

Pengenalan Topik Kecerdasan Buatan

AI for everyone¹

Hendra Bunyamin

Jurusan Teknik Informatika
Fakultas Teknologi Informasi
Universitas Kristen Maranatha

November 20, 2019



¹<https://www.coursera.org/learn/ai-for-everyone/home/welcome>

Outline

- 1 Introduction
- 2 Machine Learning
- 3 What is Data?
- 4 The Terminology of AI
- 5 What Machine Learning Can and Cannot Do
- 6 More examples of what ML can and cannot do
- 7 Non-technical explanation of deep learning
- 8 Survey of major AI application areas
- 9 MK Pilihan Jalur Komputasi Cerdas

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Introduction

AI value creation
by 2030

**\$13
trillion**

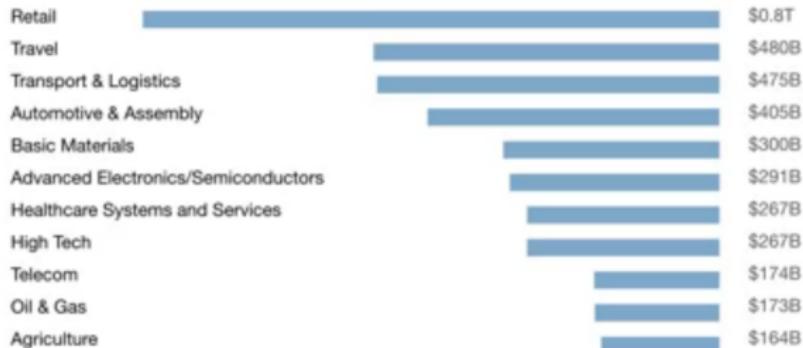


Figure 1: Source: McKinsey Global Institute (Ng, 2019)

$$\$13 \text{ trillion} = \$13 \times 10^{12} = \text{Rp}183 \times 10^{15}.$$

Demystifying AI

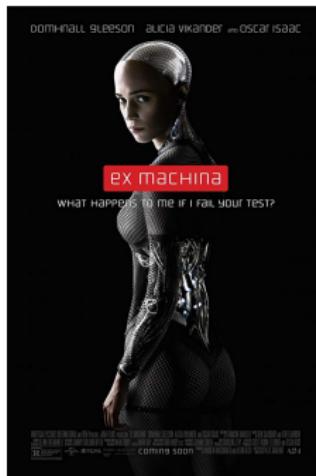
Artificial Intelligence or **AI** can be divided into 2 as follows:

- **ANI** ⇒ Artificial Narrow Intelligence.

Examples: smart speaker, self-driving car, web search, AI in farming and factories.

- **AGI** ⇒ Artificial General Intelligence.

Examples: Do anything a human can do atau bahkan melebihi.



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Supervised Learning (1/1)

- One of the tools that drive the significant progress of AI is **Machine Learning**.
- A common type of Machine Learning is a type of AI that learns from A to B or is often called **Supervised Learning**.

$$A \longrightarrow B$$

input output



Supervised Learning (2/2)

Input (A)	→	Output (B)	Application
email	→	spam? (0/1)	spam filtering
audio	→	text transcript	speech recognition
English	→	Indonesia	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



Why Now?

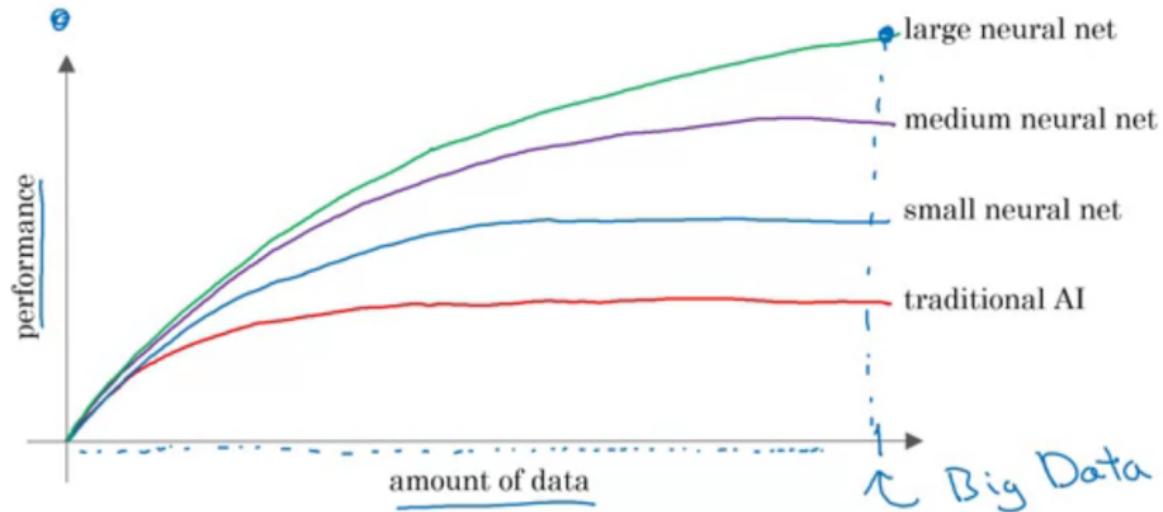


Figure 2: Large neural net + Big Data = High Performance (Ng, 2019)

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Example of a Table of Data (Dataset) (1/3)

size of house (square feet)		price (1000\$)
523		115
645		150
708		210
1034		280
2290		355
2545		440

A → B

Figure 3: House prices dataset (Ng, 2019)

Example of a Table of Data (Dataset) (2/3)

size of house (square feet)	# of bedrooms	price (1000\$)
523	1	115
645	1	150
708	2	210
1034	3	280
2290	4	355
2545	4	440

