2019
怪兽
学堂

机器学习

汇报人：虾米　　时间：2019年2月

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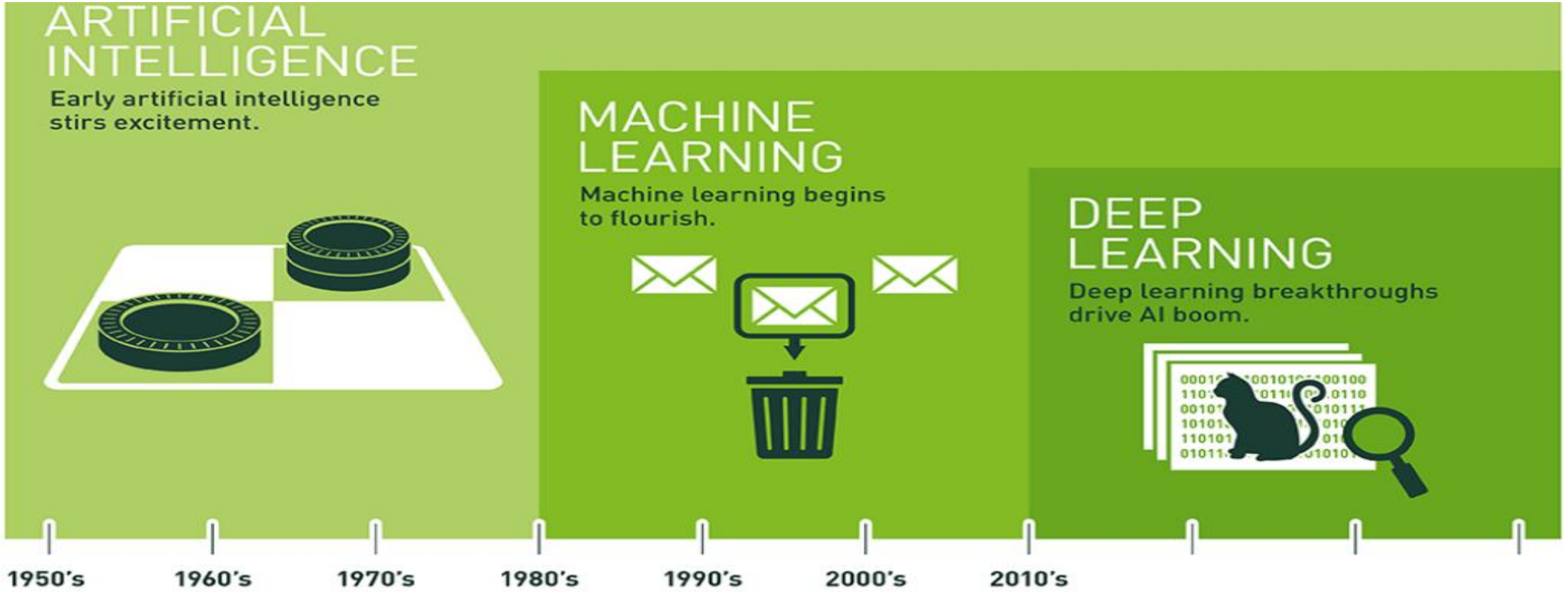
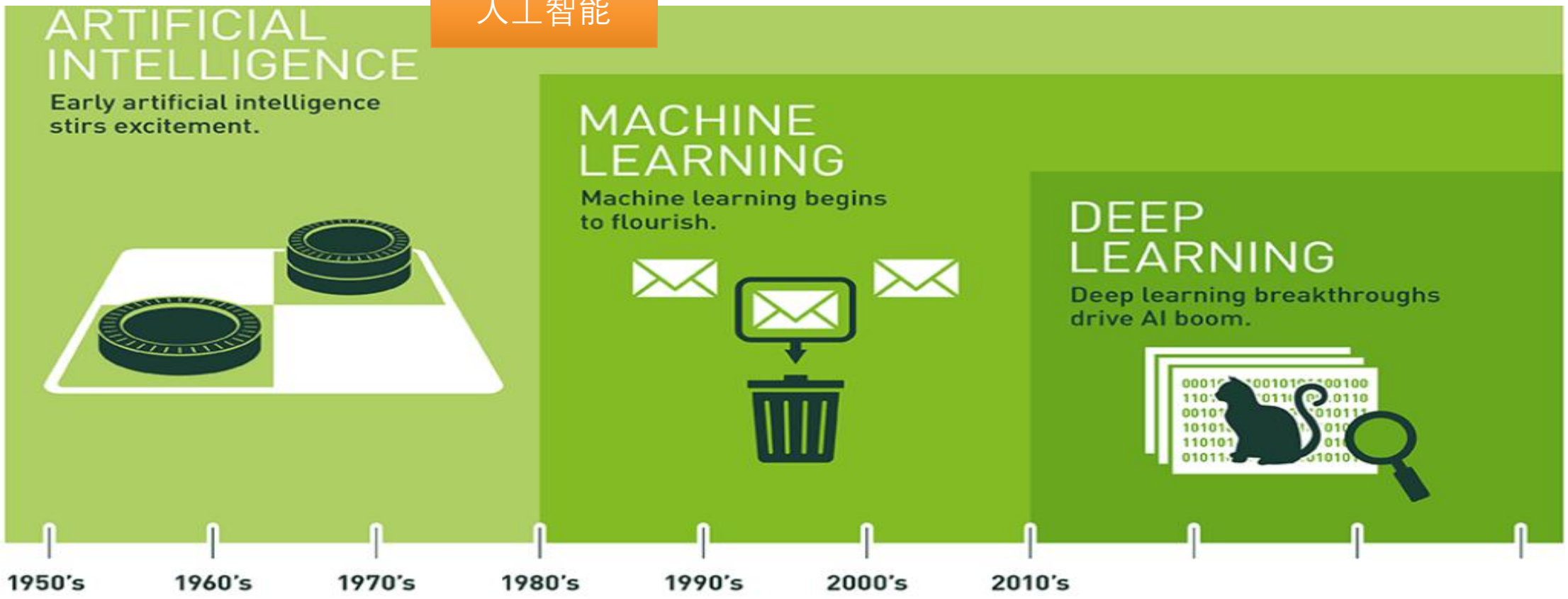


Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then

人工智能



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人工智能 目标

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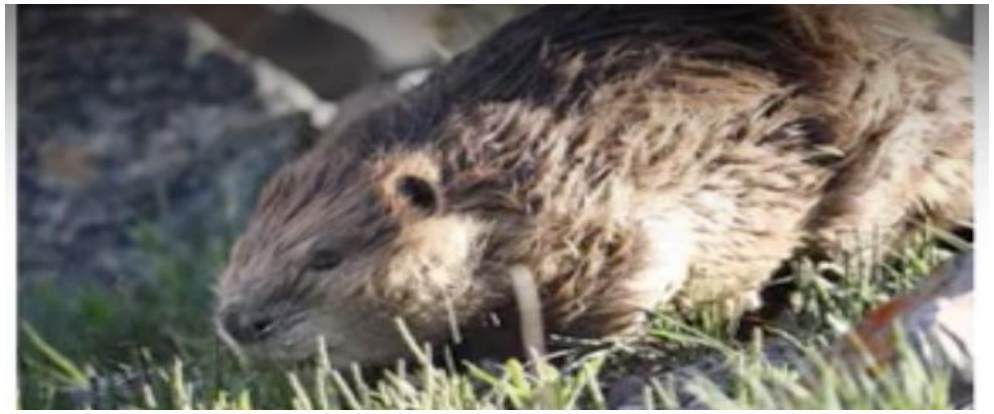
生物的本能



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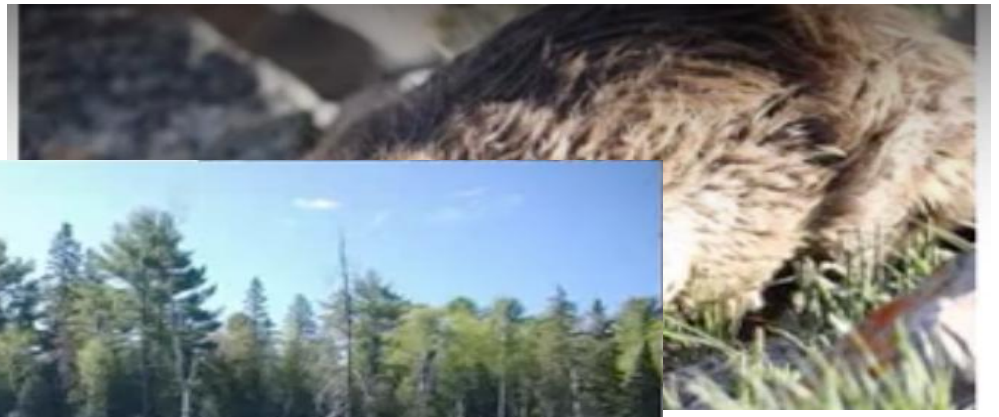

生物的本能

- 河狸筑水坝的能力是天生的
  - If “听到流水声”，筑堤坝直到听不到流水声

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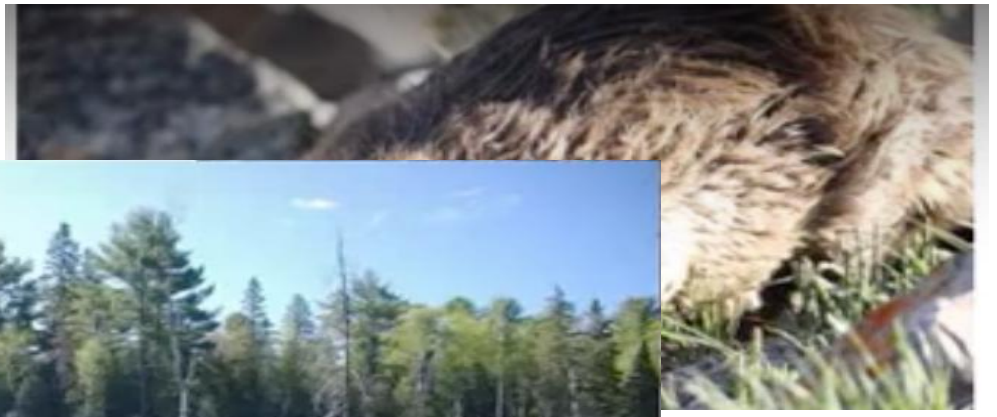

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人类设定好的本能

- E.g. You want to build a Chat-bot …

人类设定好的本能

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  - Hard to consider all possibilities
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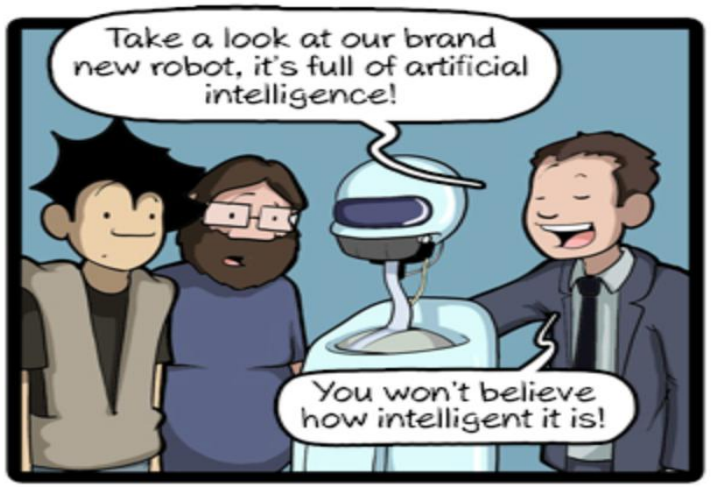
  - Lots of human efforts (not suitable for small industry)

人类设定好的本能

- AI?



http://www.commitstrip.com/en/2017/06/07/ai-inside/
Shared on Yann LeCun's FB

人类设定好的本能

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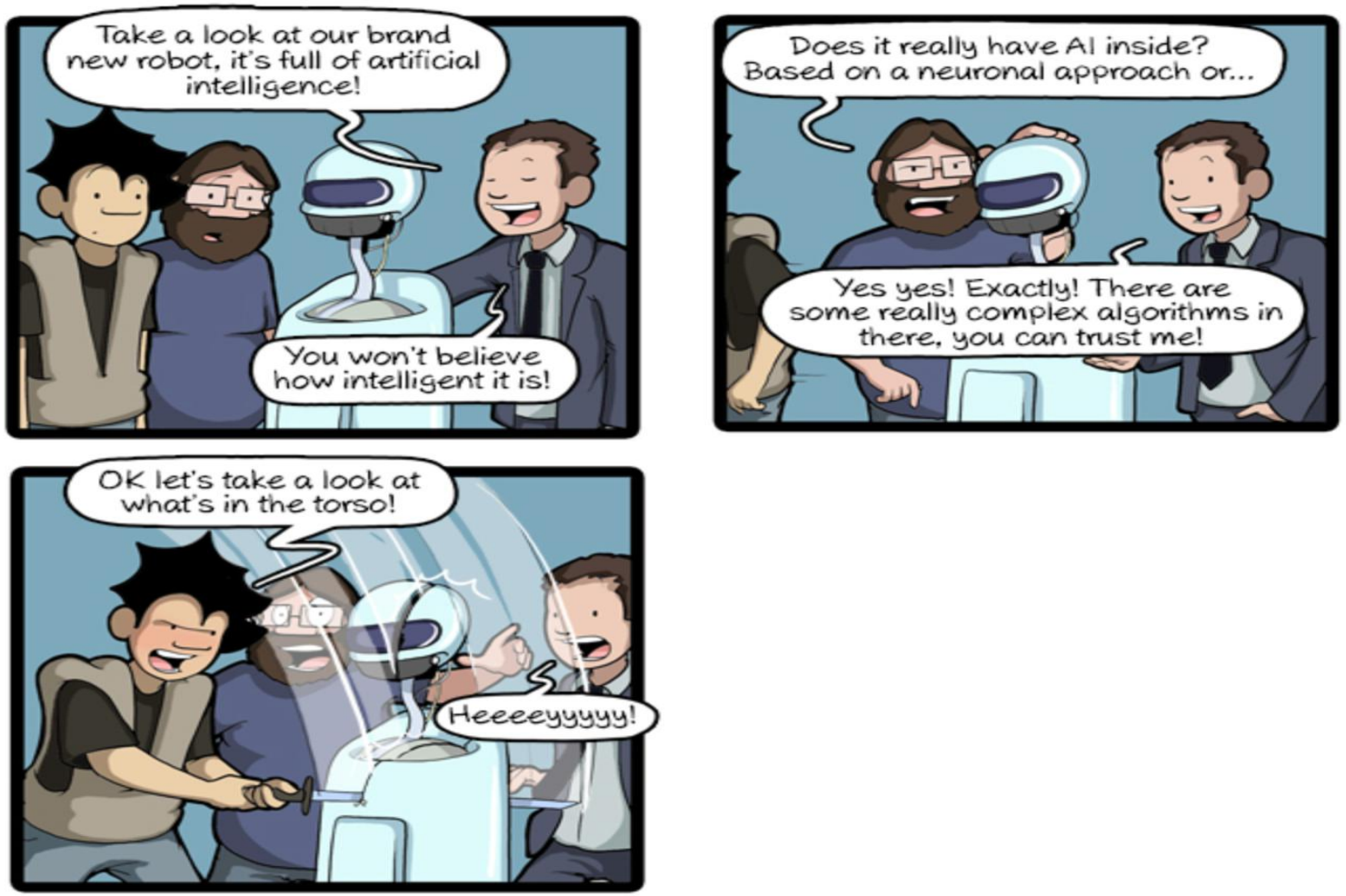

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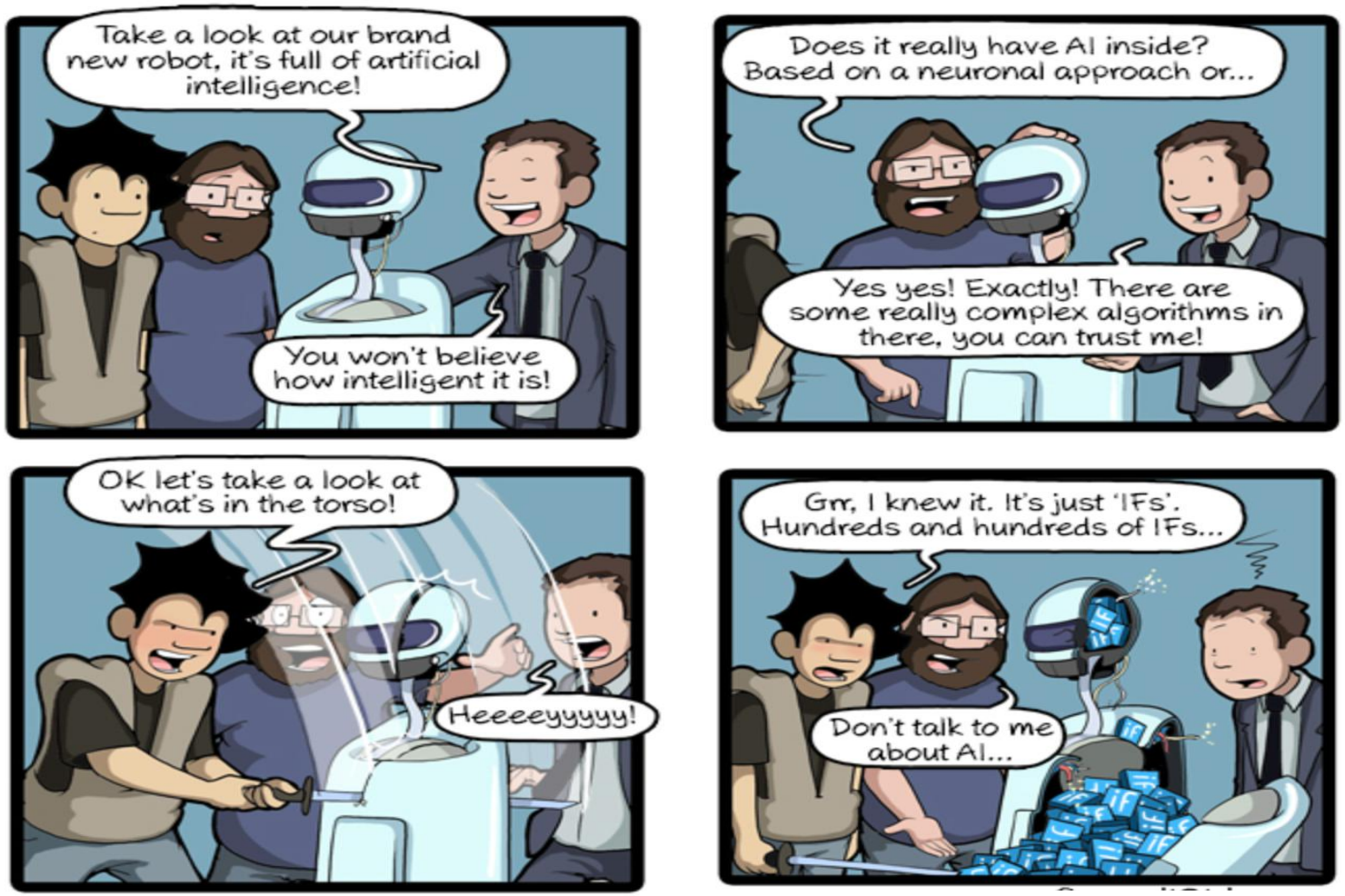

