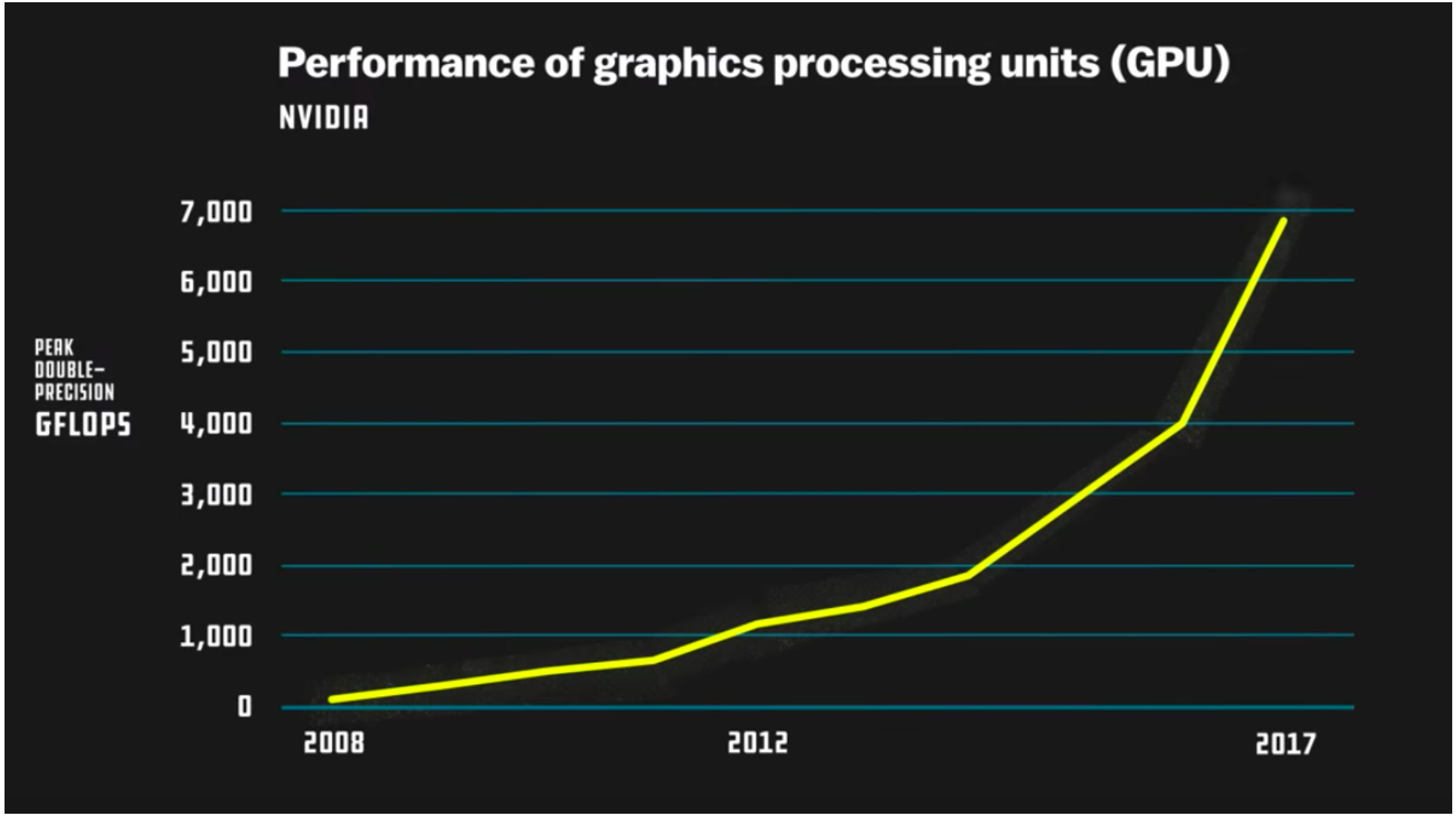
175 Zettabytes By 2025



China is Saudi Arabia of Data

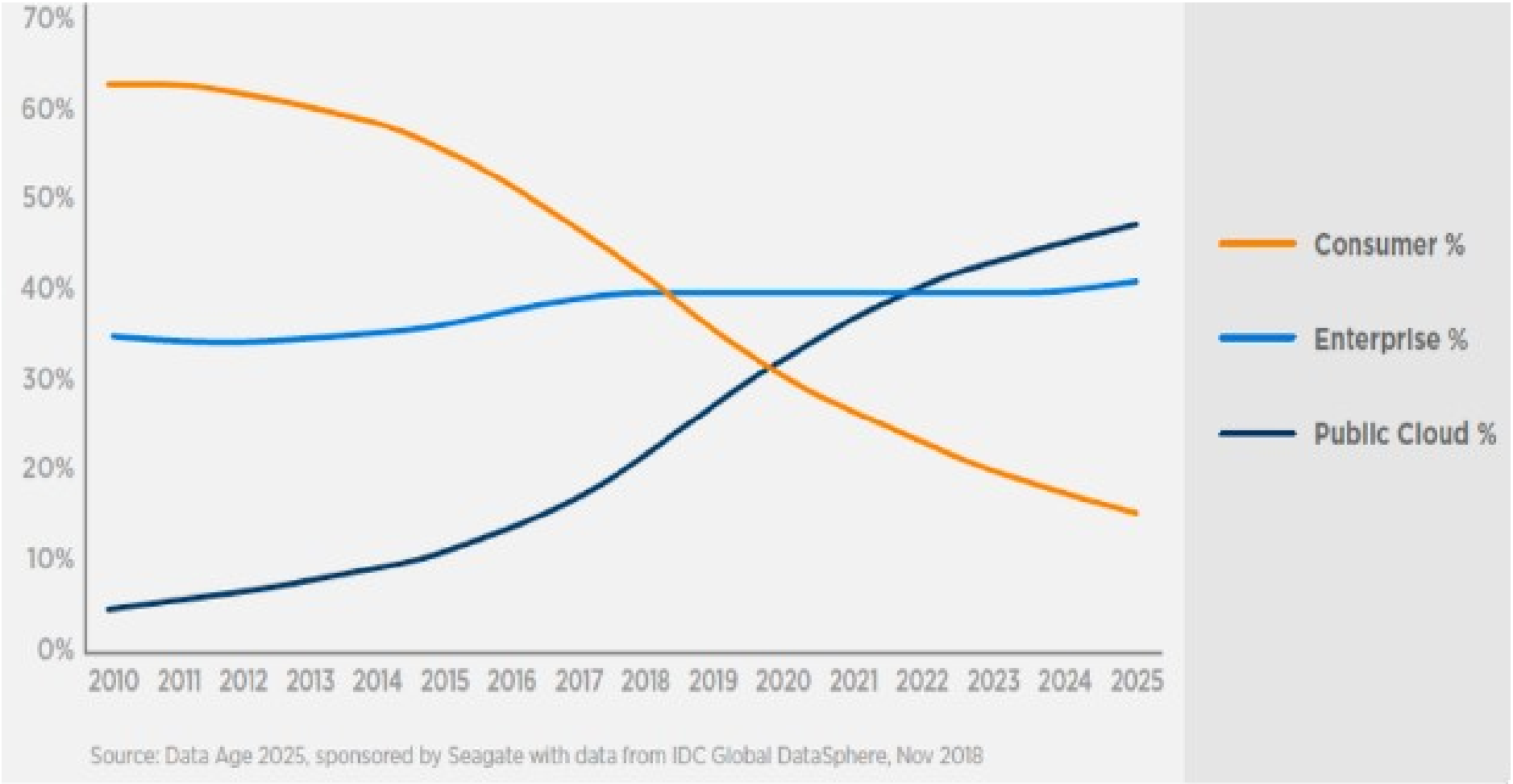


Source: IDC's Data Age 2025 study, sponsored by Seagate

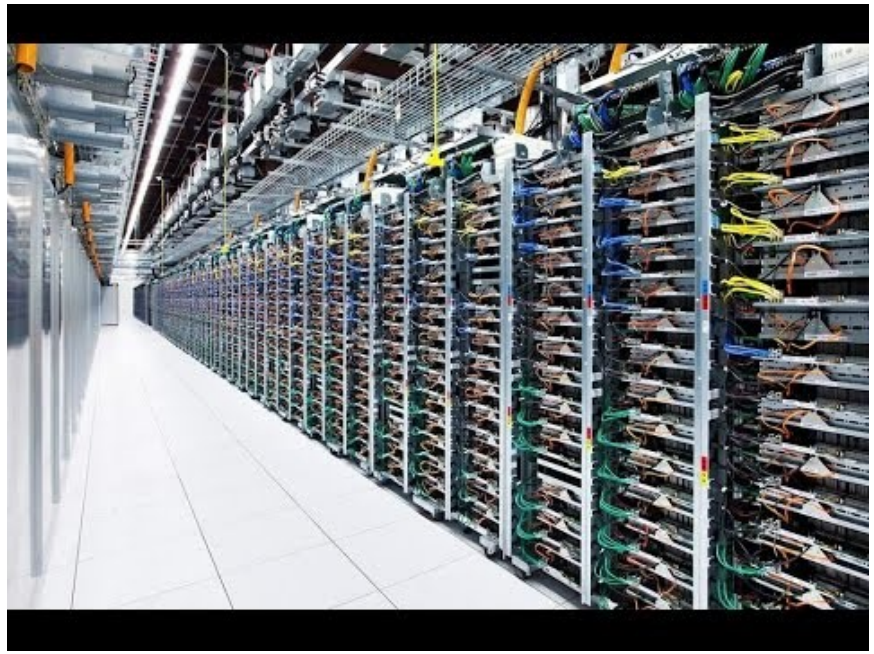


Source: How smart is today's artificial intelligence?,

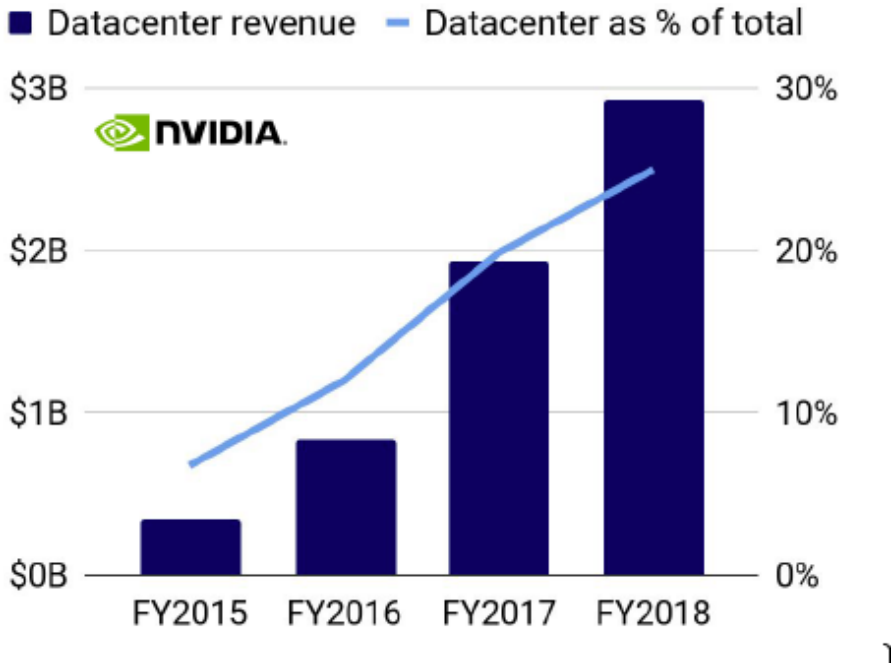
Where is the data store?



Computing is also shift to the cloud



Gartner estimated in a July 2016 report that Google at the time had 2.5 million servers.



AI hardware sales for data centers is very strong and growing

Understanding AI

เปลี่ยนแนวคิดการทำธรุกิจของ Google

Google chief: we are moving from “a mobile first to an AI first world”

22 APR 2016

113 471 96

AUTHOR

Richard Handford

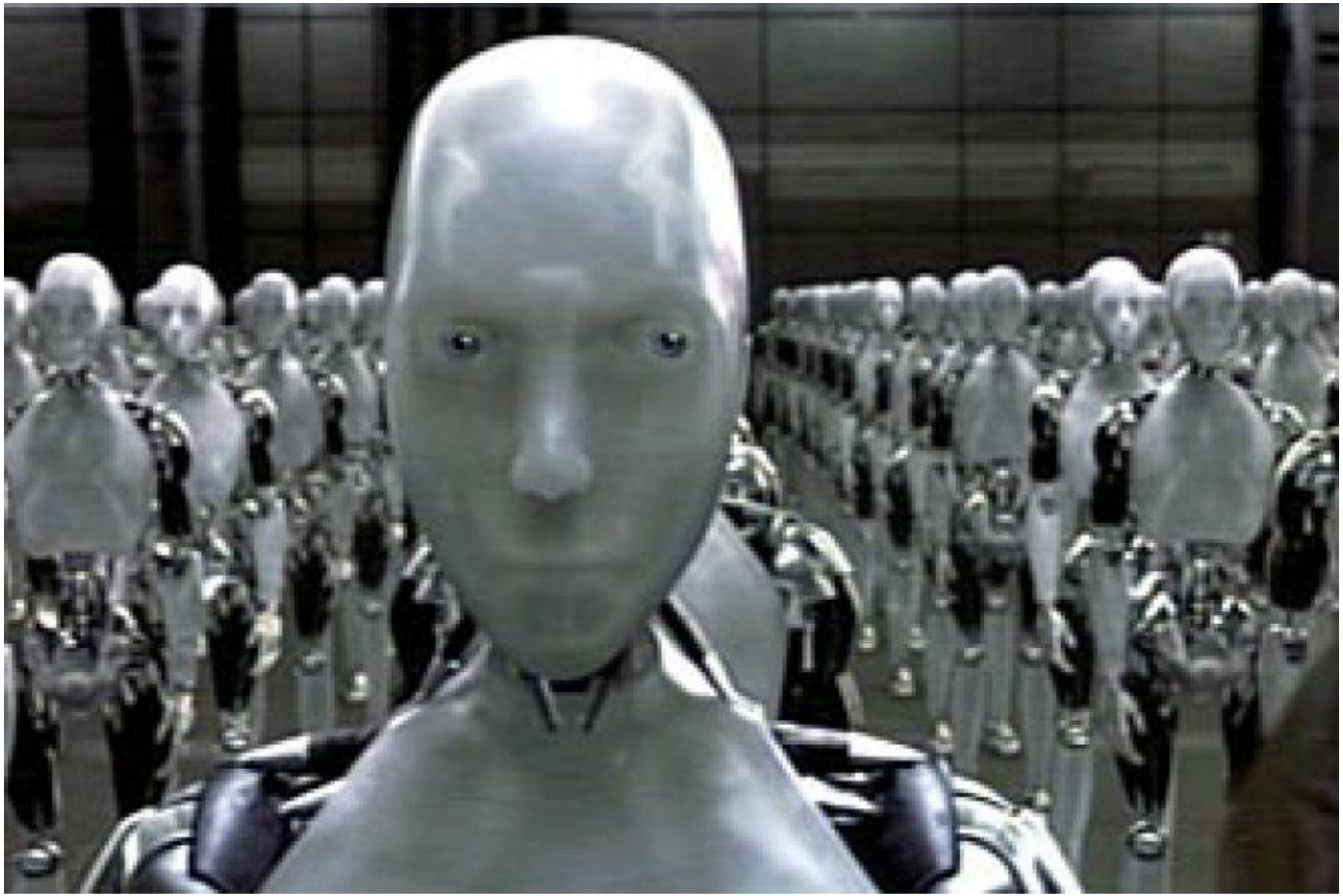
Richard is the editor of Mobile World Live's money channel and a contributor to the daily news service. He is an experienced technology and business journalist who previously worked as a freelancer for many publications over the last decade including...

Read more

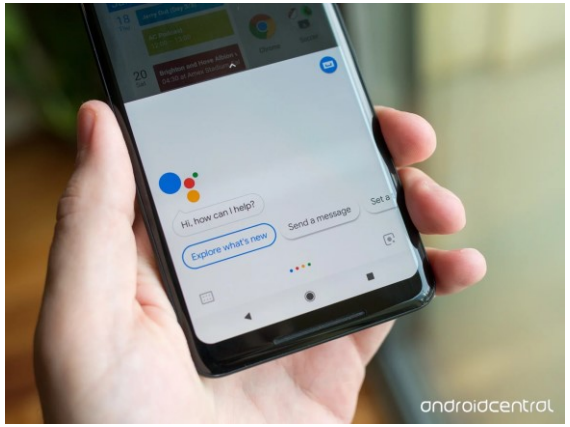
AI-first World

Source http://www.investors.com/

AI ไม่ใช่แค่ยุคของหุ่นยนต์



What is modern AI, really?



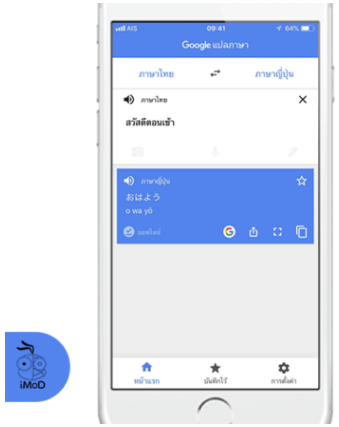
Voice recognition

amazon

NETFLIX

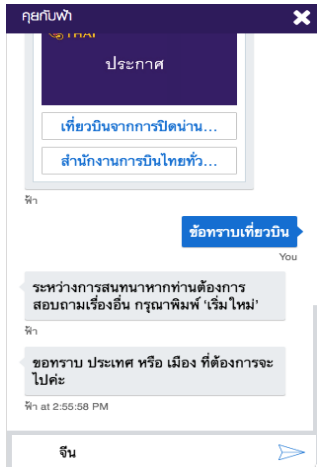
Recommendation

Self driving car



Google Translate
อัปเดตใหม่สวยขึ้นและฉลาดมากยิ่งขึ้น

Machine Translation



Chatbot

What is AI?

Artificial intelligence (AI) is the simulation of human intelligence processes by machines, especially computer systems.

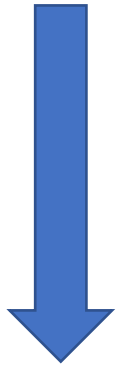
Source https://searchenterpriseai.techtarget.com/definition/AI-Artificial-Intelligence

AI

- ANI - Artificial Narrow Intelligence
  - Smart speaker, translator, self driving car
- AGI- Artificial General Intelligence
  - Do anything human can do
- ASI- Artificial Superhuman Intelligence
  - Far surpassing that of the brightest and most gifted human minds

AI เก่งเป็นเรื่องๆ

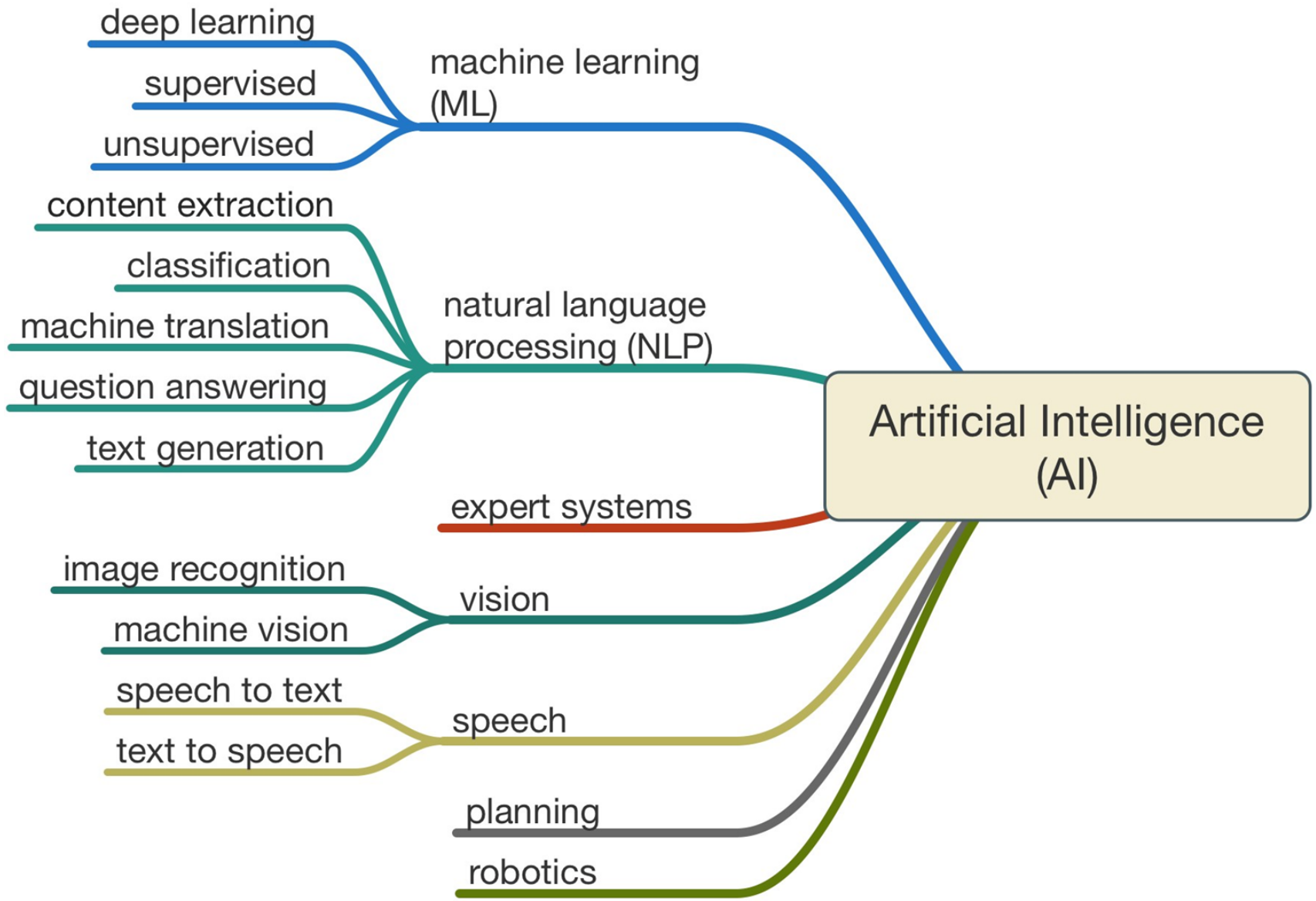
(We are here)



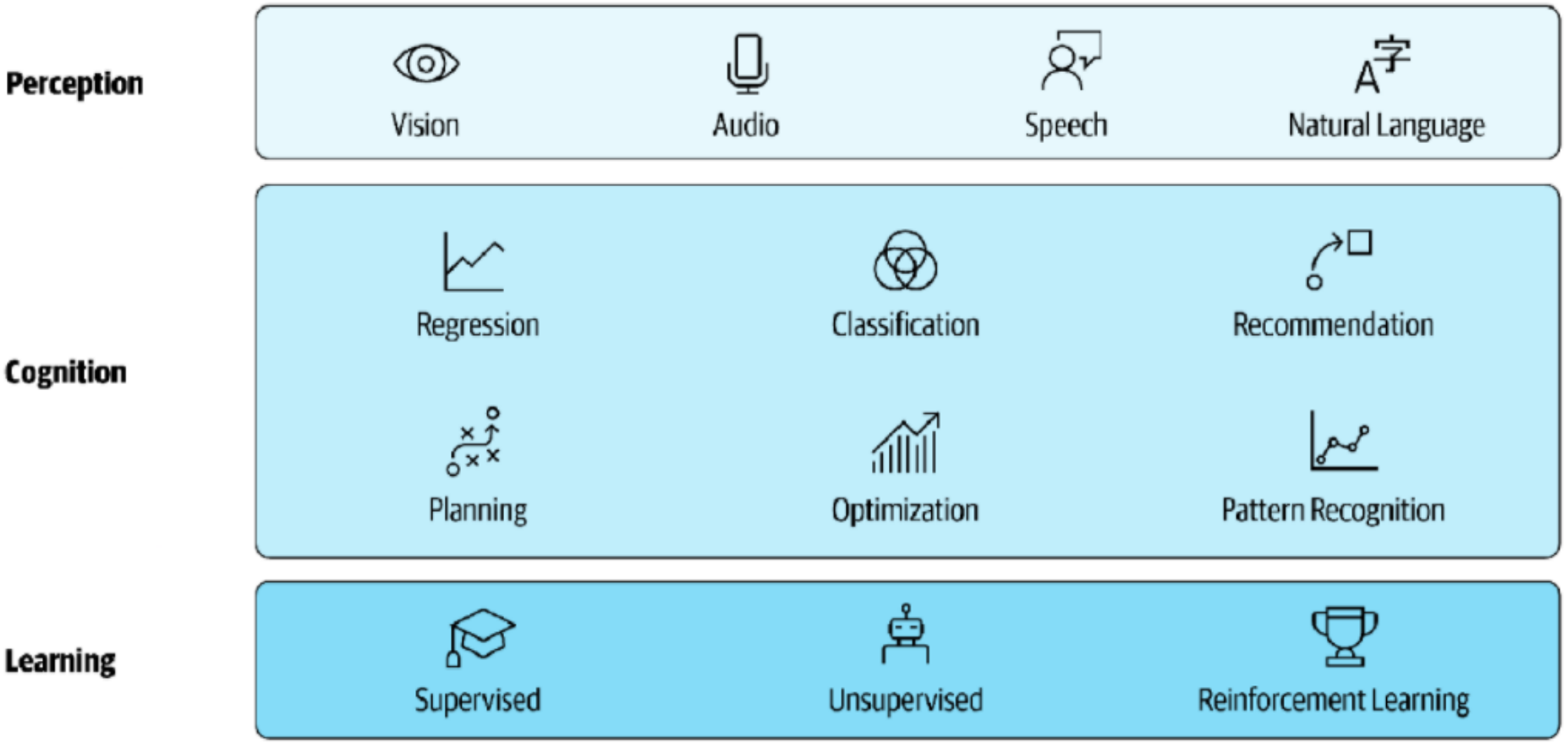
Future! When????

