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What is AI

Introduction

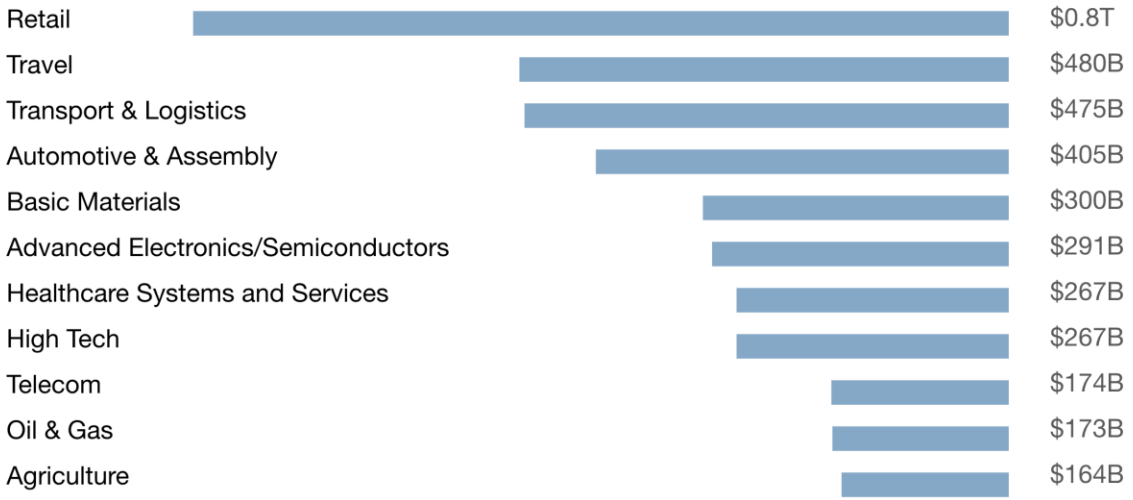
Andrew Ng

Introduction

AI value creation by 2033

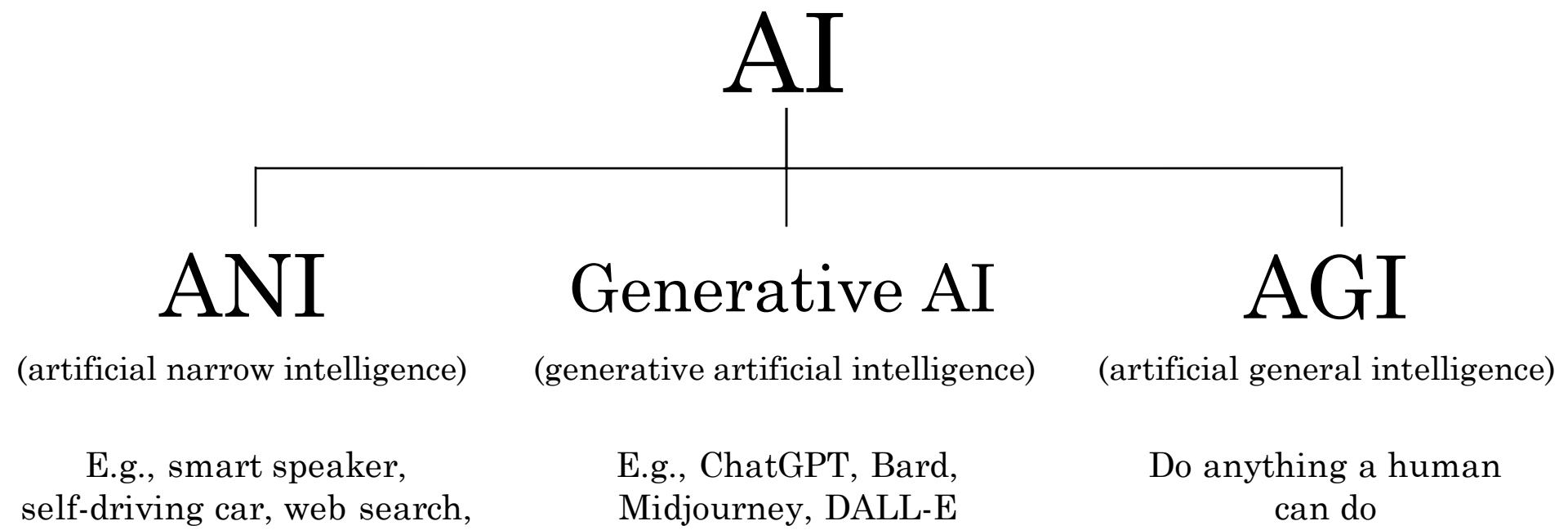
$13-22 trillion

(includes $3-4 trillion from generative AI)



[Source: McKinsey]

Demystifying AI



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

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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→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.