A → B

Figure 4: House prices dataset (Ng, 2019)

Example of a Table of Data (Dataset) (3/3)

image	label
	cat
	not cat
	cat
	not cat




Figure 5: Cat images dataset (Ng, 2019)

Acquiring data

- Manual labeling



cat



not
cat



cat



not
cat

- From observing behaviors

user ID	time	price (\$)	purchased
4783	Jan 21 08:15.20	7.95	yes
3893	March 3 11:30.15	10.00	yes
8384	June 11 14:15.05	9.50	no
0931	Aug 2 20:30.55	12.90	yes

machine	temperature (°C)	pressure (psi)	machine fault
17987	60	7.65	N
34672	100	25.50	N
08542	140	75.50	Y
98536	165	125.00	Y

A

B

- Download from websites / partnerships

Data is Messy

- Garbage in, garbage out
- Data problems: *incorrect labels* and *missing values*

size of house (square feet)	# of bedrooms	price (1000\$)
523	1	115
645	1	0.001
708	unknown	210
1034	3	unknown
unknown	4	355
2545	unknown	440

- Multiple types of data
images, audio, text ⇒ **unstructured data**

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Machine Learning vs. Data Science (1/2)

size of house (square feet)	# of bedrooms	# of bathrooms	newly renovated	price (1000\$)
523	1	2	N	115
645	1	3	N	150
708	2	1	N	210
1034	3	3	Y	280
2290	4	4	N	355
2545	4	5	Y	440



Figure 6: Home prices (Ng, 2019)

According to *Machine Learning*:

$A \rightarrow B$: Running AI system (e.g., websites / mobile app)

According to *Data Science*:

Homes with 3 bedrooms are more expensive than homes with 2 bedrooms of a similar size.

Newly renovated homes have a 15% premium.

Machine Learning vs. Data Science (2/2)

Machine Learning

"Field of study that gives computers the ability to learn without being explicitly programmed."

→ software

-Arthur Samuel (1959)

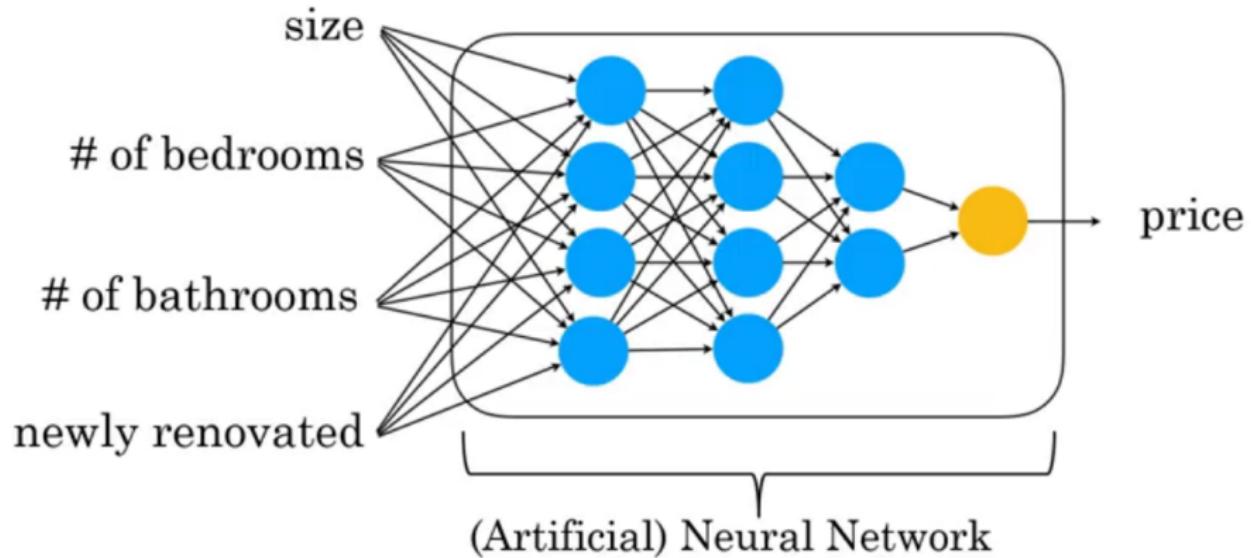
Data Science

Science of extracting knowledge and insights from data.