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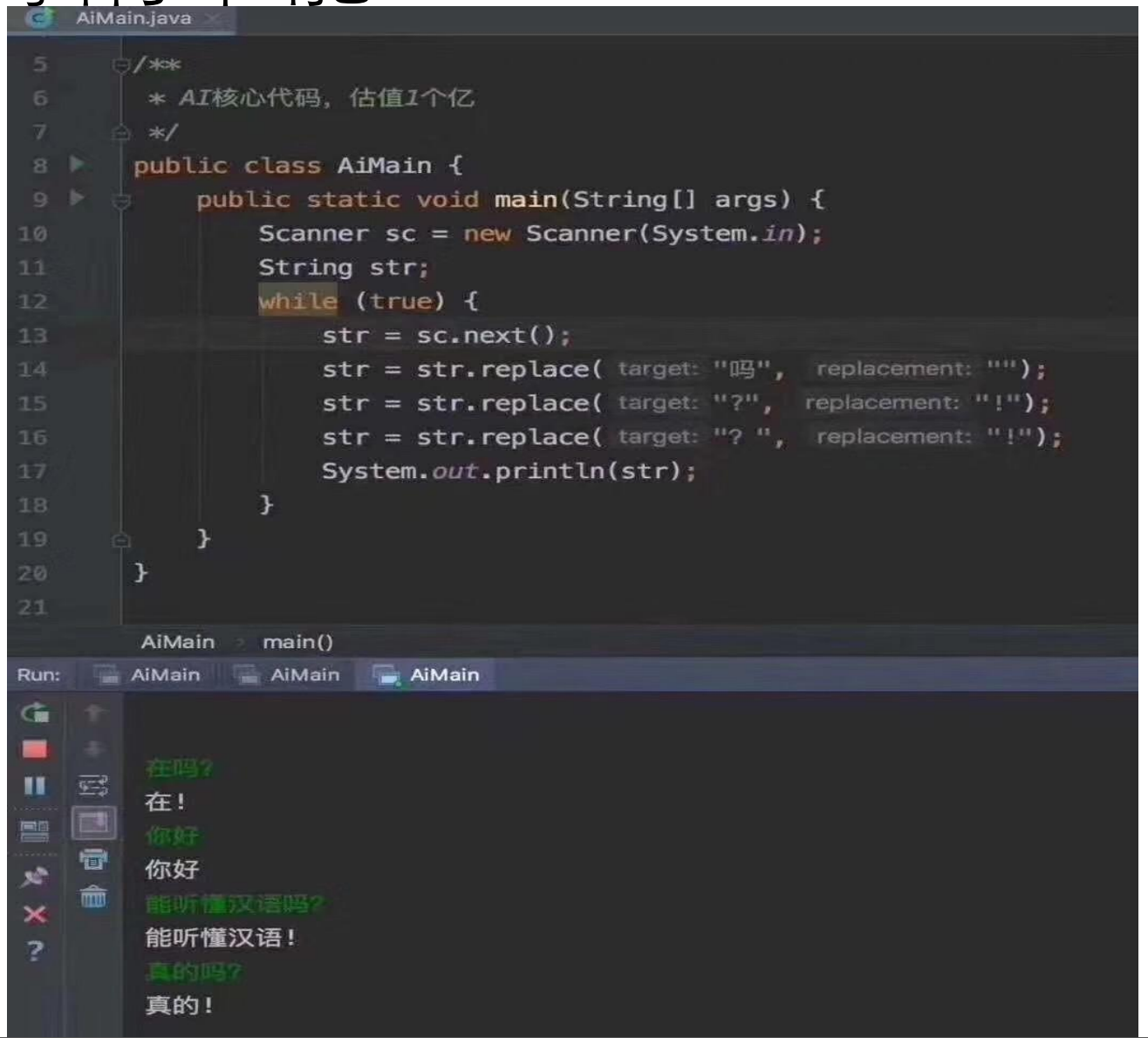
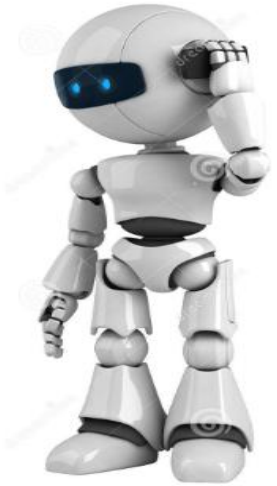
人类设定好的本能

- AI?


AiMain.java
/**
* AI核心代码，估值1个亿
*/
public class AiMain {
public static void main(String[] args) {
Scanner sc = new Scanner(System.in);
String str;
while (true) {
str = sc.next();
str = str.replace(target: "吗", replacement: "");
str = str.replace(target: "?", replacement: "!");
str = str.replace(target: "? ", replacement: "!");
System.out.println(str);
}
}
}
AiMain › main()
Run: AiMain AiMain AiMain
在吗?
在!
你好
你好
能听懂汉语吗?
能听懂汉语!
真的吗?
真的!

What is Machine Learning?



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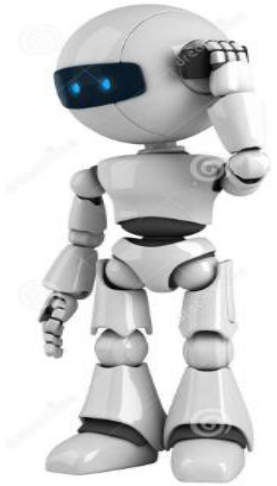

You write the program for learning.

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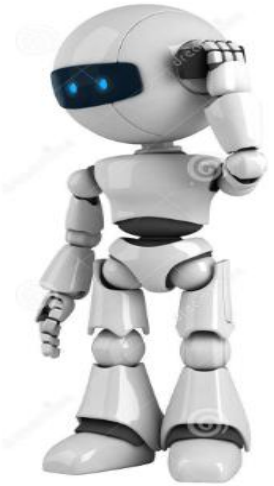

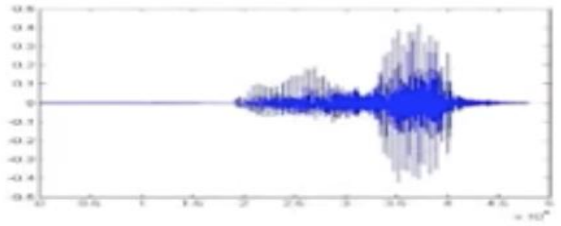

Hi

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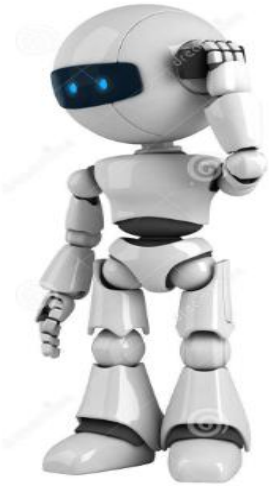
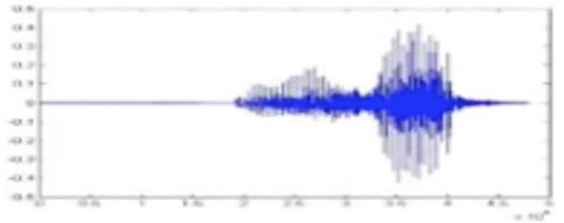
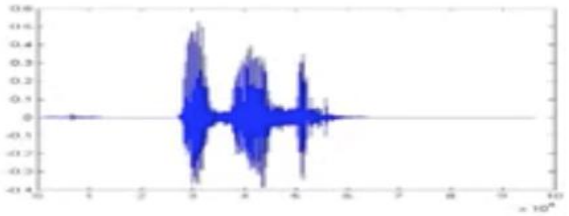
What is Machine Learning?





Hi



How are you

You write the program for learning.

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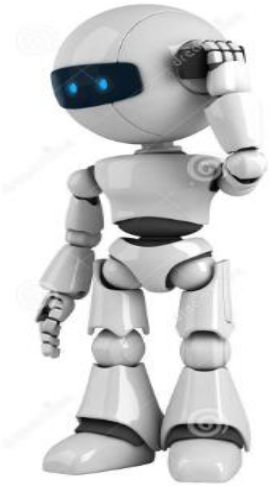

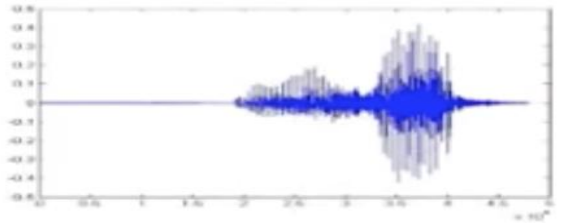

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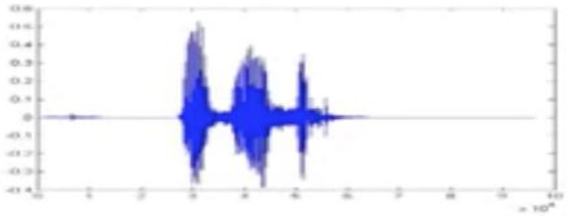

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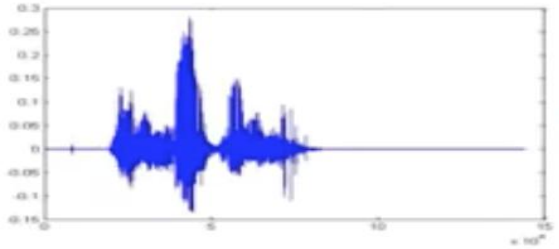
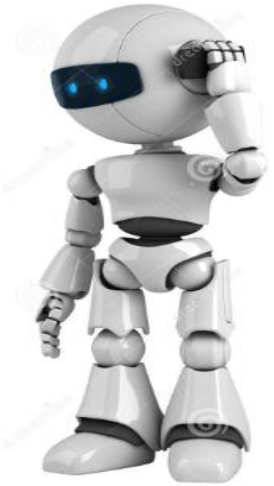


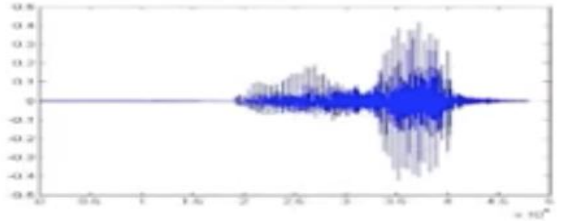
Good bye

You write the program for learning.

What is Machine Learning?

Learning…





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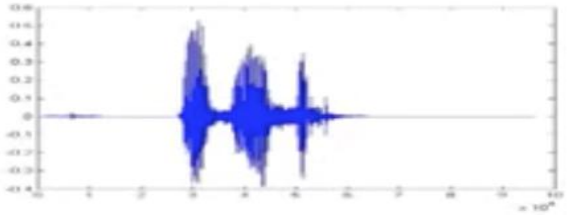

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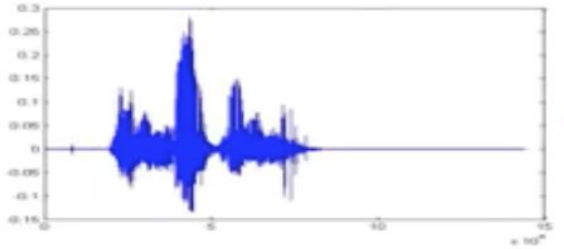

Good bye

A large amount of audio data

You write the program for learning.

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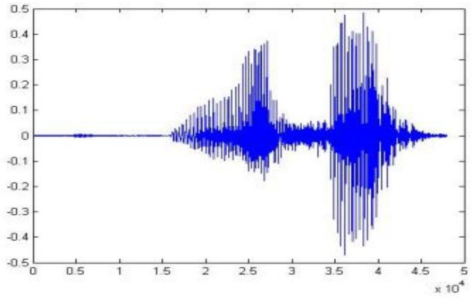
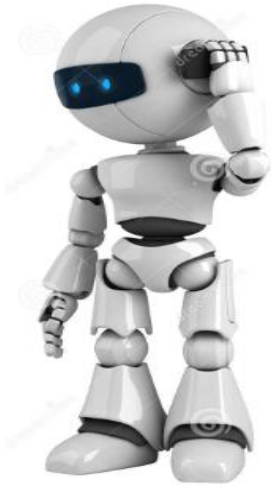
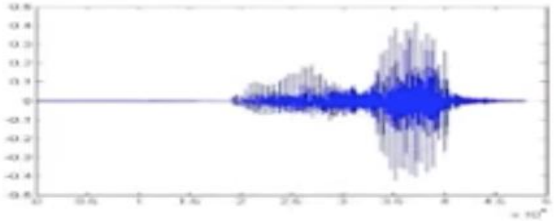


Learning…





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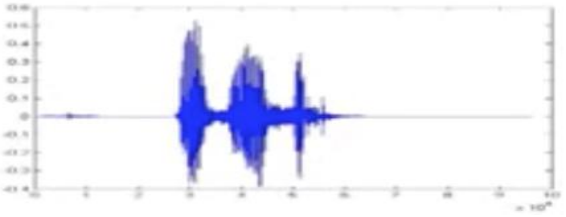

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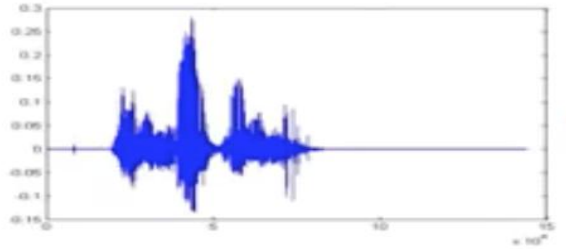

Good bye

A large amount of audio data

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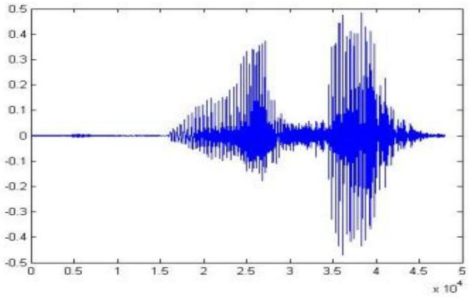
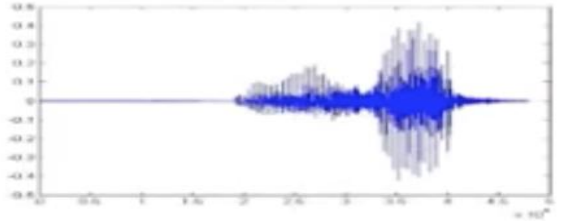
What is Machine Learning?

Learning…



You Said “Hello”



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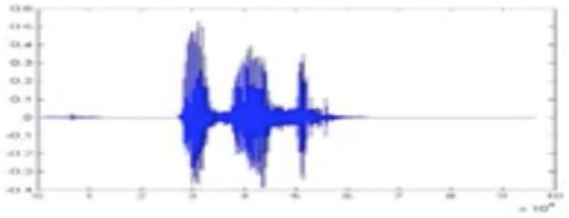

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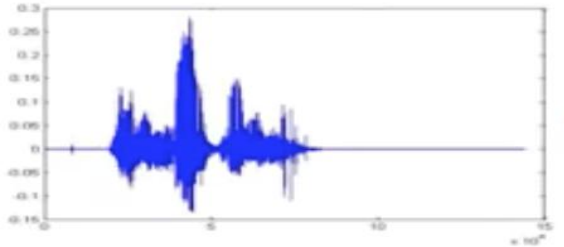

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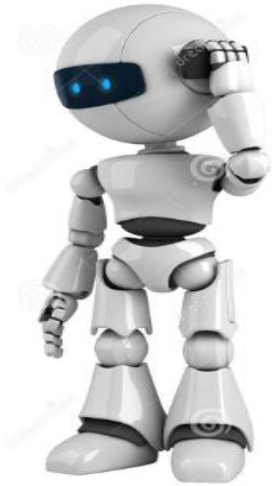

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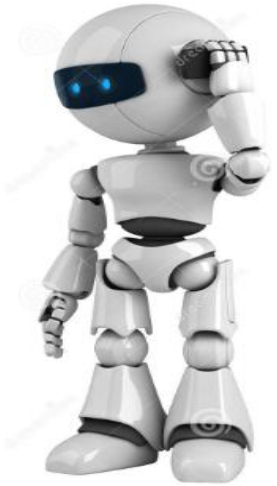
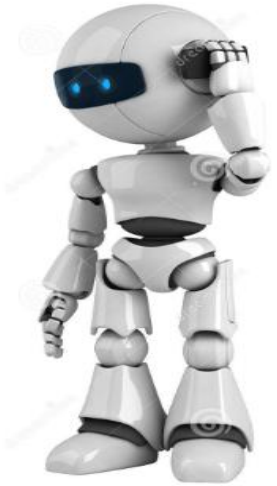


monkey

You write the program for learning.