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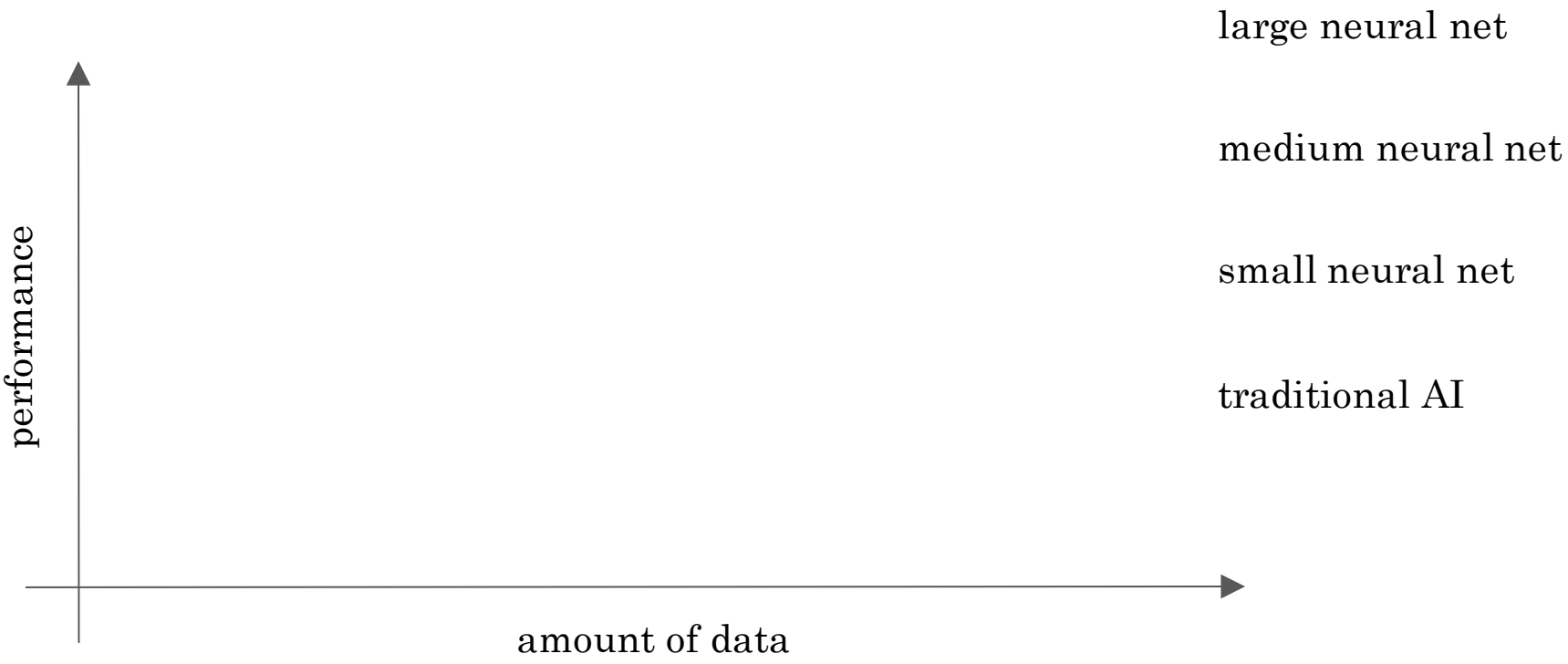
Why Now?


large neural net
medium neural net
small neural net
traditional AI
performance
amount of data

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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

