MACHINE LEARNING

With Neurocomputation Lab

COURSE INSTRUCTORS

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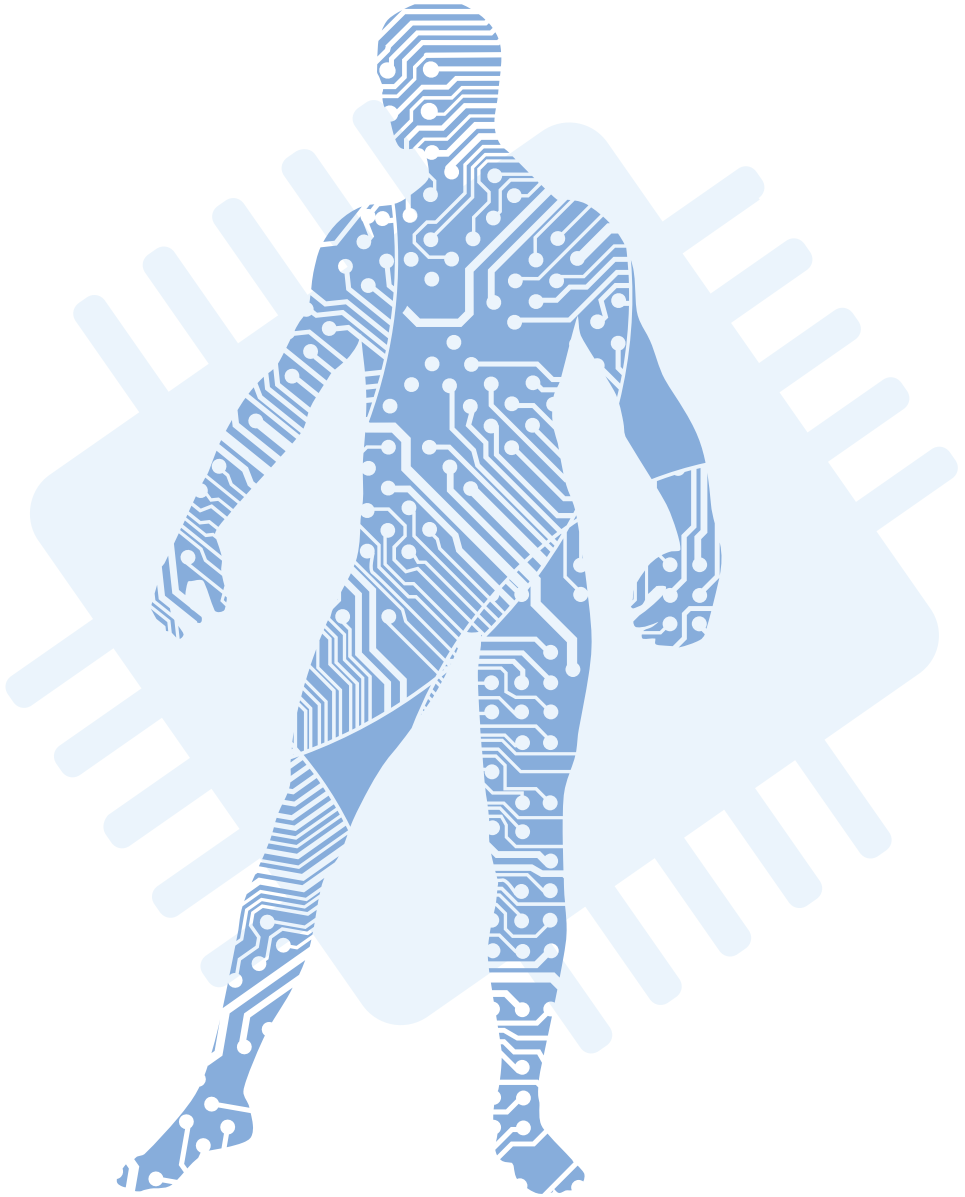
OVERVIEW