Narrow (weak) AI Capabilities

- Learning (การเรียนรู้)
  - The ability to learn over time, without the need of explicit programming.
- Perception (การรับรู้)
  - understanding an image or converting speech to text
- Cognition (ความรู้ความเข้าใจ)
  - The ability to acquire and process knowledge on top of data



Source:http://mse238blog.stanford.edu



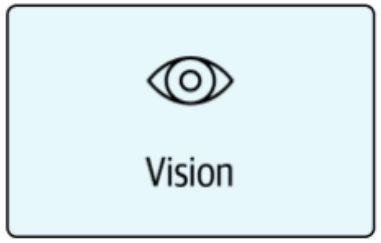
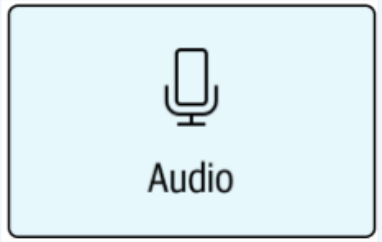
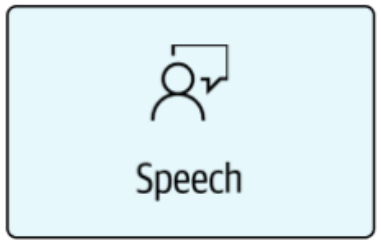
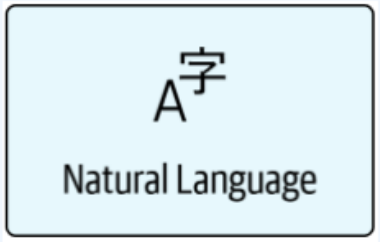
Source:The AI Organization, David Carmona

Learning

 Supervised	Learn by iterating over training datasets containing labeled data (pairs of inputs and outputs)—for example, using data on previous customer interactions to predict churn.
 Unsupervised	Infer hidden structures in an unlabeled dataset, such as relationships, categories, patterns, or features—for example, identifying different usage patterns or user segments in a website.
 Reinforcement Learning	Learn by experimenting in an environment, trying to maximize a reward provided in the training—for example, operating a vehicle autonomously or optimizing the energy consumption in a datacenter.

Source:The AI Organization, David Carmona

Perception

 Vision	Extract information from or understand images and videos—for example, performing image classification, scene identification, or face recognition.
 Audio	Perform audio processing tasks such as sound recognition or audio pattern identification—for example, identifying machinery failures based on sound.
 Speech	Interact with humans using speech—for example, performing natural text-to-speech and speech-to-text conversions.
 Natural Language	Understand and generate text language—for example, identifying intent, extracting concepts, analyzing sentiment, or answering questions.

Source:The AI Organization, David Carmona

Cognition

	Estimate a numerical value based on other variables or their values over time—for example, predicting house values or forecasting sales.
	Identify a set of categories of a given instance—for example, fraud detection or medical diagnosis.
	Predict a user's preference for a particular item given similarities with other items or other users' preferences—for example, movie recommendations or experience personalization.

Source:The AI Organization, David Carmona

Cognition (Cont)

 Planning	Find the best sequential approach for a goal—for example, identifying a path for an autonomous vehicle or the steps in a business process.
 Optimization	Maximize a given outcome by finding the right parameters in a process—for example, resource allocation or dynamic pricing.
 Pattern Recognition	Augment the decision-making process by providing relevant insights on data—for example, clustering or key factor identification.

Source:The AI Organization, David Carmona

Introduction to Machine Learning

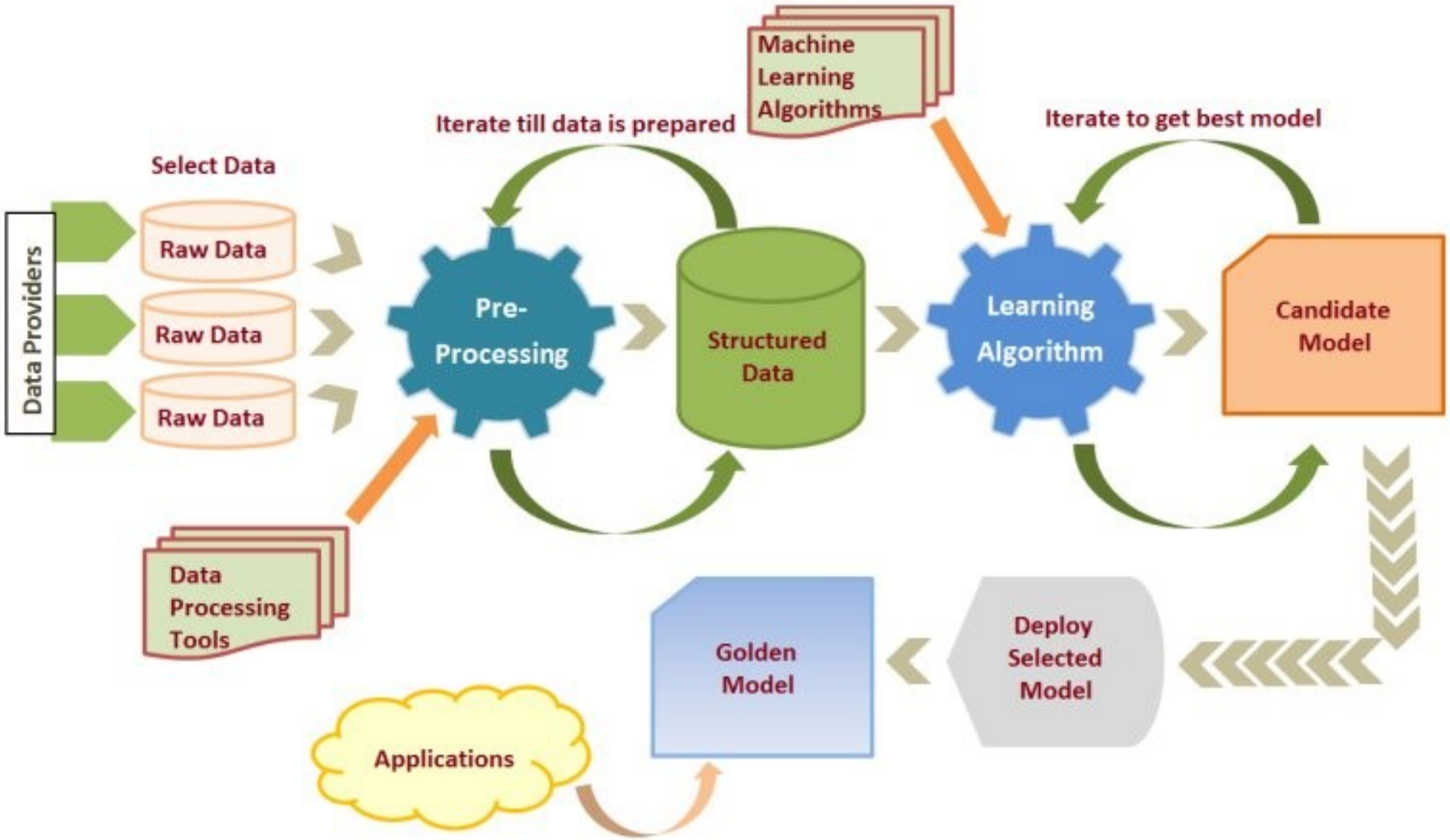
What is Machine Learning?

Machine learning is the study of computer algorithms that improve automatically through experience. It is seen as a subset of artificial intelligence. Machine learning algorithms build a model based on sample data, known as "training data", in order to make predictions or decisions without being explicitly programmed to do so

Machine Learning Components

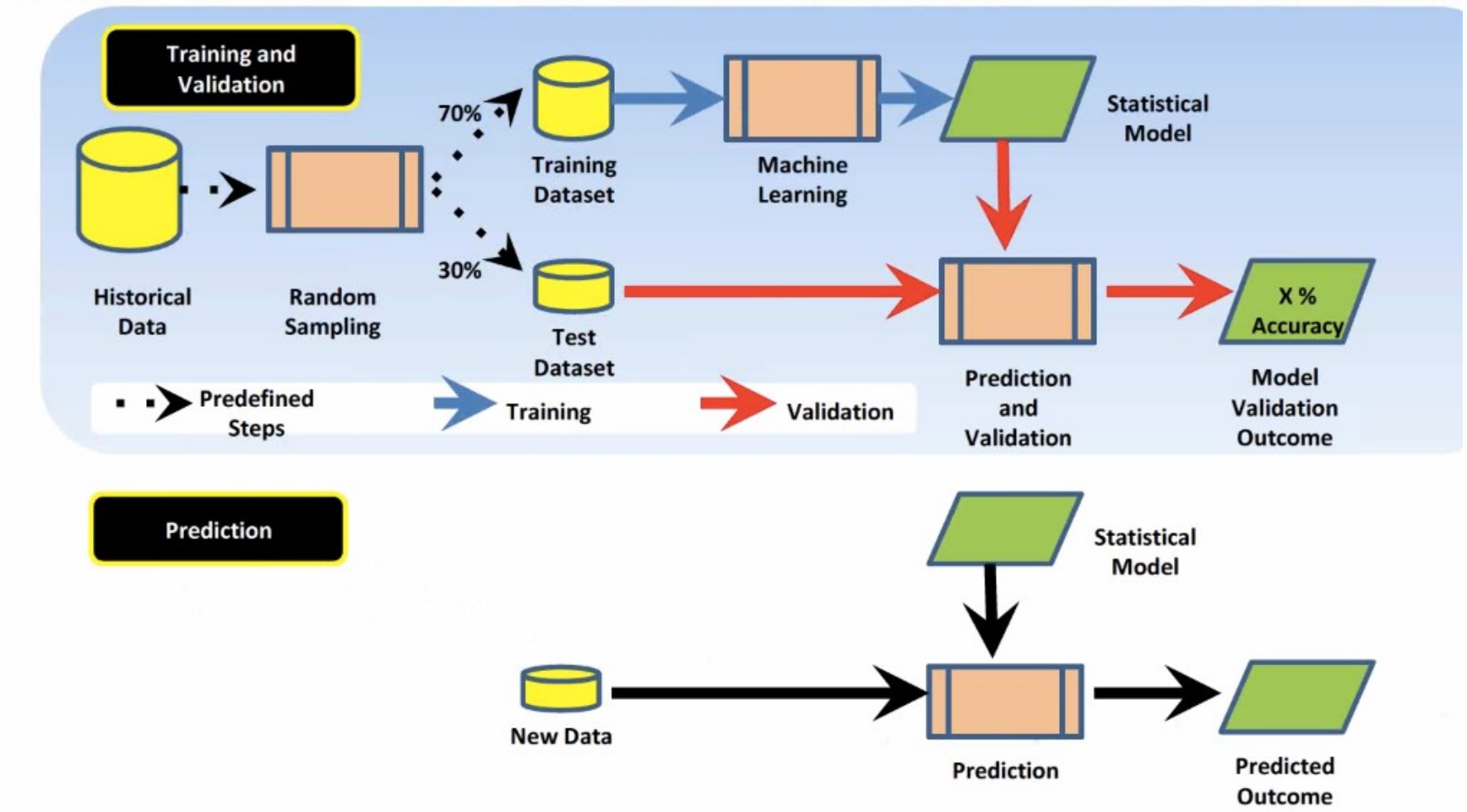
7 Steps of Machine Learning

- Gathering data
- Preparing the data
- Choosing a model
- Training
- Evaluation
- Hyperparameter tuning
- Prediction



Source: Imarticus

Machine Learning Process



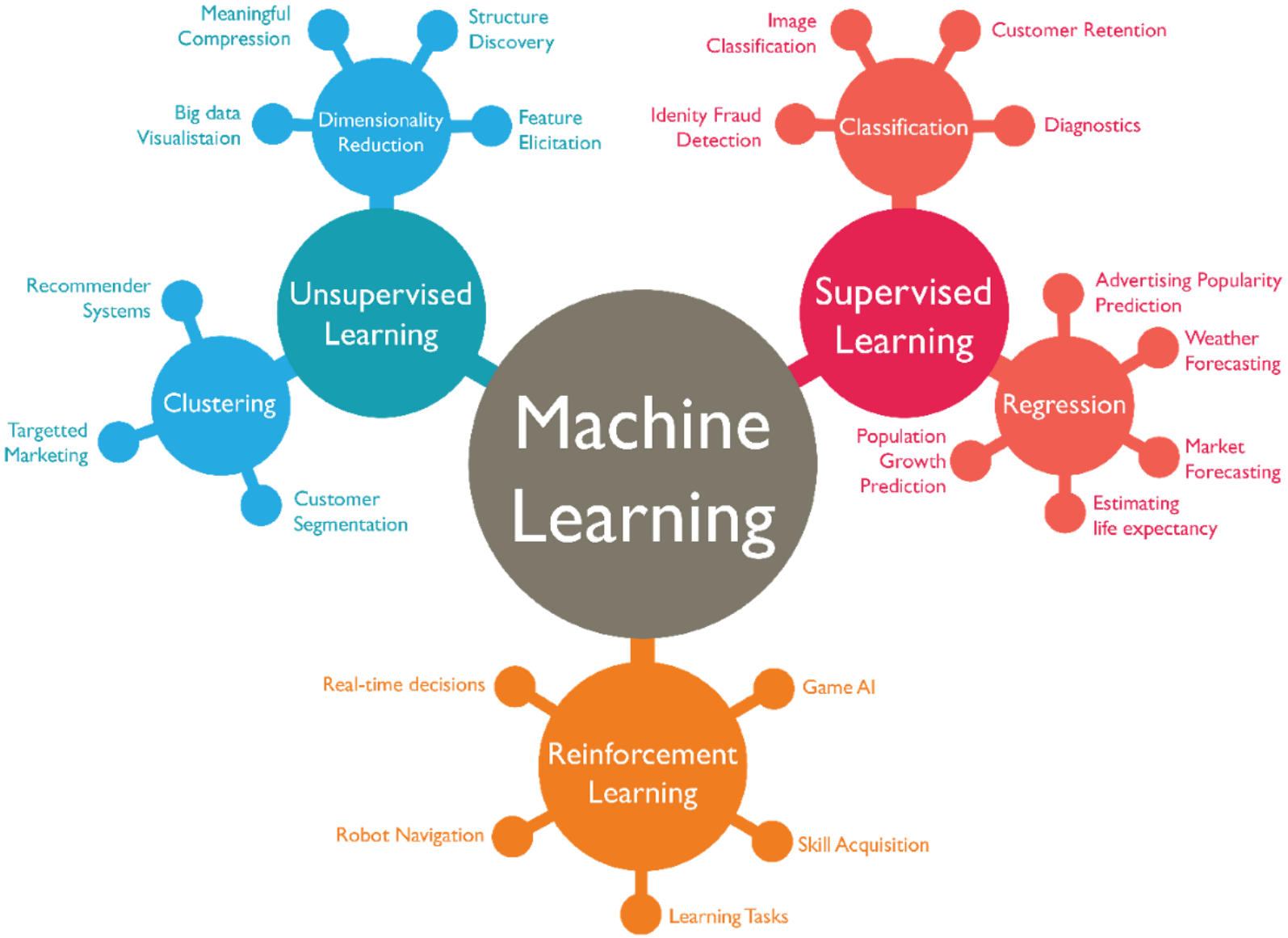
Source: www.edureka.in/data-science

Big Data for Training Models

- Training process requires large resources: both storage & computing power.
- Big data should leverage cloud services.
- Separate between compute & storage.
- Load data into cloud storage.
- Use distributed compute engine for training.

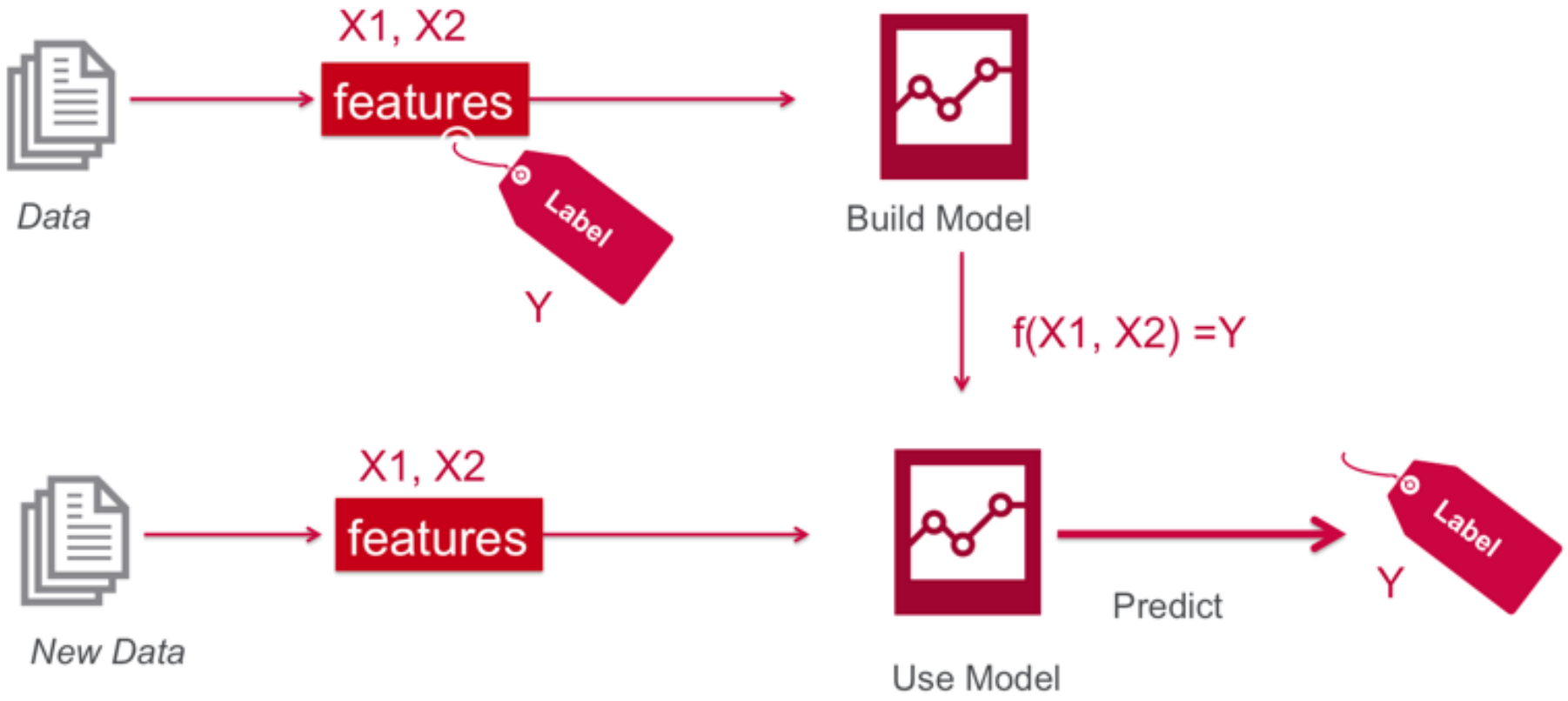
Type of Machine Learning

- **Supervised learning**: The learning algorithm is given labeled data and the desired output.
- **Unsupervised learning**: The data given to the learning algorithm is unlabeled, and the algorithm is asked to identify patterns in the input data.
- **Reinforcement learning:** The algorithm interacts with a dynamic environment that provides feedback in terms of rewards and punishments.



Source: Types of Machine Learning Algorithms, 7wData

Supervised Learning



Source: https://mapr.com/blog/demystifying-ai-ml-dl/

Classification v.s. Regression

Classification

- Predict which category an item belongs to based on labeled examples of known items
- Use in classify a new data

Regression

- Predict a continuous value target.
- Linear regression predicts a numeric value
- Logistic regression predicts a probability

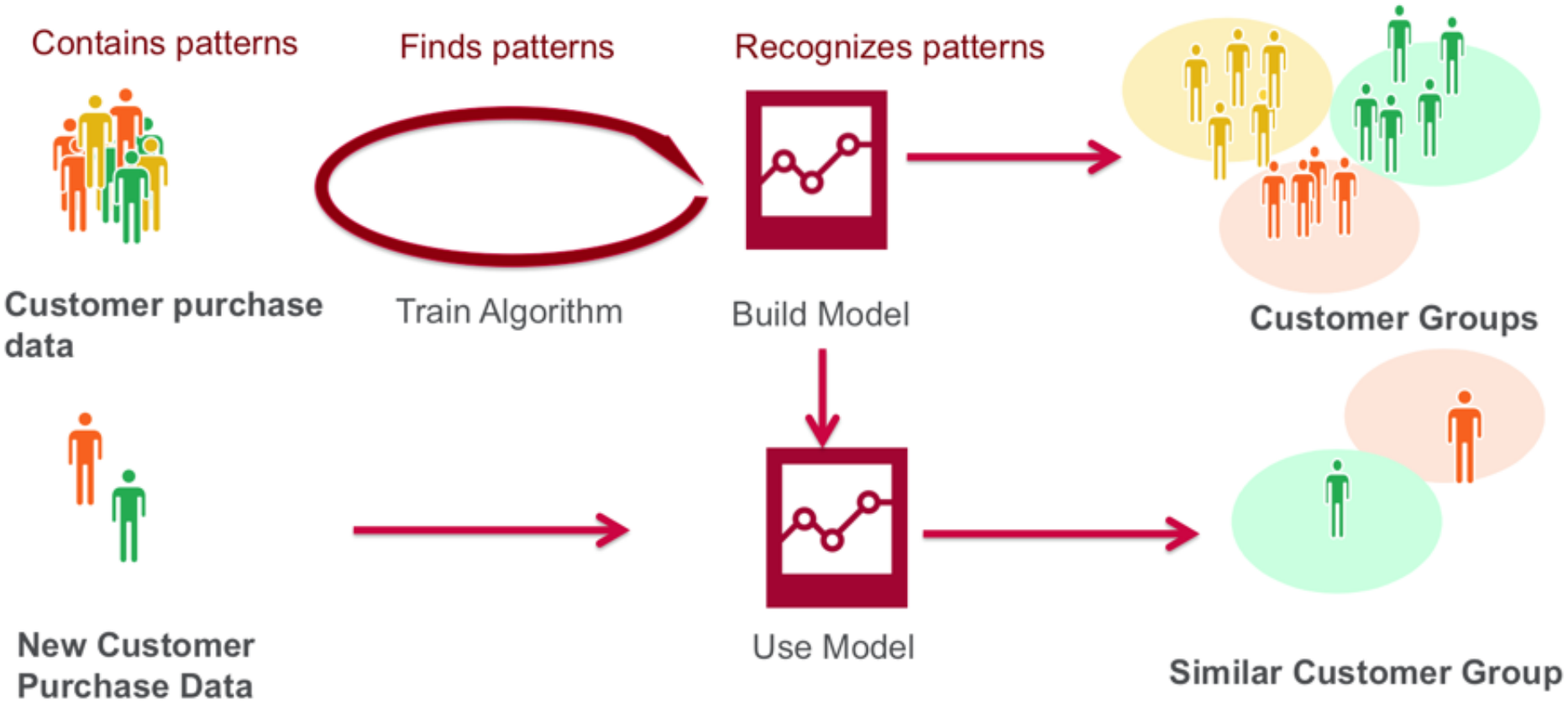
Examples of classification

- Credit card fraud detection (fraud, not fraud)
- Credit card application (good credit, bad credit)
- Email spam detection (spam, not spam)
- Text sentiment analysis (happy, not happy)
- Predicting patient risk (high risk patient, low risk patient)
- Classifying a tumor as malignant or not

Examples of regression

- Predicting the price of the house.
- Predicting age of a person
- Predicting the stock price for tomorrow.
- Predicting next year GDP.

Unsupervised Learning



Source: https://mapr.com/blog/demystifying-ai-ml-dl/

Clustering v.s. Association

Clustering

- Process of grouping data into different clusters and groups.
- Partitional clustering
- Hierarchical clustering

Association

- Attempts to find relationships between different entities.

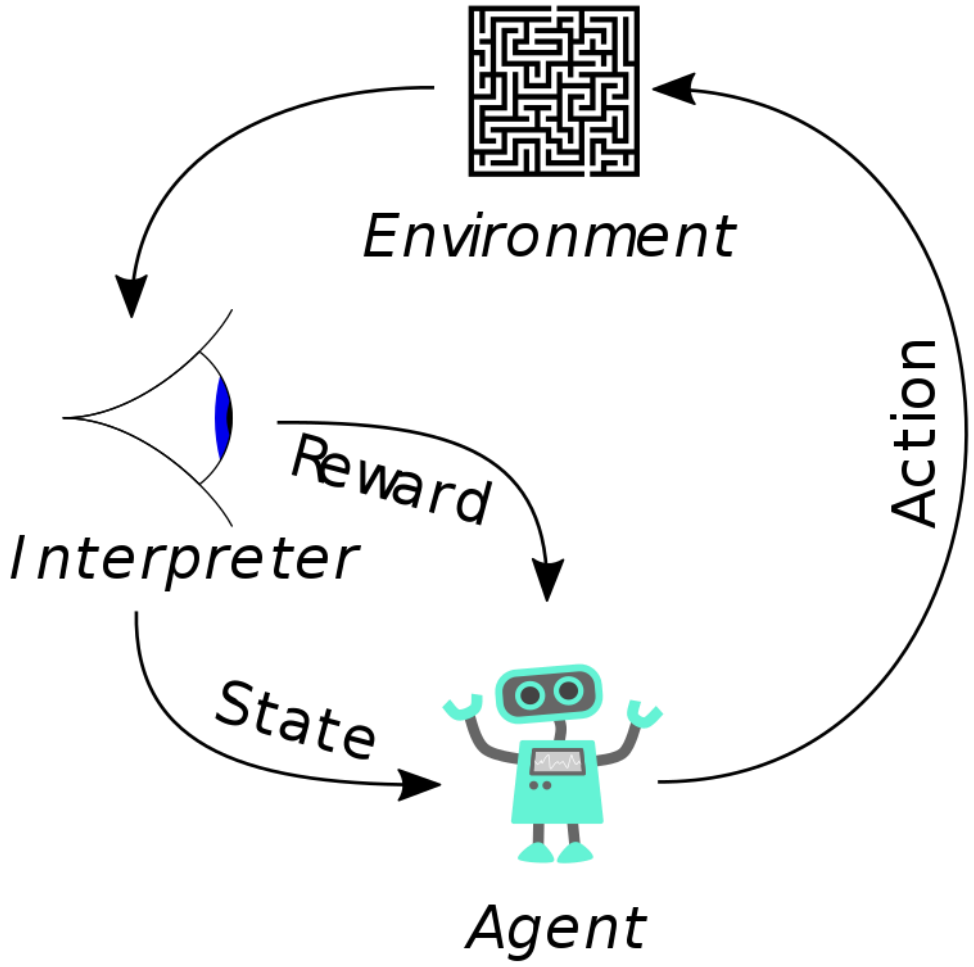
Examples of clustering

- Search results grouping
- Grouping similar customers
- Grouping similar patients
- Text categorization
- Network Security Anomaly detection

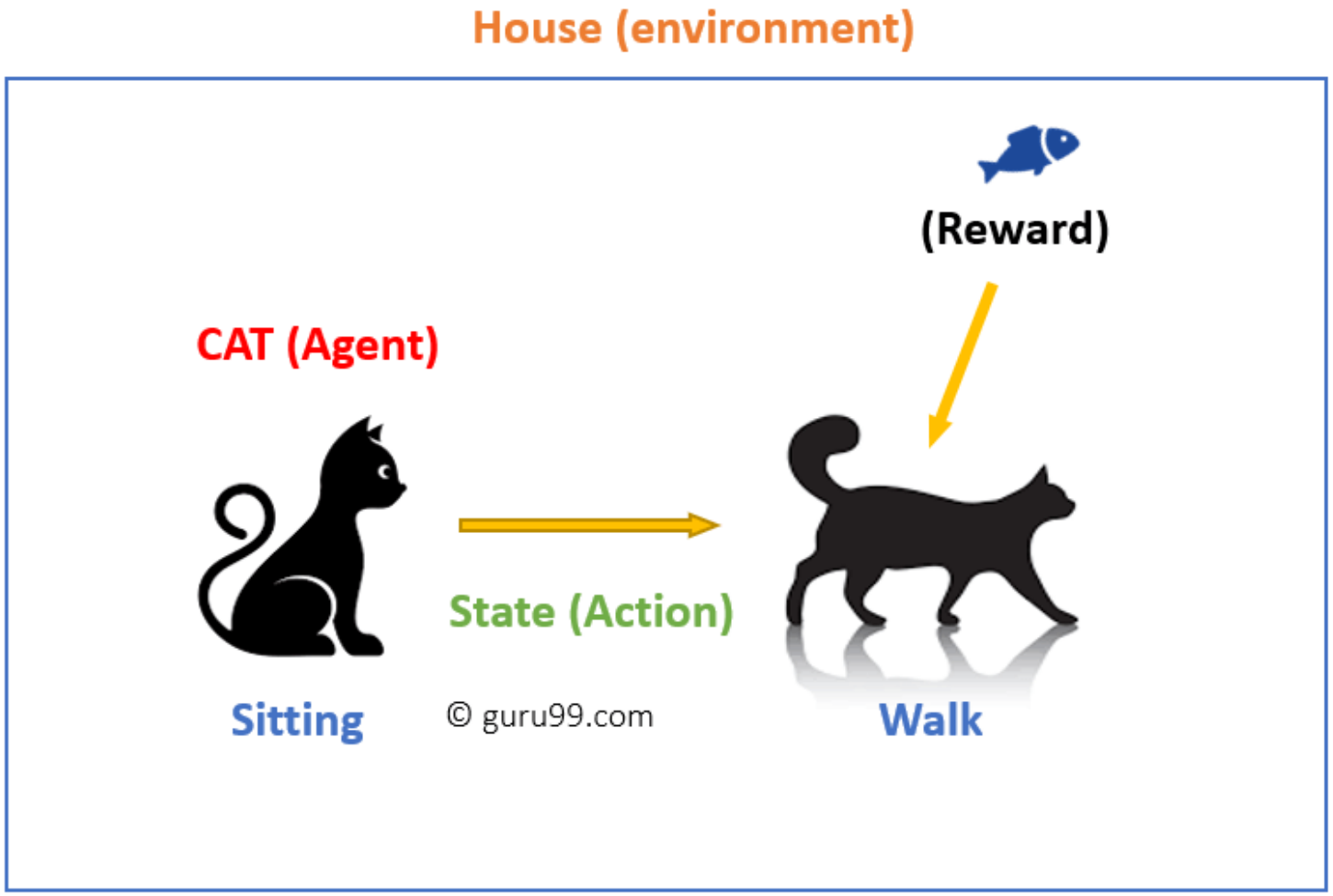
Examples of association

- Market basket analysis
- Credit card fraud detection
- Recommendation
    - AirBnb
    - Amazon
    - NetFlix

Reinforcement learning



How Reinforcement Learning works?