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

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

Machine learning

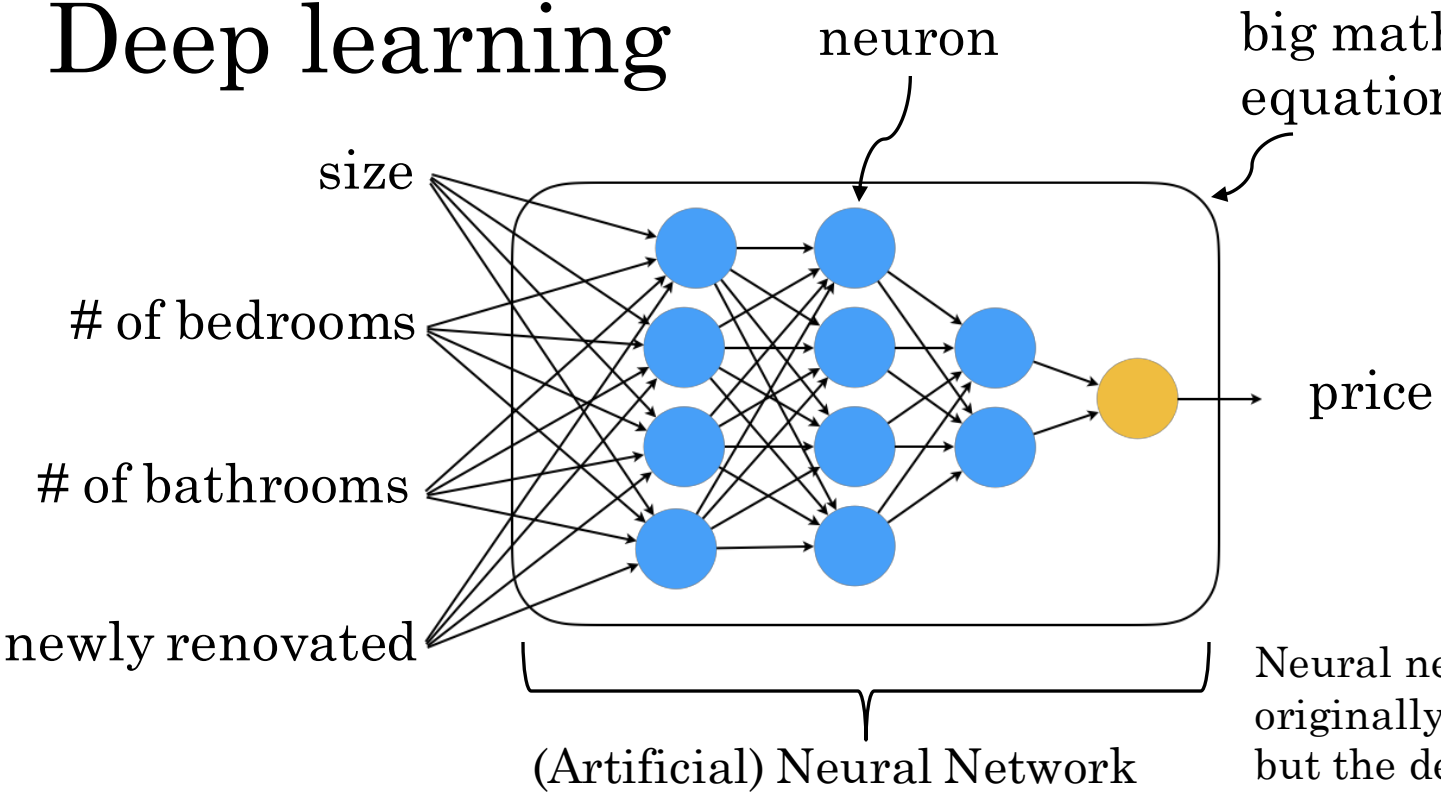
"Field of study that gives computers the ability to learn without being explicitly programmed."

-Arthur Samuel (1959)

Data science

Science of extracting knowledge and insights from data.

Deep learning



Neural networks were originally inspired by the brain, but the details of how they work are almost completely unrelated to how biological brains work.

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?

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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

Andrew Ng

Supervised Learning

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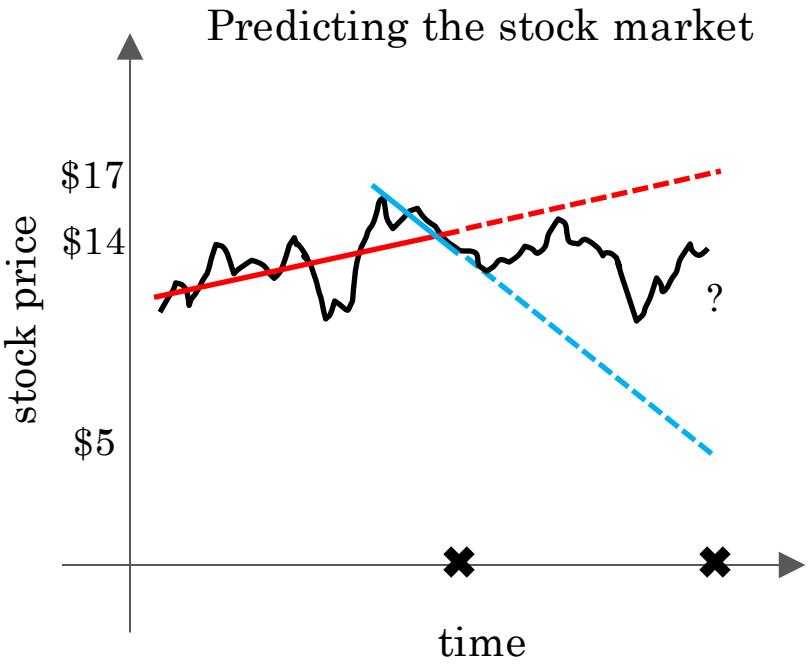
Anything you can do with 1 second of thought, we can probably now or soon automate.