01 What is Artificial Intelligence

02 What is Machine Learning

03 What is Deep Learning

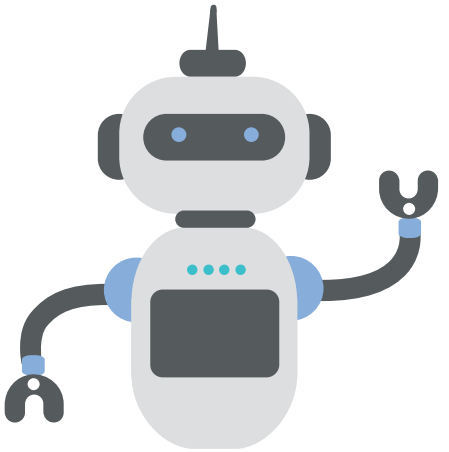
04 Difference between AI, ML, DL



Artificial Intelligence

AN INTRODUCTION

DEFINITION OF AI



“**Artificial intelligence** (AI) is an area of computer science that emphasizes the creation of **intelligent** machines that work and react like humans. Some of the activities computers with **artificial intelligence** are designed for include: Speech recognition.”

DEMYSTIFYING AI

1. Artificial Narrow Intelligence (ANI)

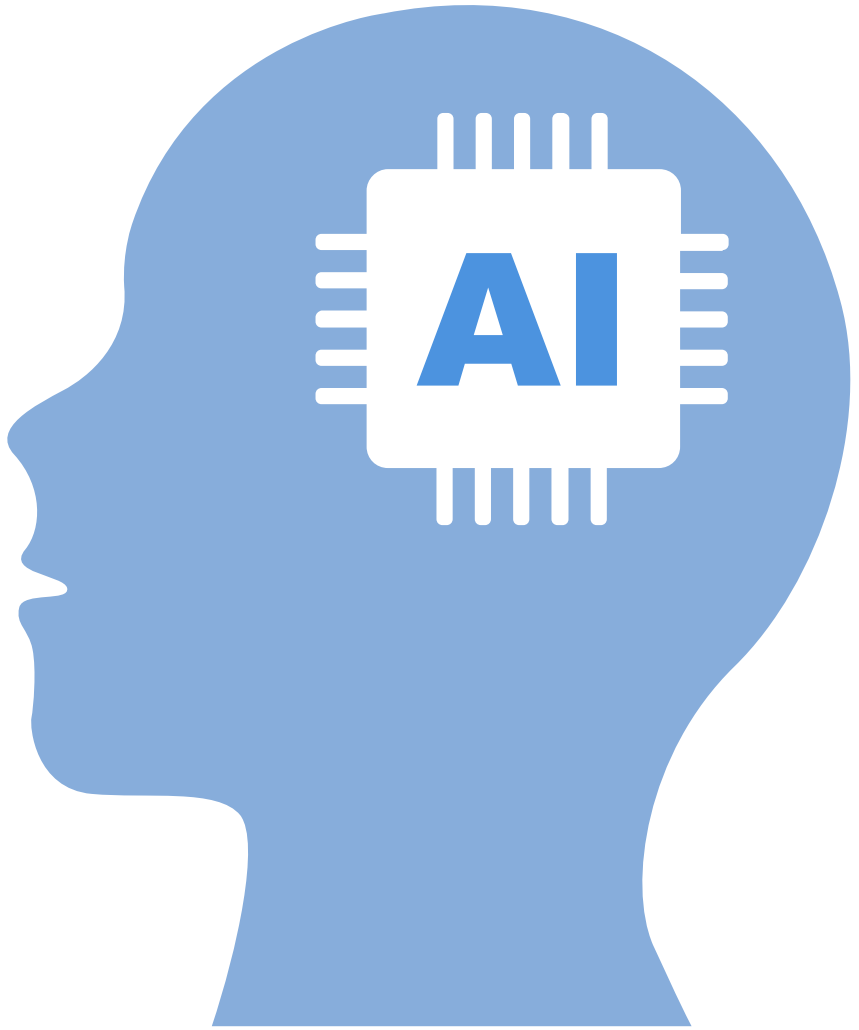
E.g., self-driving cars, web search,
AI in farming and factories

2. Artificial General Intelligence (AGI)

Do anything a human can do

3. Artificial Super Intelligence (ASI)

More powerful and sophisticated than a human intelligence



WHY **ARTIFICIAL INTELLIGENCE** IS THE FUTURE?