Source: Reinforcement Learning: What is, Algorithms, Applications, Example,

How Reinforcement Learning works?

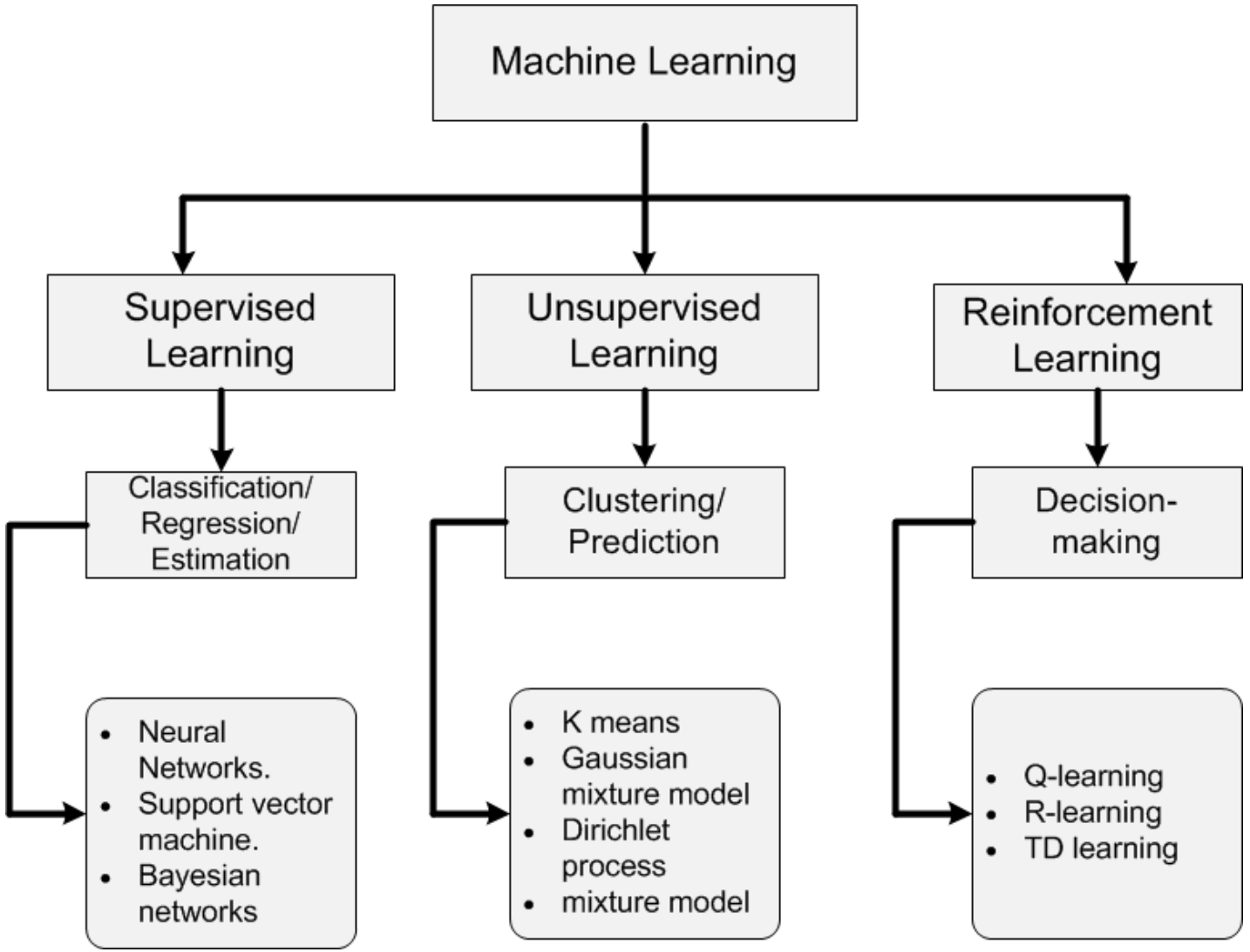
- Your cat is an agent that is exposed to the environment. In this case, it is your house. An example of a state could be your cat sitting, and you use a specific word in for cat to walk.
- Our agent reacts by performing an action transition from one "state" to another "state."
- For example, your cat goes from sitting to walking.
- The reaction of an agent is an action, and the policy is a method of selecting an action given a state in expectation of better outcomes.
- After the transition, they may get a reward or penalty in return.

Source: Reinforcement Learning: What is, Algorithms, Applications, Example,

Examples of Reinforcement Learning

- Robotics for industrial automation.
- Business strategy planning
- Self-driving car
- Traffic light control
- Aircraft control and robot motion control

Source: Reinforcement Learning: What is, Algorithms, Applications, Example,



Source: https://www.researchgate.net/figure/Comparison-of-different-types-of-machine-learning_fig6_325928183

Introduction to Deep Learning

What is Deep Learning?

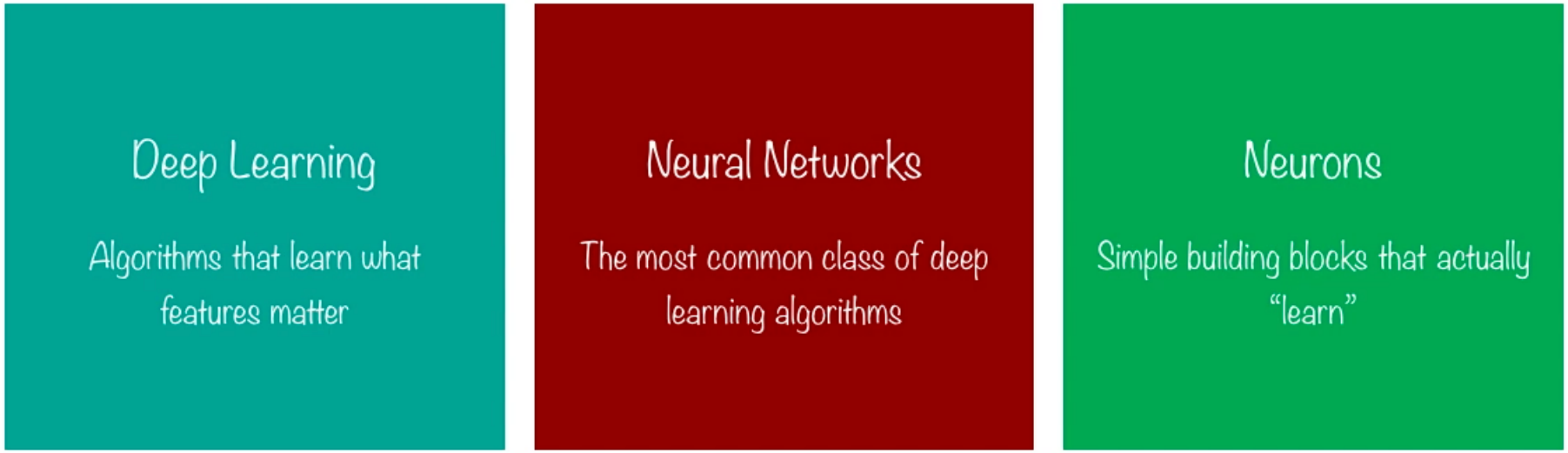
Deep learning is part of a broader family of machine learning methods based on artificial neural networks with representation learning. Learning can be supervised, semi-supervised or unsupervised.

What is Deep Learning?

- A machine learning technique that learns features and task directly from data.
- Input are run through “neural networks”
- “Neural networks” inspired by the neurons of the human brain
- “Neural networks” have hidden layers

Source: Deep Learning Crash Course for Beginners, freeCodeCamp.org

Deep Learning and Neural Networks



Source: TensorFlow and the Google Cloud ML Engine for Deep Learningu: Loonycorn

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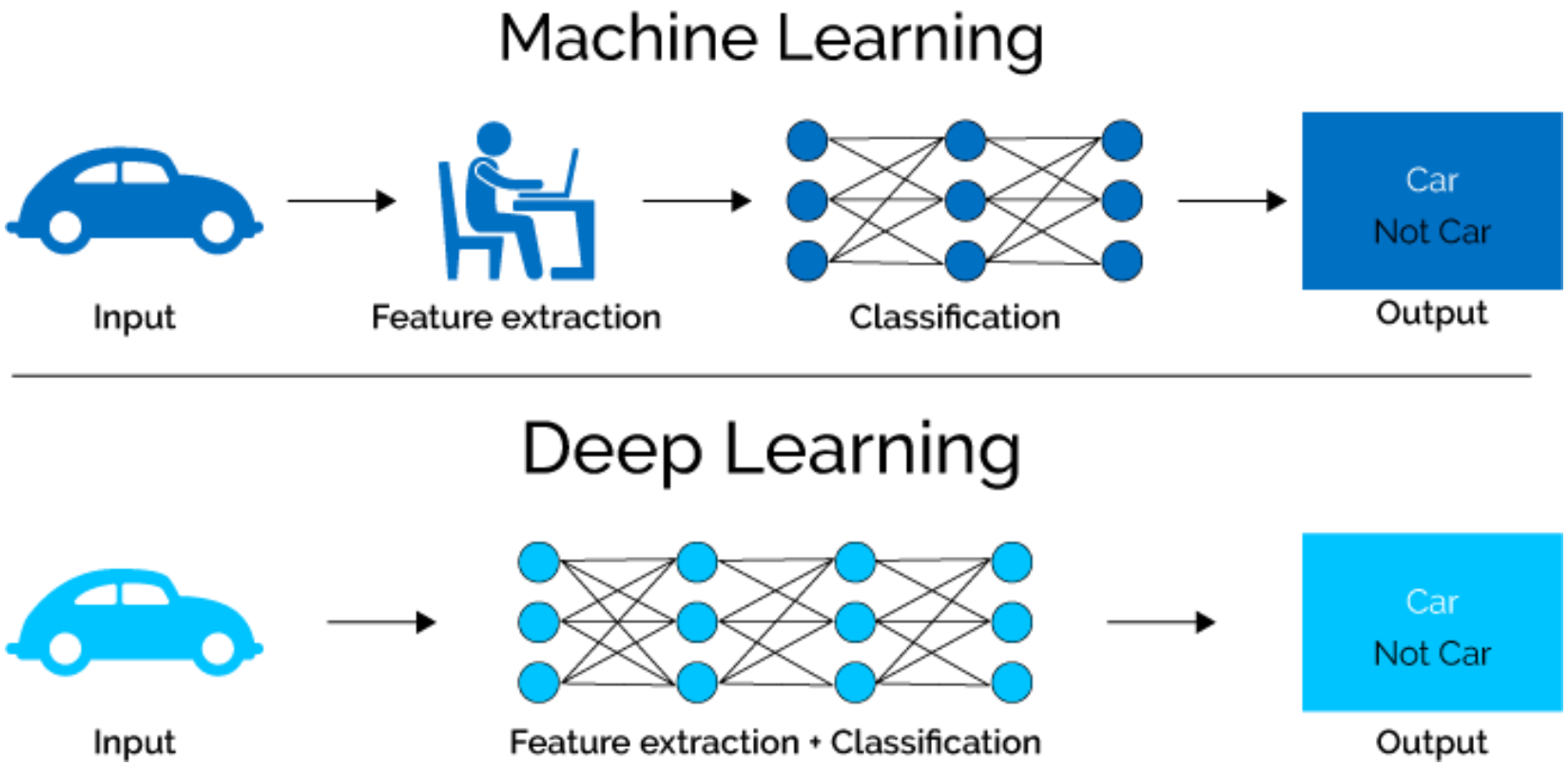
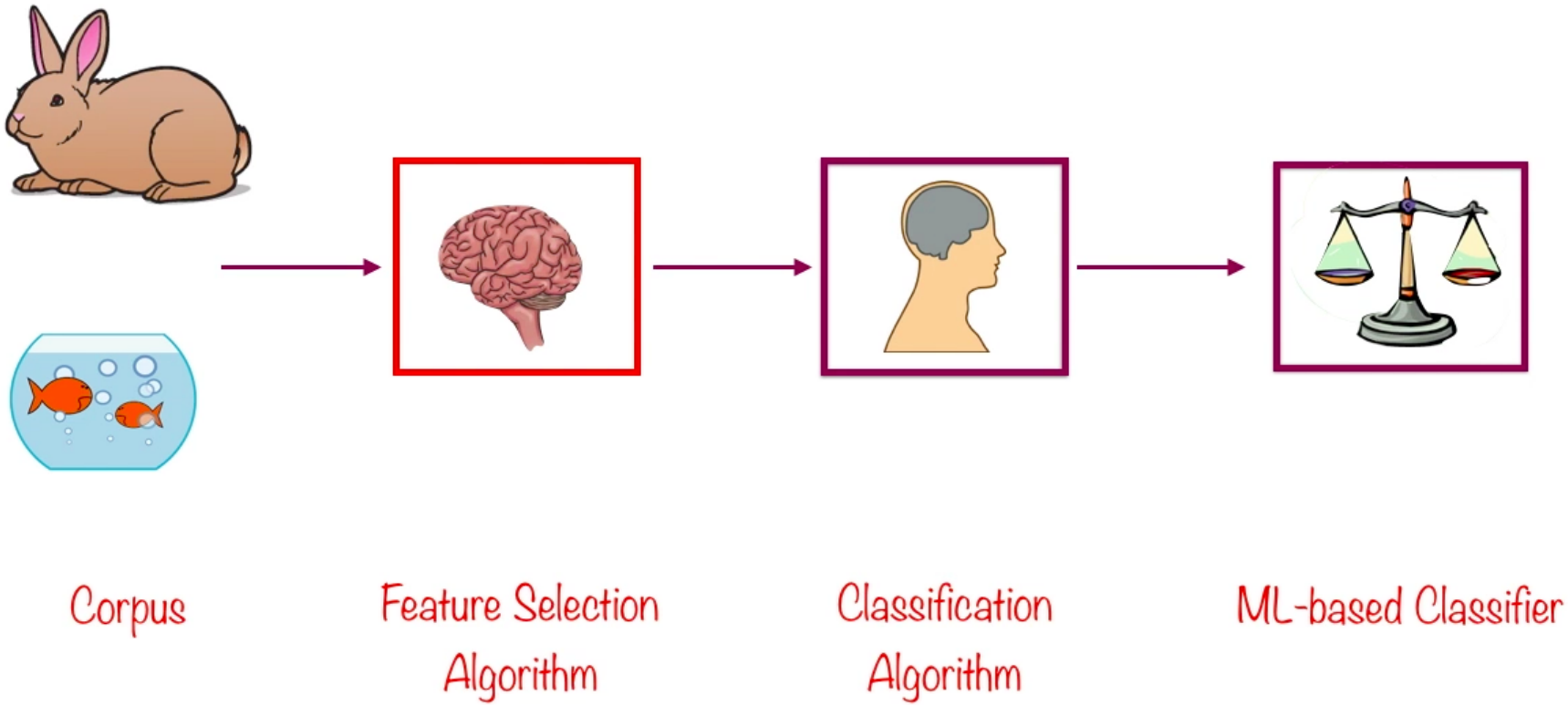
Why Deep Learning?



"Representation" ML-based Binary Classifier



Source: TensorFlow and the Google Cloud ML Engine for Deep Learning: Loonycorn

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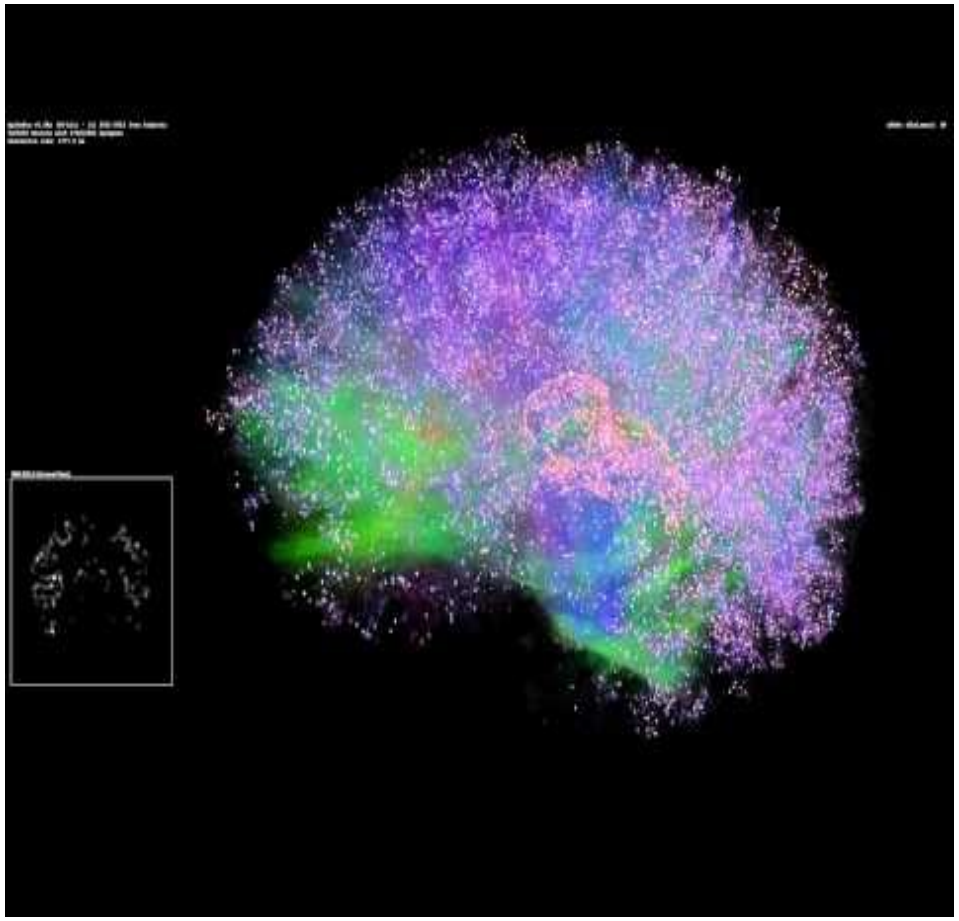
Human Brain

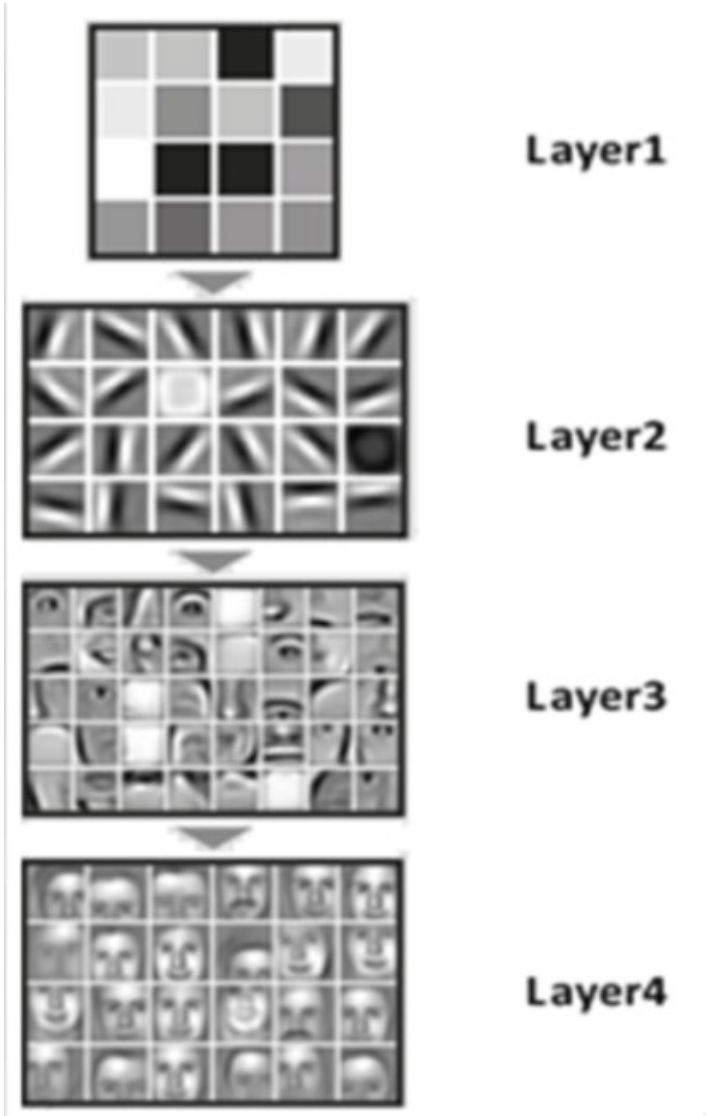


Source: MIT Deep Learning Basics

- Thalamocortical Brain
  - 3 Million Neuron
  - 476 Million synapses
- Full Brain
  - 100 Billion Neuron
  - 1,000,000 Billion synapses

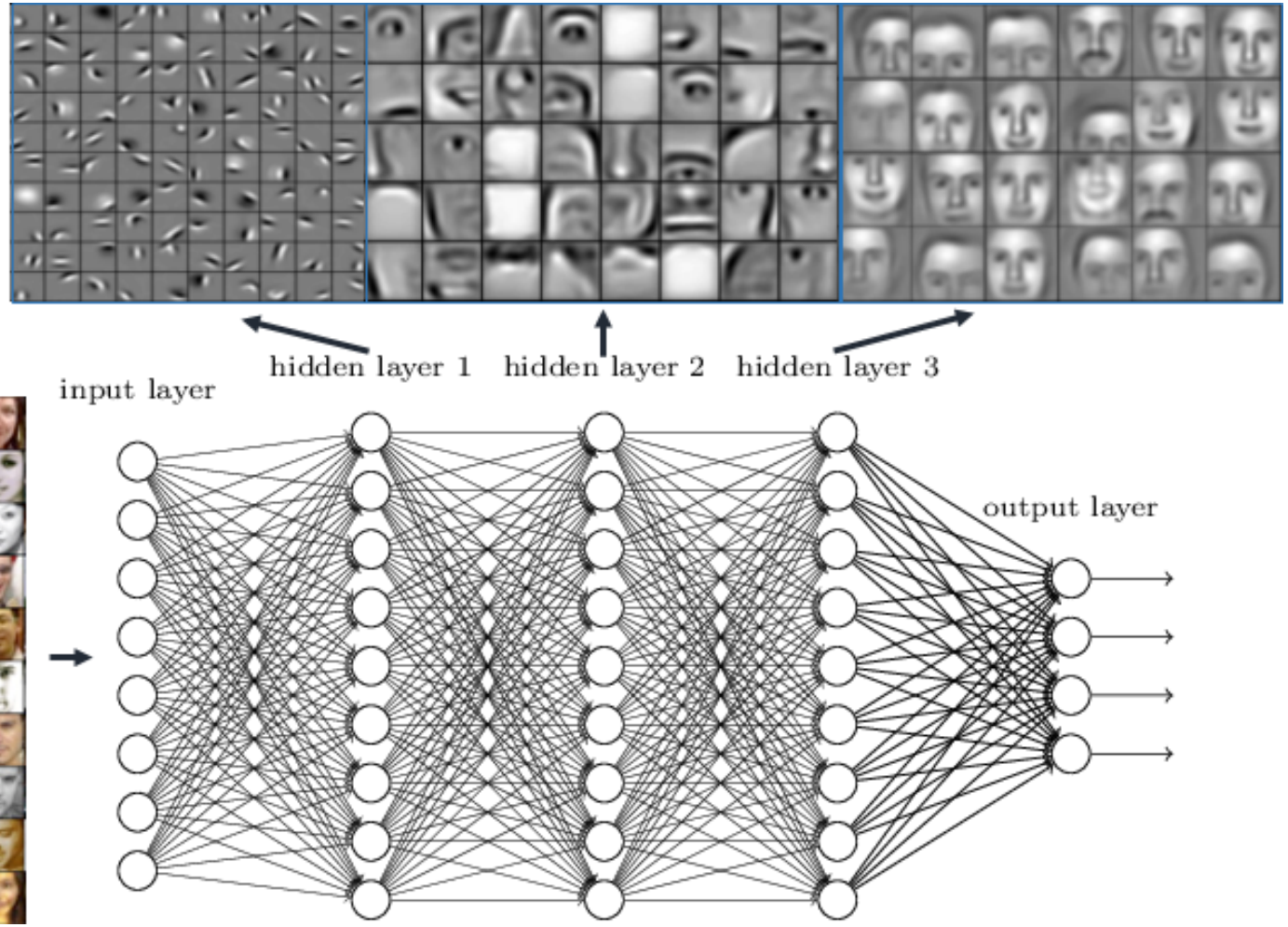
How the human brain works?