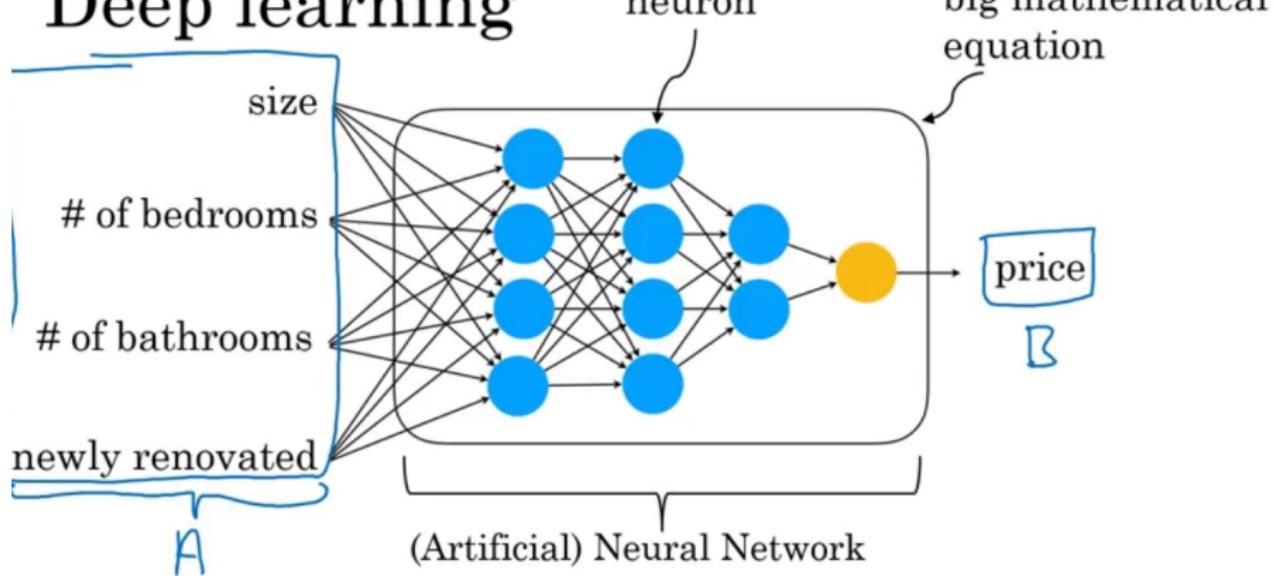
→ slide deck



Deep Learning (1/2)



Deep learning



AI has many tools (1/2)

- Machine learning and data science
- Deep learning / neural network
- Other buzzwords: Unsupervised learning, reinforcement learning, graphical models, planning, knowledge graph, ...

AI has many tools (2/2)

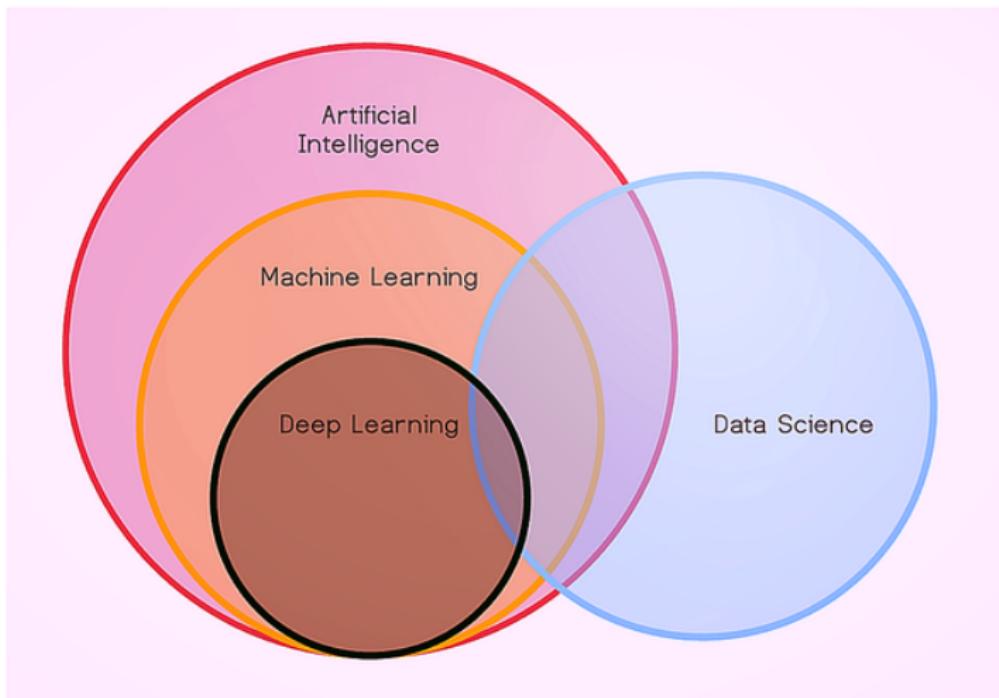


Figure 7: Relationship among AI, ML, DL, and DS (Kharkovyba, 2019)

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Supervised Learning

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image of phone	defect? (0/1)	visual inspection

Anything you can do with 1 second of thought, we can probably now or soon automate.



What machine learning today can and cannot do

The toy arrived two days late, so I wasn't able to give it to my niece for her birthday.

Can I return it?

→ "*Refund request*"

Input text → Refund/Shipping/Other

$A \rightarrow B$

→ "*Oh, sorry to hear that. I hope your niece had a good birthday.
Yes, we can help with ...*"



What happens if you try?

Input (A) → **Output (B)**

User email 2-3 paragraph response

1000 examples

"My box was damaged" → Thank you for your email.

"Where do I write a review?" → Thank you for your email.

"What's the return policy" → Thank you for your email.

"When is my box arriving?" → Thank yes now your....



What makes an ML problem easier

- ① Learning a "simple" concept

$\leq 1 \text{ sec}$

- ② Lots of data available

$A \longrightarrow B$
input output



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Self-driving car

Can do



A → B

Cannot do



stop

hitchhiker

bike turn
left signal

A → B

① Data

② Need high accuracy

X-ray diagnosis



Can do

Diagnose pneumonia from
~10,000 labeled images

Cannot do

Diagnose pneumonia from
10 images of medical textbook
chapter explaining pneumonia

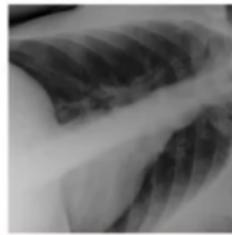
Strengths and weaknesses of machine learning

ML tends to work well when:

- ① Learning a "simple" concept
- ② There are lots of data available

ML tends to work poorly when:

- ① Learning complex concepts from small amounts of data
- ② It is asked to perform on new types of data