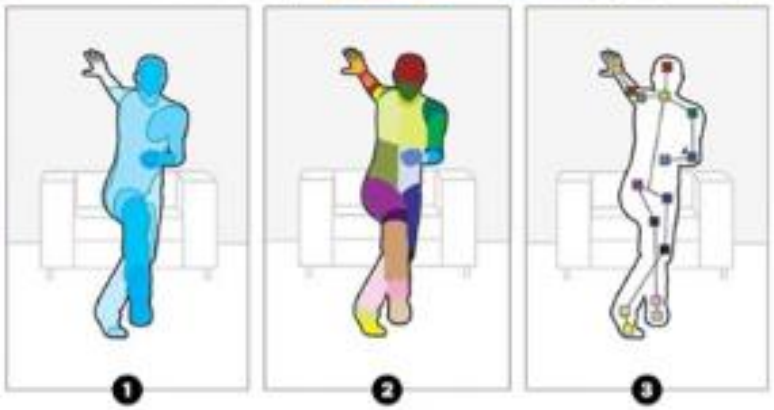
Machine Learning

AN INTRODUCTION

Applications of ML

1

2



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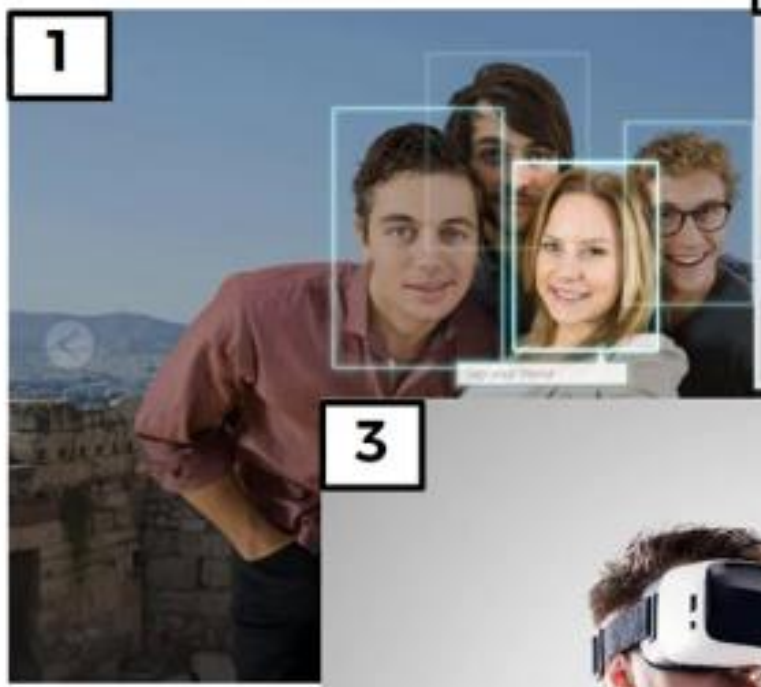
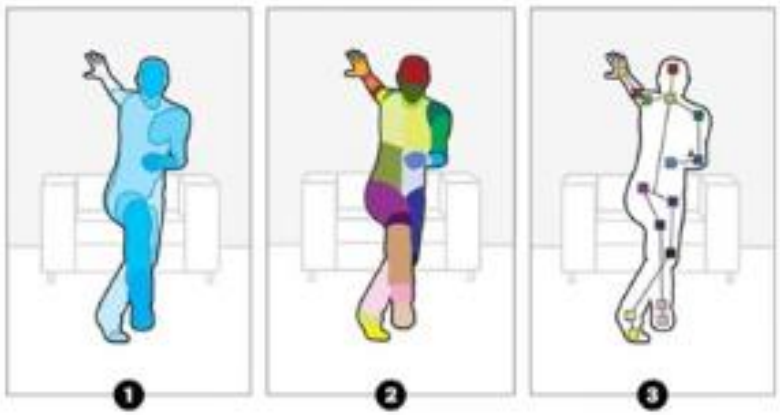
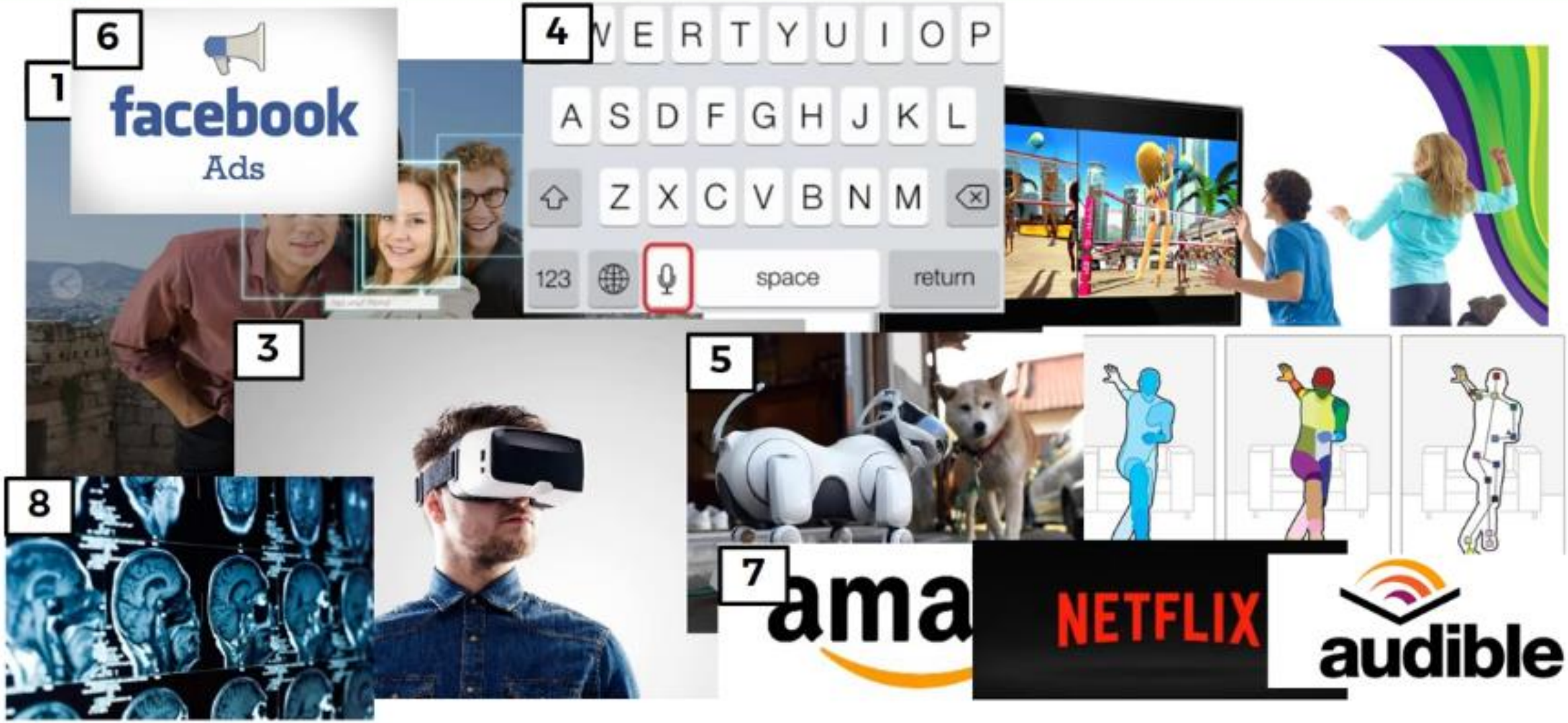
Applications of ML