- Layer 1: The system starts identifying the dark and light pixels
- Layer 2: The system identifies edges and shapes
- Layer 3: The system learns more complex shapes and objects
- Layer 4: The system learns which objects define a human face



Source: Deep Learning with TensorFlow, Giancarlo Zaccone;

Deep neural networks learn hierarchical feature representations



Source: Deep Learning and Convolutional Neural Networks: RSIP Vision Blogs

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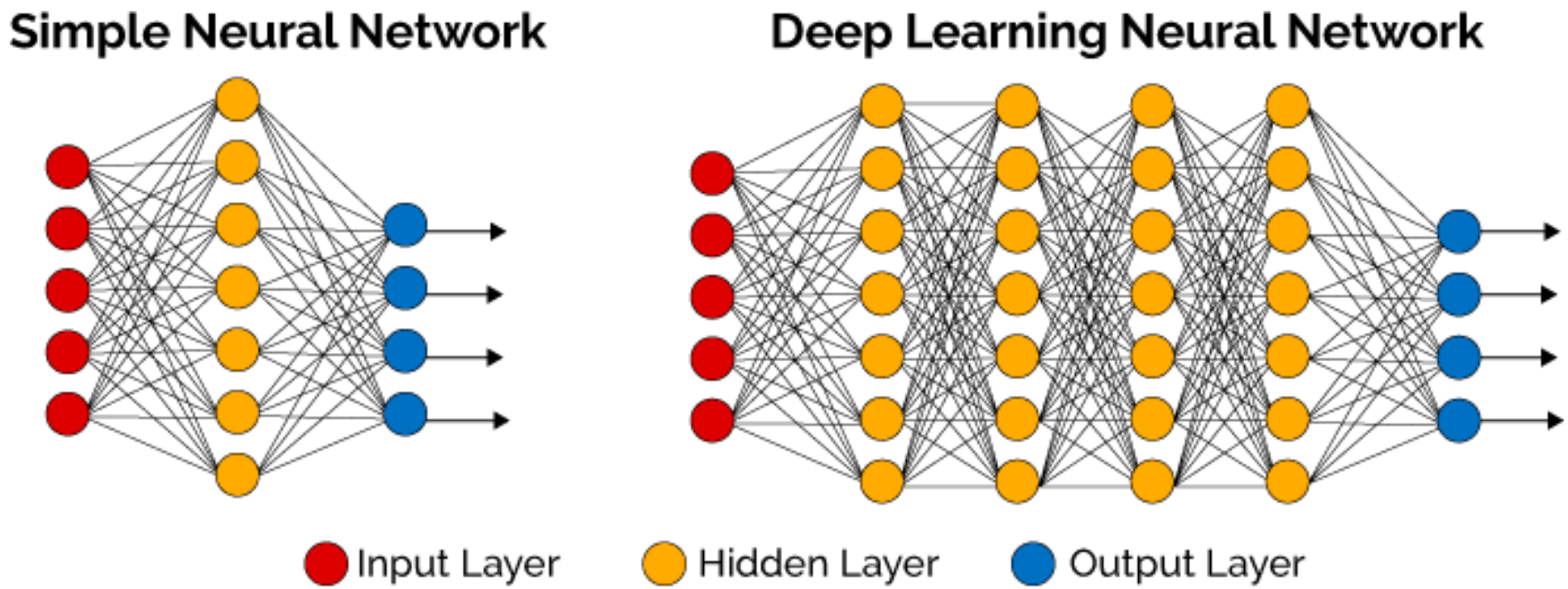
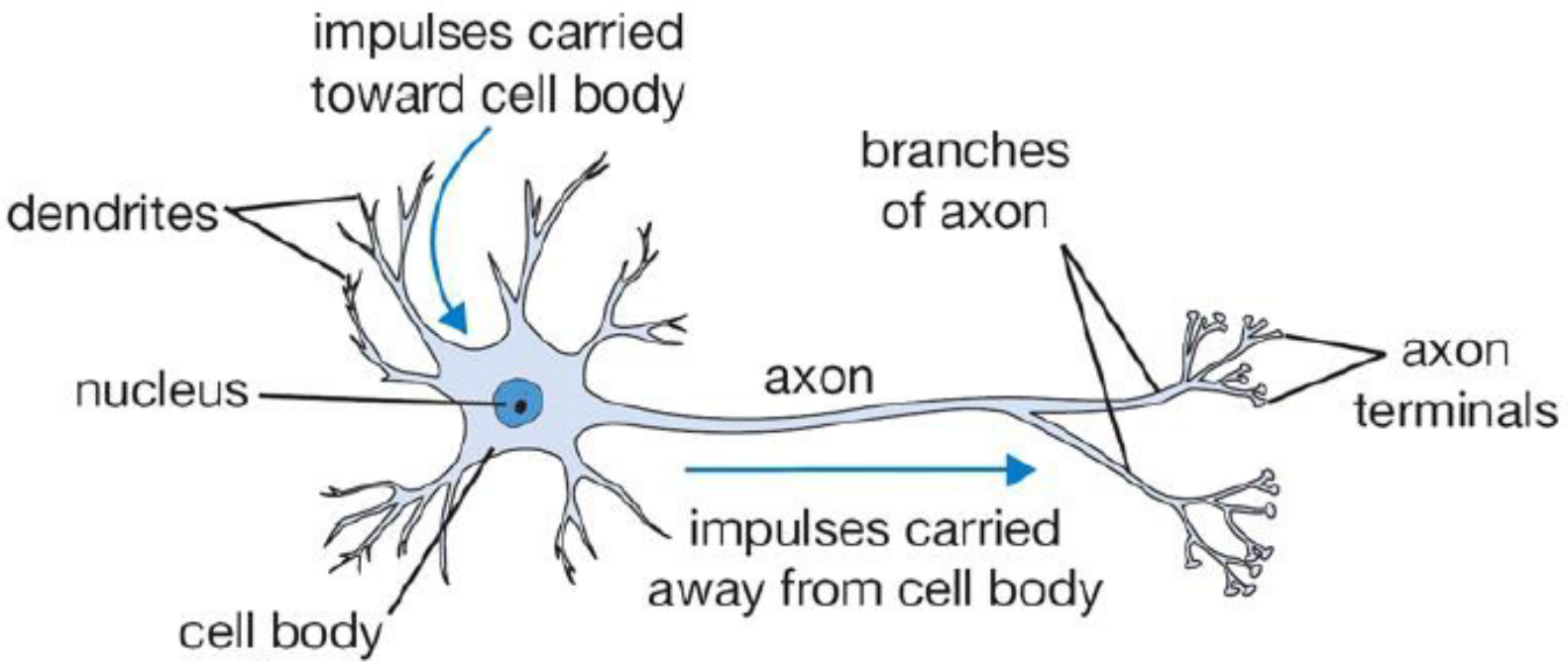

Simple Neural Network
Deep Learning Neural Network
Input Layer
Hidden Layer
Output Layer

Neural Networks

- Take in data as input
- Train themselves to understand patterns in the data
- Output useful predictions

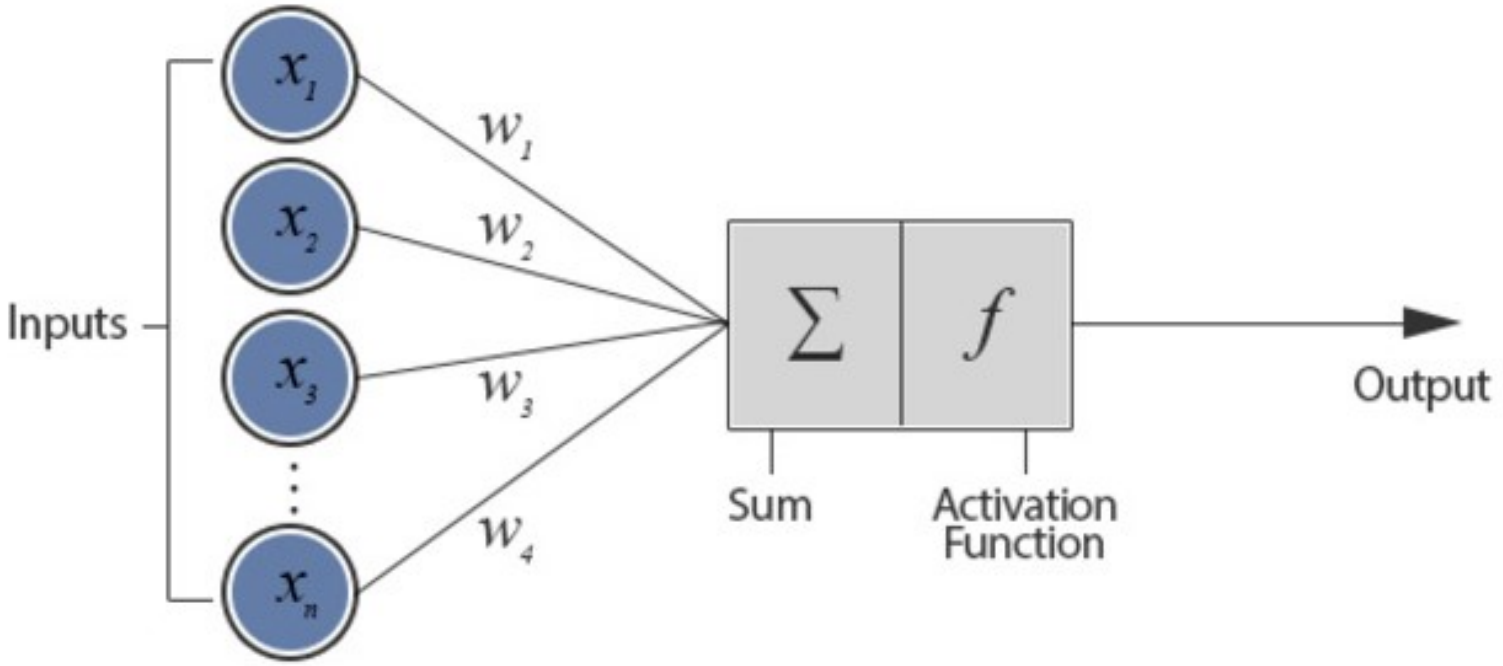
Source: Deep Learning Crash Course for Beginners, freeCodeCamp.org

Biological neuron



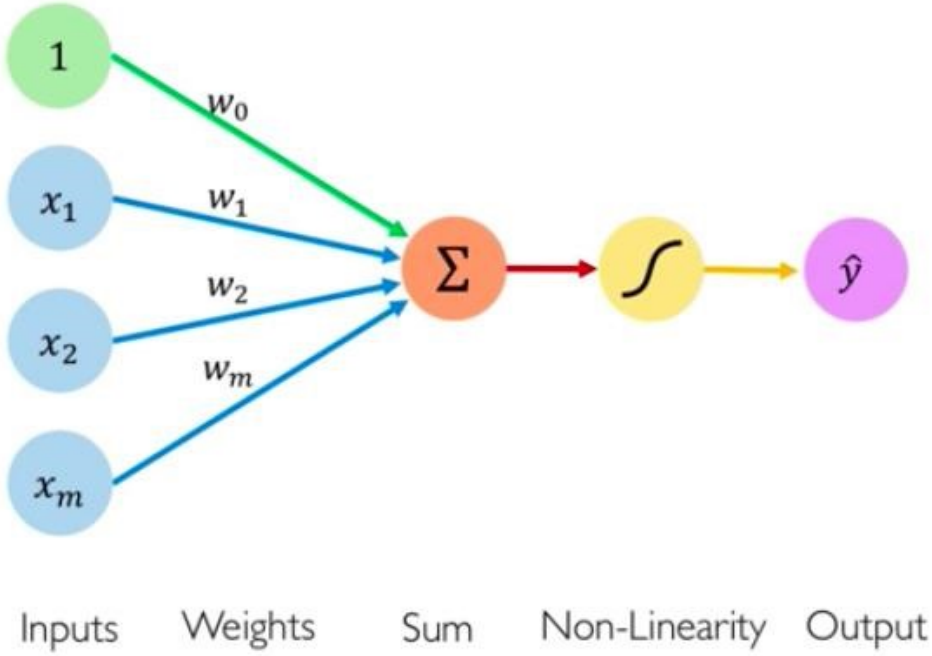
Source: MIT Deep Learning Basics

Artificial neuron (Perceptron)



Source: Deep Learning with TensorFlow, Giancarlo Zaccone;

Artificial neuron

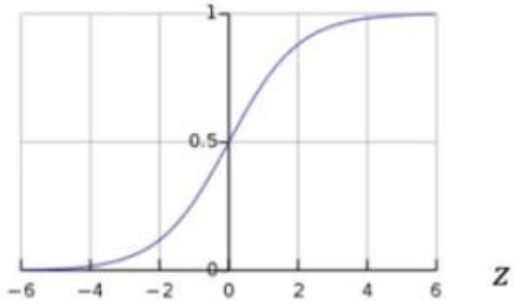


Activation Functions

$$\hat{y} = g(w_0 + \boldsymbol{X}^T \boldsymbol{W})$$

- Example: sigmoid function

$$g(z) = \sigma(z) = \frac{1}{1 + e^{-z}}$$



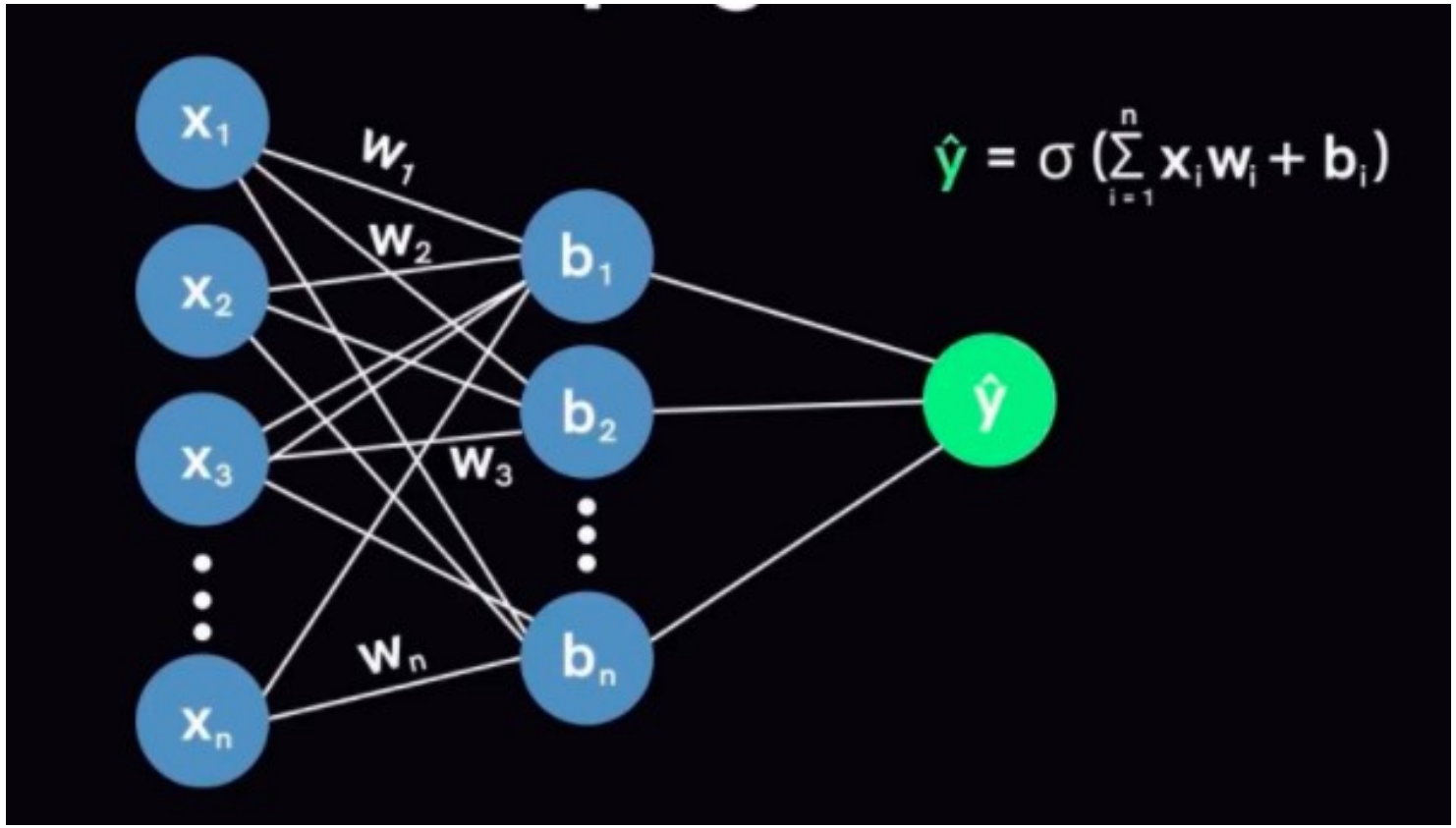
Source: © Alexander Amini and Ava Soleimany, MIT 6.S191: Introduction to Deep

Learning Process of Neural Networks

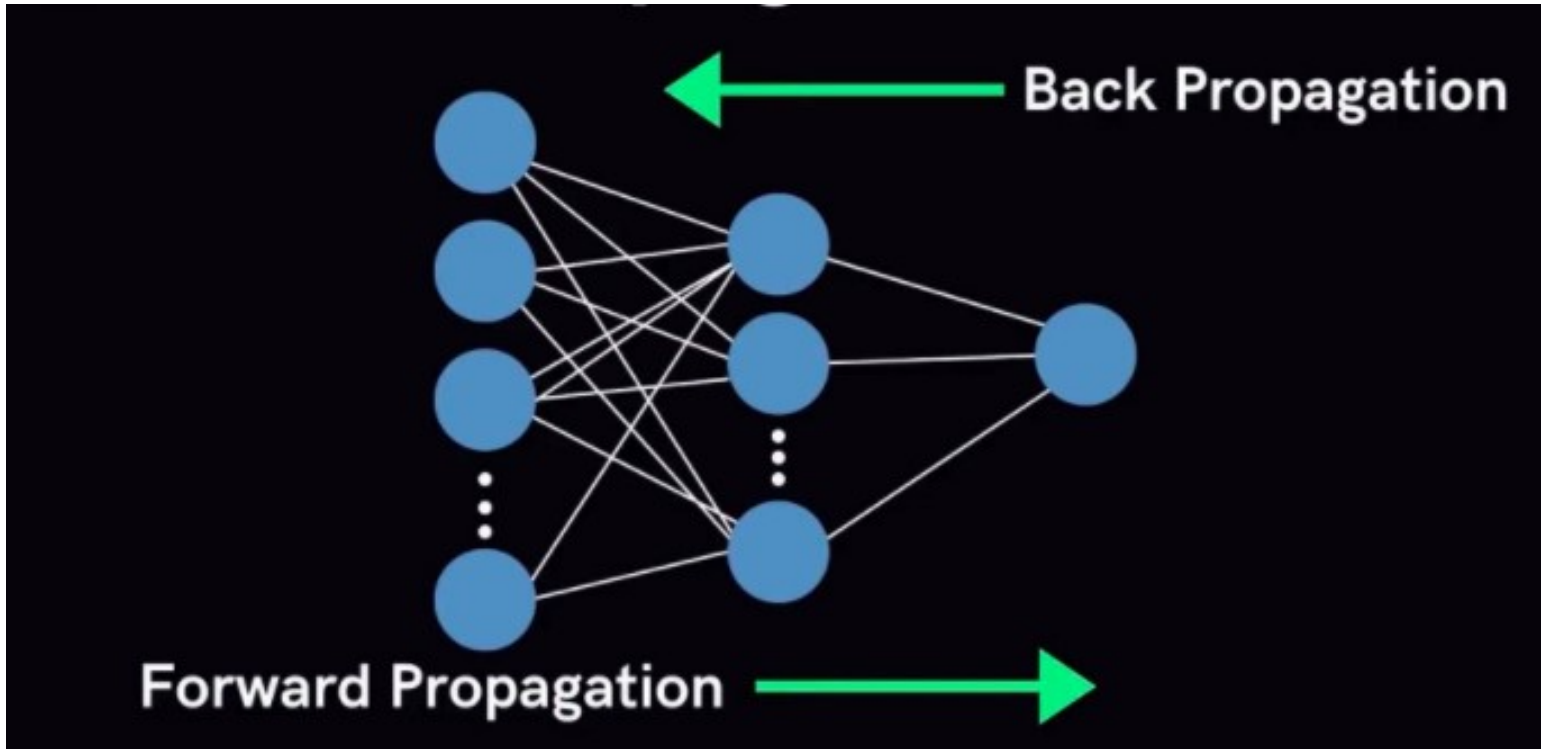
Forward Propagation

Backward Propagation

Forward Propagation



Backward Propagation



Learning Algorithm

- Initialize parameters with random values.
- Feed input data to network
- Compare predicted value with expected value & calculate loss
- Perform backpropagation to propagate this loss back through the network.
- Update parameters based on the loss
- Iterate previous steps till loss is minimized.

Source: Deep Learning Crash Course for Beginners, freeCodeCamp.org

Neural Networks Terms

- Weight - how important is that neuron
- Bias - allows for the shifting of activation function to the right of left.

Source: Deep Learning Crash Course for Beginners, freeCodeCamp.org

Neural Networks Terms

- Weight - how important is that neuron
- Bias - allows for the shifting of activation function to the right of left.

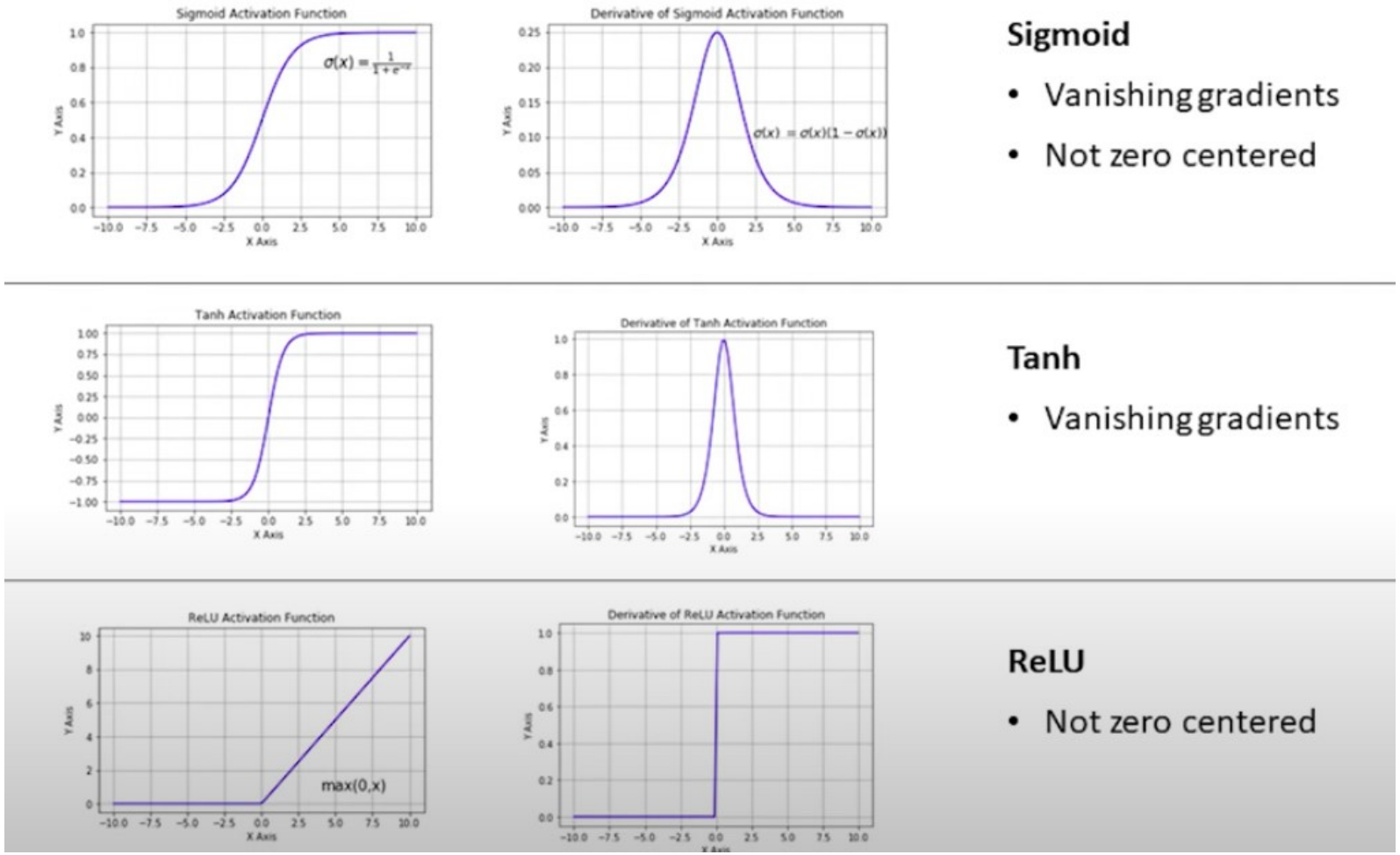
Source: Deep Learning Crash Course for Beginners, freeCodeCamp.org

1) Activation functions

- Introduce no-linearity in the network
- Decide whether a neuron can contribute the next layer.

Source: Deep Learning Crash Course for Beginners, freeCodeCamp.org

Most used activation function



Source: MIT Deep Learning Basics: Introduction and Overview

Which Activation Function to use?