What is Machine Learning?

Learning…



monkey

cat

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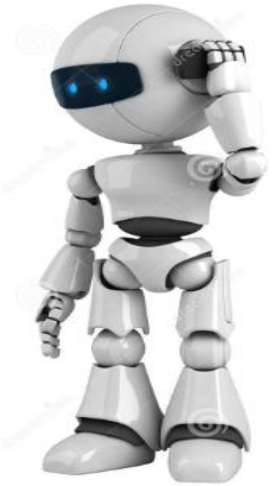

monkey

cat

dog

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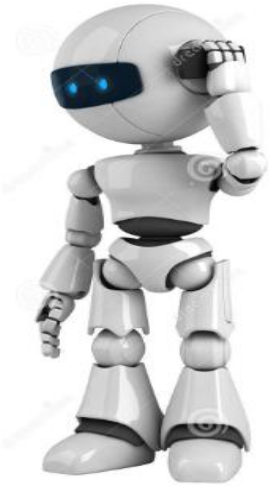


monkey

cat

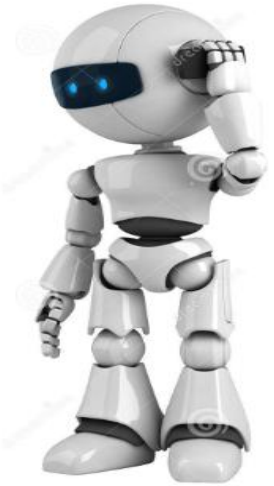
dog

You write the program for learning.

A large amount of images

What is Machine Learning?

Learning…



monkey

cat

dog

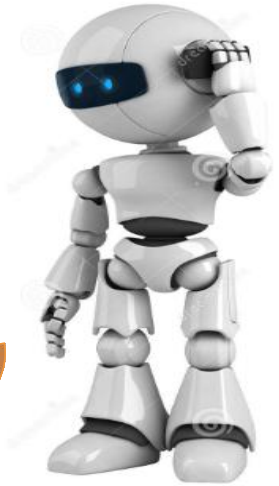
You write the program for learning.

A large amount of images

What is Machine Learning?

This is “Cat”

Learning…



You write the program for learning.

monkey

cat

dog

A large amount of images

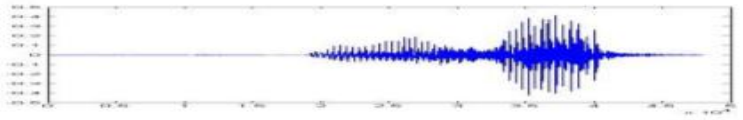
Machine Learning
≈ Looking for a Function

From Data

Machine Learning
≈ Looking for a Function

From Data

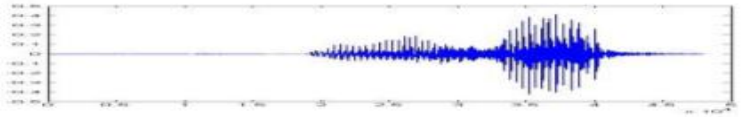
- Speech recognition

$f($  $)=$ “How are you”

Machine Learning
≈ Looking for a Function

From Data

- Speech recognition

$f($  $)=$ “How are you”

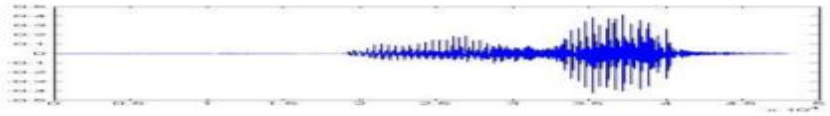
- Image recognition

$f($  $)=$ “Cat”

Machine Learning
≈ Looking for a Function

From Data

- Speech recognition

$f($  $)=$ “How are you”

- Image recognition

$f($  $)=$ “Cat”

- Play Go

$f($  $)=$ “5-5” (next move)

Framework

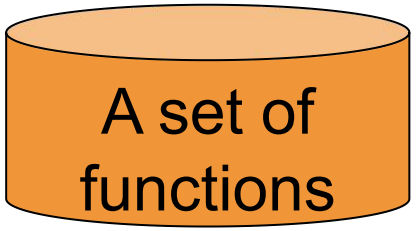
Image Recognition:

$f($  $)=$ “cat”

Framework

Image Recognition:

$f($  $) =$ “cat”



$f_1, f_2 \cdots$

Framework

Image Recognition:

$f($  $) =$ "cat"

A set of functions

$f_1, f_2 \cdots$

$f_1($  $) =$ "cat"

$f_1($  $) =$ "dog"

Framework

Image Recognition:

$f($  $) =$ "cat"

A set of functions

$f_1, f_2 \cdots$

$f_1($  $) =$ "cat"

$f_2($  $) =$ "money"

$f_1($  $) =$ "dog"

$f_2($  $) =$ "snake"

Framework

Image Recognition:

$f($  $) =$ "cat"

A set of functions

Model

$f_1, f_2 \cdots$

$f_1($  $) =$ "cat"

$f_2($  $) =$ "money"

$f_1($  $) =$ "dog"

$f_2($  $) =$ "snake"

Framework

A set of functions

Model

$f_1, f_2 \cdots$

Image Recognition:

$f($  $) =$ "cat"

$f_1($  $) =$ "cat"

$f_2($  $) =$ "money"

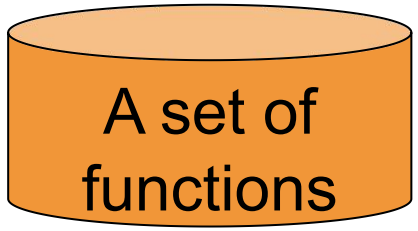
$f_1($  $) =$ "dog"

$f_2($  $) =$ "snake"

Framework

Image Recognition:

$f($  $) =$ "cat"



Model

$f_1, f_2 \cdots$

$f_1($  $) =$ "cat"

$f_2($  $) =$ "money"

$f_1($  $) =$ "dog"

$f_2($  $) =$ "snake"

Function input:

Function output:

Framework

Image Recognition:

$f($  $) =$ "cat"

A set of functions

Model

$f_1, f_2 \cdots$

$f_1($  $) =$ "cat"

$f_2($  $) =$ "money"

$f_1($  $) =$ "dog"

$f_2($  $) =$ "snake"

Training Data

Function input:

Function output:

"dog"

Framework

Image Recognition:

$f($  $) =$ "cat"

A set of functions

Model

$f_1, f_2 \cdots$

$f_1($  $) =$ "cat"

$f_2($  $) =$ "money"

$f_1($  $) =$ "dog"

$f_2($  $) =$ "snake"

Training Data

Function input:

Function output:

"dog"

"cat"

Framework

Image Recognition:

$f($  $) =$ "cat"

A set of functions

Model

$f_1, f_2 \cdots$

$f_1($  $) =$ "cat"

$f_2($  $) =$ "money"

$f_1($  $) =$ "dog"

$f_2($  $) =$ "snake"

Training Data

Function input:

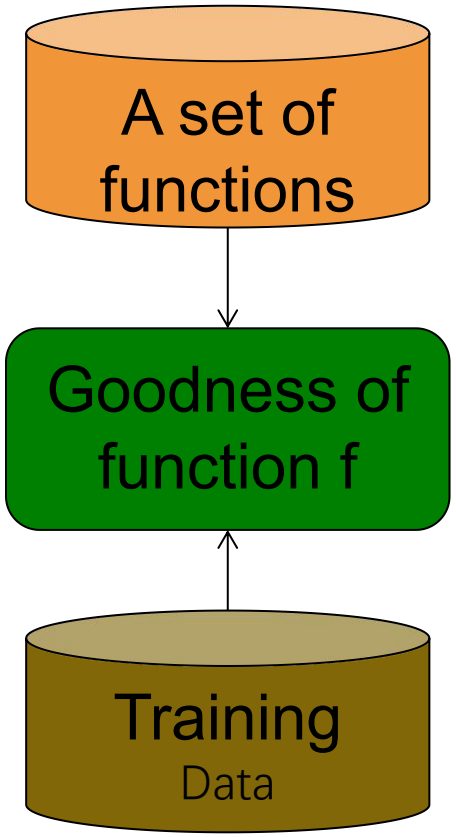
Function output:

"dog"

"cat"

"monkey"

Framework



Model

$f_1, f_2 \cdots$

Image Recognition:

$f($  $) =$ "cat"

$f_1($  $) =$ "cat"

$f_2($  $) =$ "money"

$f_1($  $) =$ "dog"

$f_2($  $) =$ "snake"

Function input:

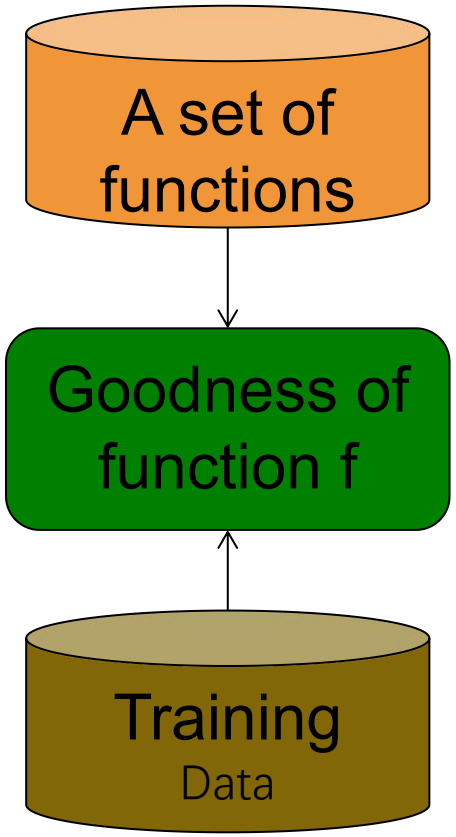
Function output:

"dog"

"cat"

"monkey"

Framework



Model

$f_1, f_2 \cdots$

Image Recognition:

$f($  $) =$ "cat"

$f_1($  $) =$ "cat"

$f_2($  $) =$ "money"

Better!

$f_1($  $) =$ "dog"

$f_2($  $) =$ "snake"

Function input:

Function output:

"dog"

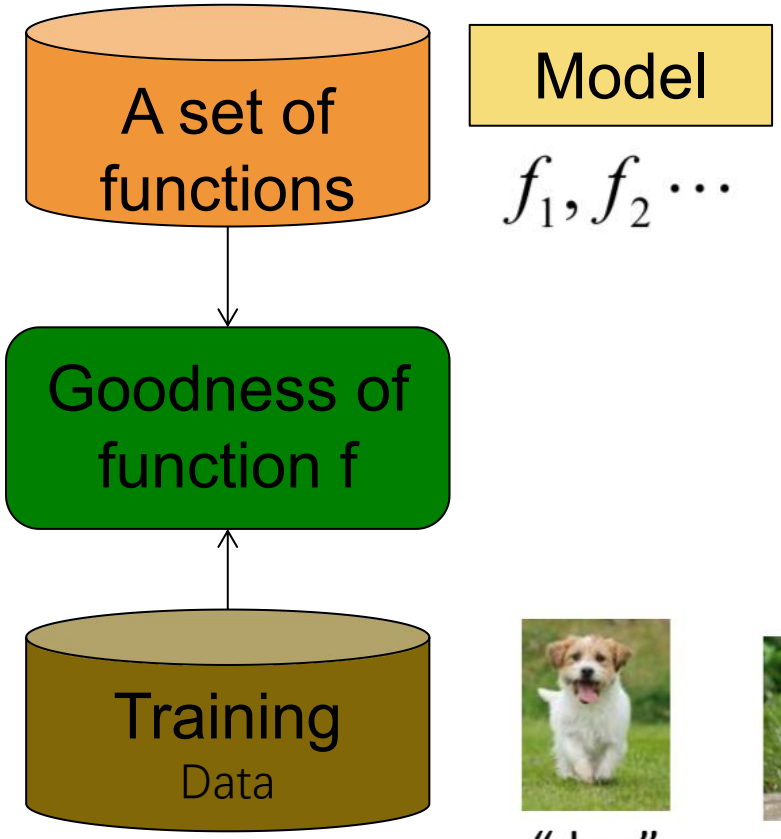
"cat"

"monkey"

Framework

Image Recognition:

$f($  $)=$ "cat"



"dog"


"cat"


"monkey"

$f_1($  $)=$ "cat"

Better!

$f_1($  $)=$ "dog"

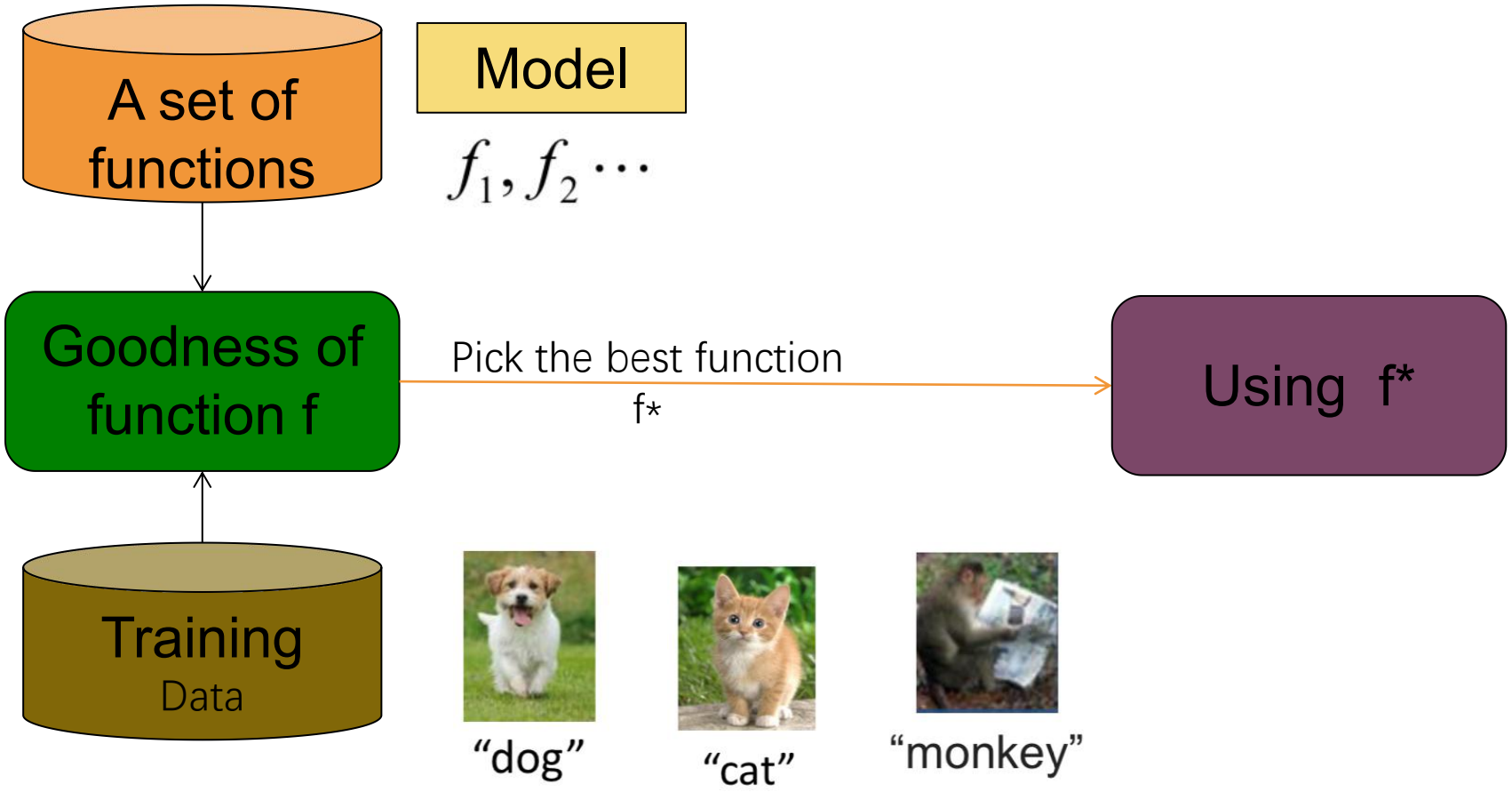
$f_2($  $)=$ "money"

$f_2($  $)=$ "snake"

Framework

Image Recognition:

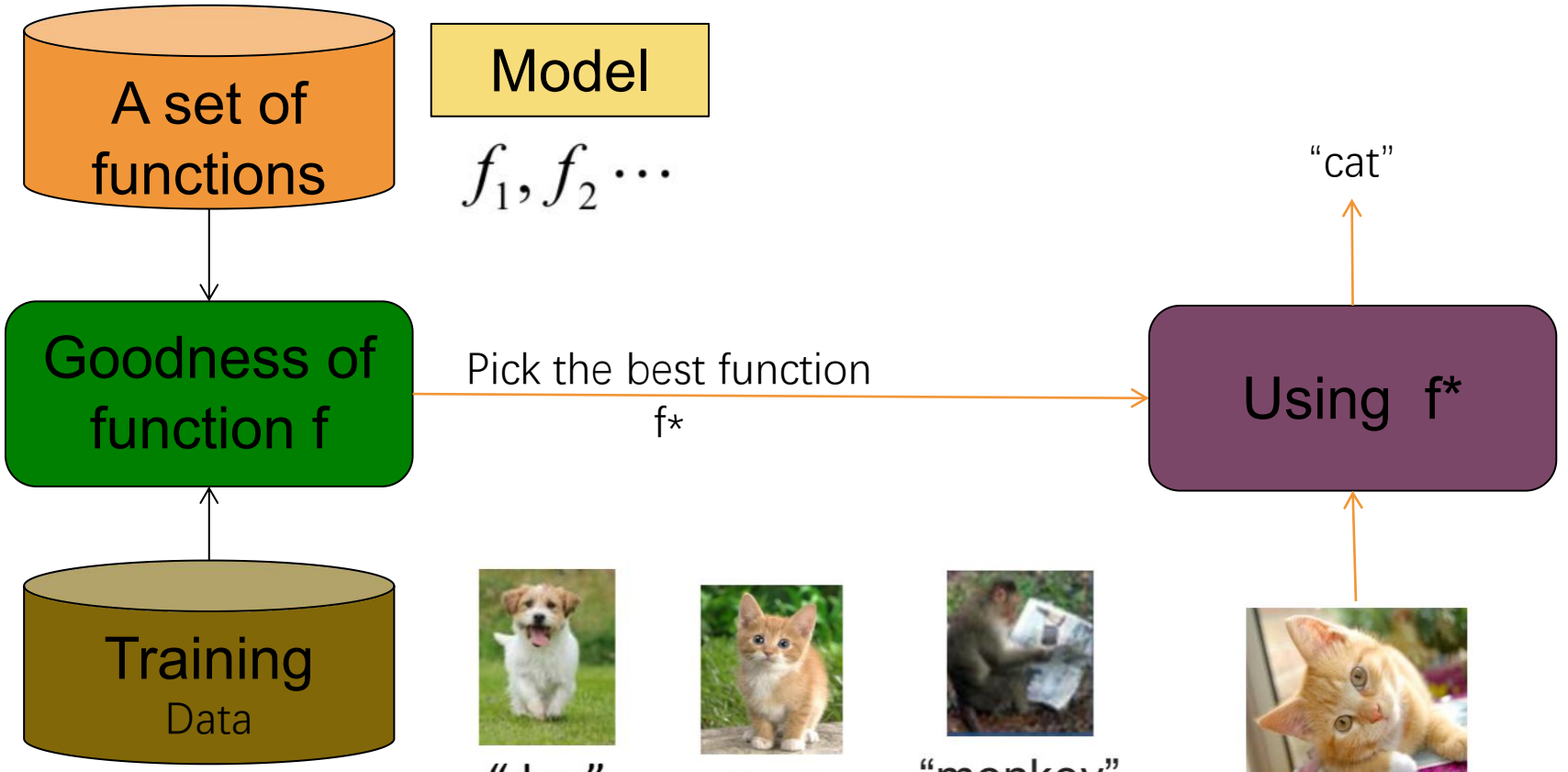
$f($  $) =$ "cat"



Framework

Image Recognition:

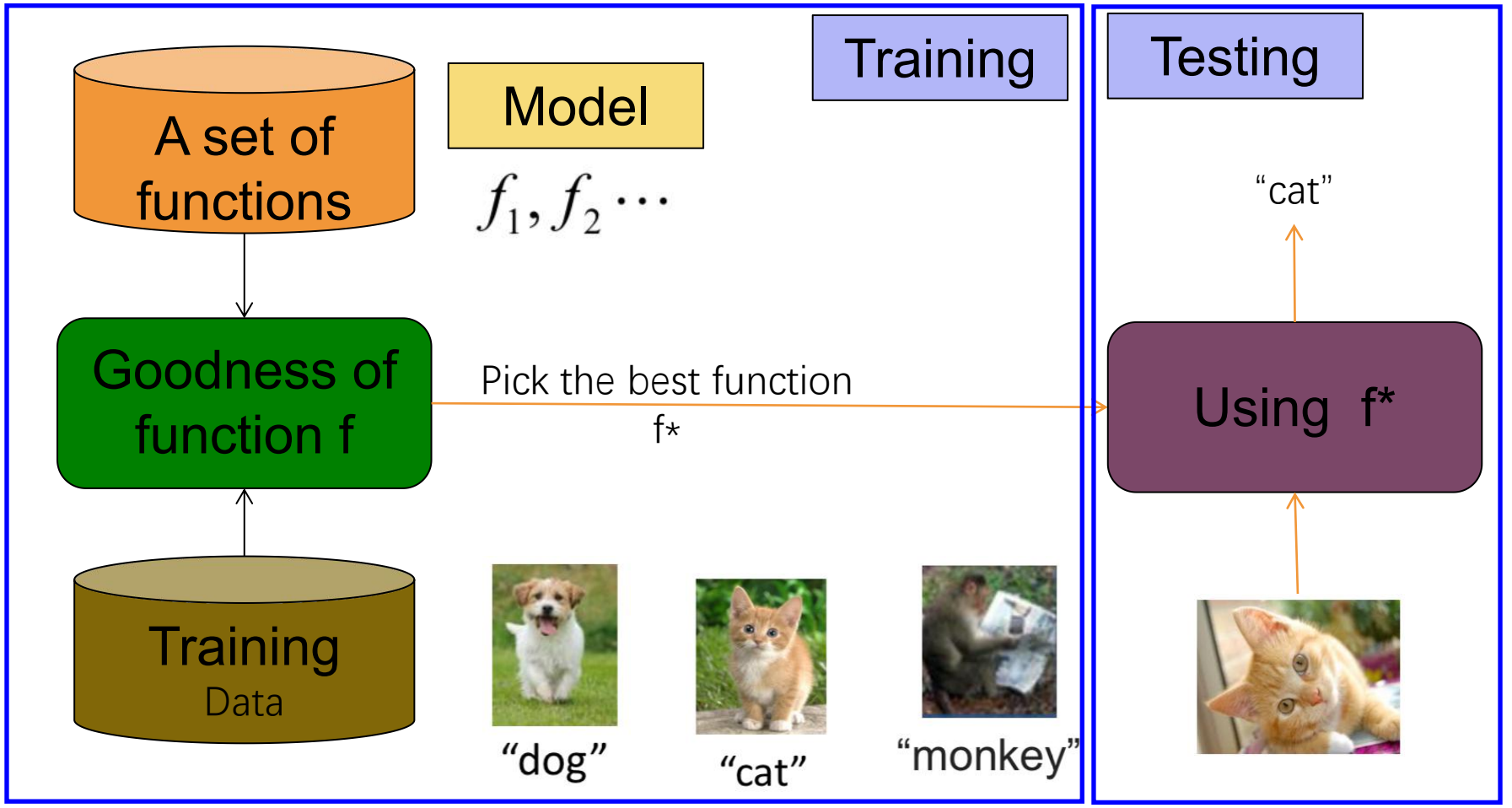
$f($  $) =$ "cat"



Framework

Image Recognition:

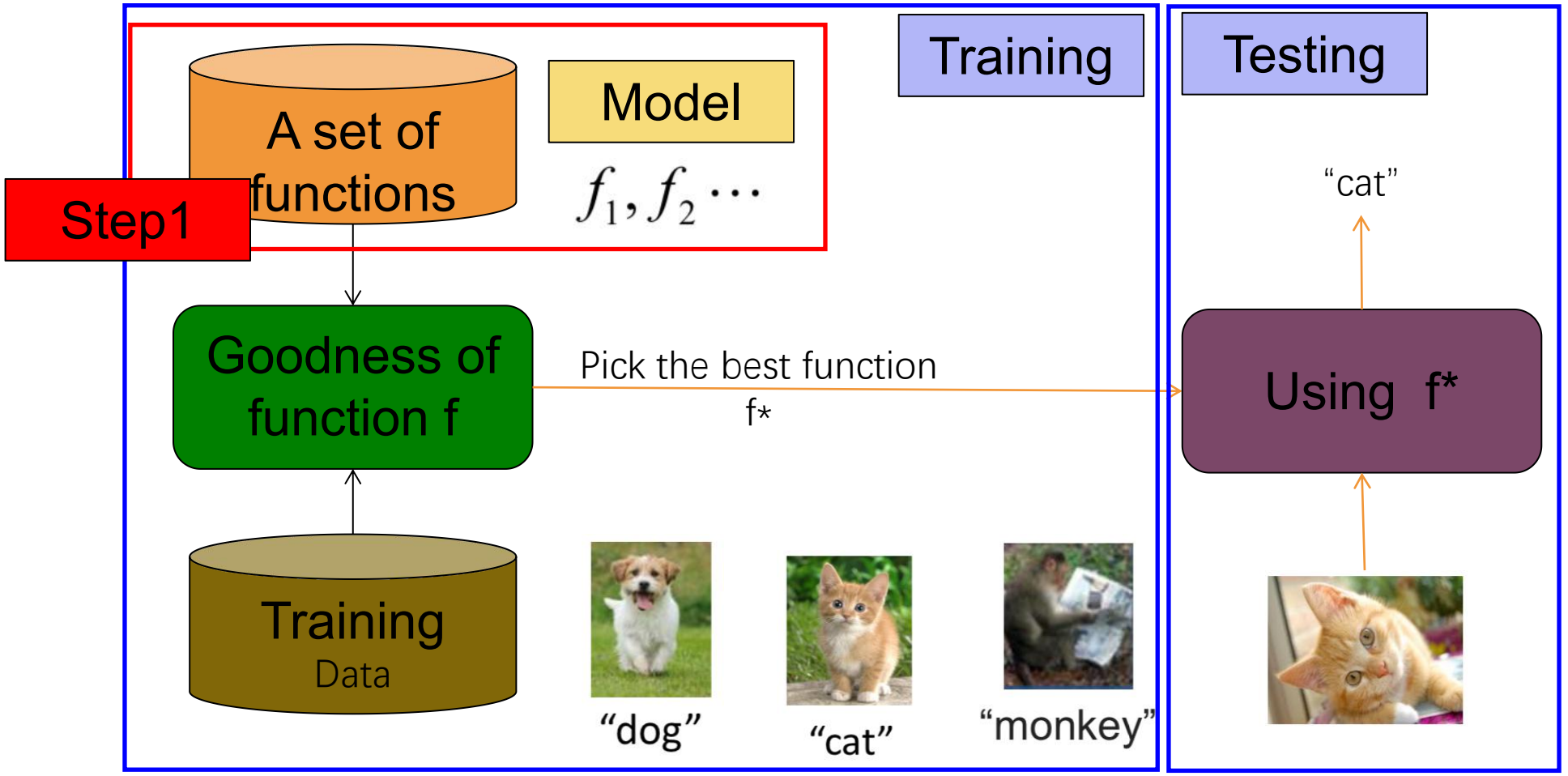
$f($  $) =$ "cat"



Framework

Image Recognition:

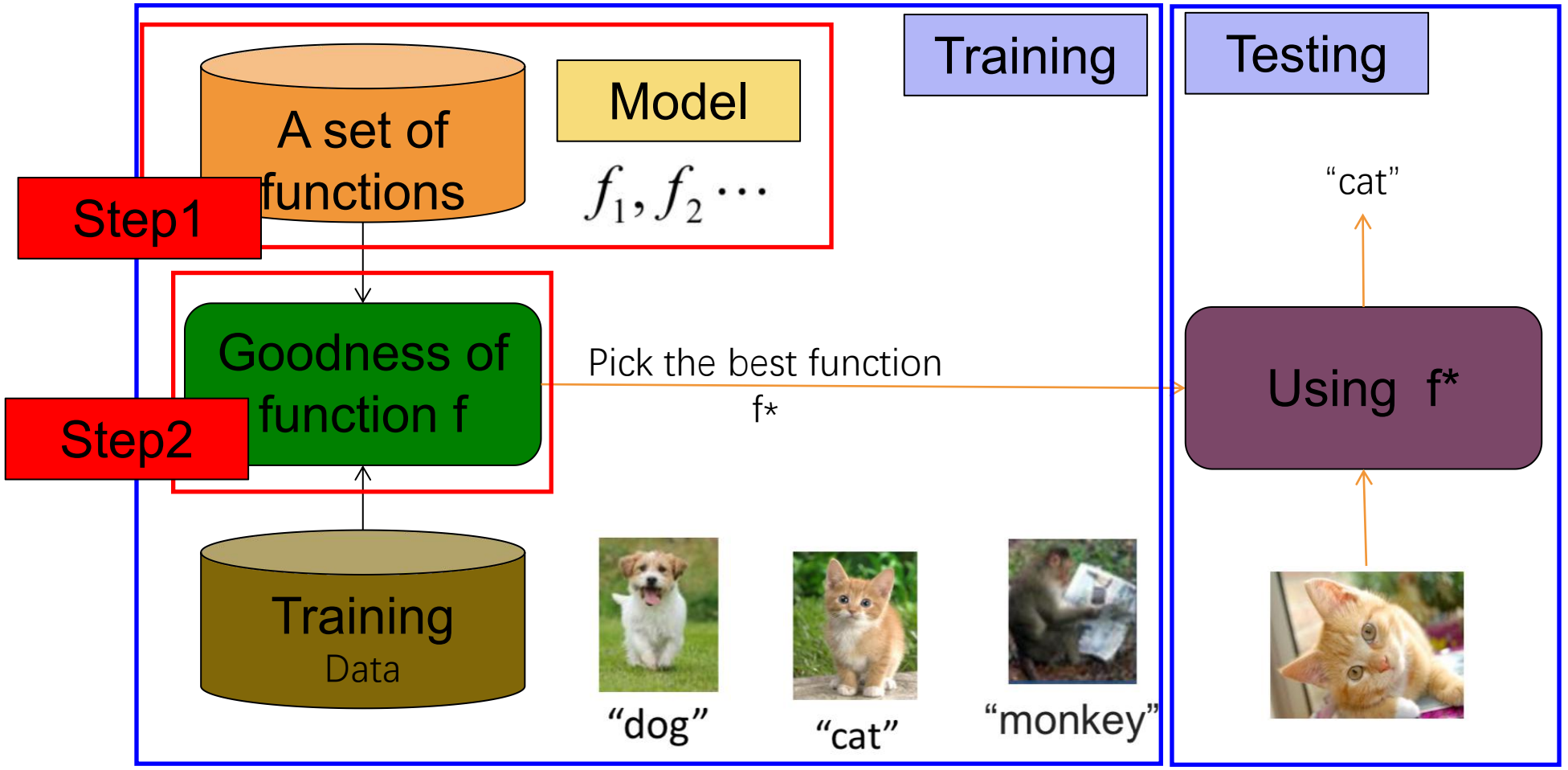
$f($  $)=$ “cat”



Framework

Image Recognition:

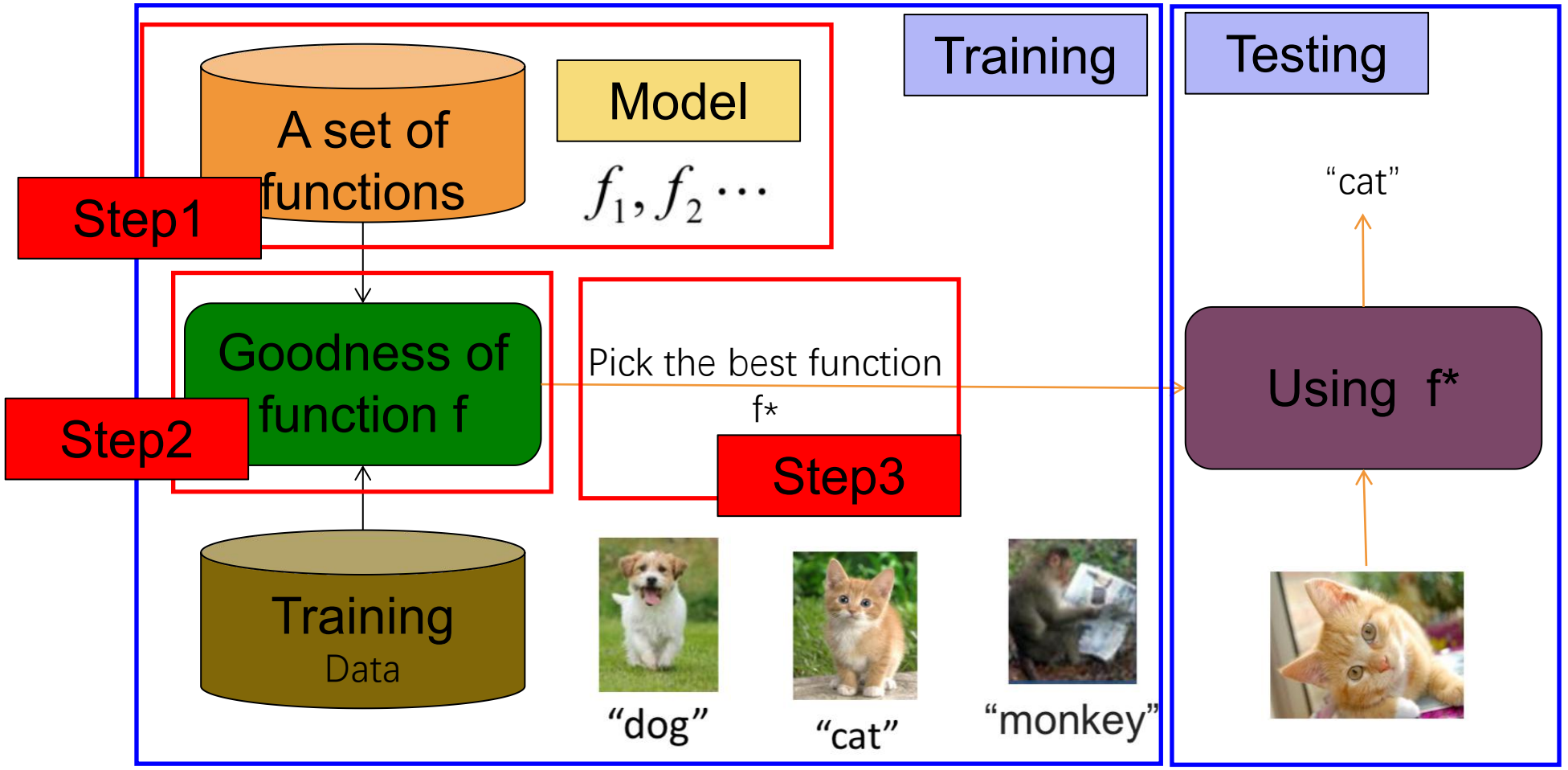
$f($  $)=$ “cat”