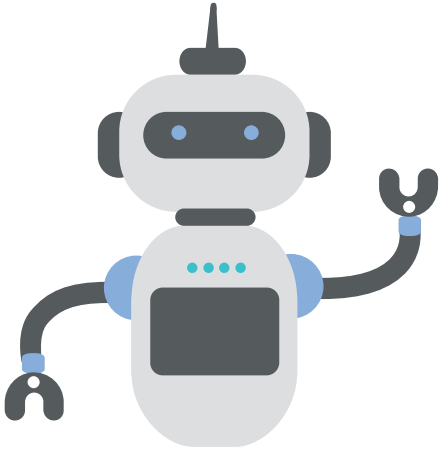




Applications of ML



DEFINITION OF ML

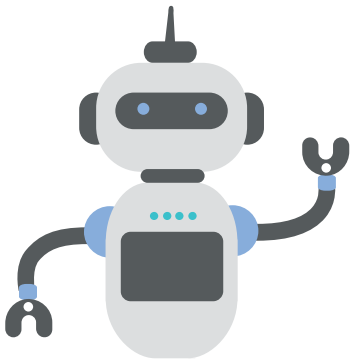


Arthur Samuel described it as:

> The field of study that gives computers the ability to learn without being explicitly programmed.

Tom Mitchell provides a more modern definition:

> A computer program is said to learn from experience E with respect to some class of tasks T and performance measure P, if its performance at tasks in T, as measured by P, improves with experience E.



Example: Playing checkers.

E = the experience of playing many games of checkers
T = the task of playing checkers.
P = the probability that the program will win the next game.

CLASSIFICATION OF ML PROBLEMS

1. Supervised Learning
   a) Regression
   b) Classification

2. Unsupervised Learning
   a) Clustering
   b) Non-clustering

Input (A)	Output (B)	Application
email	spam? (0/1)	spam filtering
audio	text transcript	speech recognition
English	Chinese	machine translation
ad, user info	click? (0/1)	online advertising
image, radar info	position of other cars	self-driving car
image of phone	defect? (0/1)	visual inspection

Deep Learning

AN INTRODUCTION


ATARIWRITER
SONY
ATARI 800
ATARI 1050
ATARI 1050

1956

1980

2017

SanDisk Ultra 256GB MicroSDXC UHS-I Card with Adapter (SDSQUNI-256G-GN6MA).

by SanDisk

$149.99 ~~$199.99~~ Prime

Get it by **Wednesday, Mar 22**

FREE Shipping on eligible orders

More Buying Choices

$147.99 (10 new offers)