- Binary classification problems. Sigmoid
- If you are unsure: ReLu

Source: Deep Learning Crash Course for Beginners, freeCodeCamp.org

2) Loss functions

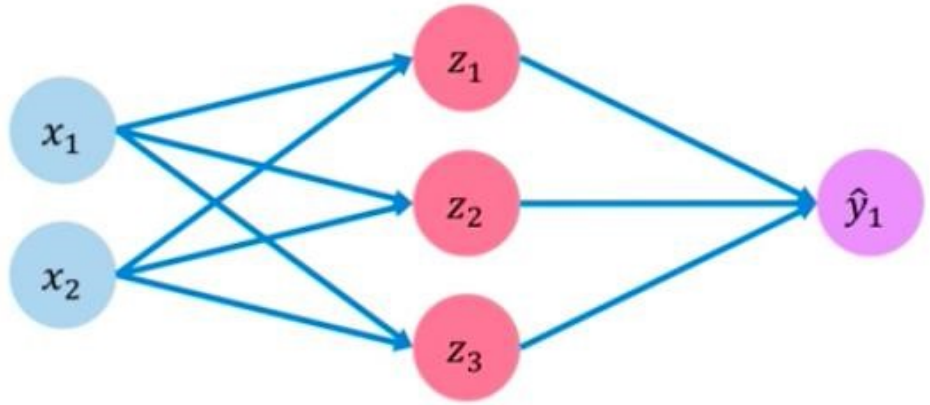
- Quantify the deviation of the predicted output by the neural network to the expected output.
- Different type of Loss functions:
    - Regression: Squared error, Huber loss
    - Binary classification: Binary cross-entropy. Hinge loss
    - Multi-class classification: Multi-class cross-entropy.

Source: Deep Learning Crash Course for Beginners, freeCodeCamp.org

Binary cross-entropy loss

Cross entropy loss *can be used with models that output a probability between 0 and 1*

$$X = \begin{bmatrix} 4, & 5 \\ 2, & 1 \\ 5, & 8 \\ \vdots & \vdots \end{bmatrix}$$



$f(x)$ y

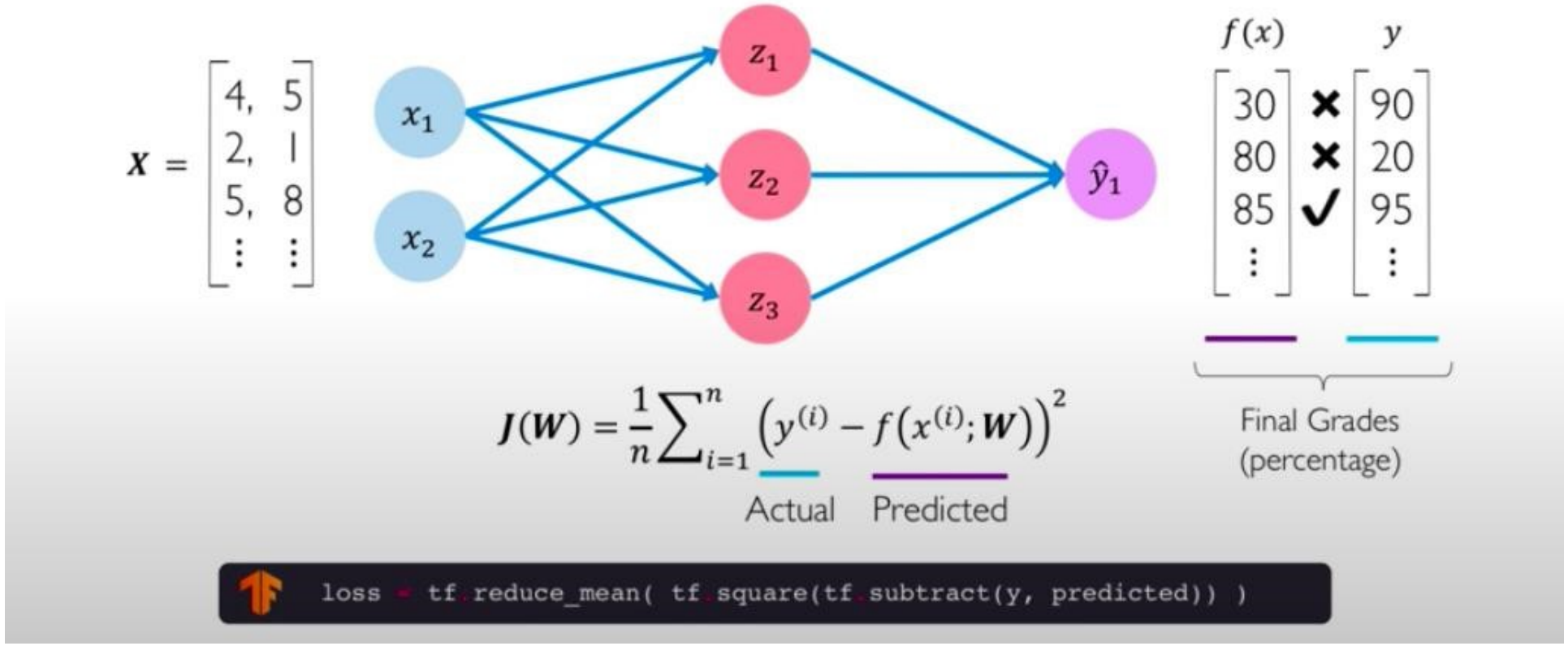
$$\begin{bmatrix} 0.1 \\ 0.8 \\ 0.6 \\ \vdots \end{bmatrix} \times \begin{bmatrix} 1 \\ 0 \\ 1 \\ \vdots \end{bmatrix}$$

$$J(W) = \frac{1}{n}\sum_{i=1}^{n} \underbrace{y^{(i)}}_{\text{Actual}} \log\Big(\underbrace{f\big(x^{(i)}; W\big)}_{\text{Predicted}}\Big) + (1 - \underbrace{y^{(i)}}_{\text{Actual}}) \log\Big(1 - \underbrace{f\big(x^{(i)}; W\big)}_{\text{Predicted}}\Big)$$

```
loss = tf.reduce_mean( tf.nn.softmax_cross_entropy_with_logits(y, predicted) )
```

Source: © Alexander Amini and Ava Soleimany, MIT 6.S191: Introduction to Deep

Mean squared error loss



Source: © Alexander Amini and Ava Soleimany, MIT 6.S191: Introduction to Deep

3) Optimizers

- During training, we adjust the parameters to minimize the loss function and make our model as optimized as possible.
- Tie together the loss function and model parameters by updating the network based on the output of the loss function.
- Loss functions guide optimizers.

Source: Deep Learning Crash Course for Beginners, freeCodeCamp.org

Gradient Descent

- Iterative algorithm that starts off at a random point on the loss function and travels down to its slope in steps until it reaches the lowest point (minimum) of the function.
    - Most popular optimizer
    - Fast, Robust, Flexible

$$\nabla f(x,y) = \left(\frac{\partial f}{\partial x}(x,y), \frac{\partial f}{\partial y}(x,y)\right)$$

Source: Deep Learning Crash Course for Beginners, freeCodeCamp.org

Gradient Descent Algorithm

- Calculate what a small change in each individual weight would do to the loss function.
- Adjust each parameter based on its gradient (i.e. take a small step in the determined direction)
- Repeat above steps until the loss function is as low as possible.

Source: Deep Learning Crash Course for Beginners, freeCodeCamp.org

Learning Rate

- To avoid getting stuck in a local minima, we use the proper Learning Rate.
- Usually a small number, like .001, that are multiplied to scale the gradients.
- Ensures that any changes made to the weight are quite small.
- We don’t want a large learning rate and also too small.

Source: Deep Learning Crash Course for Beginners, freeCodeCamp.org

Stochastic Gradient Descent (SGD)

- Like Gradient Descent, except uses a subset of training examples rather than the entire lot.
- SGD is an implementation of Gradient Descent that uses batches on each pass.
- Use momentum to accumulate gradients.
- Less intensive computationally.

Source: Deep Learning Crash Course for Beginners, freeCodeCamp.org

Examples of Gradient Descent

- SGD
- Adgrad
- RMSprop
- Adaprop
- Adam

Source: Deep Learning Crash Course for Beginners, freeCodeCamp.org

4) Parameters & Hyperparameters

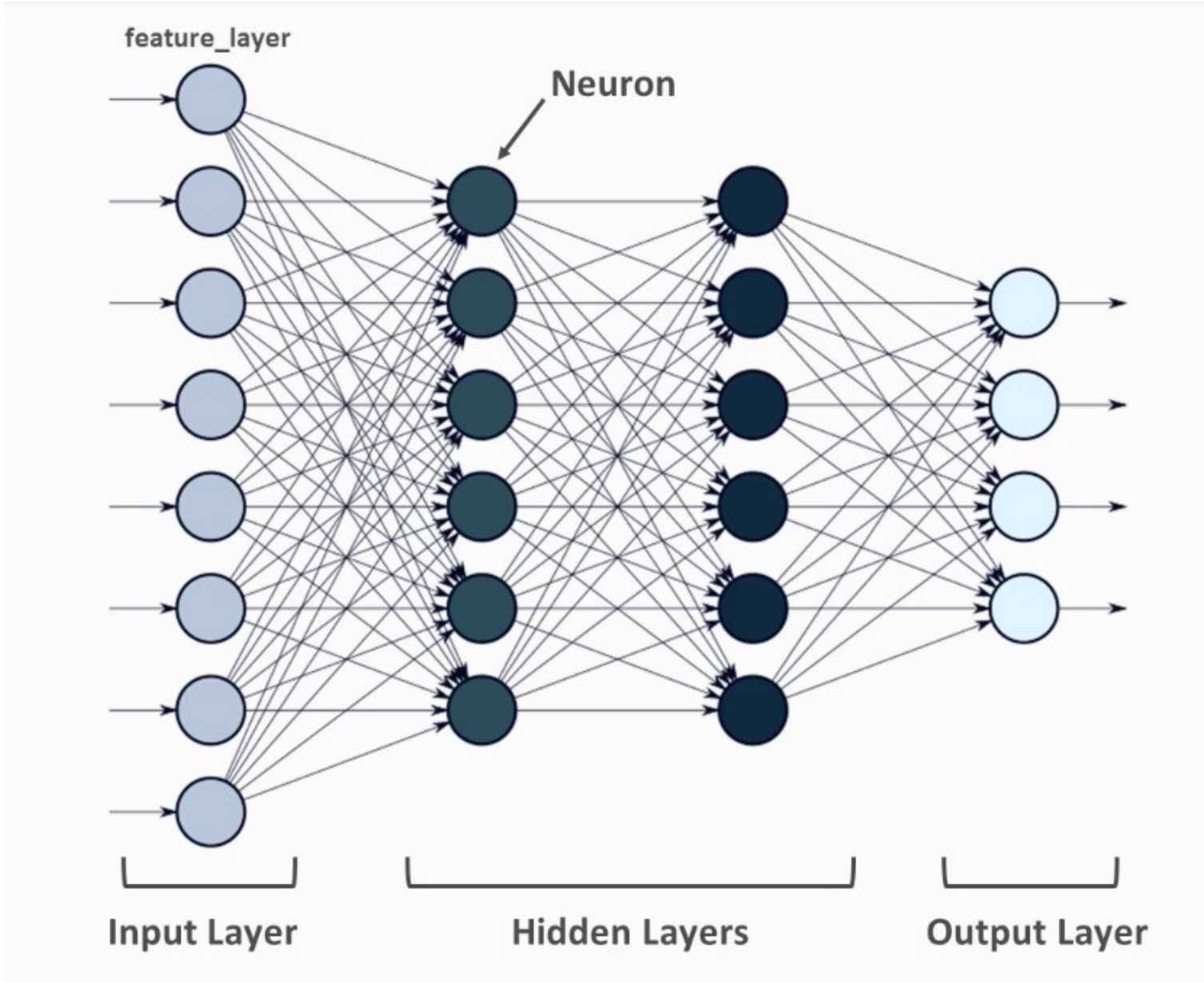
- Model parameters: variable internal to the neural network. Value can be estimated right from the data.
    - Weights, Biases
- Model Hyperparameters: Configurations external to the neural network. Value cannot be estimated right from the data.
    - Learning rate, Activation function

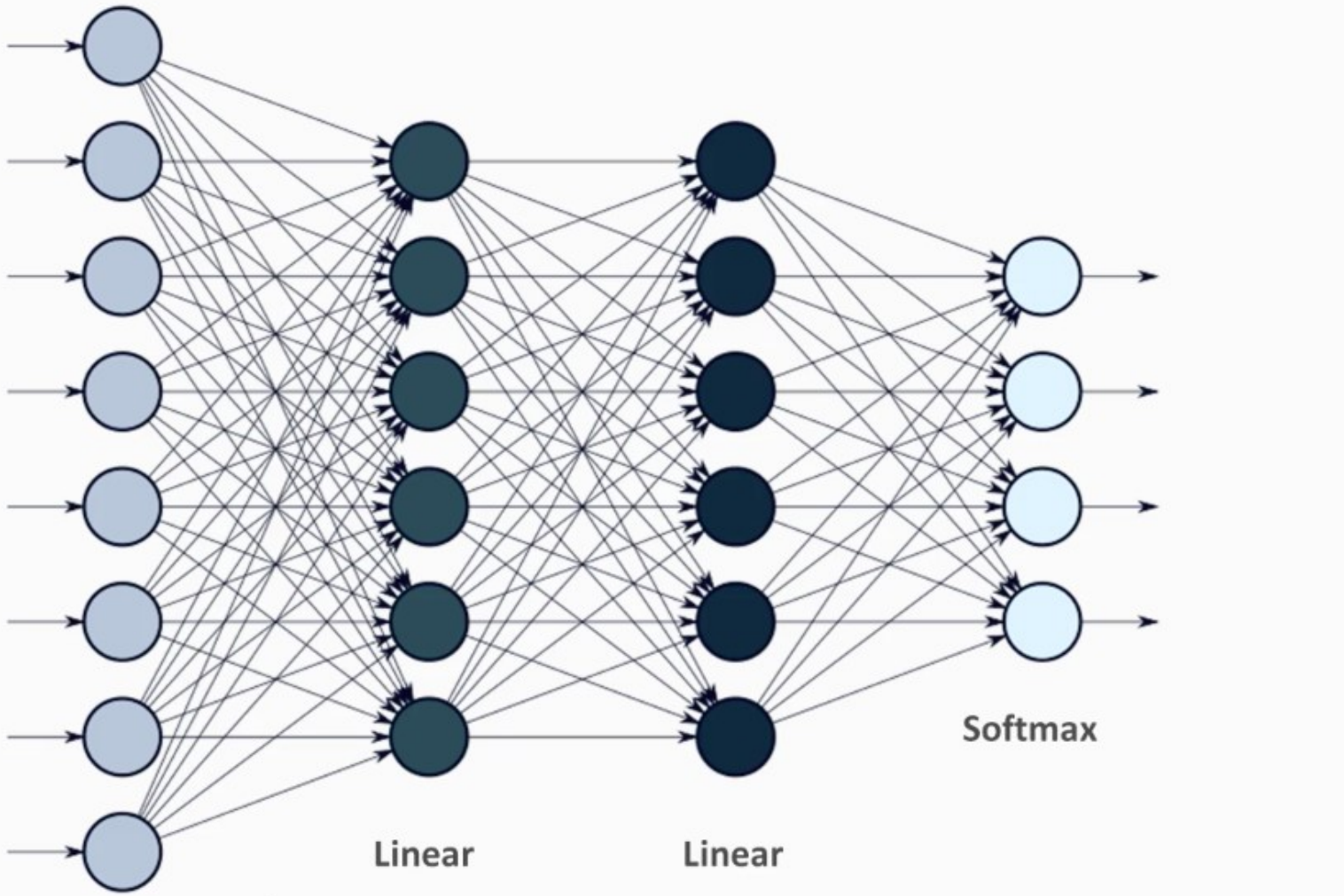
Source: Deep Learning Crash Course for Beginners, freeCodeCamp.org

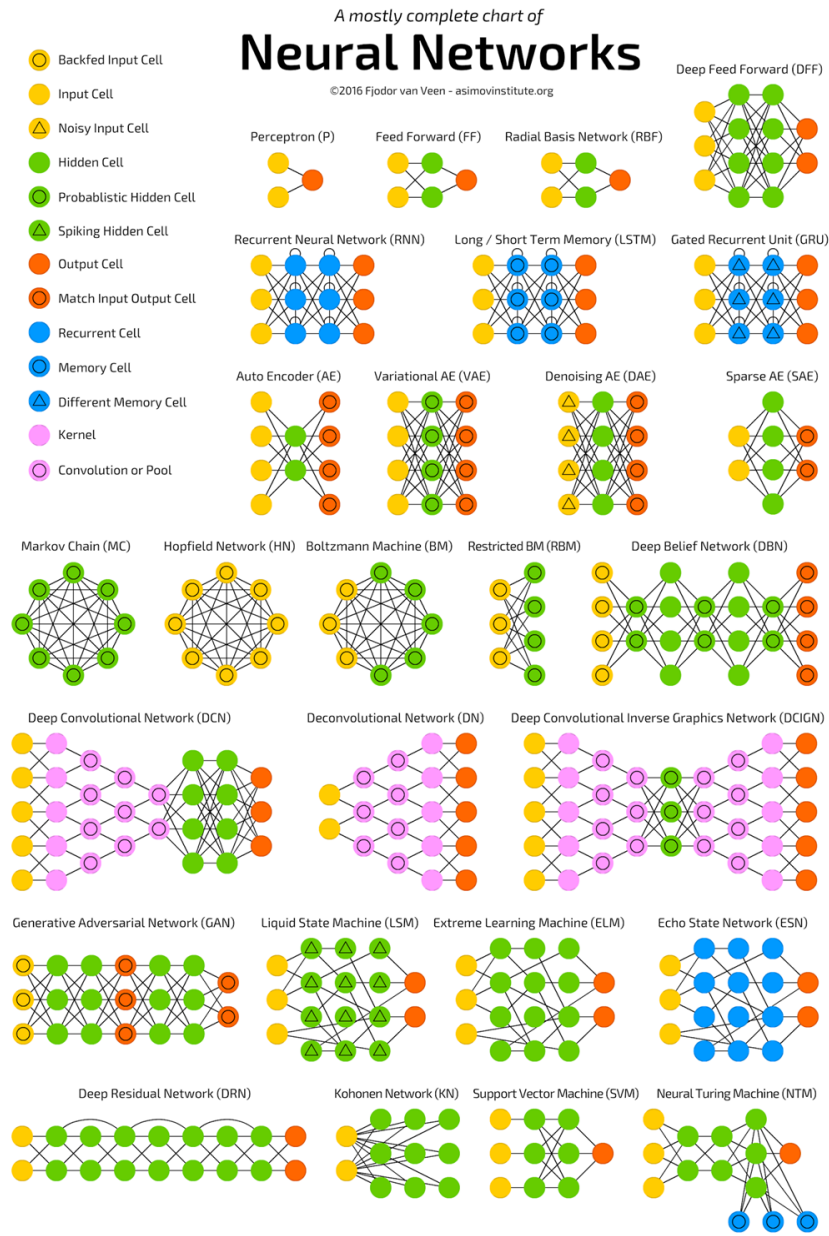
5) Epochs, Batches, Batch Sizes & Iterations

- Epochs: When the entire dataset is passed forward and backward through the neural network only once.
- Batch: Divide the large dataset into smaller chunks and feed those chunks to the neural network.
- Batch size: Total number of training examples in a batch.
- Iterations: Number of batches needs to complete one epoch.

Source: Deep Learning Crash Course for Beginners, freeCodeCamp.org


feature_layer
Neuron
Input Layer
Hidden Layers
Output Layer


Linear
Linear
Softmax
8 * 6
= 48 weights
6 * 6
= 36 weights
6 * 4
= 24 weights
= 108 weights



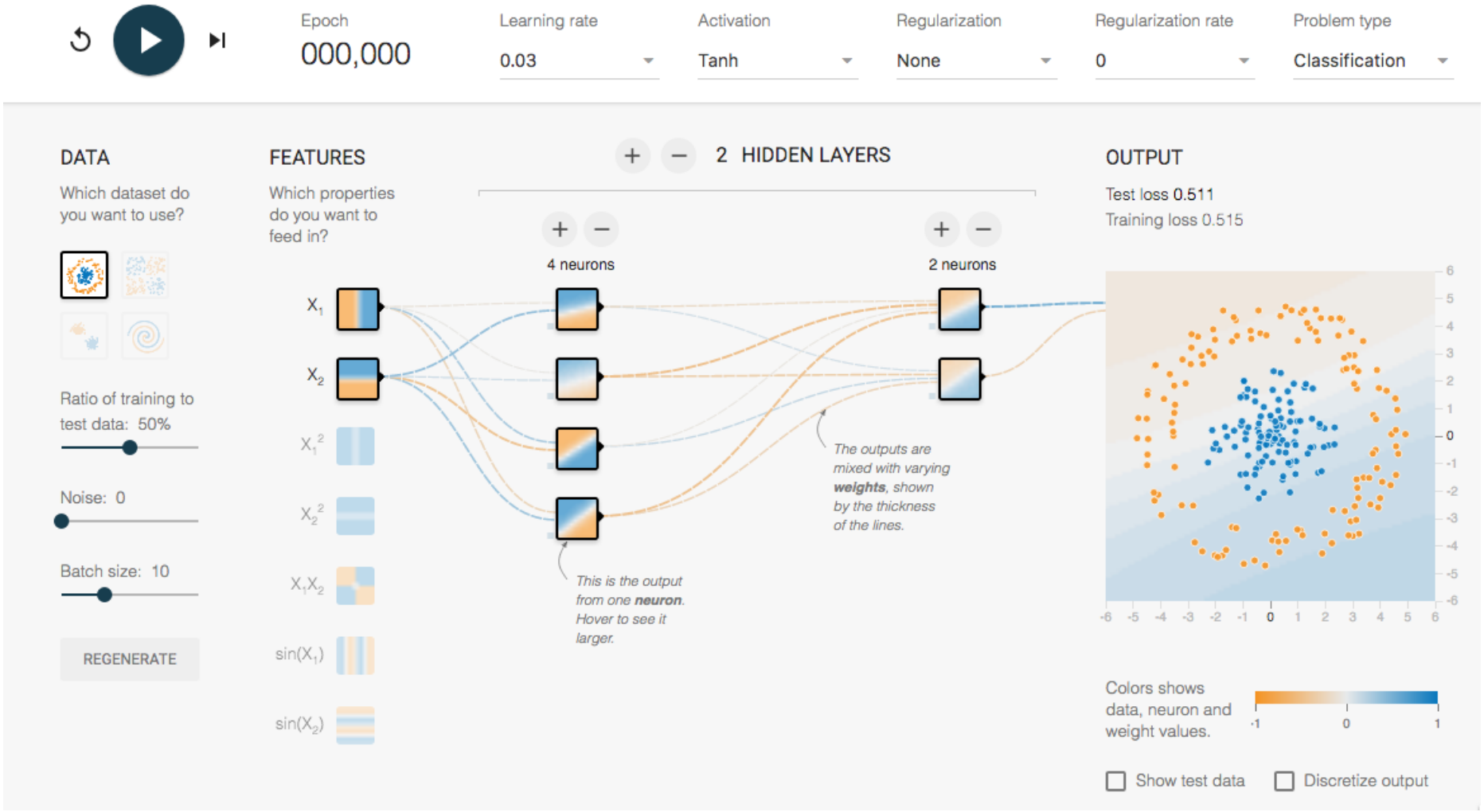
Source: Deep Learning with TensorFlow, Giancarlo Zaccone;

Overfitting Problem.

- Model perform exceptionally well on training data, but not on new test data.
- Tackling Overfitting: Regularization
    - Dropout
    - Dataset Augmentation (Create fake data)
    - Early stopping

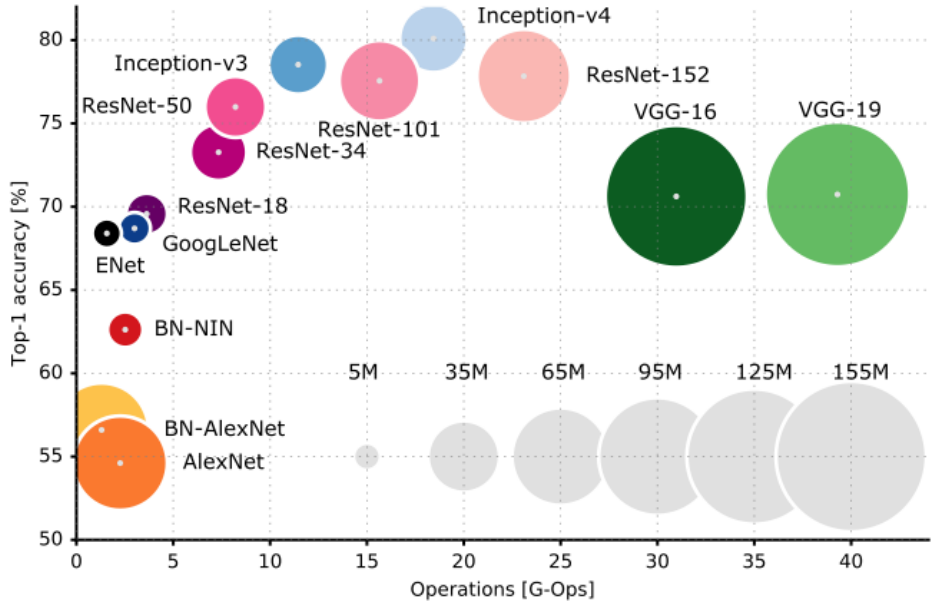
Source: Deep Learning Crash Course for Beginners, freeCodeCamp.org

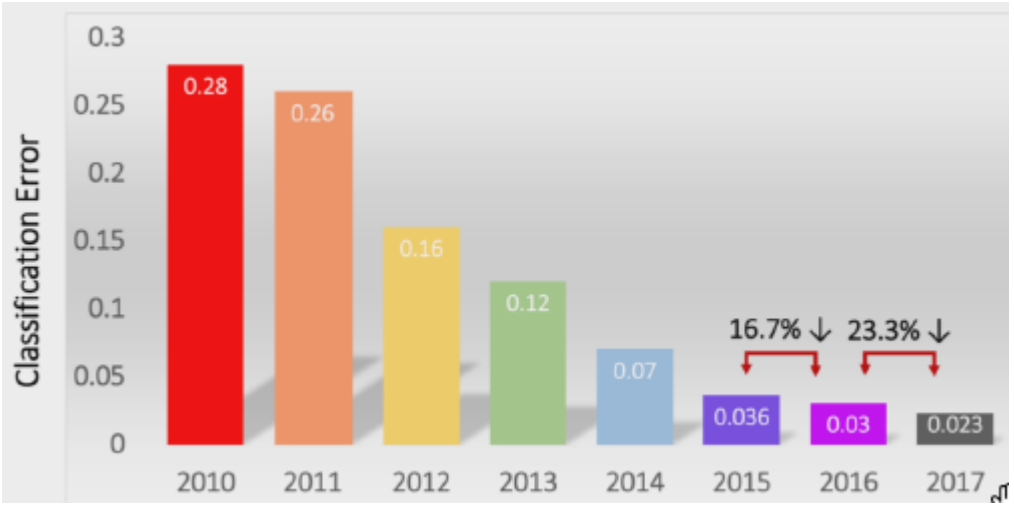
http://playground.tensorflow.org



- 1943: Neural networks
- 1957: Perceptron
- 1974-86: Backpropagation, RBM, RNN
- 1989-98: CNN, MNIST, LSTM, Bidirectional RNN
- 2006: “Deep Learning”, DBN
- 2009: ImageNet
- 2012: AlexNet, Dropout
- 2014: GANs
- 2014: DeepFace
- 2016: AlphaGo
- 2017: AlphaZero, Capsule Networks
- 2018: BERT

Source: MIT Deep Learning Basics

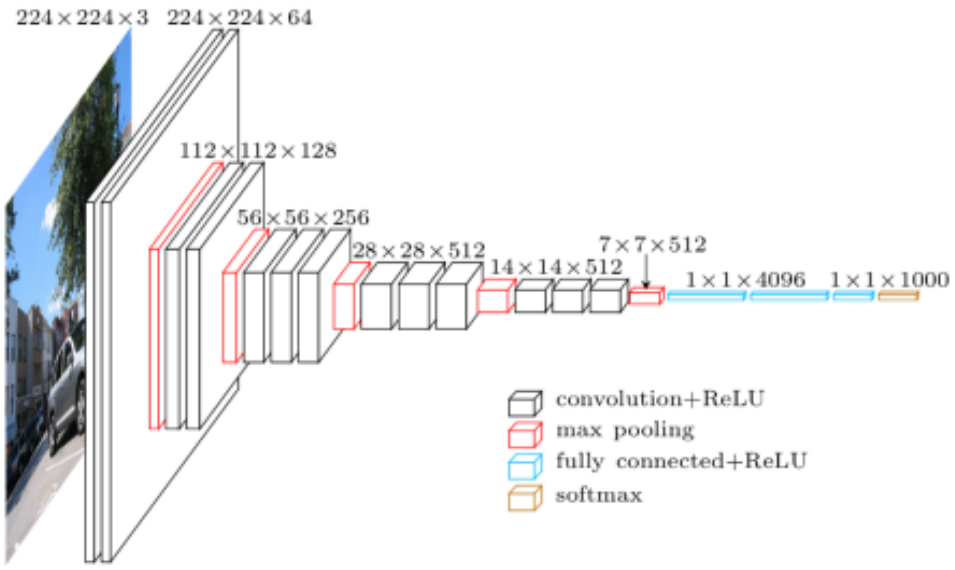




- **AlexNet (2012): First CNN (15.4%)**
  - 8 layers
  - 61 million parameters
- **ZFNet (2013): 15.4% to 11.2%**
  - 8 layers
  - More filters. Denser stride.
- **VGGNet (2014): 11.2% to 7.3%**
  - Beautifully uniform:
    3x3 conv, stride 1, pad 1, 2x2 max pool
  - 16 layers
  - 138 million parameters
- **GoogLeNet (2014): 11.2% to 6.7%**
  - Inception modules
  - 22 layers
  - 5 million parameters
    (throw away fully connected layers)
- **ResNet (2015): 6.7% to 3.57%**
  - More layers = better performance
  - 152 layers
- **CUImage (2016): 3.57% to 2.99%**
  - Ensemble of 6 models
- **SENet (2017): 2.99% to 2.251%**
  - Squeeze and excitation block: network is allowed to adaptively adjust the weighting of each feature map in the convolutional block.

