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Andrew Ng

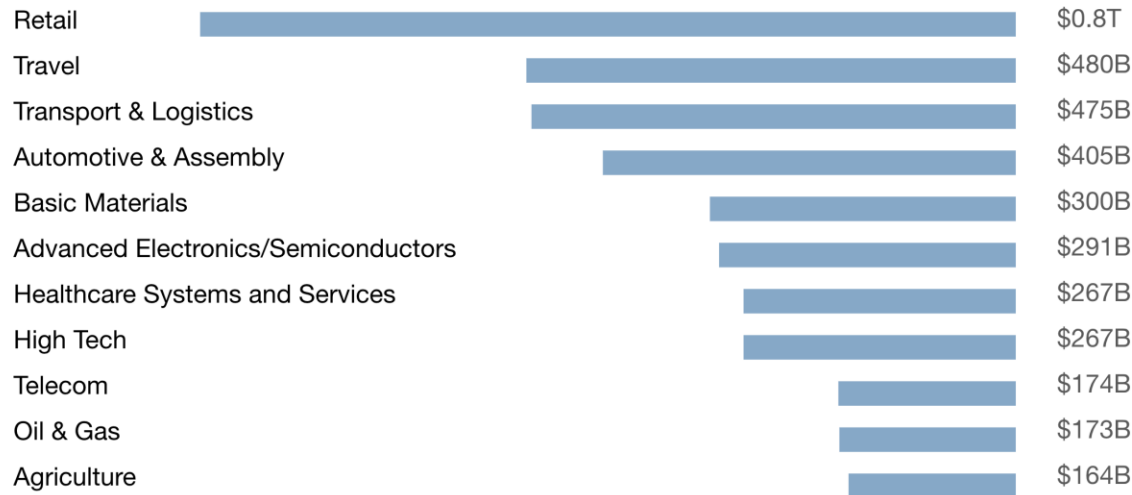
What is AI

Introduction

Introduction

AI value creation
by 2033

\$13-22
trillion
(includes \$3-4 trillion
from generative AI)



[Source: McKinsey]

Demystifying AI

AI

ANI

Generative AI

AGI

(artificial narrow intelligence)

(generative artificial intelligence)

(artificial general intelligence)

E.g., smart speaker,
self-driving car, web search,
AI in farming and factories

E.g., ChatGPT, Bard,
Midjourney, DALL-E

Do anything a human
can do



What you'll learn

- What is AI?
 - Machine Learning
 - Data
 - What makes an AI company
 - What machine learning can and cannot do
 - Optional: Intuitive explanation of Deep Learning
- Building AI projects
- Building AI in your company
- AI and society



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What is AI

Machine Learning

Supervised Learning

Input

Output

Input (A)	Output (B)	Application
email 	spam? (0/1)	spam filtering
audio 	text transcripts	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
sequence of words 	the next word	chatbot

How large language models (LLMs) work








LLMs are built by using supervised learning ($A \rightarrow B$) to repeatedly predict the next word.

My favorite drink is lychee bubble tea.