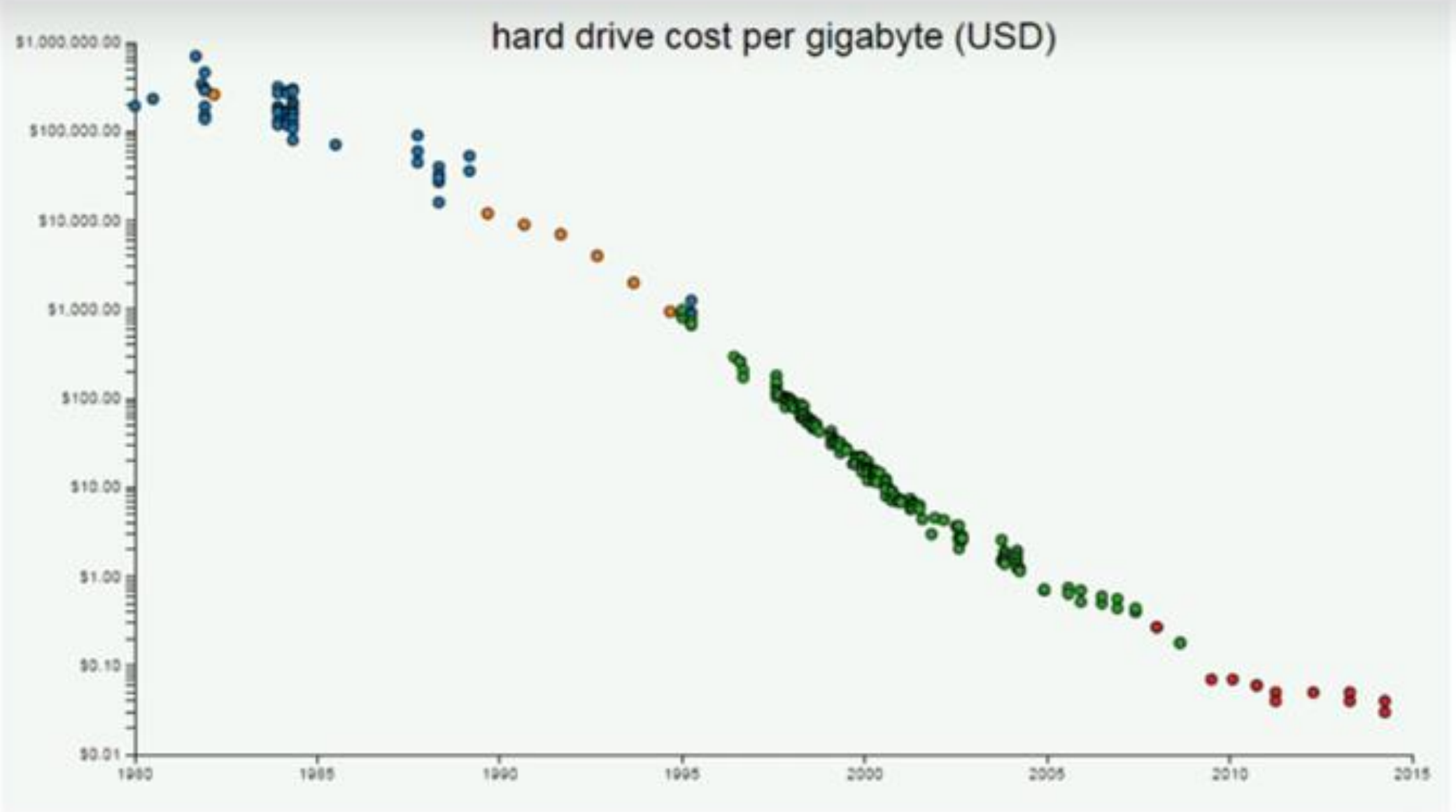
4.5 out of 5 stars

21,224

Product Features

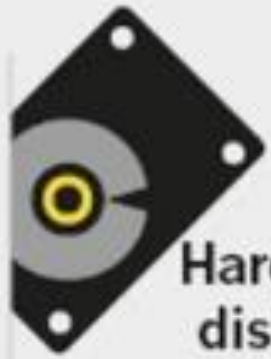
256GB capacity breakthrough

Log-scale


hard drive cost per gigabyte (USD)
$1,000,000.00
$100,000.00
$10,000.00
$1,000.00
$100.00
$10.00
$1.00
$0.10
$0.01
1980
1985
1990
1995
2000
2005
2010
2015

STORAGE LIMITS

Estimates based on bacterial genetics suggest that digital DNA could one day rival or exceed today's storage technology.

	 Hard disk	 Flash memory	 Bacterial DNA
Read–write speed (μs per bit)	~3,000–5,000	~100	<100
Data retention (years)	>10	>10	>100
Power usage (watts per gigabyte)	~0.04	~0.01–0.04	$<10^{-10}$
Data density (bits per cm^3)	$\sim10^{13}$	$\sim10^{16}$	$\sim10^{19}$

1 The accelerating pace of change ...

Agricultural Revolution — 8,000 years → Industrial Revolution — 120 years → Light-bulb — 90 years → Moon landing — 22 years → World Wide Web — 9 years → Human genome sequenced

2 ... and exponential growth in computing power ...

Computer technology, shown here climbing dramatically by powers of 10, is now progressing more each hour than it did in its entire first 90 years

COMPUTER RANKINGS
By calculations per second per $1,000

Analytical engine
Never fully built, Charles Babbage's invention was designed to solve computational and logical problems

Colossus
The electronic computer, with 1,500 vacuum tubes, helped the British crack German codes during WW II

UNIVAC I
The first commercially marketed computer, used to tabulate the U.S. Census, occupied 943 cu. ft.

Apple II
At a price of $1,298, the compact machine was one of the first massively popular personal computers

... will lead to the Singularity

Power Mac G4
The first personal computer to deliver more than 1 billion floating-point operations per second

Hollerith Tabulator · IBM Tabulator · National Ellis 3000 · Zuse 2 · Zuse 3 · ENIAC · IBM 550EC · BINAC · Whirlwind · EDVAC · DEC PDP-4 · IBM 1130 · Datamatic 1000 · IBM 1620 · DEC PDP-10 · Data General Nova · Interdata 8 · IBM PC · Compaq Deskpro 386 · Pentium PC · Pentium II PC · Dell Dimension 8400 · Mac Pro · Nvidia Tesla GPU & PC

ELECTROMECHANICAL → RELAYS → VACUUM TUBES → TRANSISTORS → INTEGRATED CIRCUITS

1900 · 1920 · 1940 · 1960 · 1980 · 2000 · 2011 · 2020 · 2045

10^{25} — **2045** Surpasses brainpower equivalent to that of all human brains combined