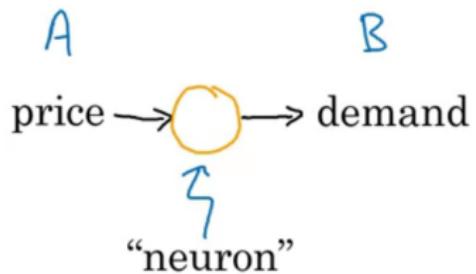
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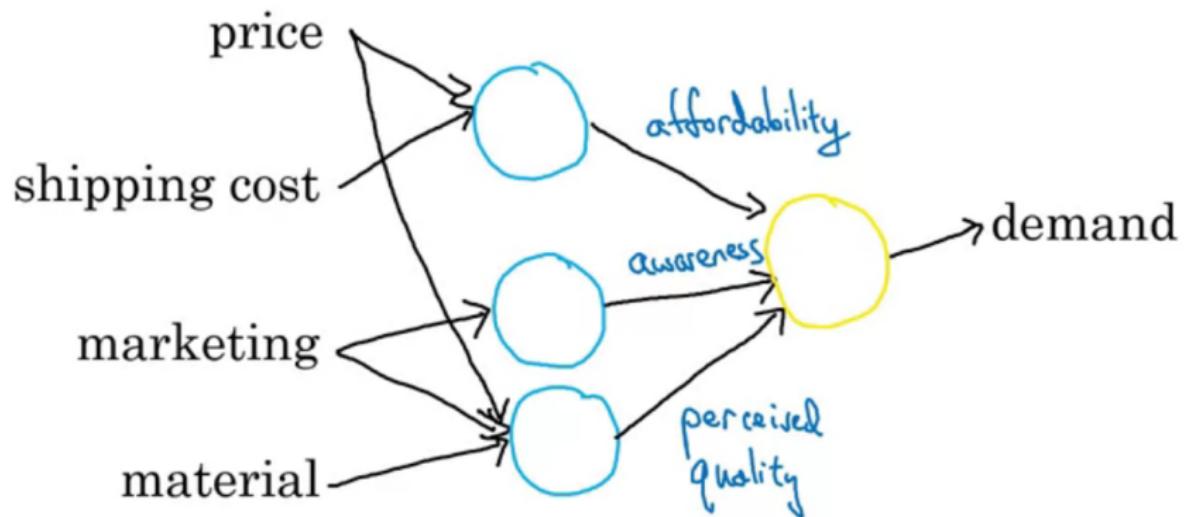
Demand prediction (1/2)



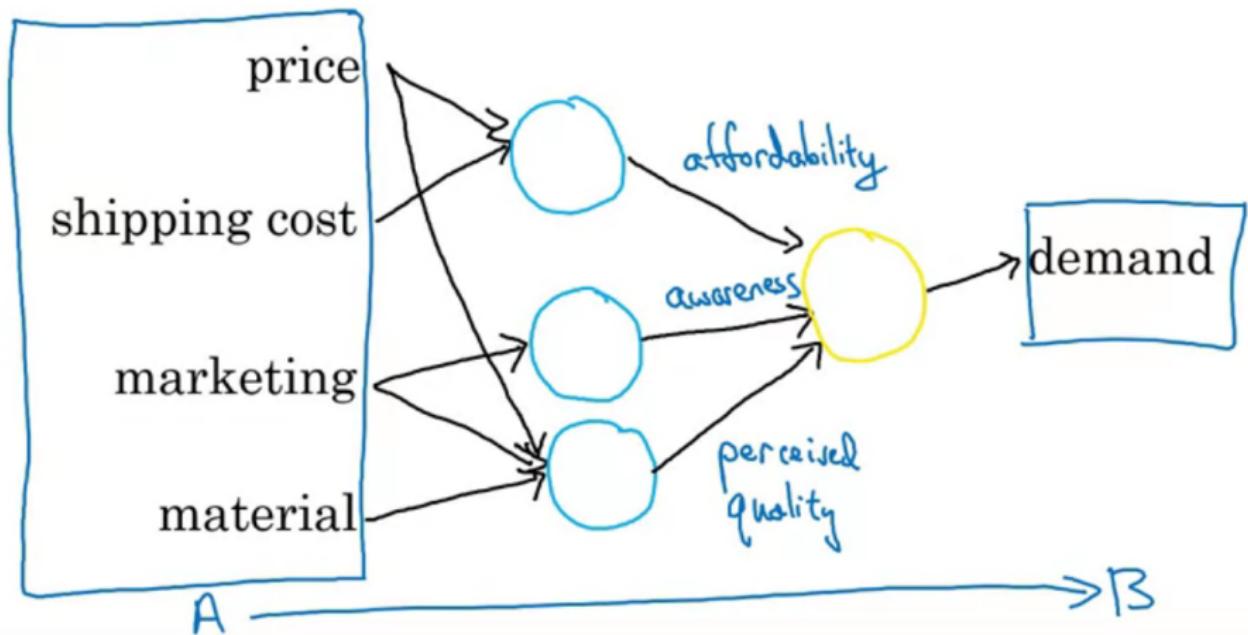
Demand prediction (2/2)