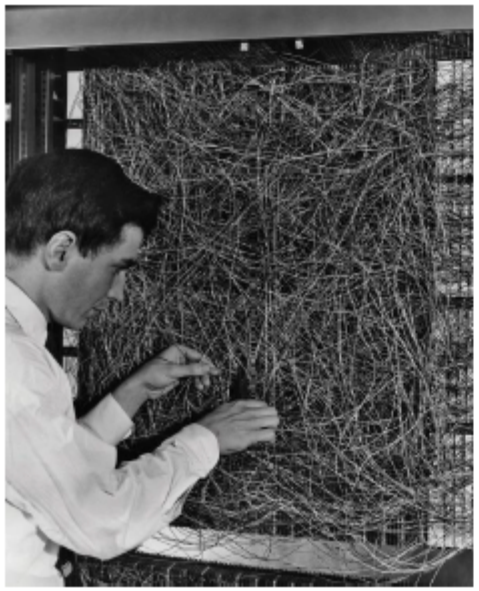
Source: MIT Deep Learning Basics

Artificial Neural Network (ANN)



Source: MIT Deep Learning Basics

- Full Brain
  - 100 พันล้าน Neuron
  - 1000 ล้านล้าน synapses
- ANN
  - VGG -19
  - 155 ล้าน synapses



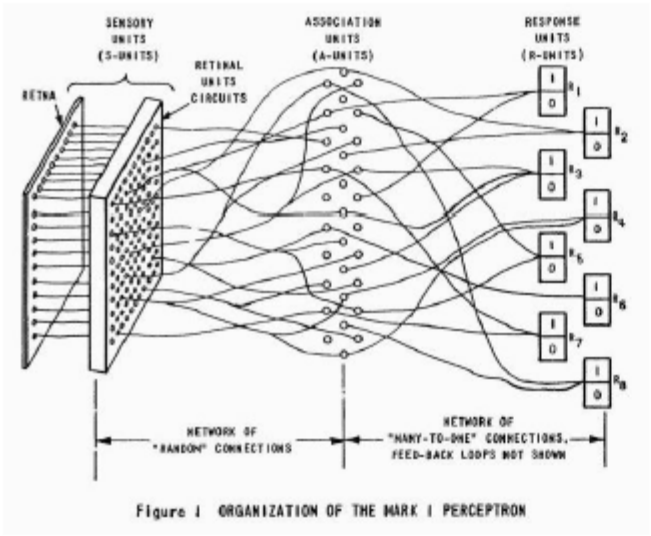


Figure 1 ORGANIZATION OF THE MARK I PERCEPTRON

History of DL Tools*

- Mark 1 Perceptron – 1960
- Torch – 2002
- CUDA – 2007
- Theano – 2008
- Caffe – 2014
- DistBelief – 2011
- TensorFlow 0.1 – 2015
- PyTorch 0.1 – 2017
- TensorFlow 1.0 – 2017
- PyTorch 1.0 – 2017
- TensorFlow 2.0 – 2019

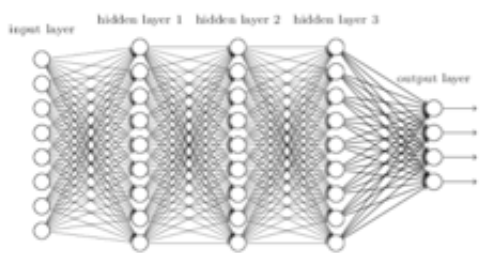
* Truncated for clarity over completeness

Source: MIT Deep Learning Basics

Deep Learning Algorithms

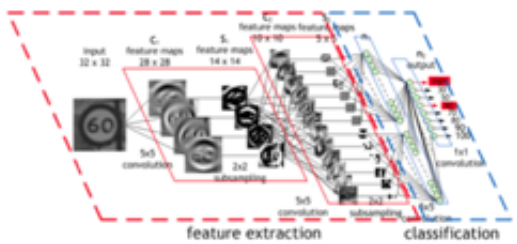
providing lift for classification and forecasting models

Deep Neural Networks



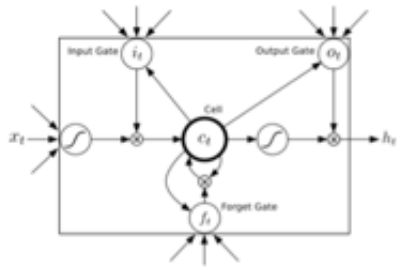
feature extraction and classification of images

Convolutional Neural Networks



for sequence of events, language models, time series, etc.

Recurrent Neural Networks



Source: https://mapr.com/blog/demystifying-ai-ml-dl/

Feed-Forward Deep Learning

- Deep Neural Networks for Improved Traditional Algorithms
    - Finance: Enhanced Fraud Detection through identification of more complex patterns
    - Manufacturing: Enhanced identification of defects based on deeper anomaly detection

Source: https://mapr.com/blog/demystifying-ai-ml-dl/

Convolutional Neural Networks

- Convolutional Neural Networks for images
    - Retail: in-store activity analysis of video to measure traffic
    - Satellite images: labeling terrain, classifying objects
    - Automotive: recognition of roadways and obstacles
    - Healthcare: diagnostic opportunities from x-rays, scans
    - Insurance: estimating claim severity based on photographs

Source: https://mapr.com/blog/demystifying-ai-ml-dl/

Recurrent Neural Networks

- Recurrent Neural Networks for sequenced data
    - Customer satisfaction: transcription of voice data to text for NLP analysis
    - Social media: real-time translation of social and product forum posts
    - Photo captioning: search archives of images for new insights
    - Finance: Predicting behavior based via time series analysis (also enhanced recommendation systems

Source: https://mapr.com/blog/demystifying-ai-ml-dl/

Use deep learning when ...

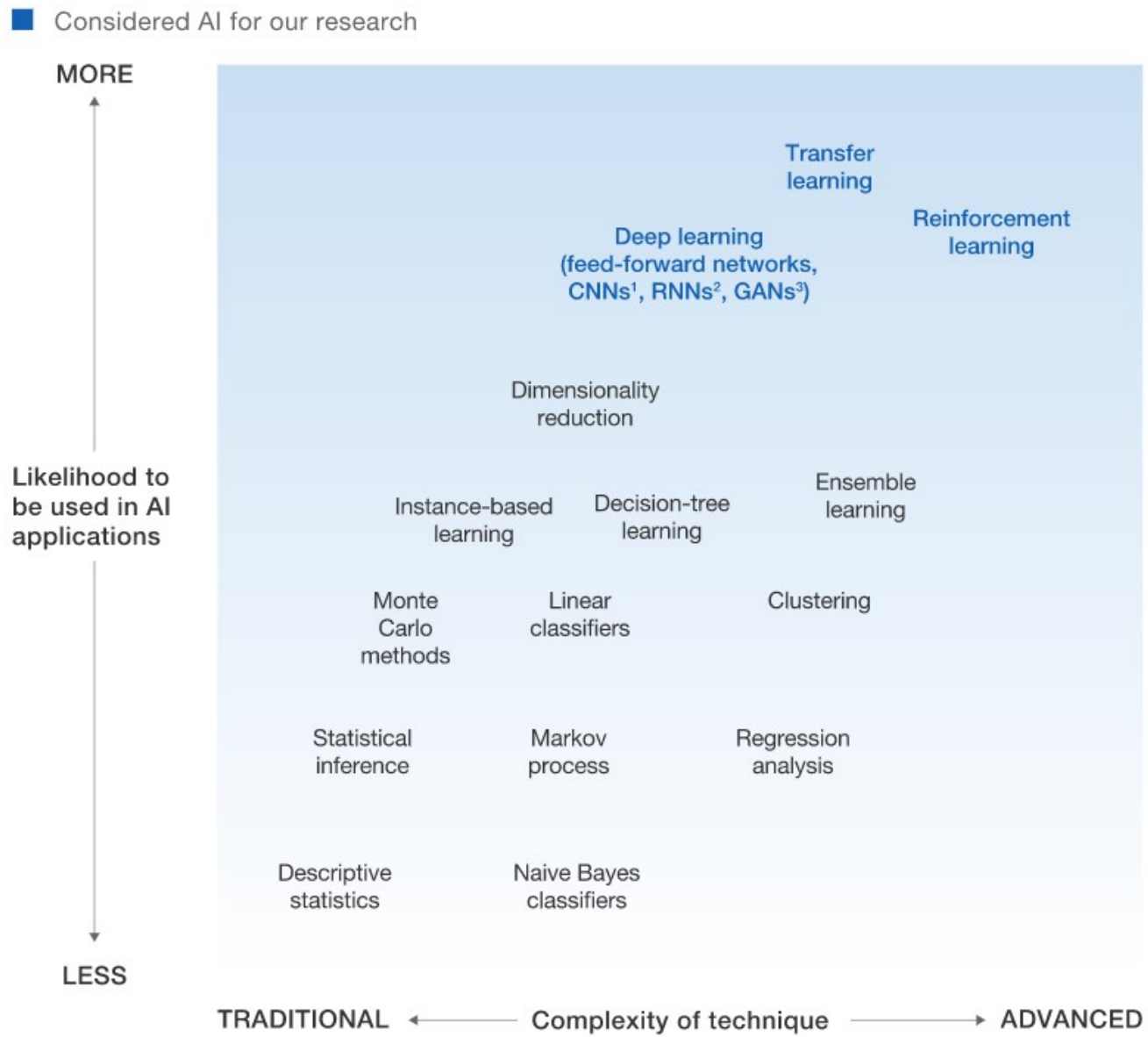
- You have lots of data (~10k+ examples).
- The problem is complex -vision, speech, natural language.
- The data is unstructured.
- You need the absolute best model.

Source: Introduction to TensorFlow 2.0, Databricks

Don’t use deep learning when ...

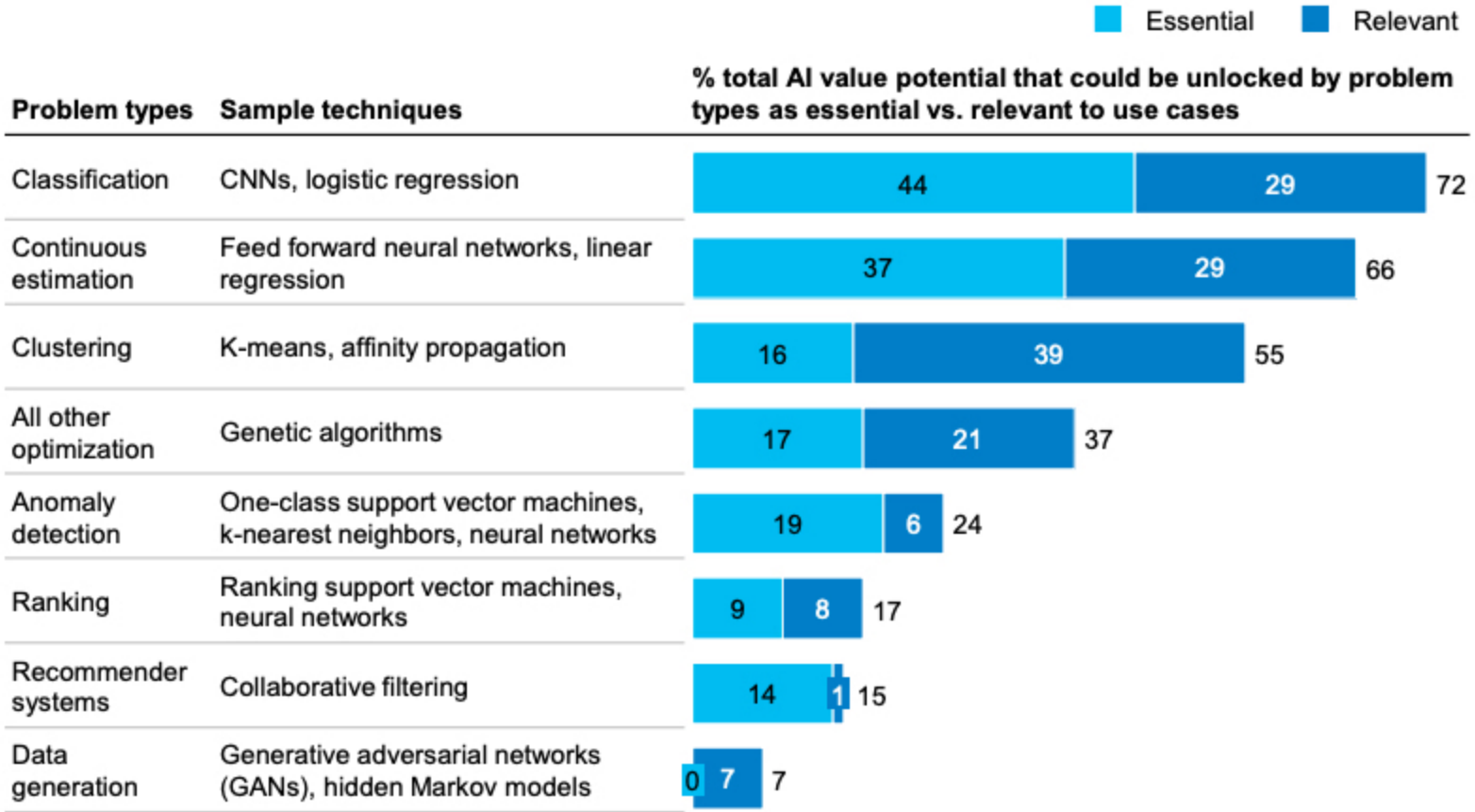
- You have don’t have a large dataset .
- You are performing sufficiently well with traditional ML methods.
- Your data is structured, and you possess the proper domain knowledge.
- Your model should be explainable.

Source: Introduction to TensorFlow 2.0, Databricks



Source: McKinsey Global Institute analysis

Problem types and sample techniques



NOTE: Sample techniques include traditional analytical techniques, machine learning, and the deep learning techniques we describe in this paper as AI. Numbers may not sum due to rounding.

Source: McKinsey Global Institute analysis

Introduction to Transfer Learning

What is Transfer Learning?

Transfer learning is is a machine learning method where a model developed for a task is reused as the starting point for a model on a second task.

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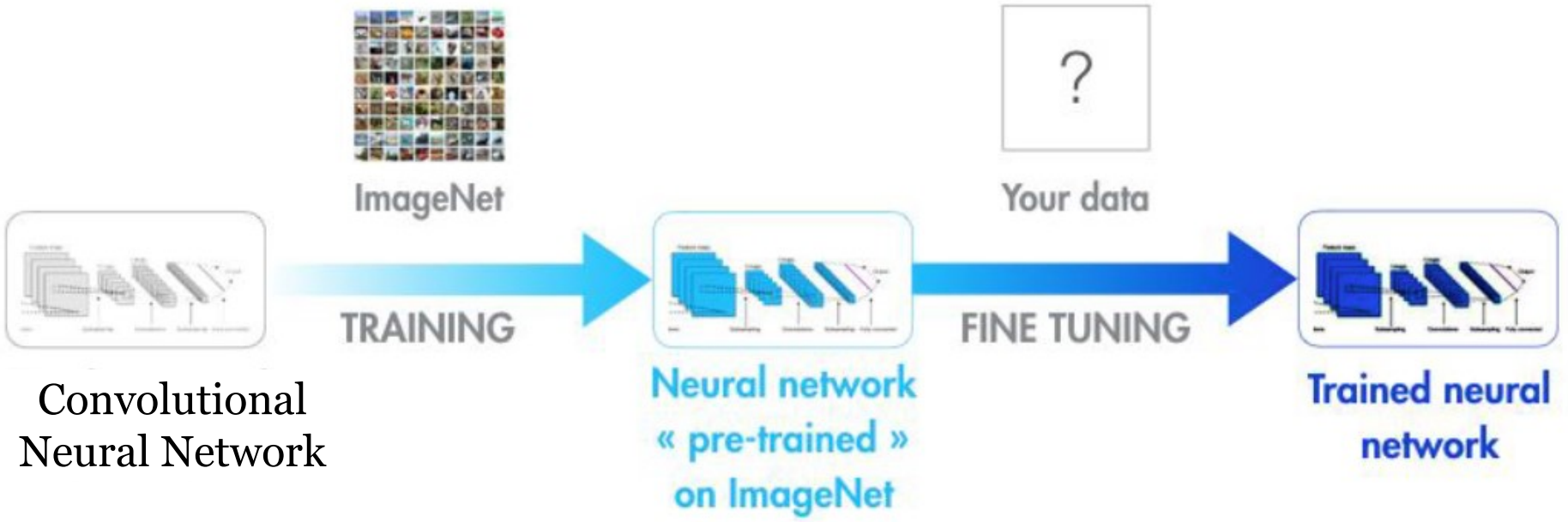
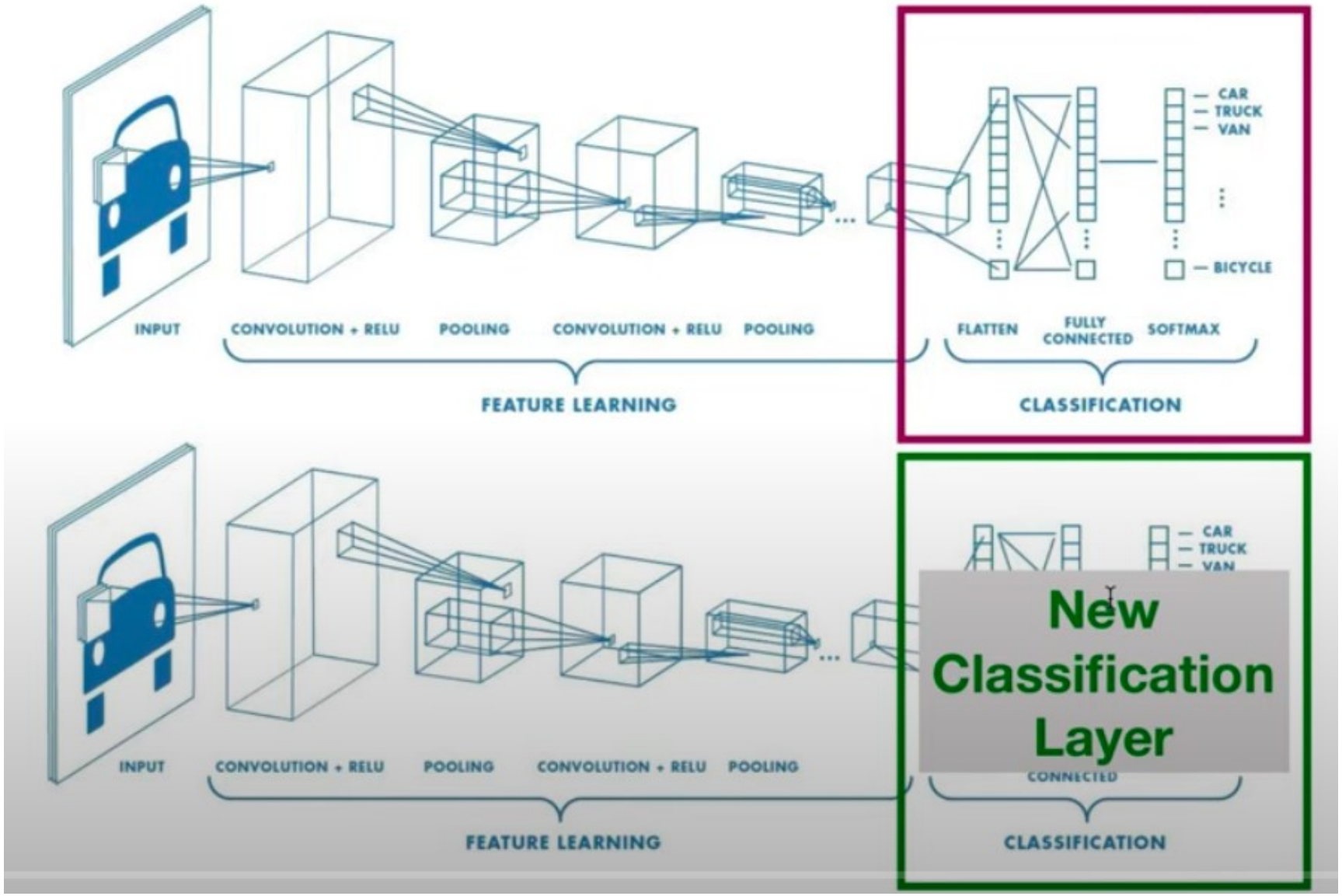