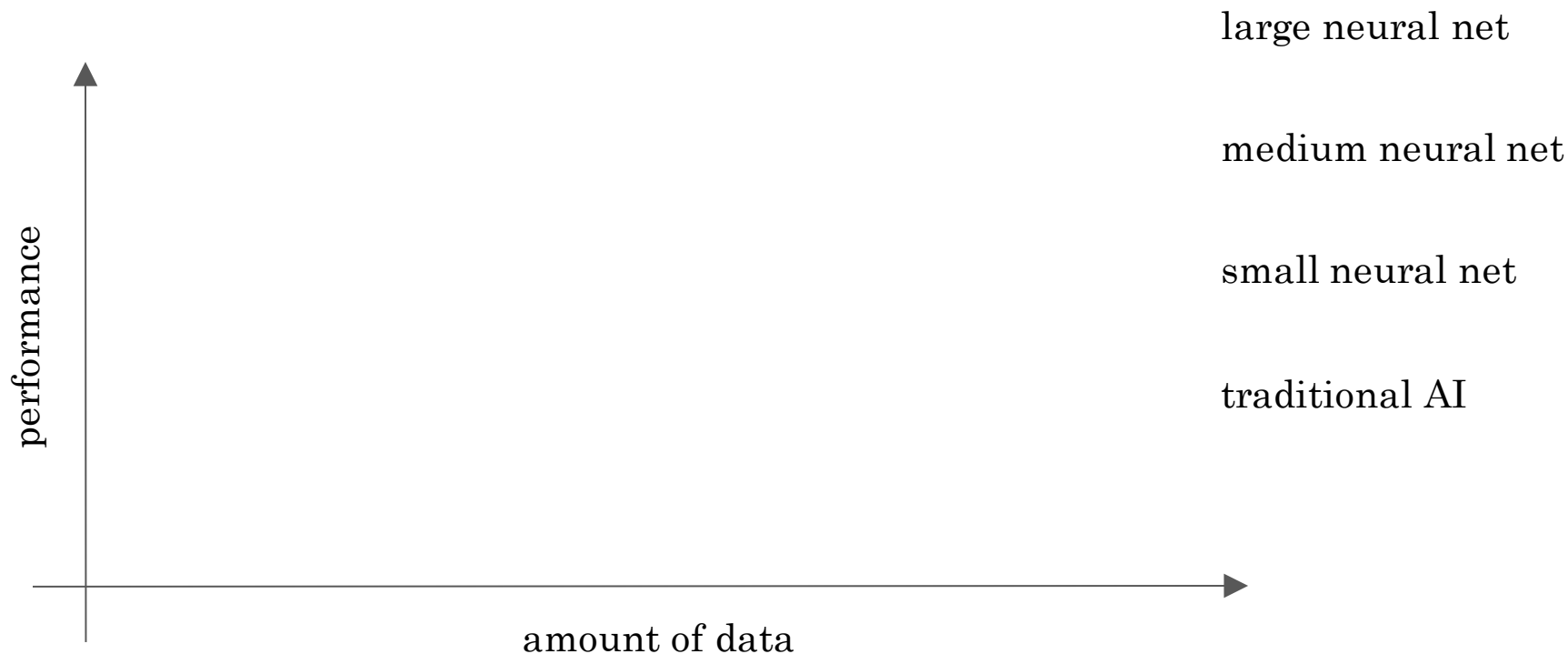


Input (A)	Output (B)
My favorite drink	is
My favorite drink is	lychee
My favorite drink is lychee	bubble
My favorite drink is lychee bubble	tea

When we train a very large AI system on a lot of data (hundreds of billions of words), we get a Large Language Model like ChatGPT.

Input (A)	Output (B)	Application
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Why Now?





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What is AI

What is data

Example of a table of data (dataset)

house (square feet)	# of bedrooms	price (1000\$)
523	1	100
645	1	150
708	2	200
1034	3	300
2290	4	350
2545	4	440

image	label
	cat
	not cat
	cat
	not cat

“Google cat”

Acquiring data

- Manual labeling



cat



not
cat



cat



not
cat

- From observing user behaviors

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

- Download from websites / partnerships

Use and mis-use of data

Don't throw data
at an AI team and
assume it will be
valuable.



Data is messy

- Garbage in, garbage out
- Data problems
 - Incorrect labels
 - Missing values
- Multiple types of data
 - images, audio, text

house (square feet)	# of bedrooms	price (1000\$)
523	1	100
645	1	0.001
708	unknown	200
1034	3	unknown
unknown	4	350
2545	unknown	440





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What is AI

The terminology of AI

Machine learning vs. data science

Home
prices

size (square feet)	# of bedrooms	# of bathrooms	newly renovated	price (1000\$)
523	1	2	N	100
645	1	3	N	150
708	2	1	N	200
1034	3	3	Y	300
2290	4	4	N	350
2545	4	5	Y	440

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

Running AI system
(e.g., websites / mobile app)

Newly renovated homes have a 15% premium.