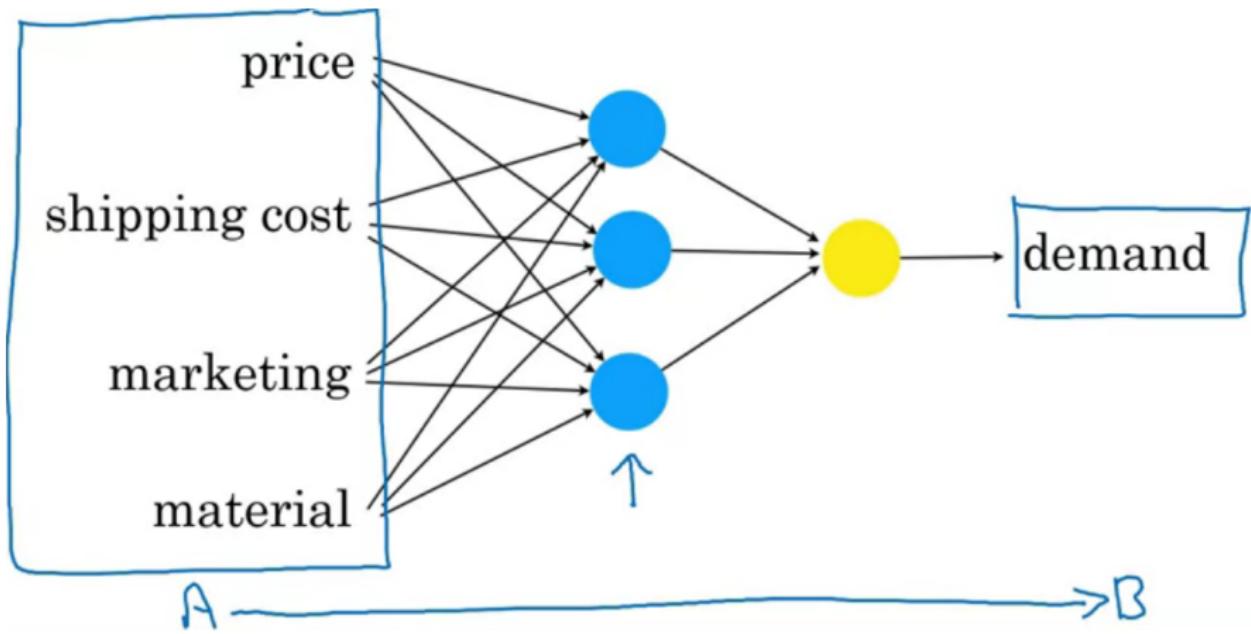
Demand prediction: a little bit more complex (1/3)



Demand prediction: a little bit more complex (2/3)

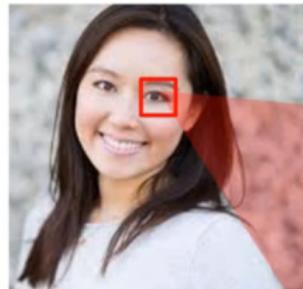


Demand prediction: a little bit more complex (3/3)



NN Application: Face recognition (1/3)

We want to build a system that recognizes people from pictures.



30	32	22	12	10	10	12	33	35	30
12	11	12	234	170	176	13	15	12	12
234	222	220	230	200	222	230	234	56	78
190	220	186	112	110	110	112	180	30	32
49	250	250	250	4	2	254	200	44	6
55	250	250	250	3	1	250	245	25	3
189	195	199	150	110	110	182	190	199	55
200	202	218	222	203	200	200	208	215	222
219	215	220	220	222	214	215	210	220	220
220	220	220	220	221	220	221	220	220	222

Figure 8: What a computer sees from an image (assume the picture is grayscale) (Ng, 2019)

NN Application: Face recognition (2/3)

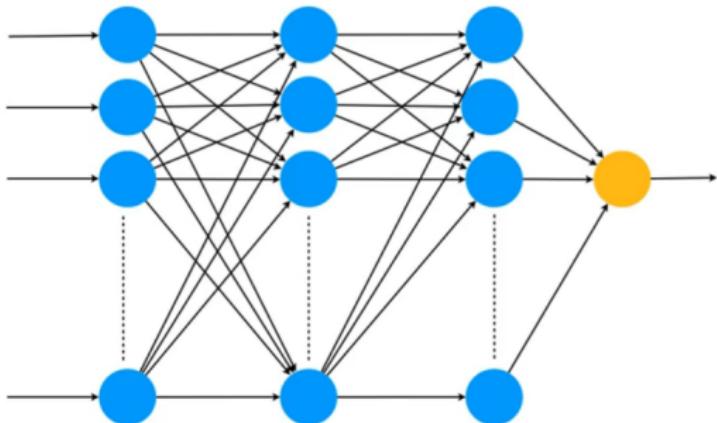
load



1600

1,000,000

3,000,000



NN Application: Face recognition (3/3)

1000

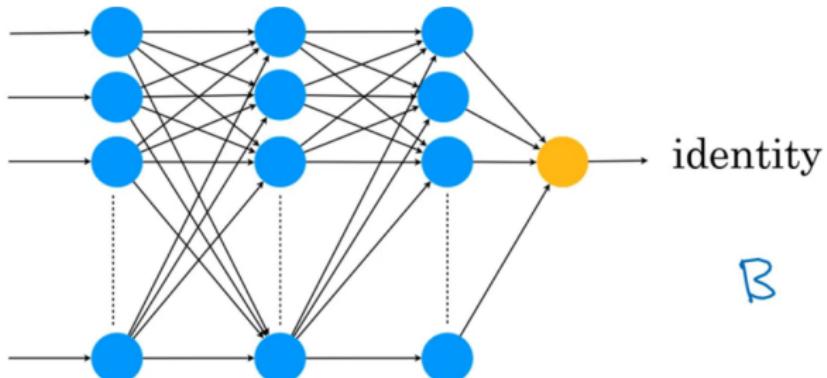


1600

1,000,000

3,000,000

A



B

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Computer Vision (1/3)

- Image classification/Object recognition



cat

- Face recognition

register

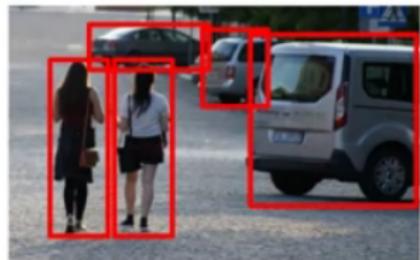


new



Computer Vision (2/3)

- Object detection



Computer Vision (3/3)

- Image Segmentation



- Tracking



Natural Language Processing (1/7)

- Text Classification

Email → Spam/Non-Spam

Product description → Product category

- Sentiment recognition

"The food was good" → 

"Service was horrible" → 

- Information retrieval

- E.g., web search



Natural Language Processing (2/7)

- Name entity recognition

"Queen Elizabeth II knighted Sir Paul McCartney for his services to music at the Buckingham Palace."