10^{20} — Surpasses brainpower of human in 2023

10^{15}

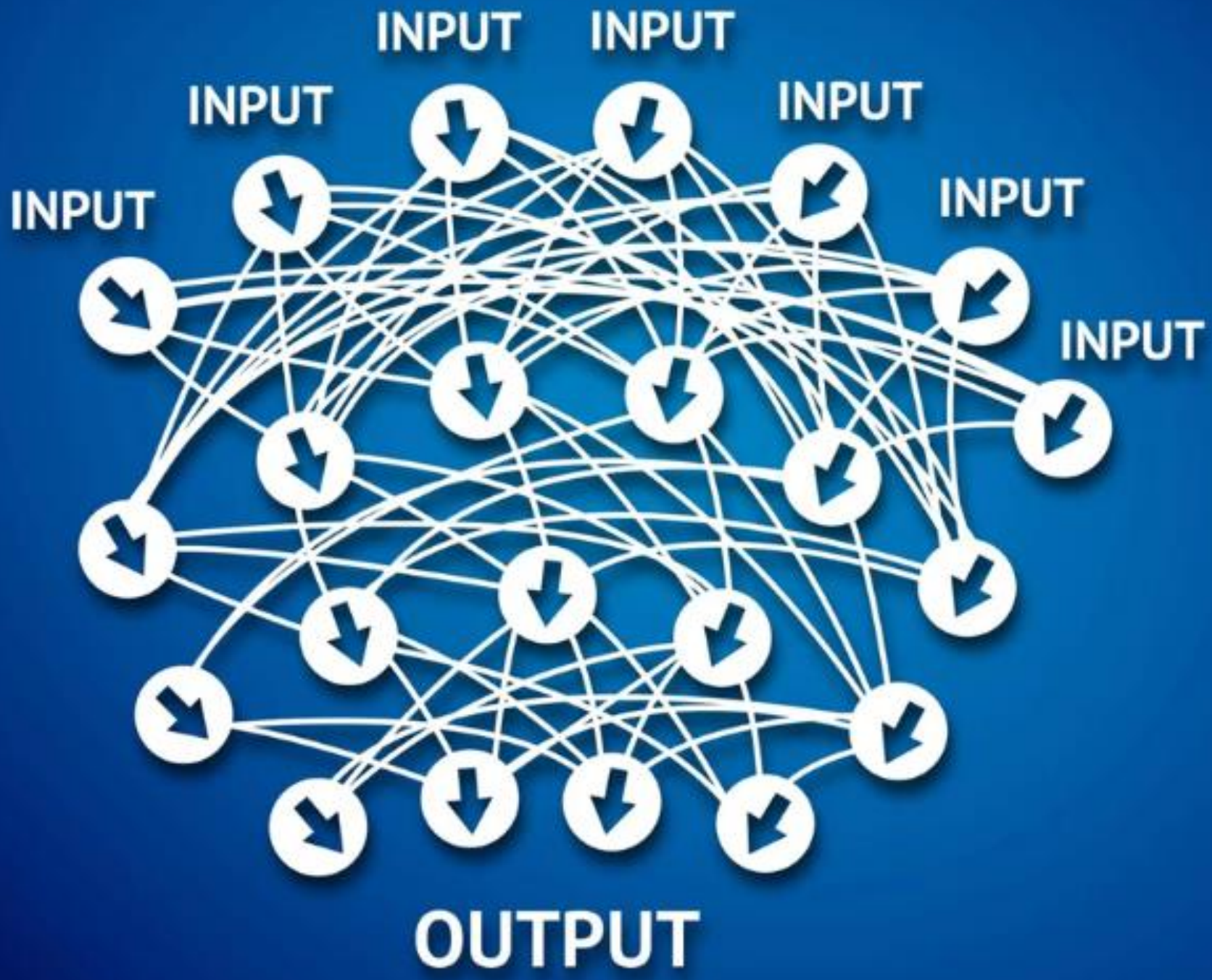
10,000,000,000 — Surpasses brainpower of mouse in 2015