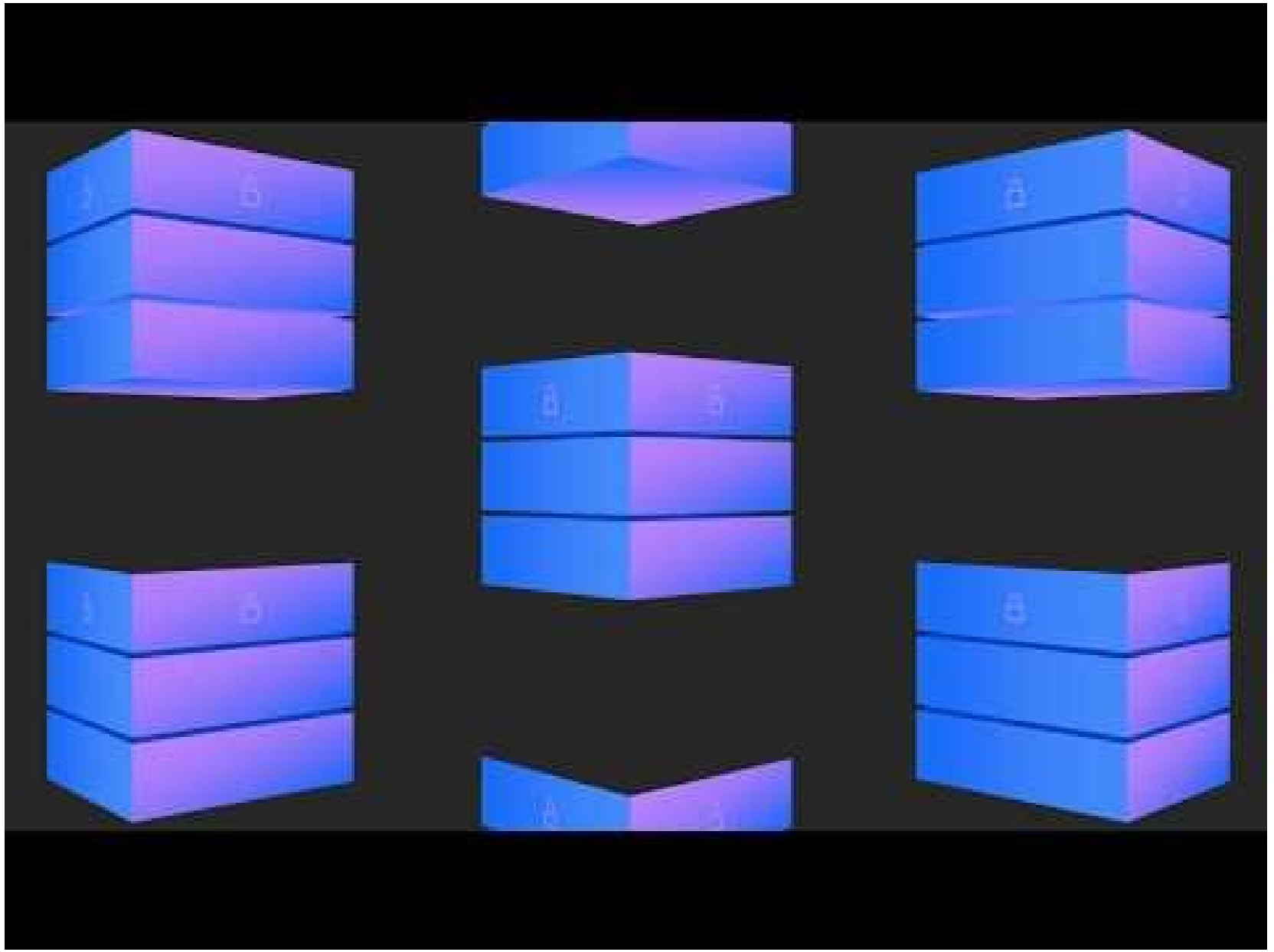
Convolutional Neural Network

Eg. VGG19

Source: State of AI, Ian Hogarth and Nathan Benaich



Source: PyTorch Tutorial 15 - Transfer Learning



Examples of Transfer Learning

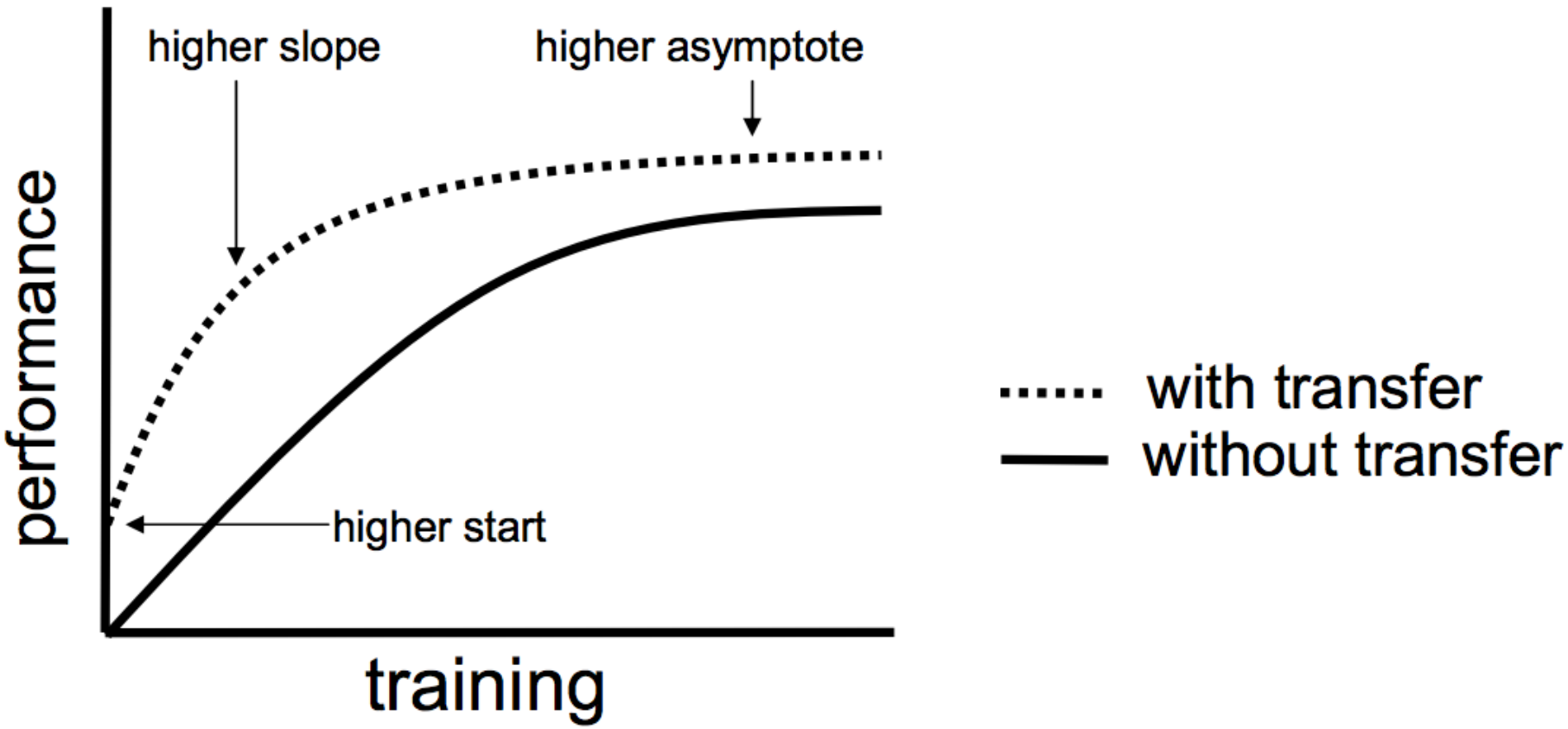
- Transfer Learning with Image Data
  - Oxford VGG Model
  - Google Inception Model
  - Microsoft ResNet Model
- Transfer Learning with Language Data
  - Google's word2vec Model
  - Stanford's GloVe Model

Source: Transfer Learning with Language Data

When to Use Transfer Learning?

- **Higher start**. The initial skill (before refining the model) on the source model is higher than it otherwise would be.
- **Higher slope**. The rate of improvement of skill during training of the source model is steeper than it otherwise would be.
- **Higher asymptote**. The converged skill of the trained model is better than it otherwise would be.

Source: Transfer Learning with Language Data



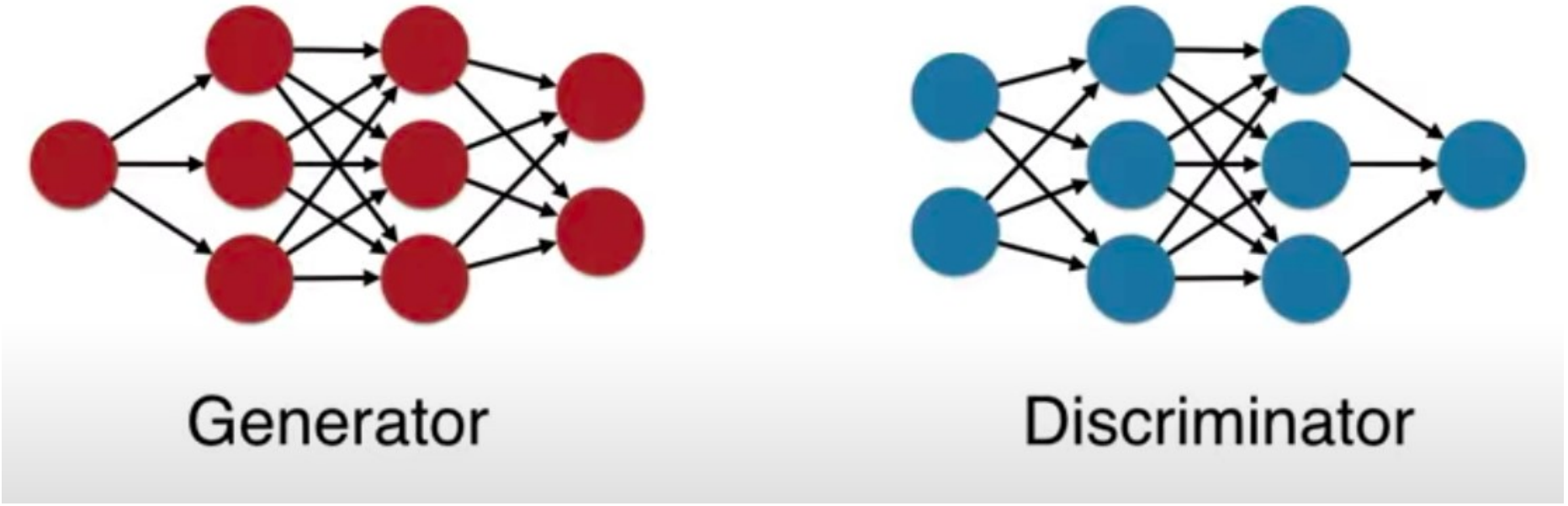
Source: Transfer Learning with Language Data

Introduction to GAN

What is GAN?

A generative adversarial network (GAN) is a class of machine learning frameworks. Two neural networks contest with each other in a game (in the form of a zero-sum game, where one agent's gain is another agent's loss)..

Generative Adversarial Networks

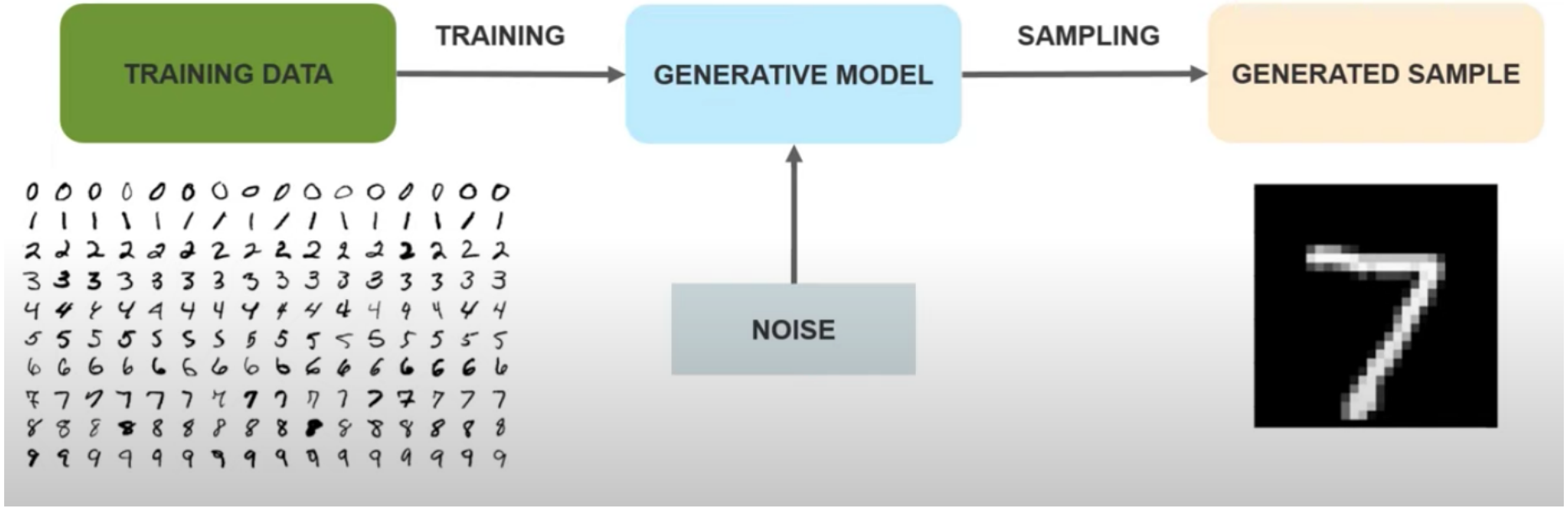


Source: A Friendly Introduction to Generative Adversarial Networks (GANs)

Generative Adversarial Networks

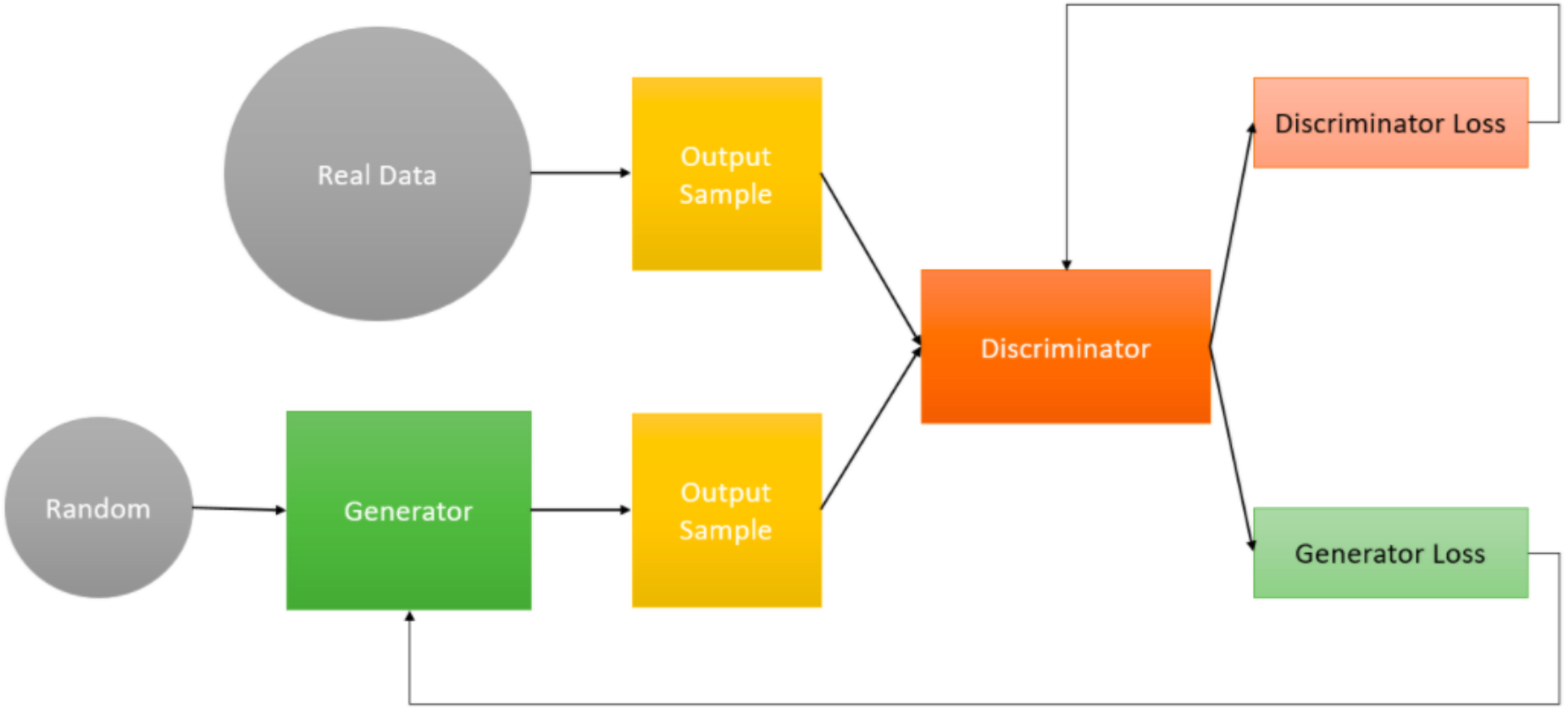
Source: A Friendly Introduction to Generative Adversarial Networks (GANs)

What is Generative Model?



Source: What Are GANs? | | Deep Learning With Python Edureka

GAN



Source: Practical AI on the Google Cloud Platform

Generative Adversarial Networks

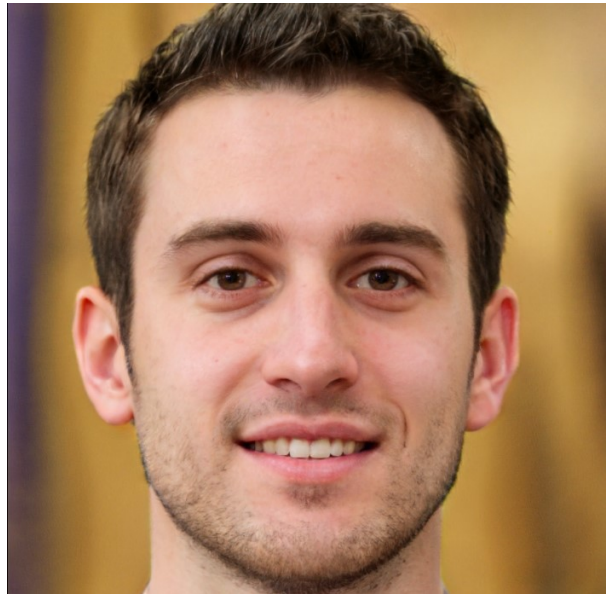
GAN Evolution

Source: The Malicious Use of Artificial Intelligence: Forecasting, Prevention, and

Large scale GAN

Source: Large Scale GAN Training for High Fidelity Natural Image Synthesis

thispersondoesnotexist.com

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We create the most realistic artificial voices in the world
Personify your product by giving it a unique voice
Create your own vocal avatar and use it wherever you want
Integrate the vocal avatars of your users in your application
CREATE MY VOICE

GAN Applications

- Prediction of next frame in a video
- Text to image generator
- Image to image translation
- Enhance the resolution of an image
- Interactive image generation

Introduction to Data Science

What is Data Science?

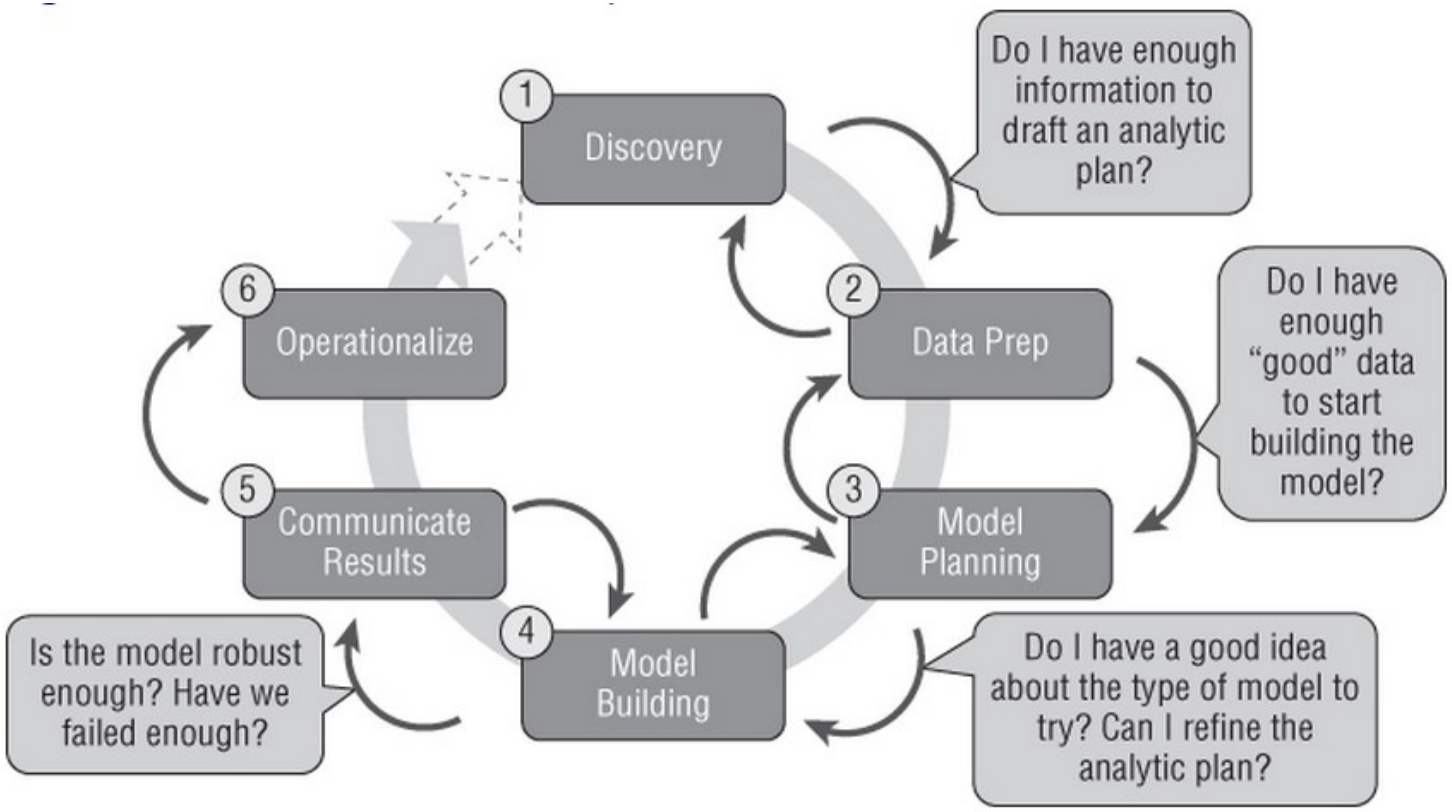
Data science is an inter-disciplinary field that uses scientific methods, processes, algorithms and systems to extract knowledge and insights from many structural and unstructured data. Data science is related to data mining, machine learning and big data.

Artificial Intelligence v.s. Data Science

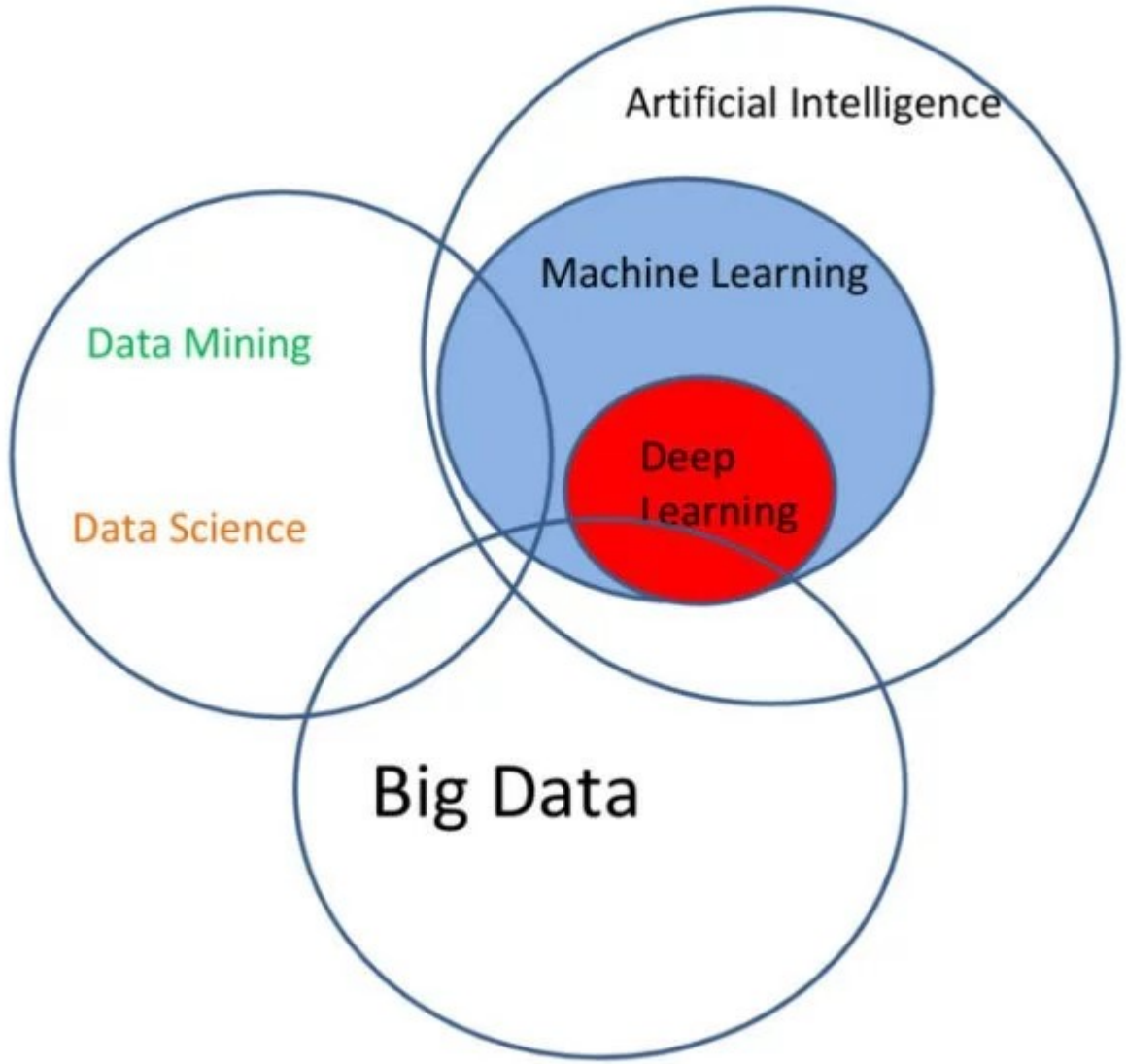
Artificial intelligence	Data science
Automates tasks or predicts future events based on data.	Produces insights based on data.
Is commonly used “live”: it continuously elaborates new data and produces answers.	Is commonly “one-off”: it produces some insights that inform decisions.
It commonly has the form of software.	It commonly has the form of a presentation or report.