Framework

Image Recognition:

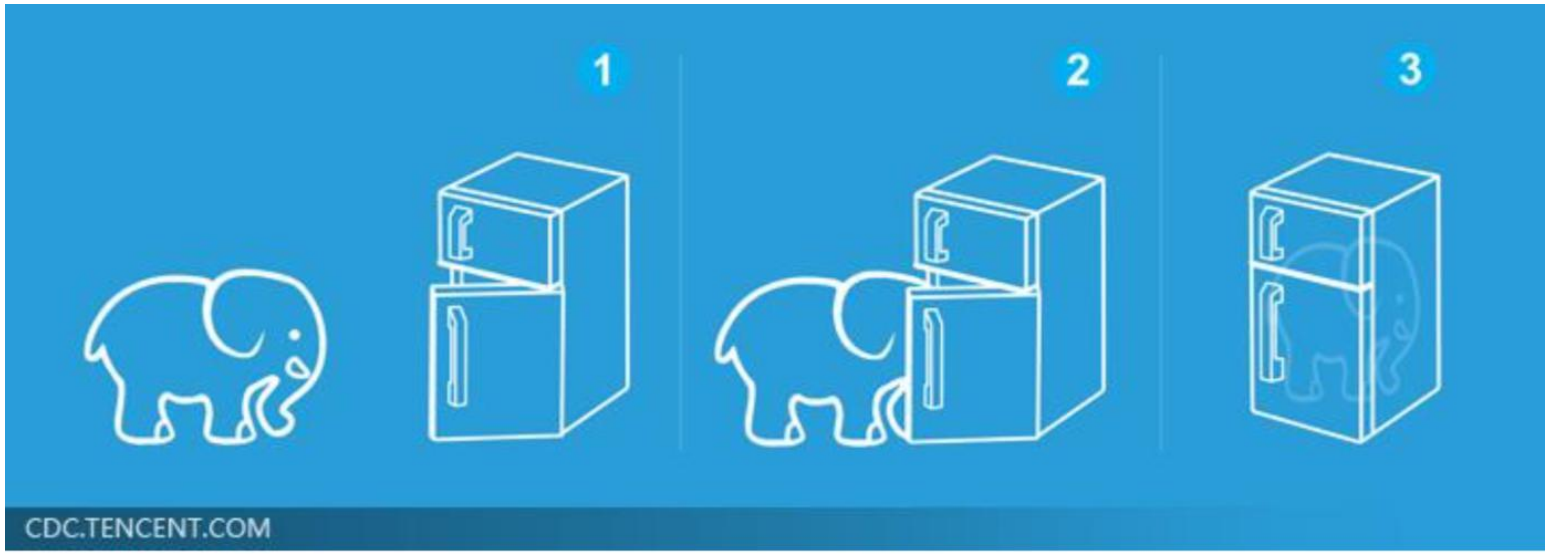
$f($  $)=$ “cat”



Machine learning is so simple …

Step 1: Define a set of function → Step 2: Goodness of function → Step 3: Pick the best function

就好像把大象装进冰箱……



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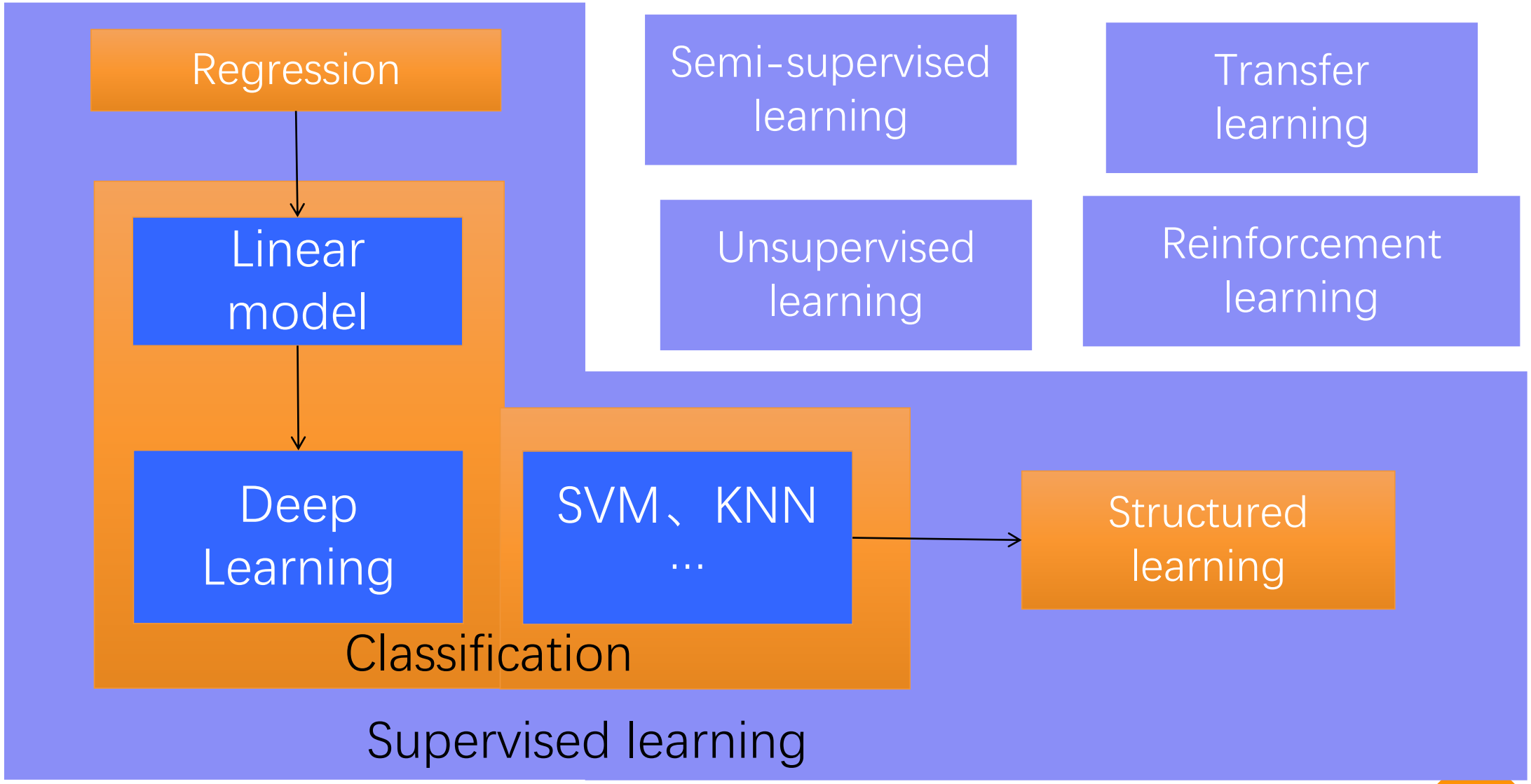
Learning map

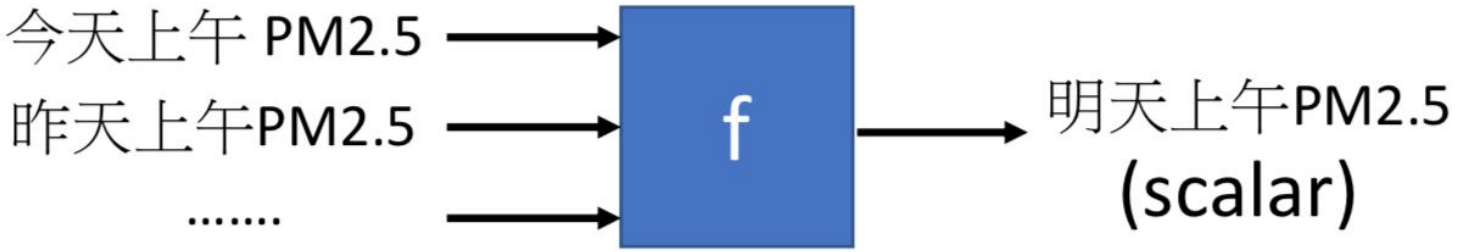


Learning map

Regression

The output of target function ***f*** is 'scalar'

预测
PM2.5



Training data

Input:

9/01 上午 PM2.5 = 63　9/02 上午 PM2.5 = 65

Output:

9/03 上午 PM2.5 = 100

Input:

9/12 上午 PM2.5 = 30　9/13 上午 PM2.5 = 25

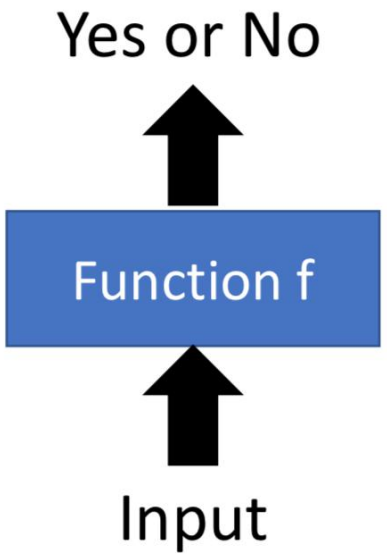
Output:

9/14 上午 PM2.5 = 20

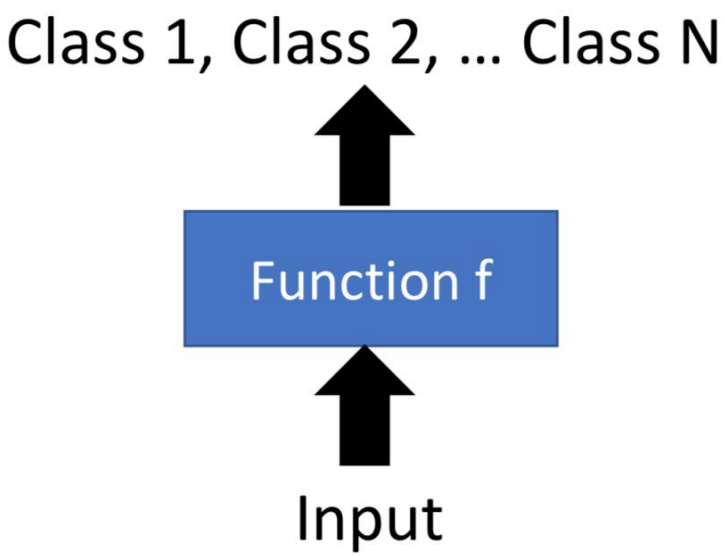
Learning map

Classification

- Binary classification

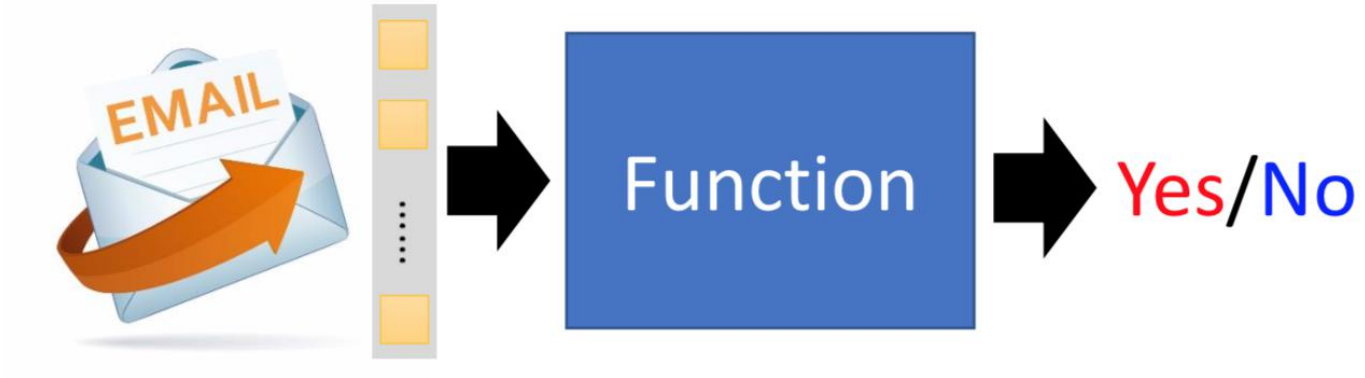


- Multi-class classification



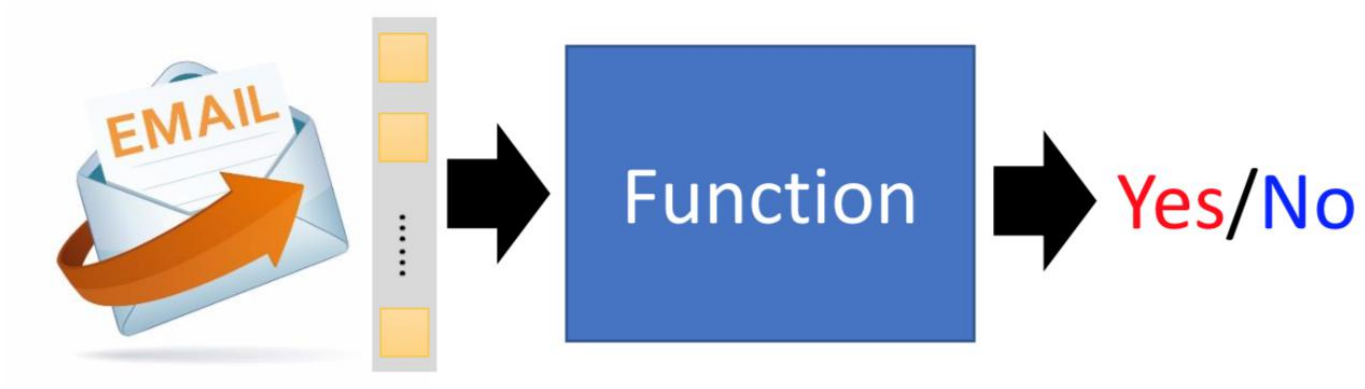
Binary classification

Spam Filtering



Binary classification

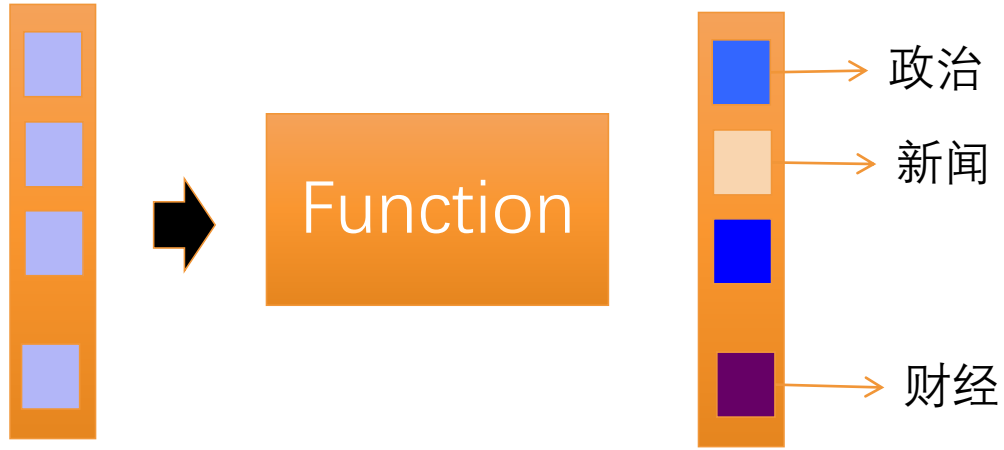
Spam Filtering



training data

Multi-class classification

document classificatio



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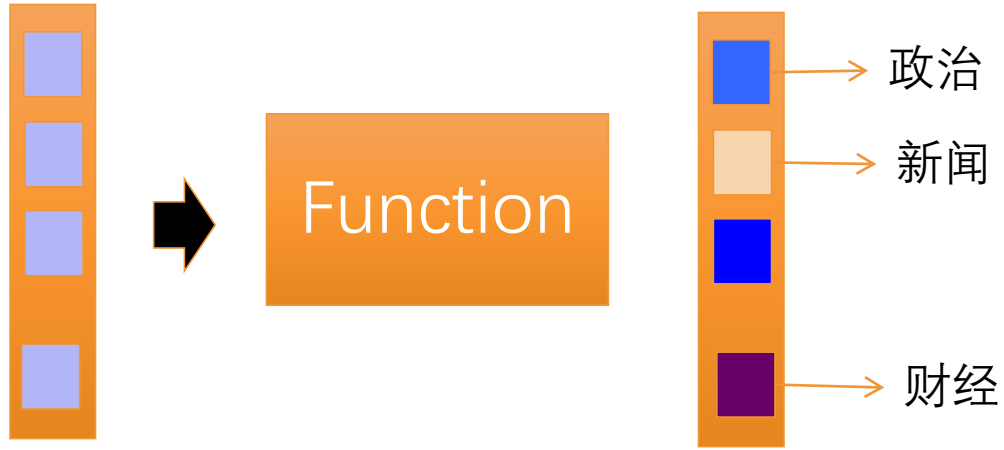
Multi-class classification