"Queen Elizabeth II knighted Sir Paul McCartney for his services to music at the Buckingham Palace."

Queen Elizabeth II knighted Sir Paul McCartney for his services to music at the Buckingham Palace"

- Machine translation

"AI adalah listrik baru" \Rightarrow "AI is new electricity"



Natural Language Processing (3/7)

- Others: parsing, part-of-speech tagging

The cat on the mat



Natural Language Processing (4/7)

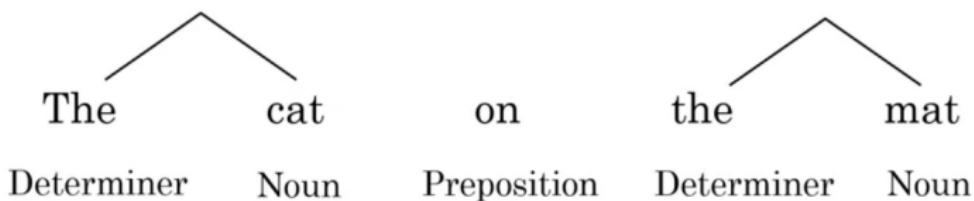
- Others: parsing, part-of-speech tagging

The	cat	on	the	mat
Determiner	Noun	Preposition	Determiner	Noun



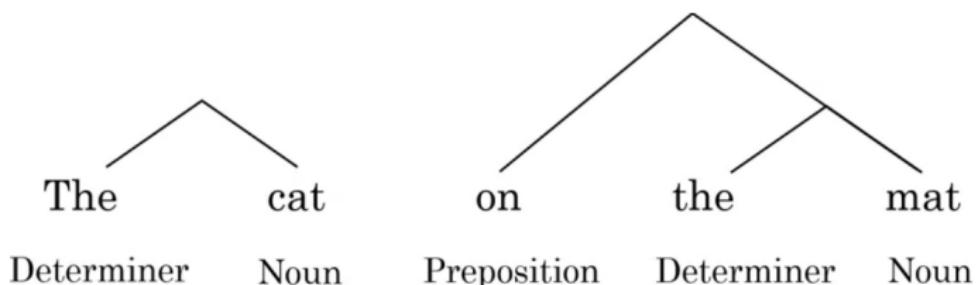
Natural Language Processing (5/7)

- Others: parsing, part-of-speech tagging

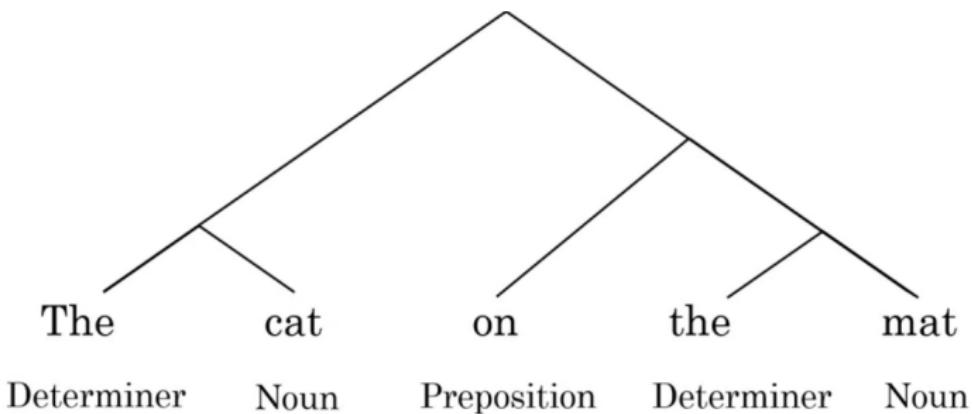


Natural Language Processing (6/7)

- Others: parsing, part-of-speech tagging



- Others: parsing, part-of-speech tagging



Speech (1/2)



- Speech recognition (speech-to-text)



Amazon
Echo / Alexa



Google
Home



Apple
Siri



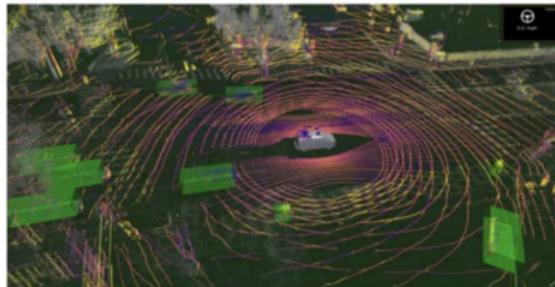
Baidu
DuerOS

- Trigger word/wakeword detection
Audio → "Hey device"? (0/1)

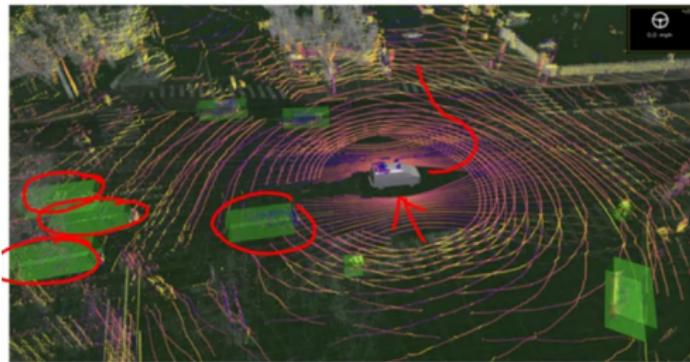
- Speaker ID
- Speech synthesis (text-to-speech, TTS)
The quick brown fox jumps over the lazy dog.

Robotics

- Perception: figuring out what's in the world around you.