Source: Zero to AI

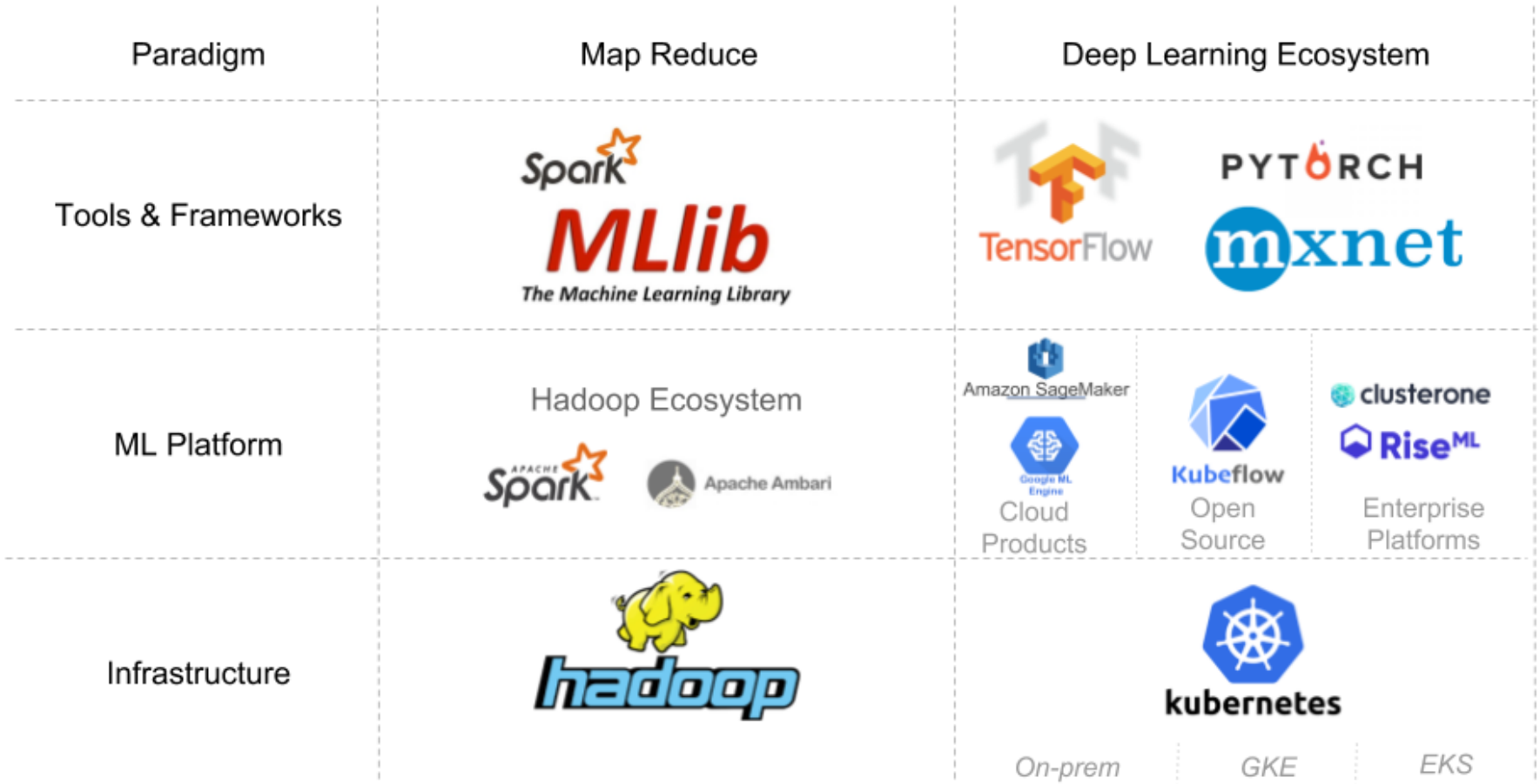
Data Scientist Lifecycle



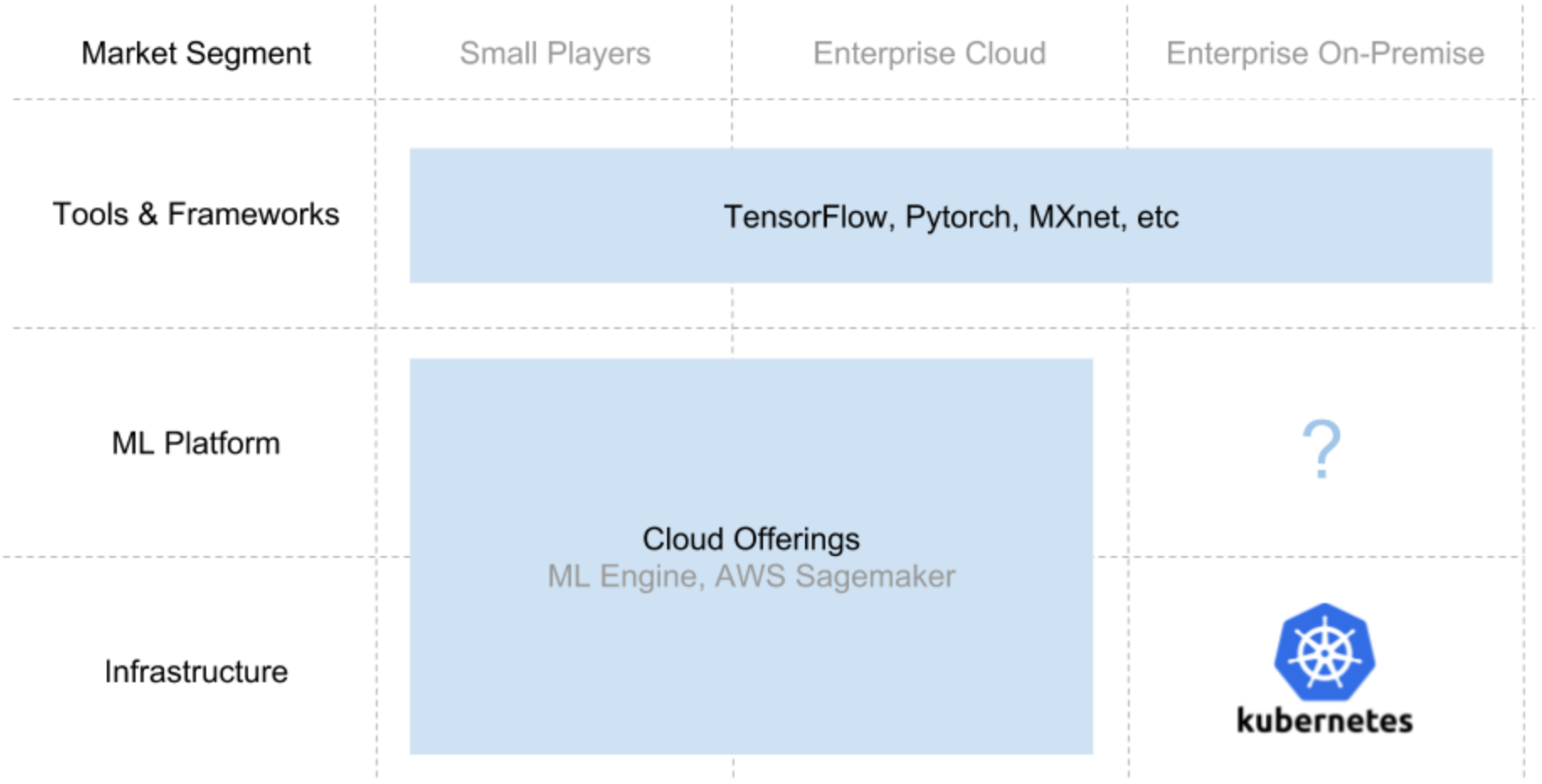
Source Big Data: Understanding How Data Powers Big Business


Artificial Intelligence
Machine Learning
Deep Learning
Data Mining
Data Science
Big Data

AI Tools
on Cloud



Source: https://towardsdatascience.com/building-the-ai-stack-ad23ac90405f



Source: https://towardsdatascience.com/building-the-ai-stack-ad23ac90405f

AI technical tools

- ML frameworks
  - TensorFlow
  - PyTorch
  - Keras
  - MXNet
  - CNTK
  - Caffe
  - Scikit-learn
  - R
  - Weka
- Research publications
  - Arxiv
- Open source repositories
  - GitHub

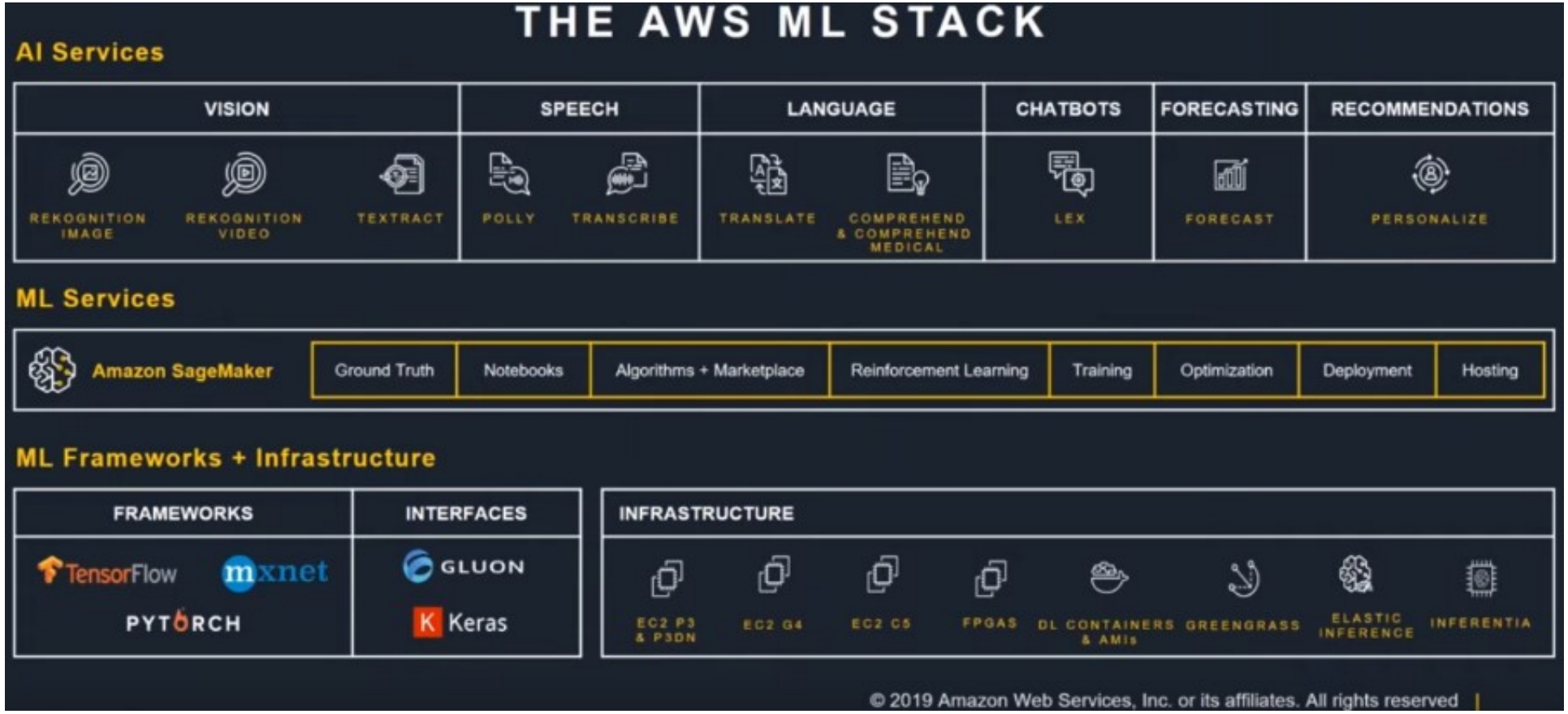
MLaaS
(Machine Learning as a Service)

Google Cloud Platform

Alibaba Cloud

Huawei Cloud

Gartner 2020 Magic Quadrant for Cloud AI Developer Services

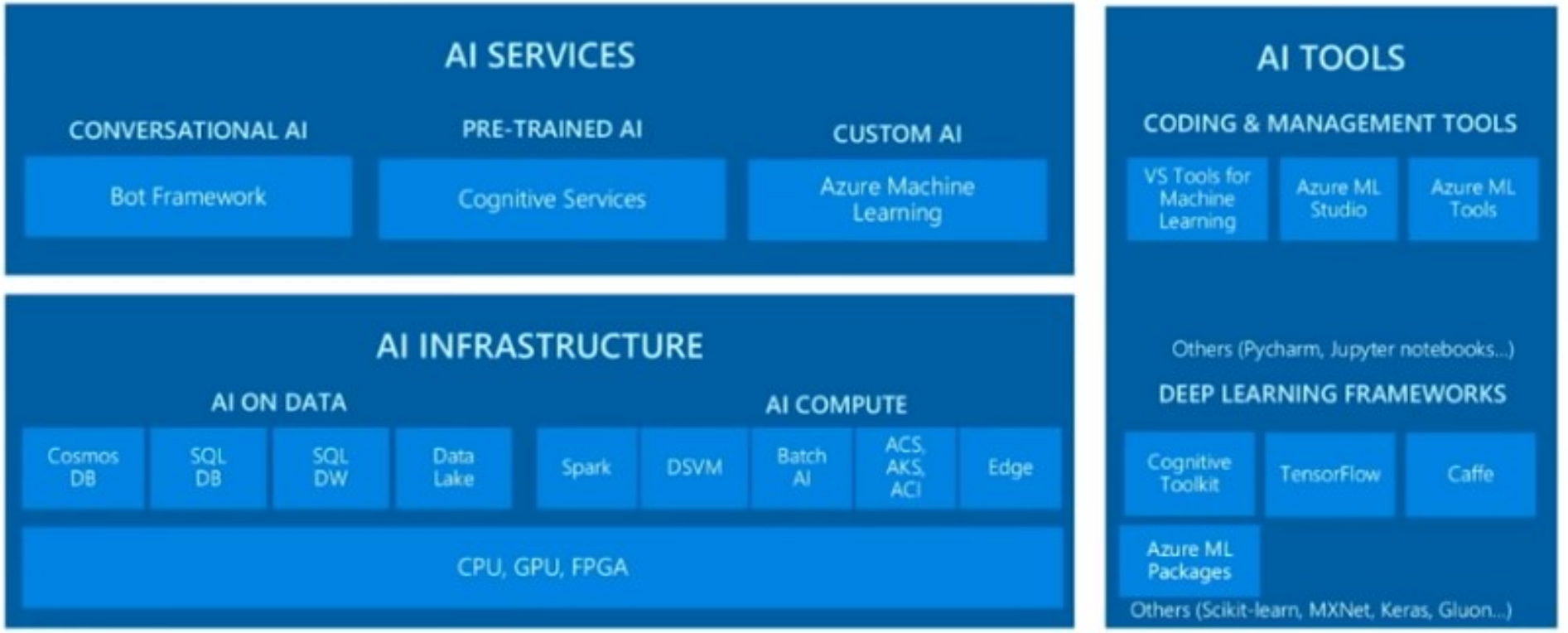


Source: A Closer Look At Amazon Machine Learning Services

AWS DeepLens

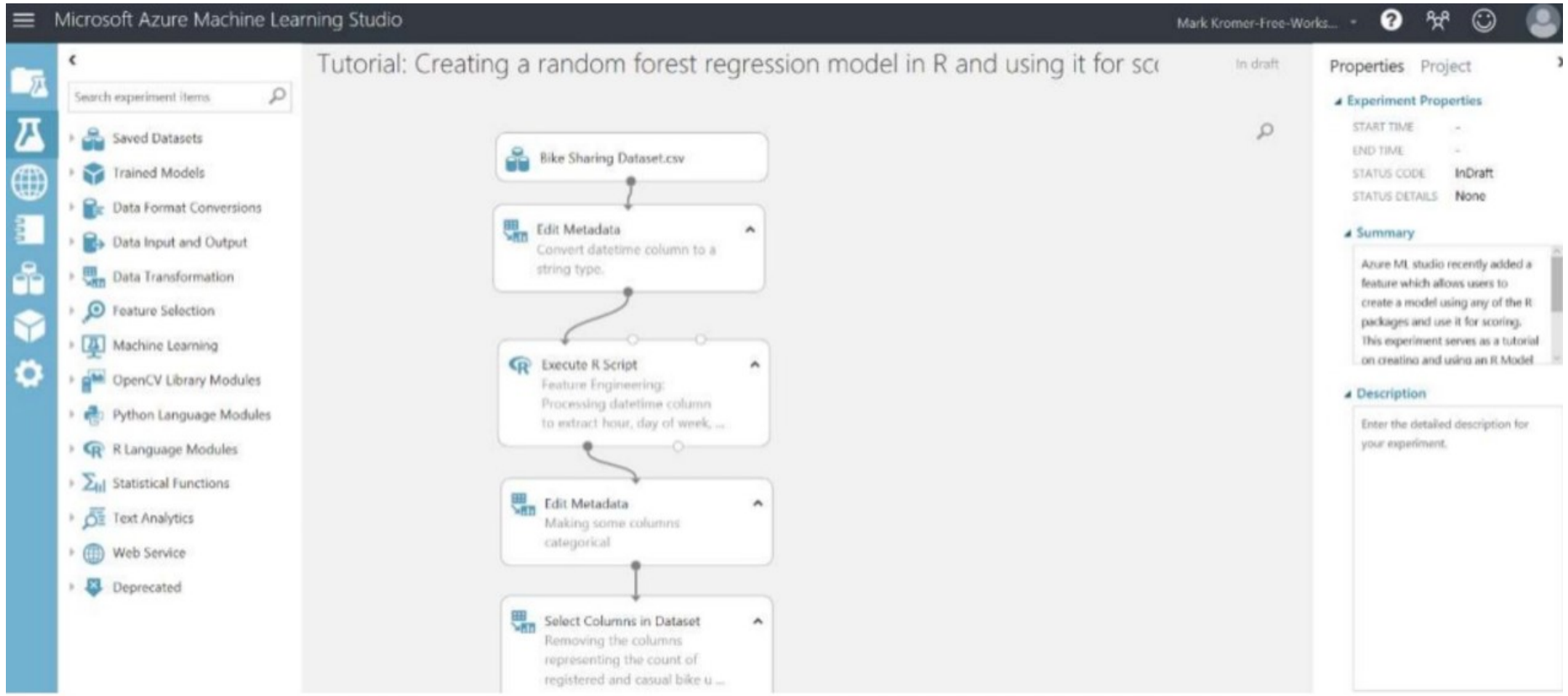
AWS DeepRacer

AI on Azure



Source: What's new with Azure Machine Learning, May 2018

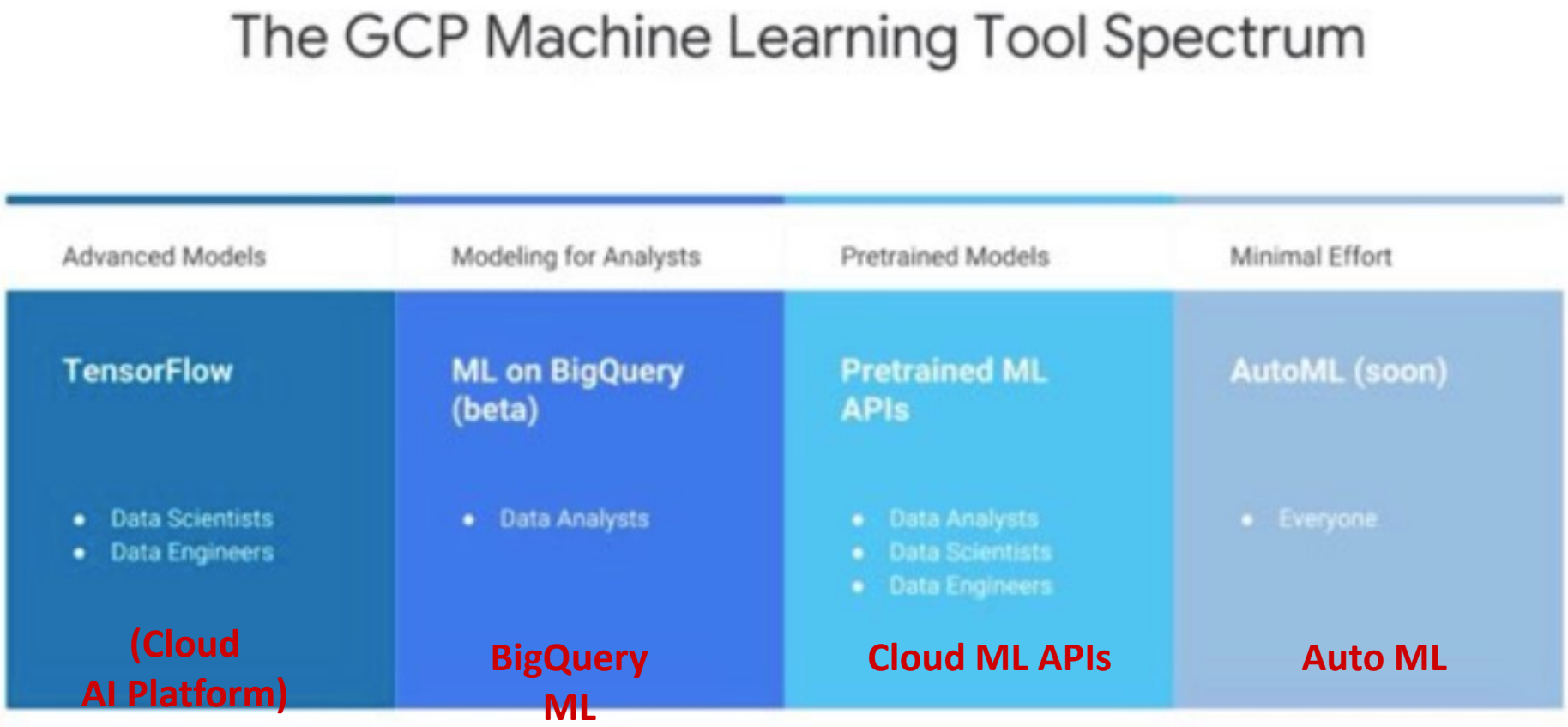
Azure Machine Learning



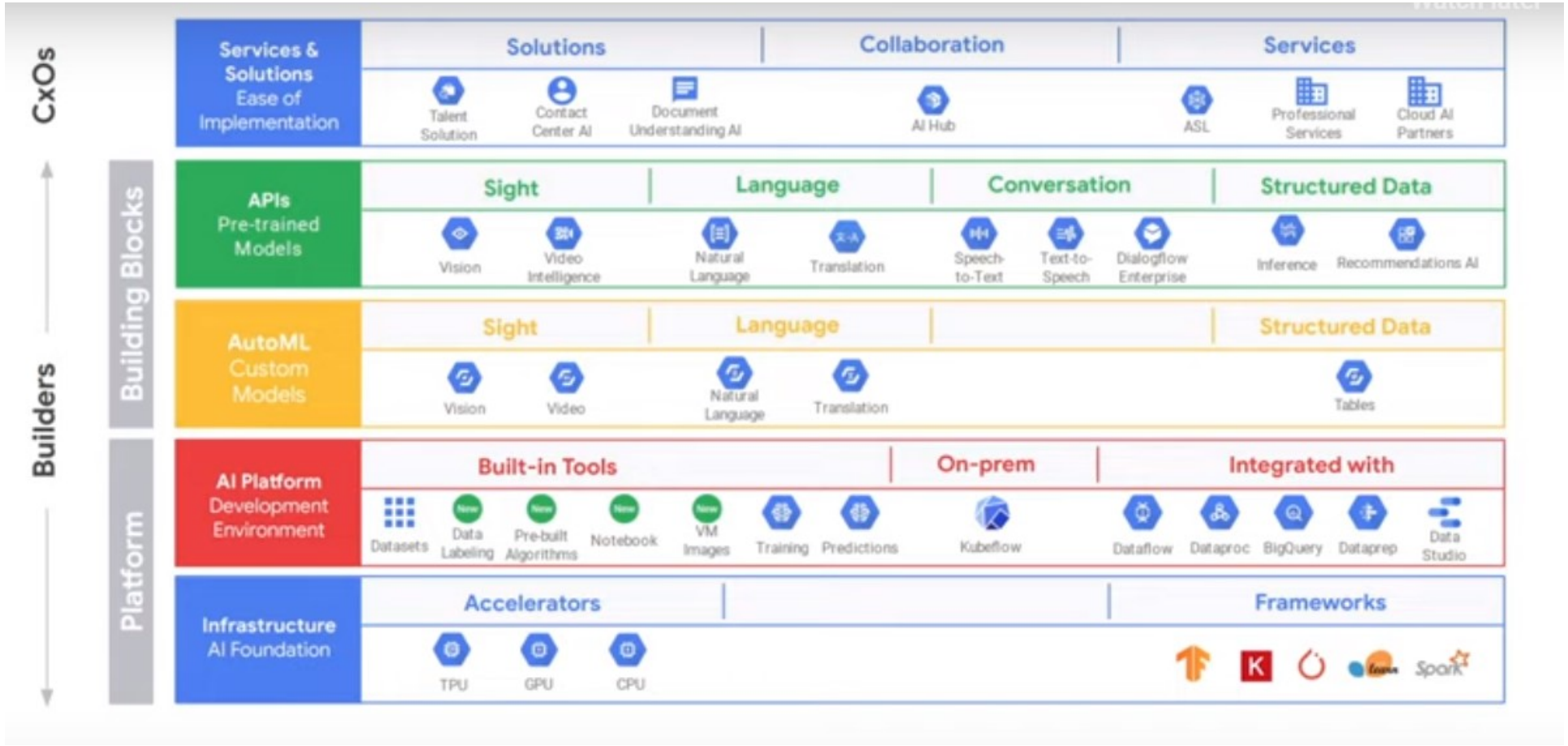
Source: Microsoft Azure Big Data Analytics


AZURE DATA SCIENCE VM
Virtual Machine images, configured with popular tools that are used for data analytics, machine learning and AI training

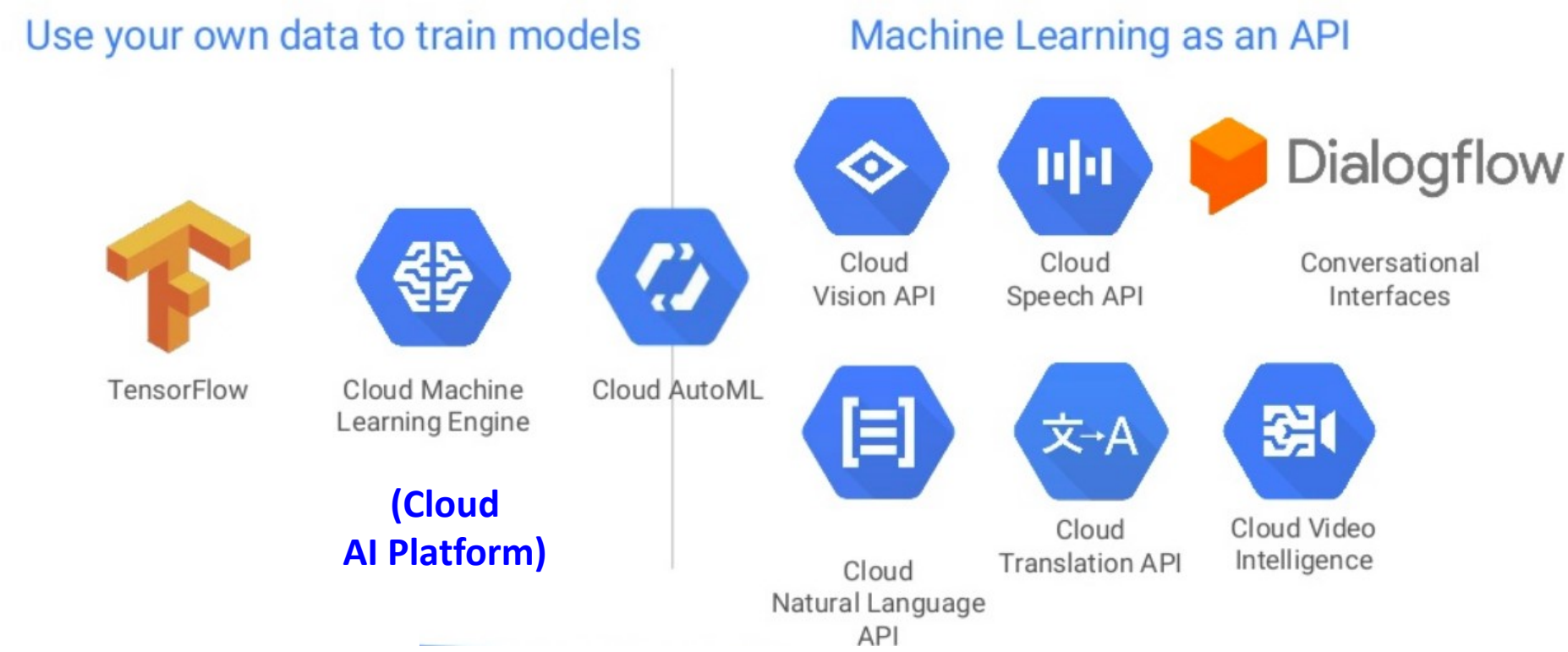
Google Cloud AI



GCP AI Services



Google's Machine Learning Tools



Cloud v.s. On-premise : Consideration

- Setup & Ease of use
- Performance
- Vendor lock-in
- Cost
- Security
- Data gravity