Machine learning vs. data science

Machine learning

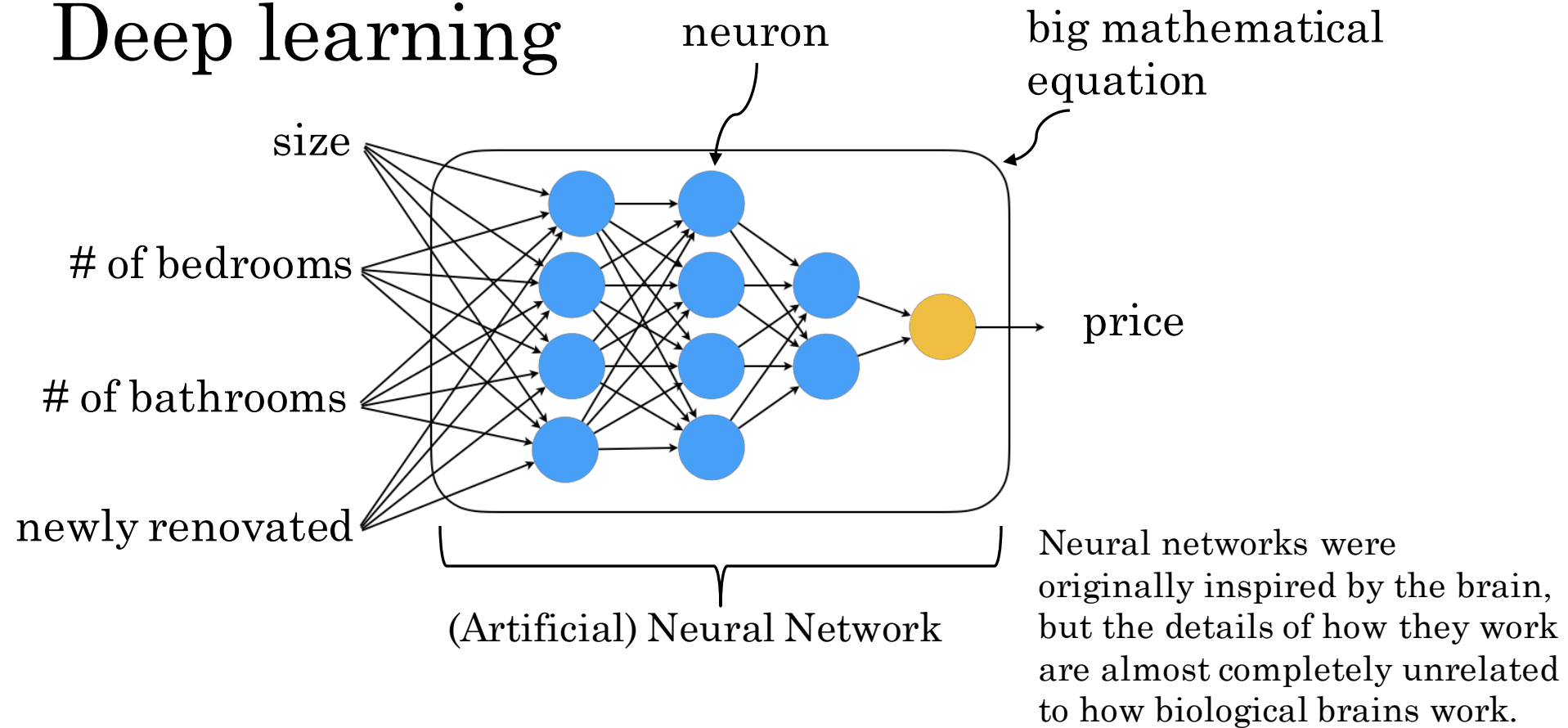
“Field of study that gives computers the ability to learn without being explicitly programmed.”

-Arthur Samuel (1959)

Data science

Science of extracting knowledge and insights from data.

Deep learning



AI has many tools

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



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What is AI

What makes an AI company?

A lesson from the rise of the Internet

Internet Era

Shopping mall + website
≠ Internet company

- A/B testing
- Short iteration time
- Decision making pushed down to engineers and other specialized roles

AI era

Any company + deep learning
≠ AI company

- Strategic data acquisition
- Unified data warehouse
- Pervasive automation
- New roles (e.g., MLE) and division of labor

AI Transformation

1. Execute pilot projects to gain momentum
2. Build an in-house AI team
3. Provide broad AI training
4. Develop an AI strategy
5. Internal and external communication



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What is AI

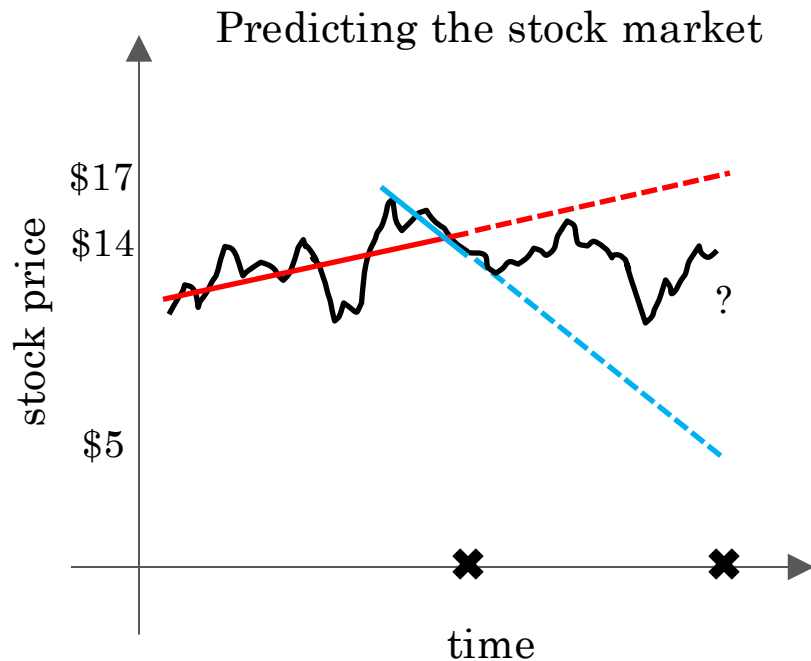
What machine learning
can and cannot do

Supervised Learning

	Input (A)	Output (B)	Application
	email	spam? (0/1)	spam filtering
→	audio	text transcripts	speech recognition
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Anything you can do with 1 second of thought,
we can probably now or soon automate.