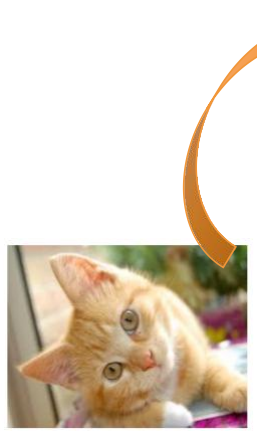
document classificatio

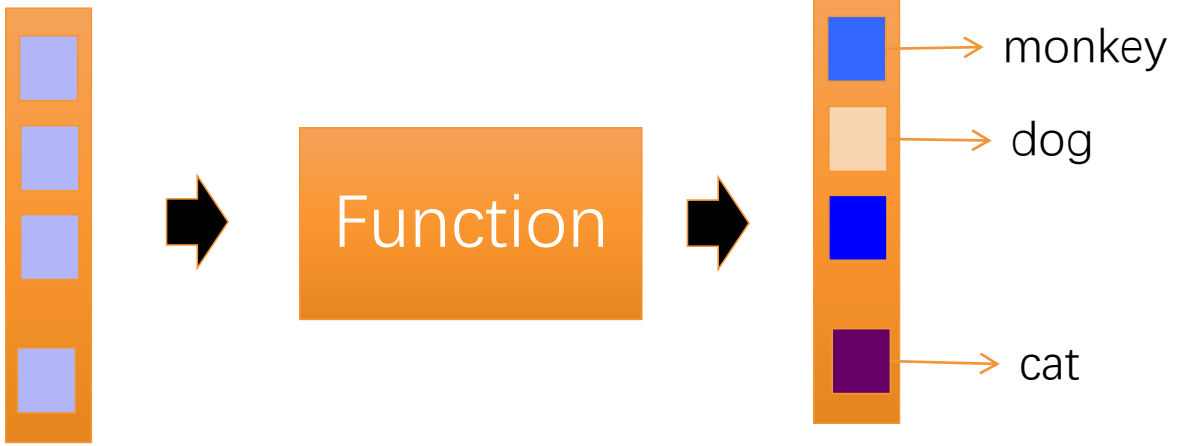


Training data

Classification: Deep Learning

image classification

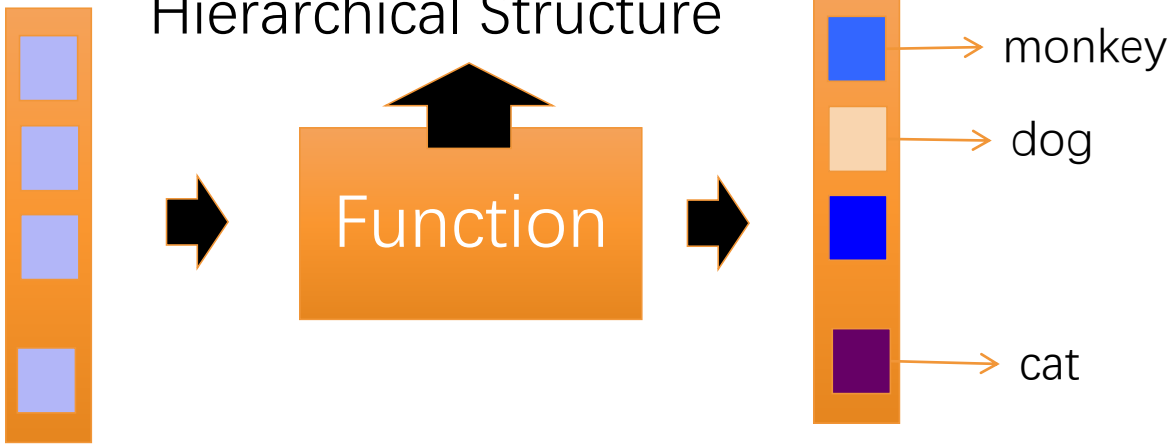




Each possible object is a class

Classification: Deep Learning

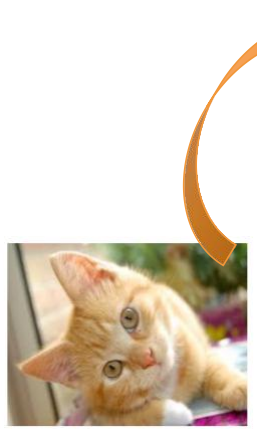
image classification

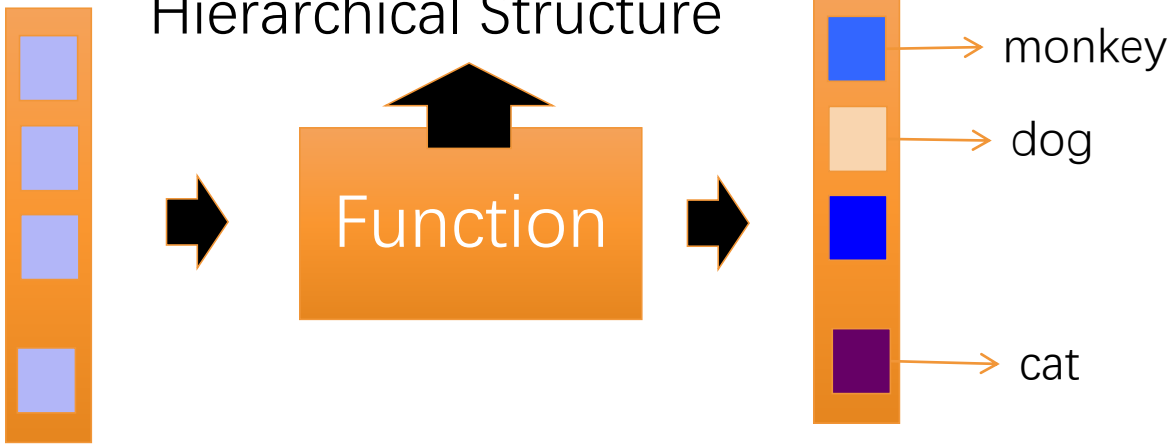


Each possible object is a class

Classification: Deep Learning

image classification





Each possible object is a class

Training Data

Classification: Deep Learning

Play Go

Function

Next move

Each position is one class (19x19)

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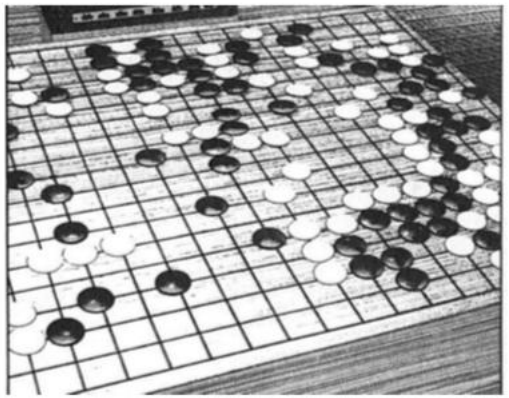
Classification: Deep Learning

Play Go

Function

Next move
Each position is one class (19x19)

Training data



一堆棋谱

进藤光VS春

黑: 5之五 → 白: 天元 → 黑: 五之5

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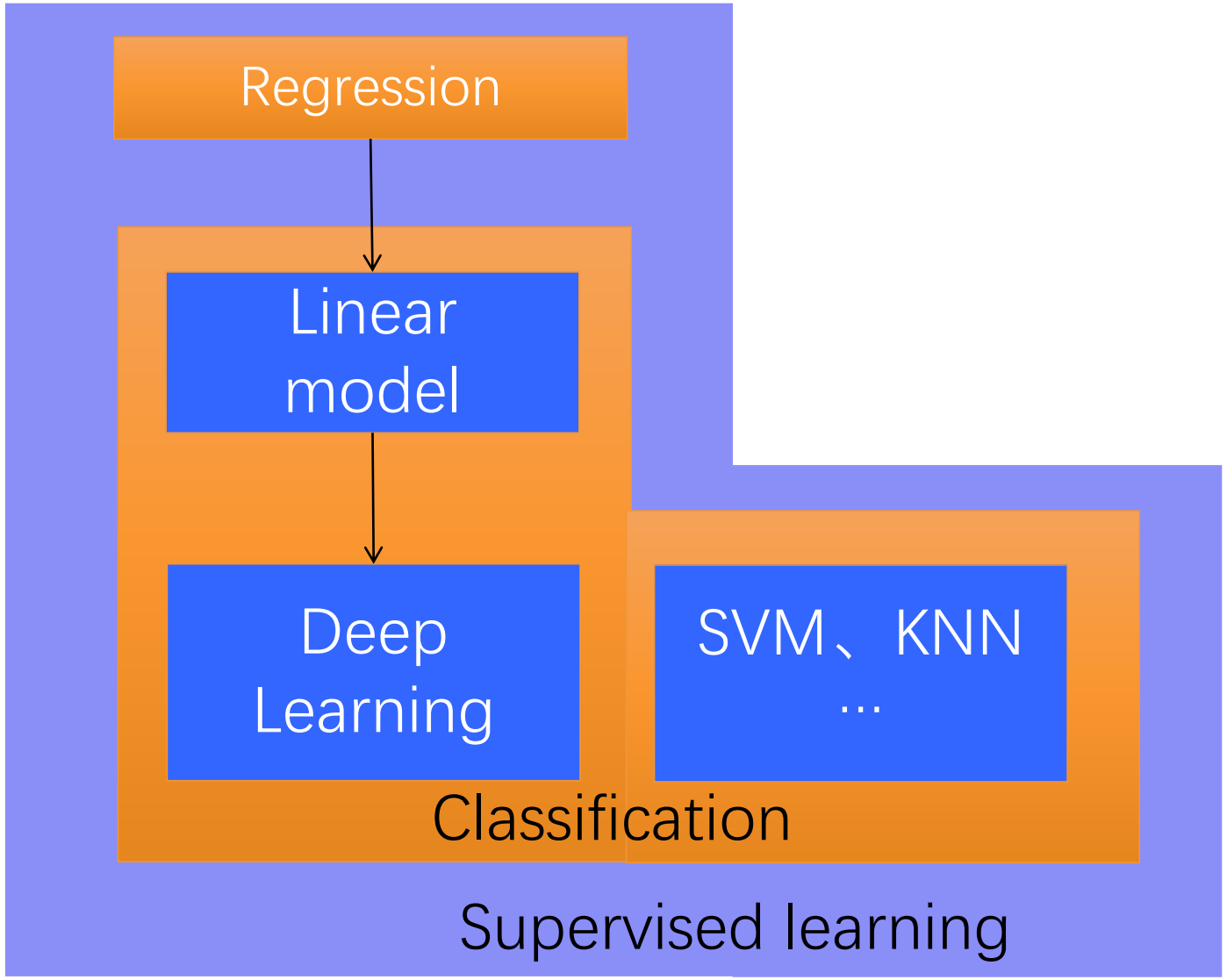
Learning map



Training data:

Input/output

Pair of target function

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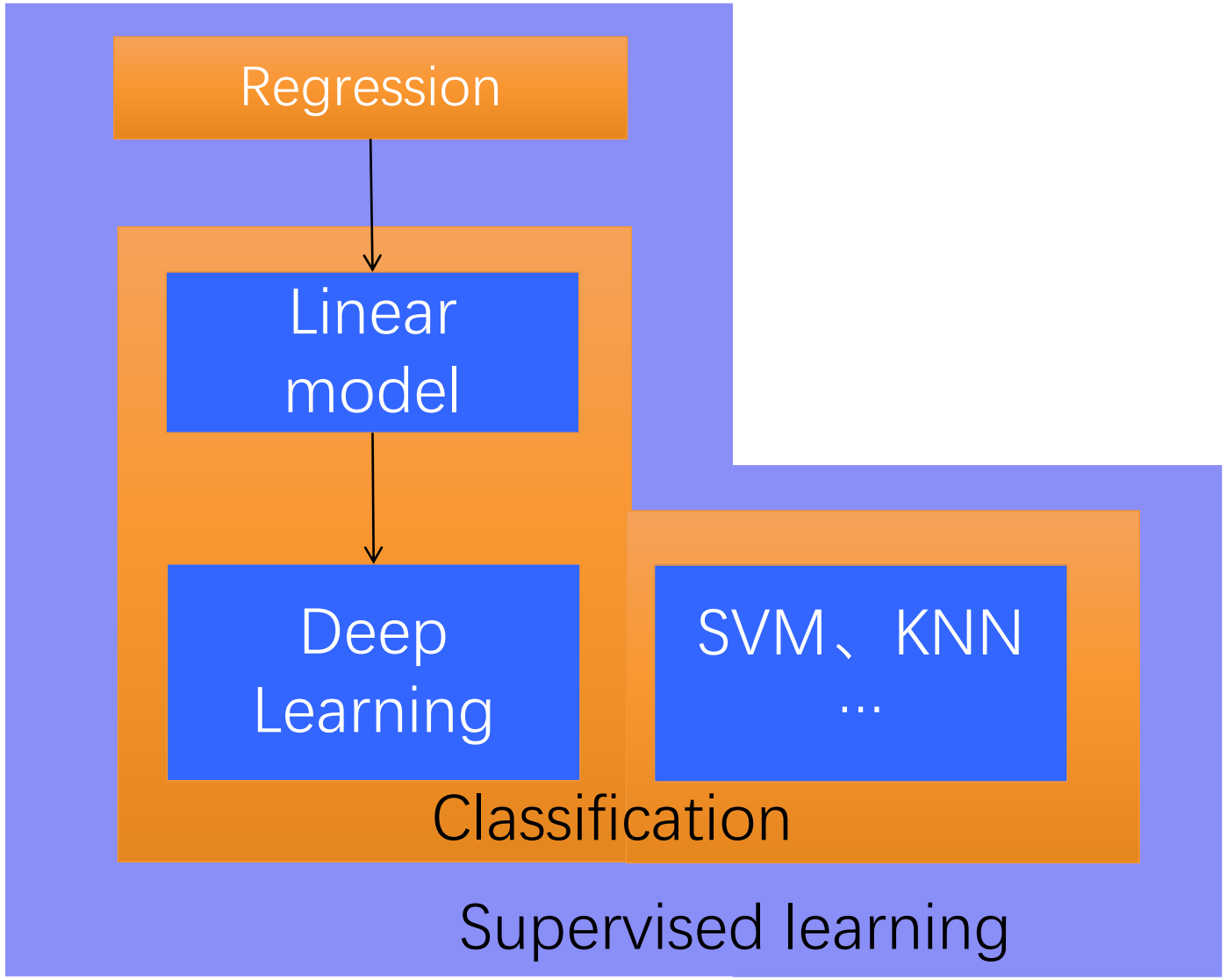
Learning map

Hard to collect a large amount of labeled data



Training data:

Input/output

Pair of target function

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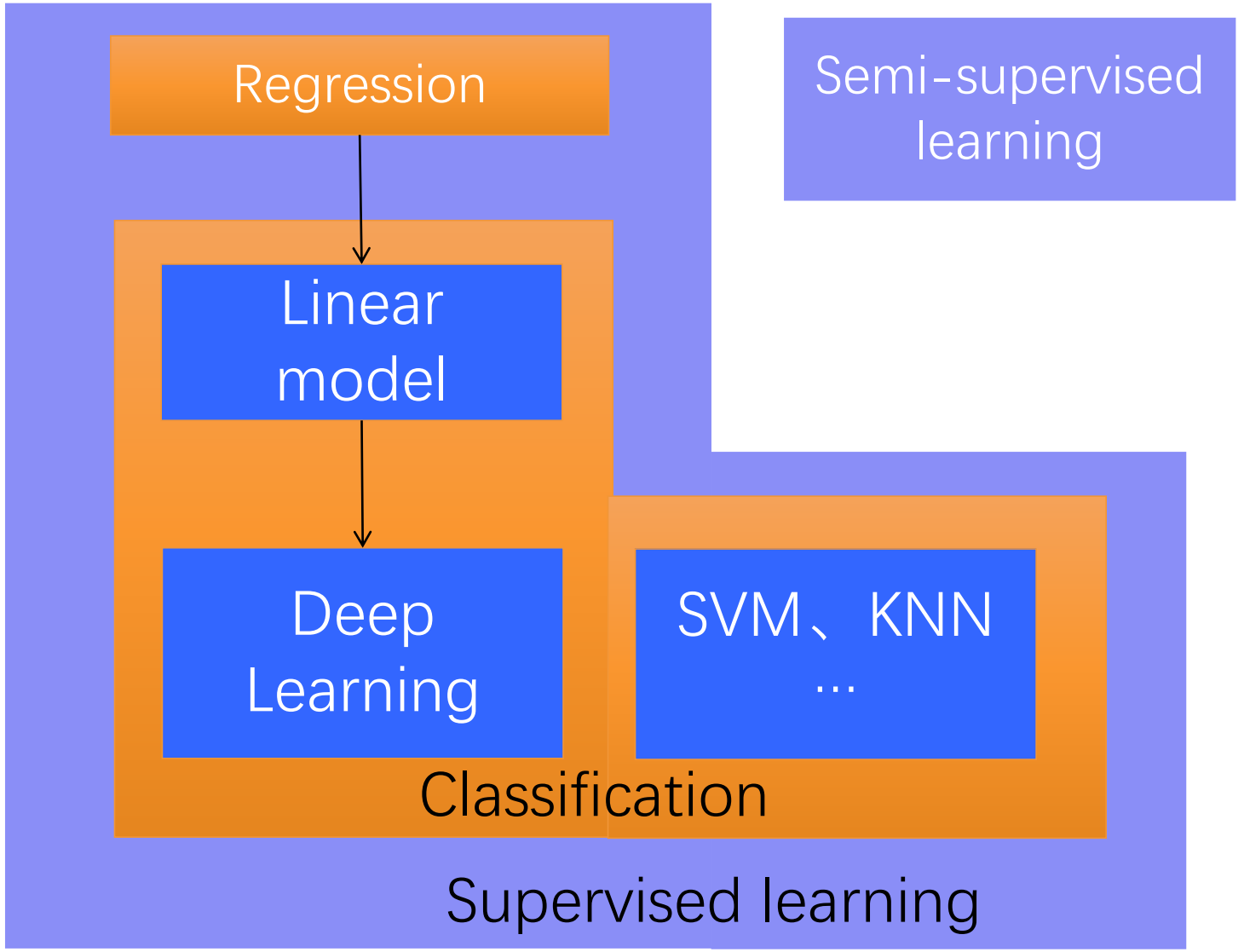
Learning map



Hard to collect a large amount of labeled data

Training data:

Input/output

Pair of target function

Semi-supervised learning

For example , recognizing dogs and cats

Labeled data

Unlabeled data

Images of dogs and cats

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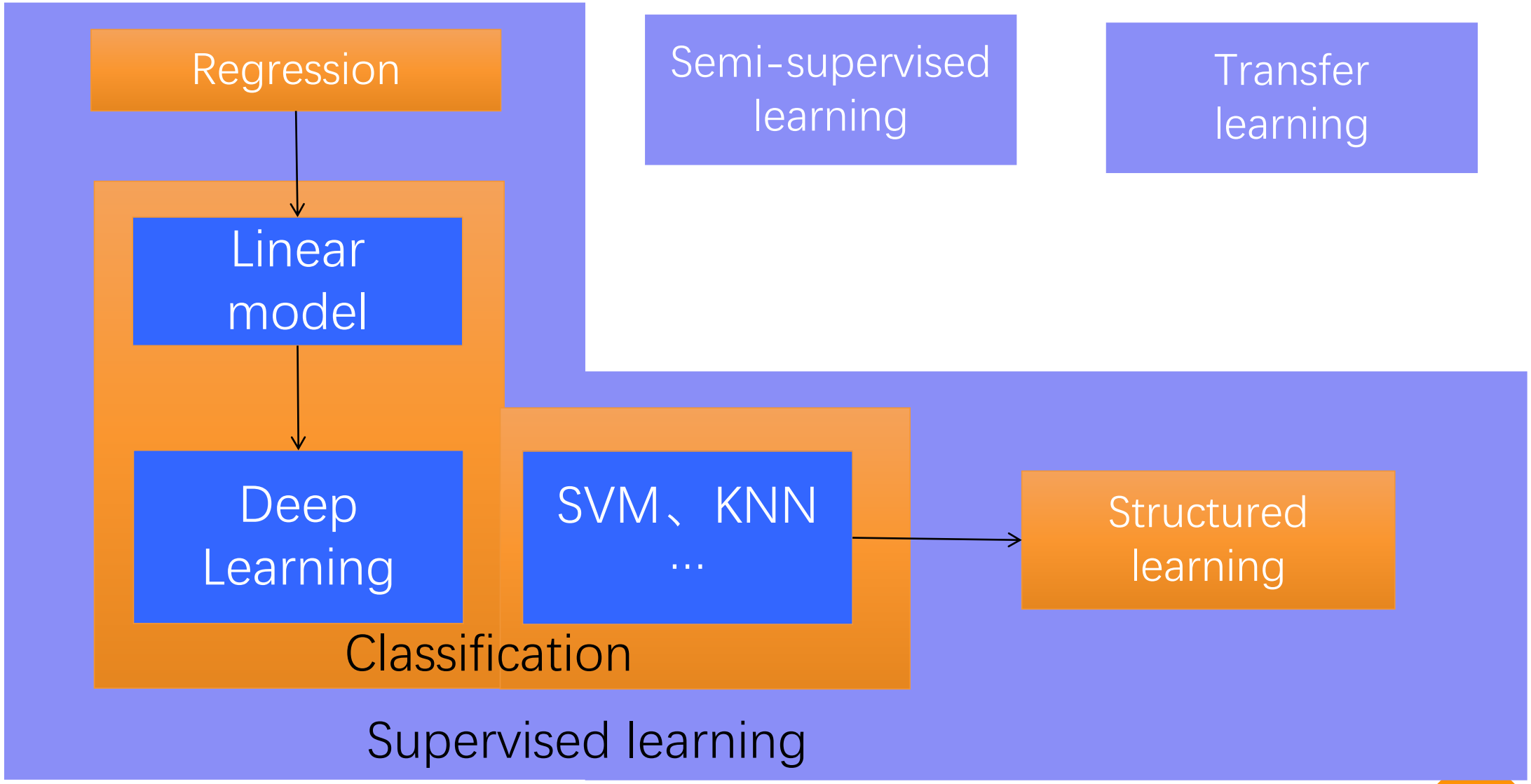
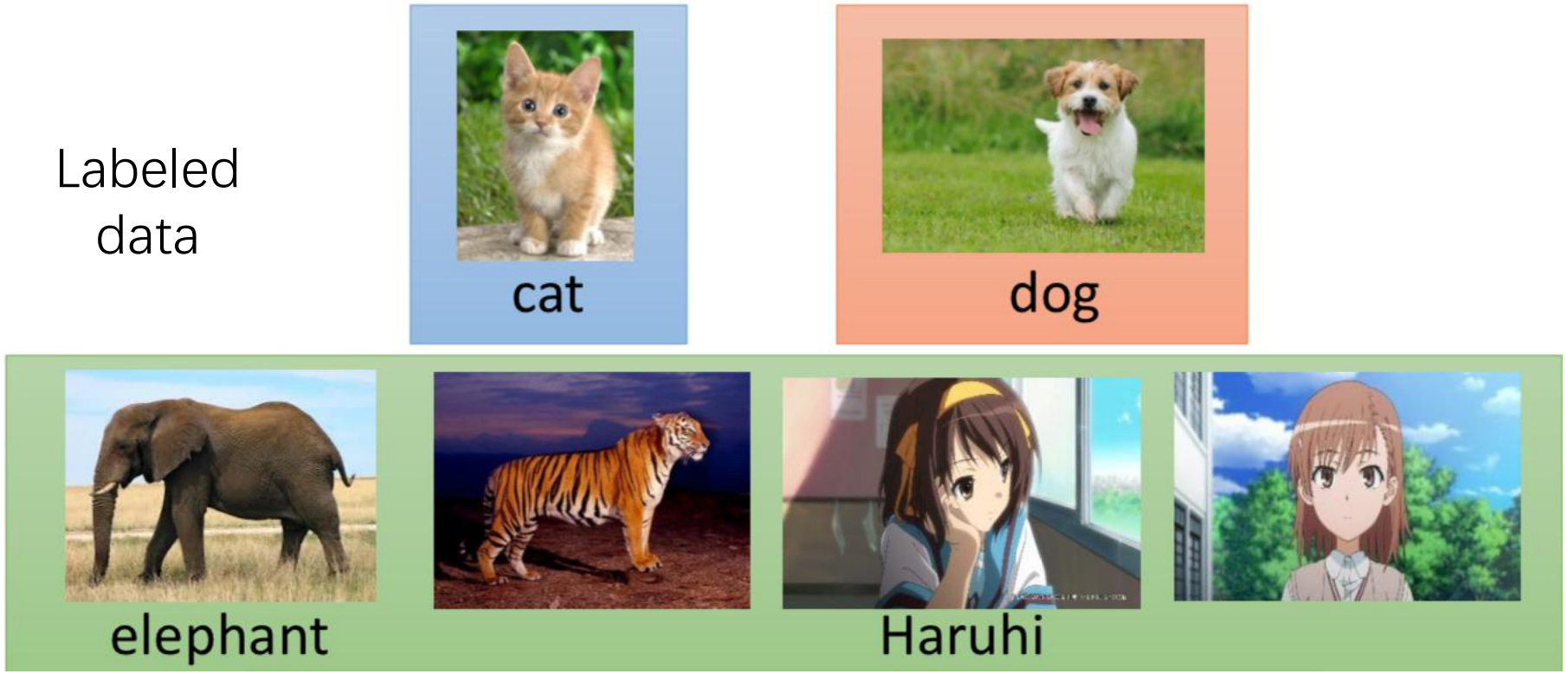
Learning map



Transfer learning

For example , recognizing dogs and cats

Labeled data



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Transfer learning

For example , recognizing dogs and cats

Labeled data

cat

dog

elephant

Haruhi

Data not related to the task considered
(either labelled or unlabelled)

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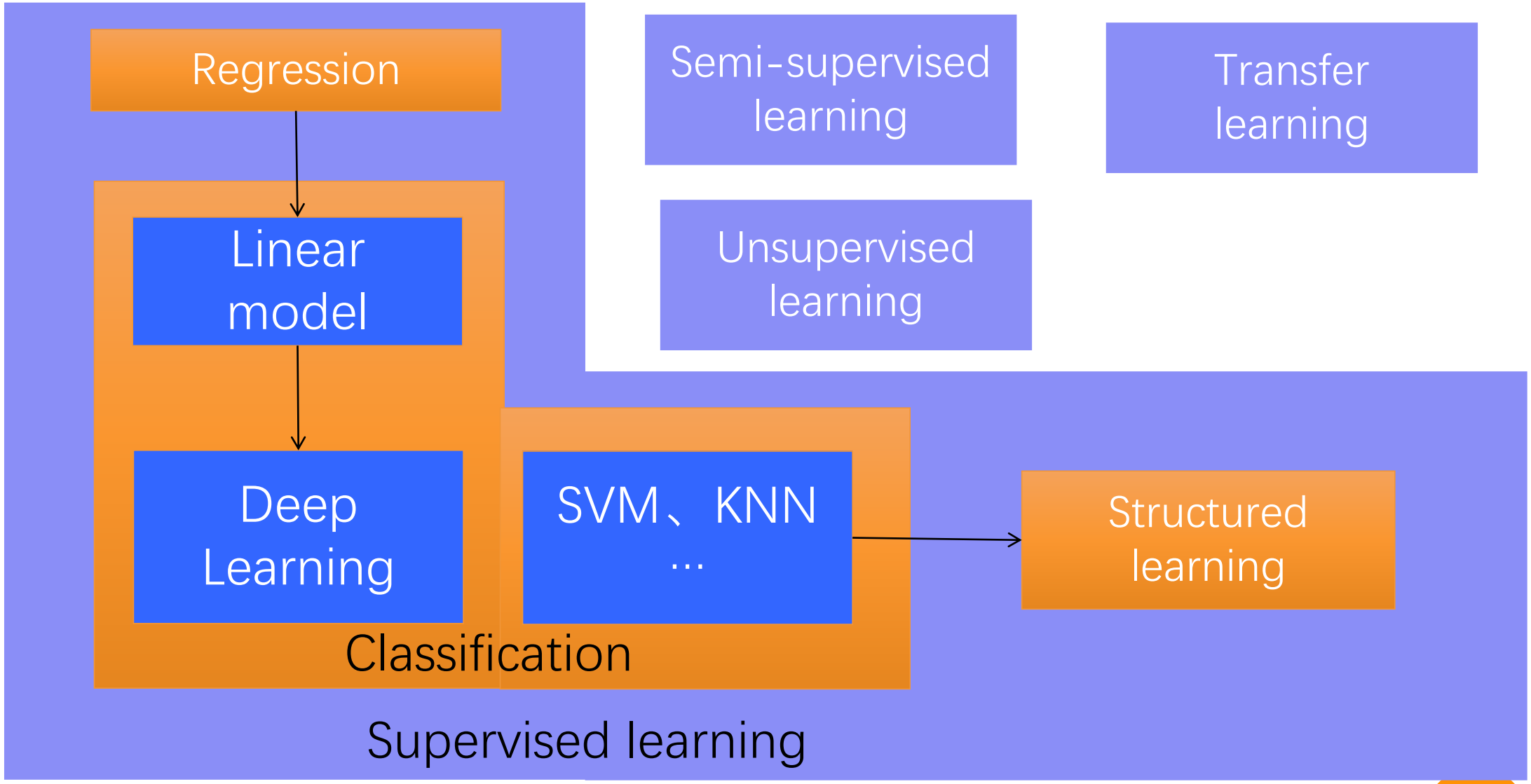
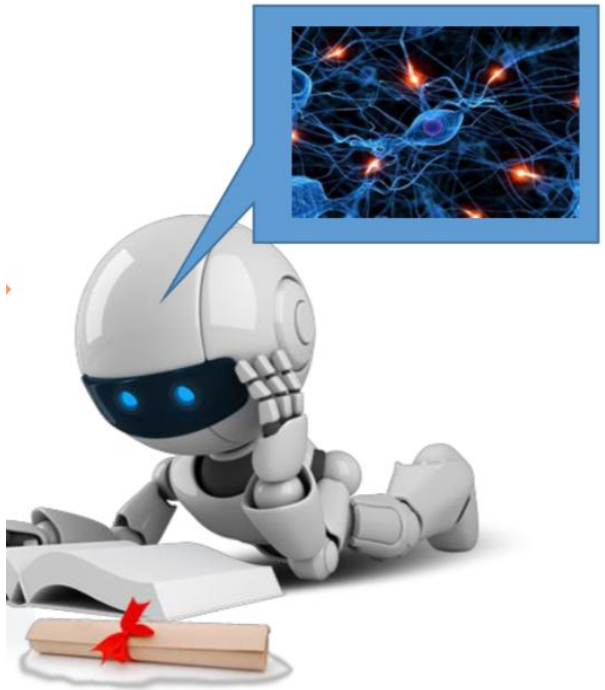
Learning map



Unsupervised learning

Machine Reading：Machine learns the meaning of words from reading a lot of documents



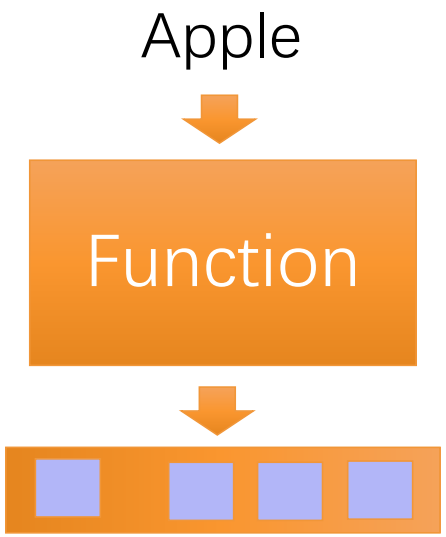
Unsupervised learning

Machine Reading：Machine learns the meaning of words from reading a lot of documents

Function

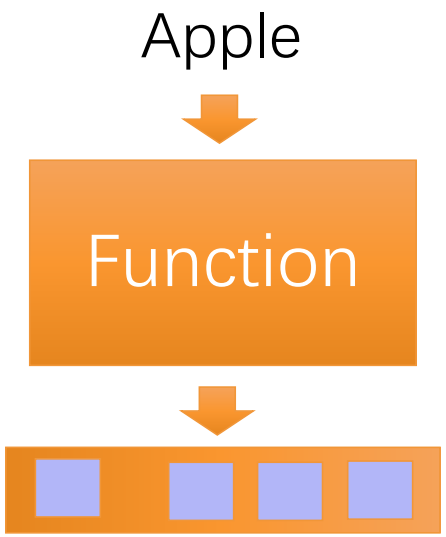
Unsupervised learning

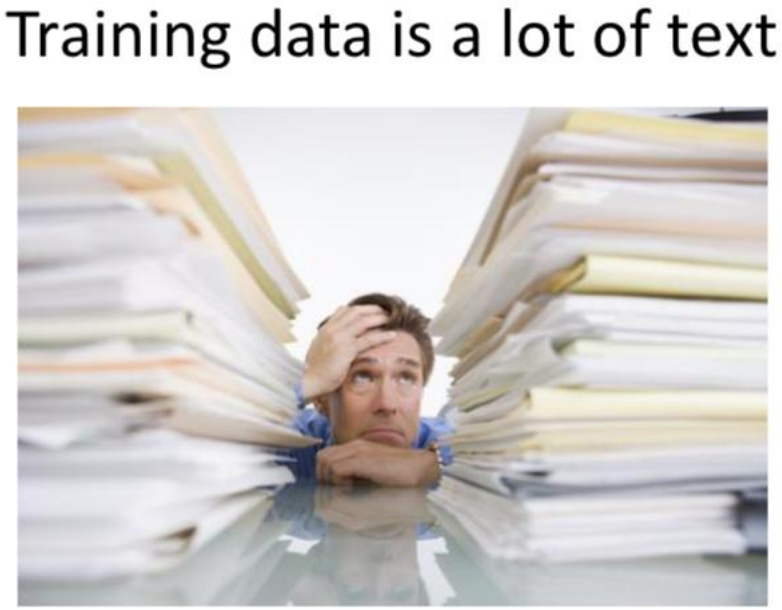
Machine Reading：Machine learns the meaning of words from reading a lot of documents



Unsupervised learning

Machine Reading：Machine learns the meaning of words from reading a lot of documents