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

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Self-driving car

Can do

Cannot do

stop

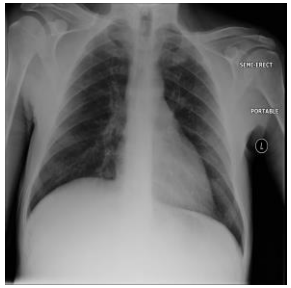
hitchhiker

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

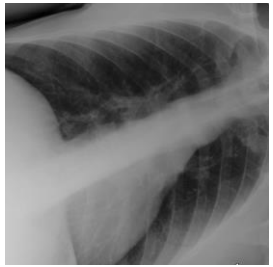
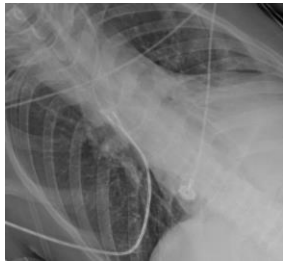
ML tends to work well when:

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)

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Demand prediction

price demand

“neuron”

Demand prediction

price

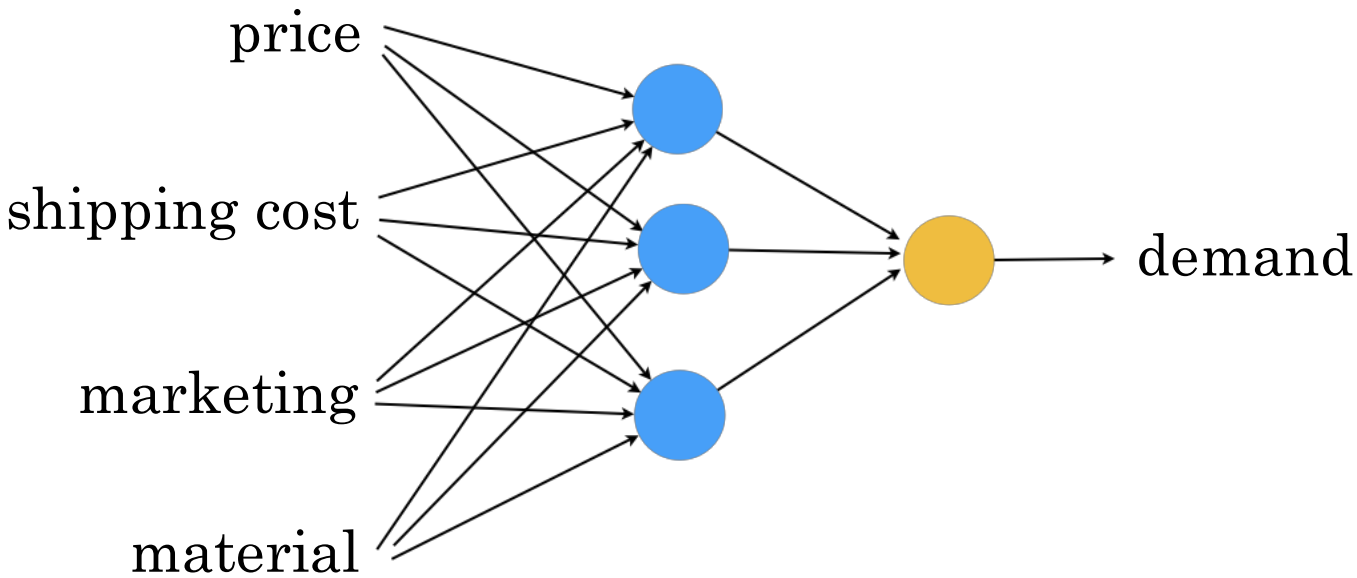
shipping cost

marketing

material

demand

Demand prediction



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What is AI

Non-technical explanation of deep learning II (optional)

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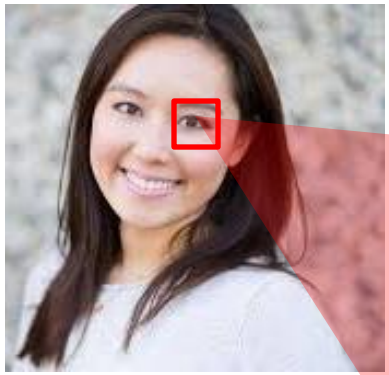
Face recognition



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