What machine learning today can and cannot do



What makes an ML problem easier

1. Learning a “simple” concept
2. Lots of data available



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What is AI

More examples of what machine learning can and cannot do

Self-driving car

Can do



Cannot do



stop



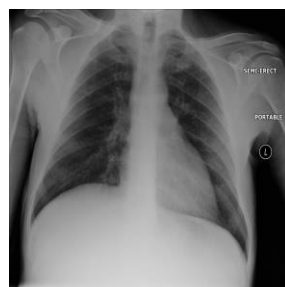
hitchhiker



bike turn
left signal

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 a medical textbook
chapter explaining pneumonia

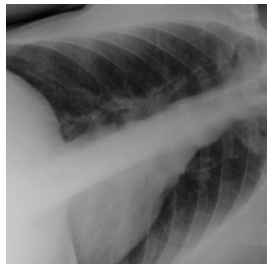
Strengths and weaknesses of machine learning

ML tends to work well when:

1. Learning a “simple” function
2. There is lots of data available

ML tends to work poorly when:

1. Learning complex functions from small amounts of data
2. It is asked to perform on new types of data that it learned from





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What is AI

Non-technical explanation of
deep learning I (optional)

Demand prediction



price

demand

“neuron”

Demand prediction

price

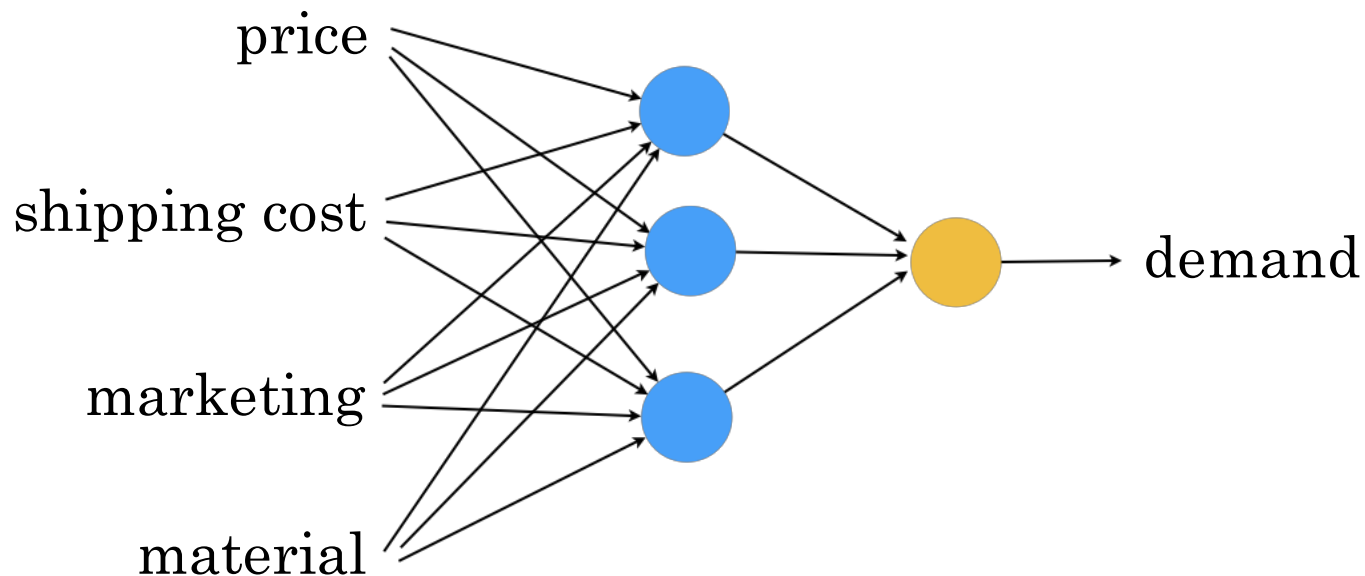
shipping cost

marketing

material

demand

Demand prediction





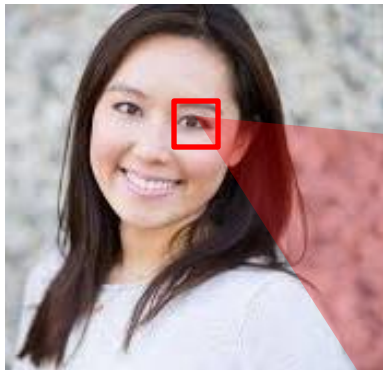
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What is AI

Non-technical explanation of
deep learning II (optional)

Face recognition



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

Face recognition