- Motion planning: finding a path for the robot to follow.



- Control: sending commands to the motors to follow a path

General machine learning

- Unstructured data (images, audio, text)



image



audio

AIは、新たな電気だ

AI is the new electricity

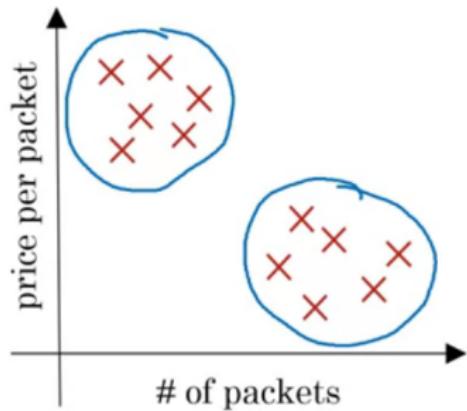
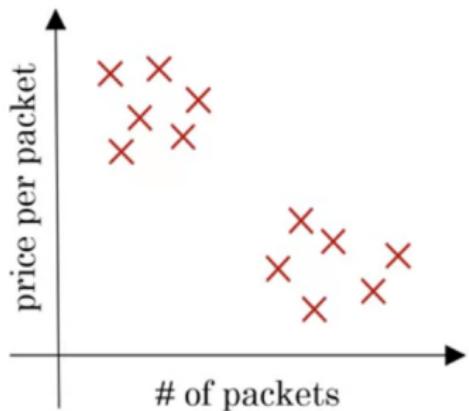
- Structured data

House size (square feet)	# of bedrooms	Price (1000\$)
523	1	100
645	1	150
708	2	200

Clay batch #	Supplier	Mixing time (minutes)
001	ClayCo	35
034	GooClay	22
109	BrownStuff	28

Unsupervised learning (1/2)

Clustering potato chip sales



Unsupervised learning (2/2)

Unsupervised learning:

Given data (without any specific desired output labels), find something interesting about the data.

Another example of unsupervised learning:

Finding cats from unlabeled YouTube videos



Transfer learning

Car detection



100,000 images

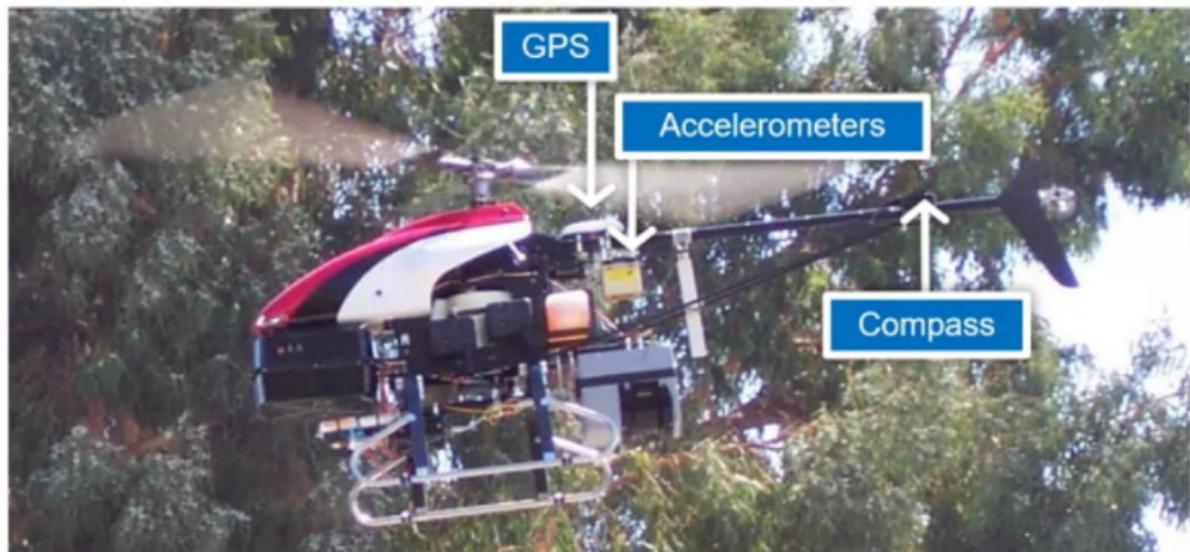
Golf cart detection



100 images

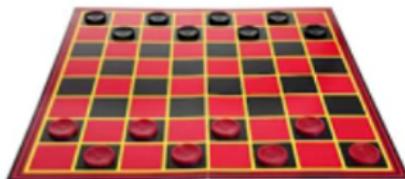
Learn from task A, and use knowledge to help on task B

Reinforcement learning (1/2)



Use a "reward" signal to tell the AI when it is doing well or poorly. It automatically learns to maximize its rewards.

Reinforcement learning (2/2)



Use a "reward" signal to tell the AI when it is doing well or poorly. It automatically learns to maximize its rewards.

GANs (Generative Adversarial Network)

Synthesize new images from scratch (Karras et al., 2017)



Knowledge Graph (1/4)

leonardo da vinci

All Images Books News Videos More Settings Tools

About 154,000,000 results (0.63 seconds)

Leonardo da Vinci - Wikipedia
https://en.wikipedia.org/wiki/Leonardo_da_Vinci ▾
Leonardo di ser Piero da Vinci more commonly Leonardo da Vinci or simply Leonardo, was an Italian polymath of the Renaissance whose areas of interest ...
Known for: Art, science
Movement: High Renaissance
Science and inventions Personal life of Leonardo da ... Portal:Leonardo da Vinci

Leonardo da Vinci - Paintings, Drawings, Quotes, Facts, & Biography
<https://www.leonardoda-vinci.net/> ▾
Leonardo da Vinci was a true genius who graced this world with his presence from April 15, 1452 to May 2, 1519. He is among the most influential artists in ...
10 Facts Bacchus - by Leonardo da Vinci - The Last Supper Masterpieces

Leonardo Da Vinci - The Complete Works - leonardoda-vinci.org
<https://www.leonardoda-vinci.org/> ▾
Leonardo Da Vinci - The complete works, large resolution images, ecard, rating, slideshow and more! One of the largest Leonardo Da Vinci resource on the ...