100,000

1

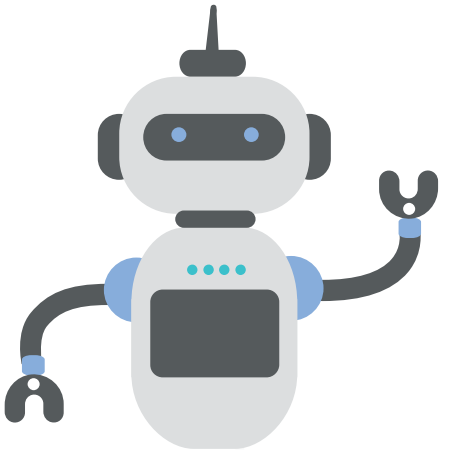
0.00001

Source: T


INPUT
INPUT
INPUT
INPUT
INPUT
INPUT
INPUT
OUTPUT

Geoffrey Hinton

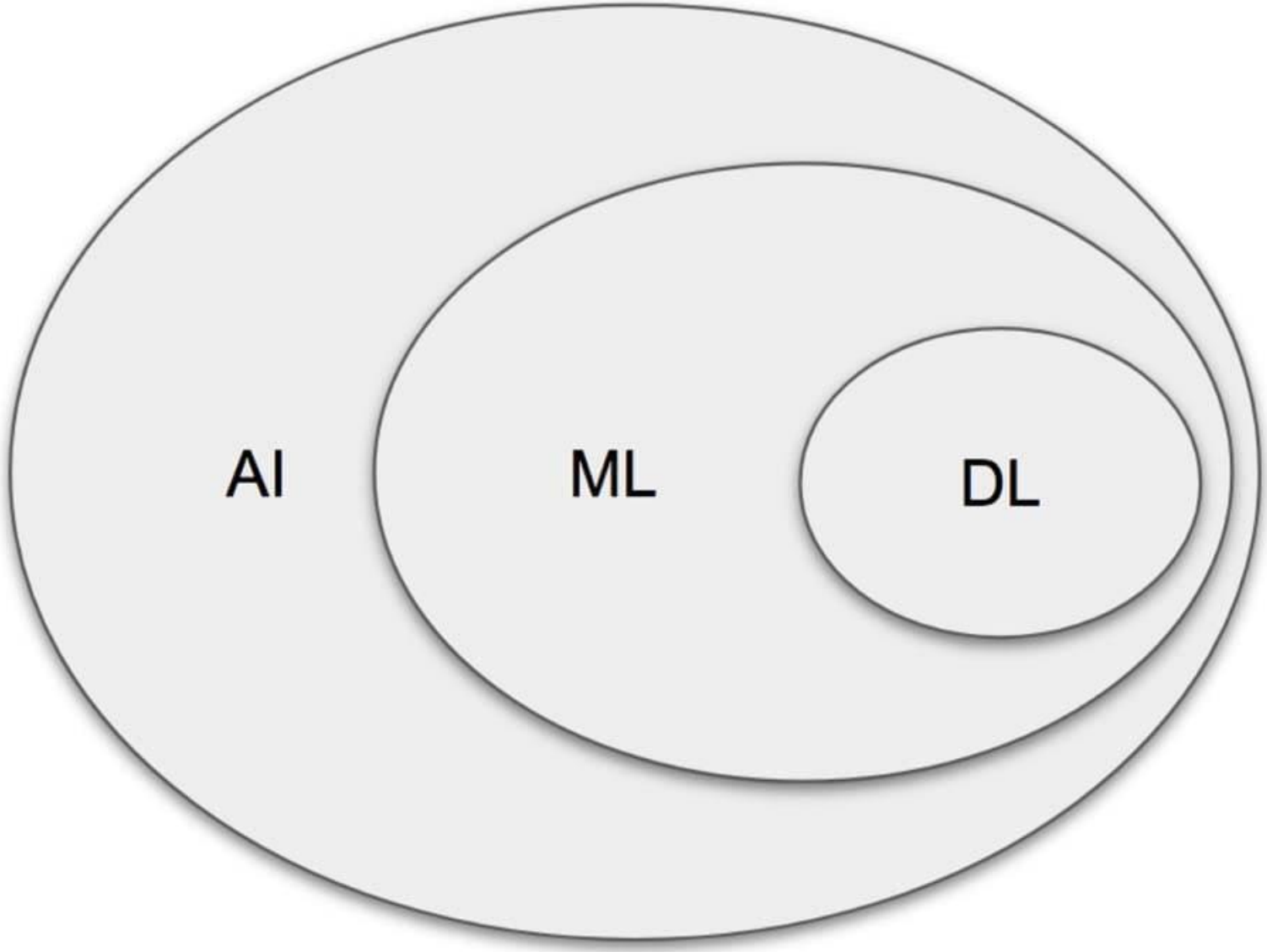
DEFINITION OF DL



“Deep learning is a subset of machine learning in artificial intelligence (AI) that has networks capable of learning unsupervised from data that is unstructured or unlabeled. Also known as deep neural learning or deep neural network.”


ColdFusion

Difference between AI, ML, and DL


AI
ML
DL


Thank You