Leonardo da Vinci - HISTORY
<https://www.history.com/topics/renaissance/leonardo-da-vinci> ▾
Leonardo da Vinci (1452-1519) was a painter, architect, inventor, and student of all things scientific. His natural genius crossed so many disciplines that he...

People also ask

What was Leonardo da Vinci's greatest achievement?



More Images

Leonardo da Vinci

Polymath

Leonardo di ser Piero da Vinci, more commonly Leonardo da Vinci or simply Leonardo, was an Italian polymath of the Renaissance whose areas of interest included invention, drawing, painting, sculpting, ...
[Wikipedia](#)

Born: April 15, 1452, Anchiano, Italy
Died: May 2, 1519, Château du Clos Lucé, Amboise, France
On view: Louvre Museum, Royal Collection Trust, Uffizi Gallery, MORE
Periods: High Renaissance, Early renaissance, Renaissance, Italian Renaissance, Florentine painting
Known for: Art, science
Siblings: Giovanni Ser Piero, Guglielmo Ser Piero, MORE

Quotes

View 7+ more

Curiosity is the ultimate sophistication.

Knowledge Graph (2/4)

The screenshot shows a search interface with two main results panels. The top panel has a search bar containing 'leonardo da vinci'. Below it are tabs for 'All', 'Images', 'Books', 'News', 'Videos', and 'More'. To the right are 'Settings' and 'Tools' buttons. The bottom panel has a search bar containing 'ada lovelace'. Below it are tabs for 'All', 'Images', 'Books', 'Videos', 'News', 'More', 'Settings', and 'Tools'. A message indicates 'About 9,260,000 results (0.35 seconds)'. The first result is 'Ada Lovelace - Wikipedia' with a link to https://en.wikipedia.org/wiki/Ada_Lovelace. It includes a brief summary: 'Augusta Ada King, Countess of Lovelace was an English mathematician and writer, chiefly known for her work on Charles Babbage's proposed mechanical ...'. Below this is information about her resting place ('Church of St. Mary Magdalene'), spouse ('William King-Noel, 1st Earl of Lovelace'), and known fields ('Mathematics, computing'). It also mentions 'Charles Babbage - Analytical Engine - William King-Noel, 1st Earl of - Lady Byron'. The second result is 'Ada Lovelace: Founder of Scientific Computing' with a link to <https://www.sdsu.edu/Science/Women/Lovelace.html>. It describes 'ADA BYRON, COUNTESS OF LOVELACE ... Ada Byron was the daughter of a brief marriage between the Romantic poet Lord Byron and Anne Isabelle ...'. A 'People also ask' section lists questions: 'What is Ada Lovelace famous for?', 'What did Ada Lovelace invent and what impact it had?', 'When did Ada Lovelace invent the computer?', and 'What is Ada Lovelace Day?'. Below these are links to 'Ada Lovelace | Biography & Facts | Britannica.com' (<https://www.britannica.com/Biography/Ada-Lovelace>) and a note: 'Jan 3, 2019 - Ada Lovelace, in full Ada King, countess of Lovelace, original name Augusta Ada Byron, Lady Byron, (born December 10, 1815, London, Eng.

Ada Lovelace

Mathematician

Augusta Ada King, Countess of Lovelace was an English mathematician and writer, chiefly known for her work on Charles Babbage's proposed mechanical general-purpose computer, the Analytical Engine. [Wikipedia](#)

Born: December 10, 1815, London, United Kingdom
Died: November 27, 1852, Marylebone, United Kingdom
Spouse: [William King-Noel, 1st Earl of Lovelace](#) (m. 1835–1852)
Children: [Anne Blunt, 15th Baroness Wentworth](#), [MORE](#)
Parents: [Lord Byron](#), [Lady Byron](#)
Known for: [Mathematics](#), [Computing](#)

People also search for [View 15+ more](#)

Knowledge Graph (3/4)

Ada Lovelace	
Born	Dec 10, 1815
Died	Nov 27, 1852
Bio	English mathematician and writer...

Knowledge Graph (4/4)

Northern Rooster Hotel	
Address	45 Rooster St, LA
Phone	(650) 555-3992
Wifi	yes
Pool	no



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Mata Kuliah Pilihan

Kode	Nama MK	SKS	Prasyarat
IN056	Teknik Kompilasi	3+1	IN035 MatDis
IN068	Competitive Programming	3+1	-
IN075	Sistem Pakar	3	-
IN086	Temu Pengetahuan	3+1	-
IN074	Pembelajaran Mesin	3+1	IN060 PKB
IN084	Pengantar Temu Balik Informasi	3+1	-
IN085	Pemrosesan Bahasa Alami	3	-
IN039	Topik Lanjut Komputasi Cerdas	3+1	-

Daftar Pustaka I

Karras, T., Aila, T., Laine, S., and Lehtinen, J. (2017). Progressive growing of gans for improved quality, stability, and variation. *arXiv preprint arXiv:1710.10196*.

Kharkovyba, O. (2019). A beginner's guide to data science.

<https://towardsdatascience.com/>

a-beginners-guide-to-data-science-55edd0288973. Accessed: 2019-11-14.

Ng, A. Y. (2019). Ai for everyone.

<https://www.coursera.org/learn/ai-for-everyone/home/welcome>.

Accessed: 2019-11-10.



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