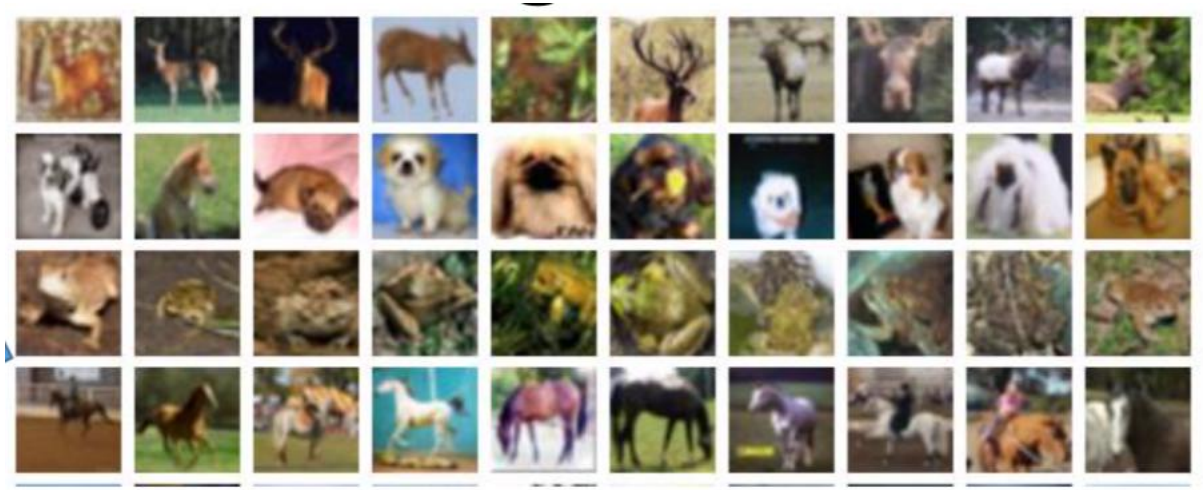




Unsupervised learning

Draw Something

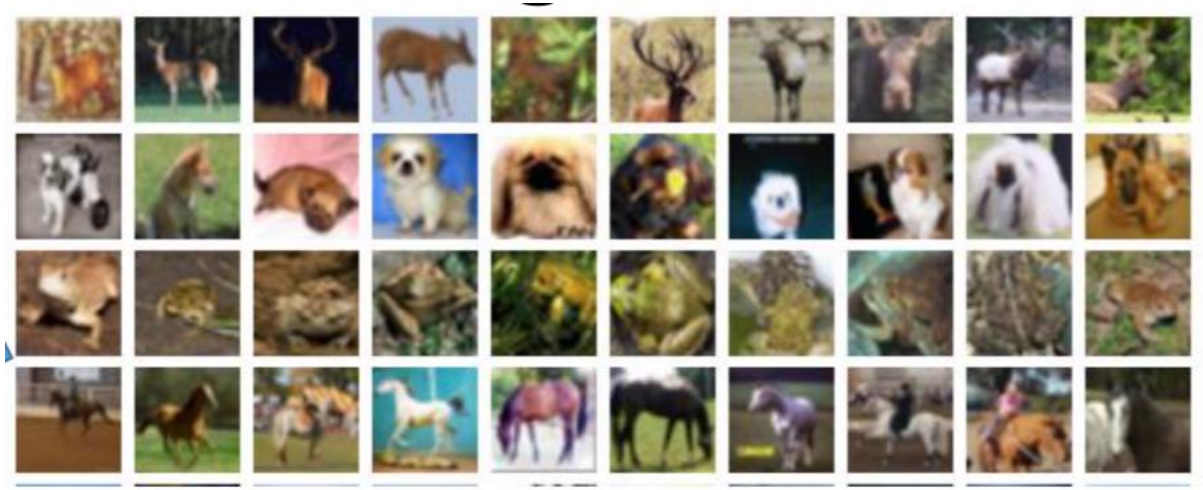
Unsupervised learning



Draw Something

Unsupervised learning

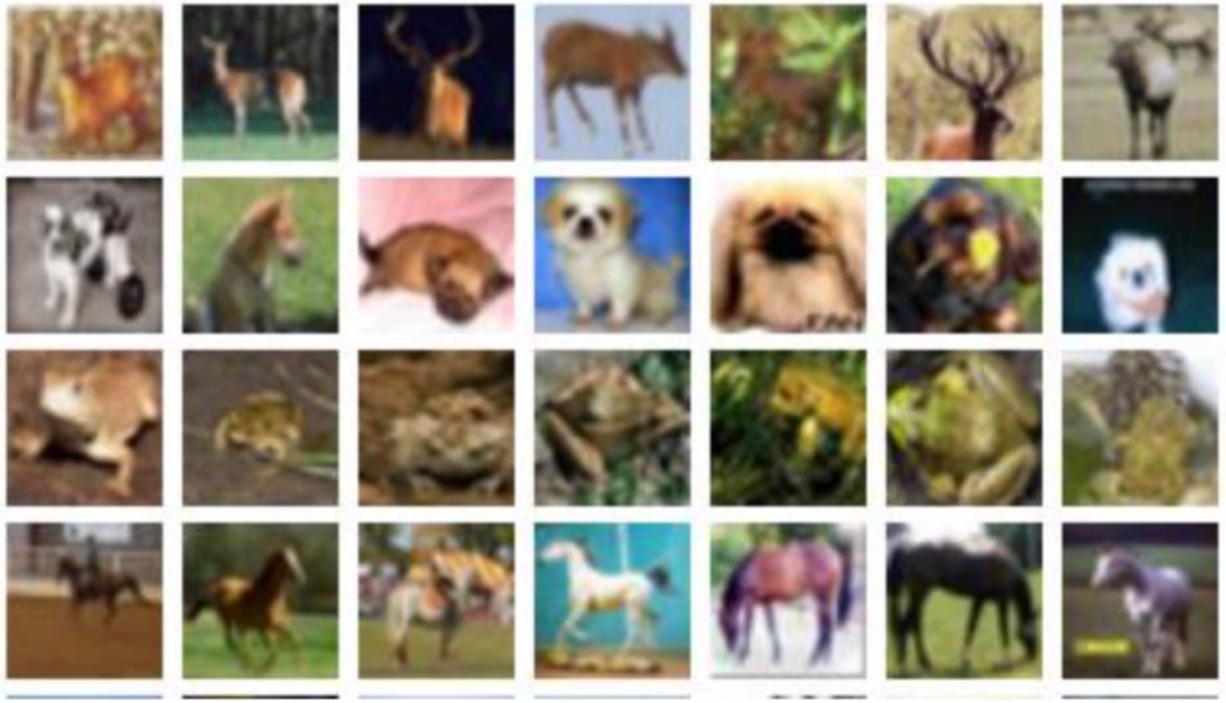
Draw Something



Unsupervised learning

Machine Draw

Training data is a lot of images



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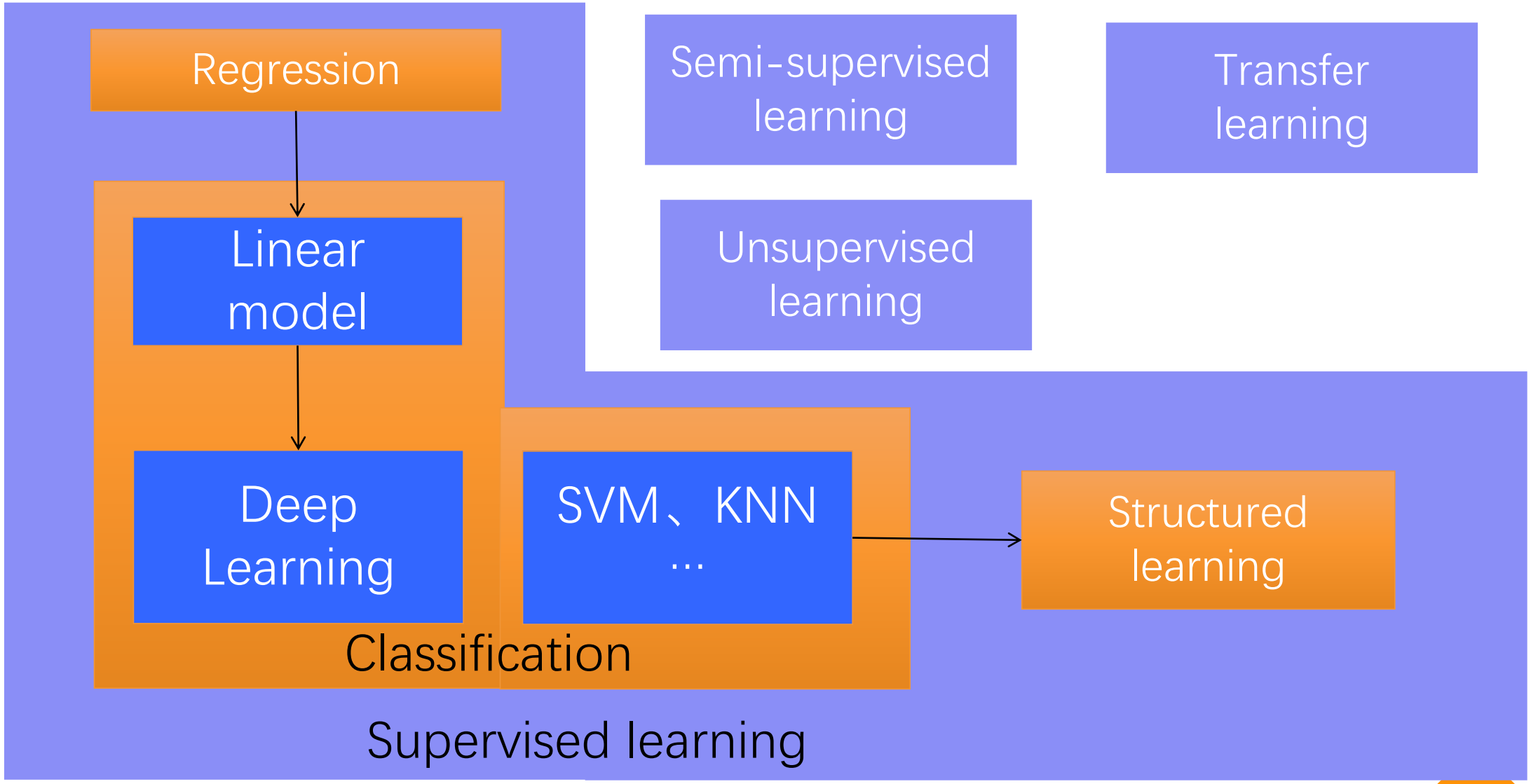
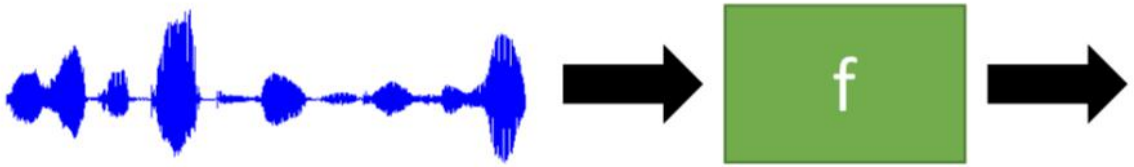
Learning map



Structured learning – beyond classification



Speech recognition

Machine translation

人脸识别

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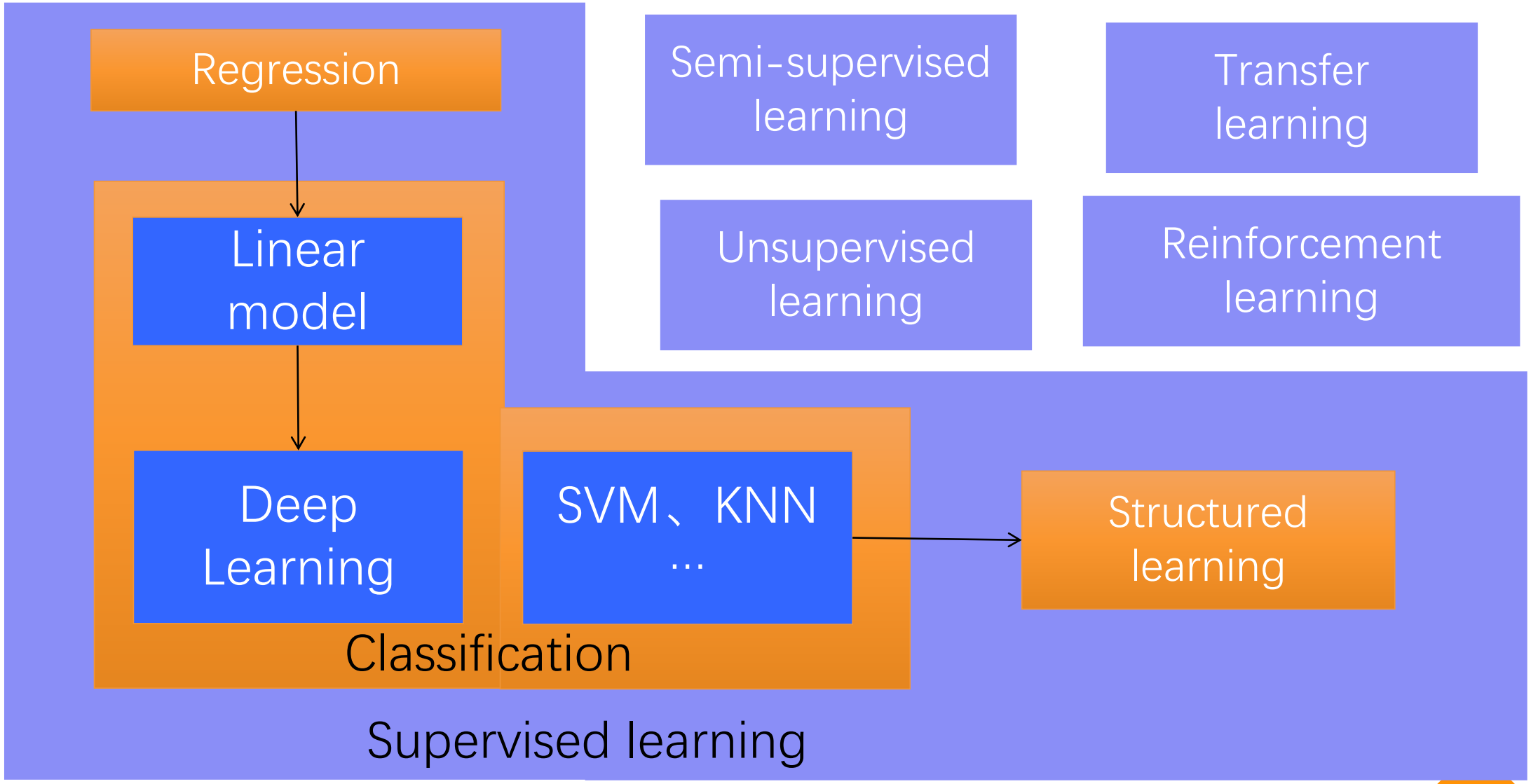
Learning map



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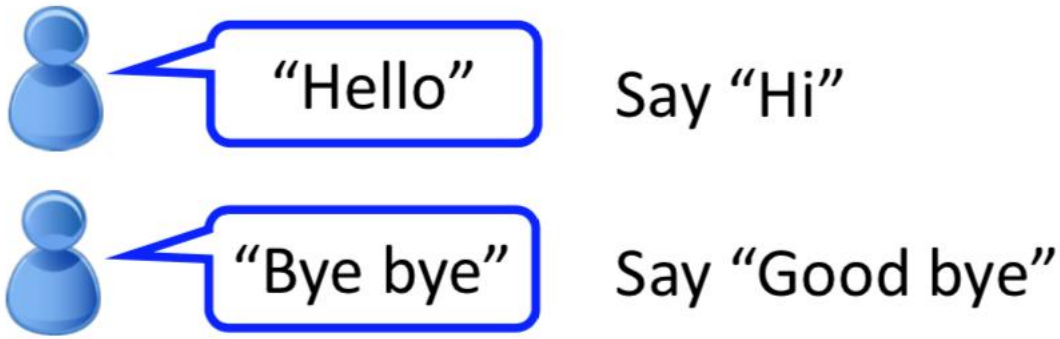
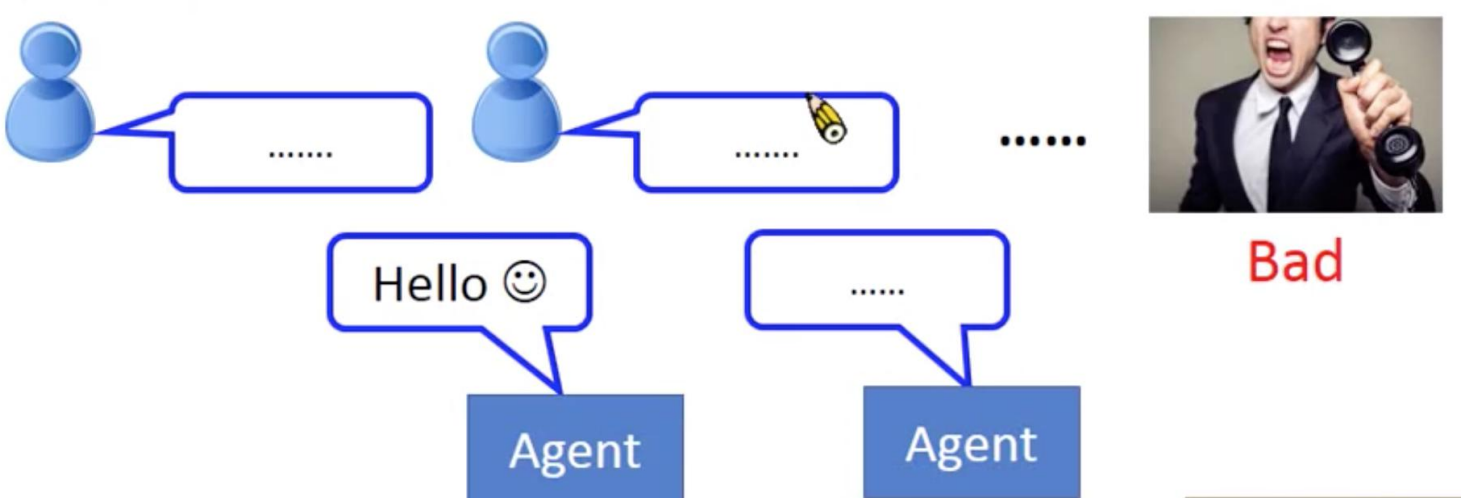
Reinforcement learning

Supervised v.s. Reinforcement

- Supervised



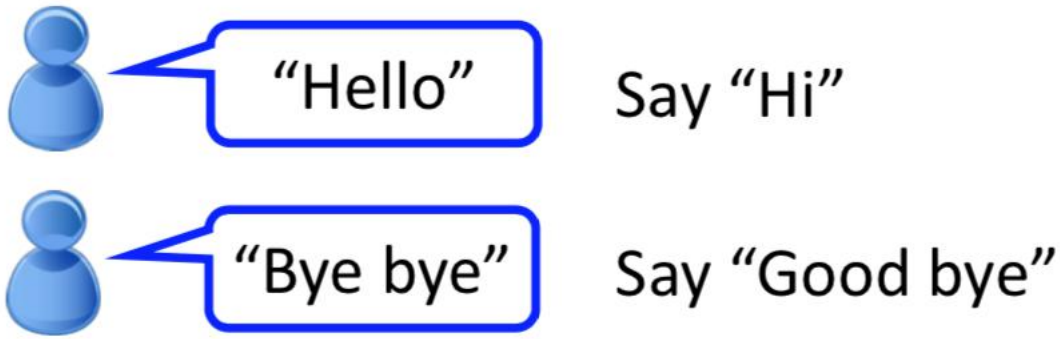
- Reinforcement



Supervised v.s. Reinforcement

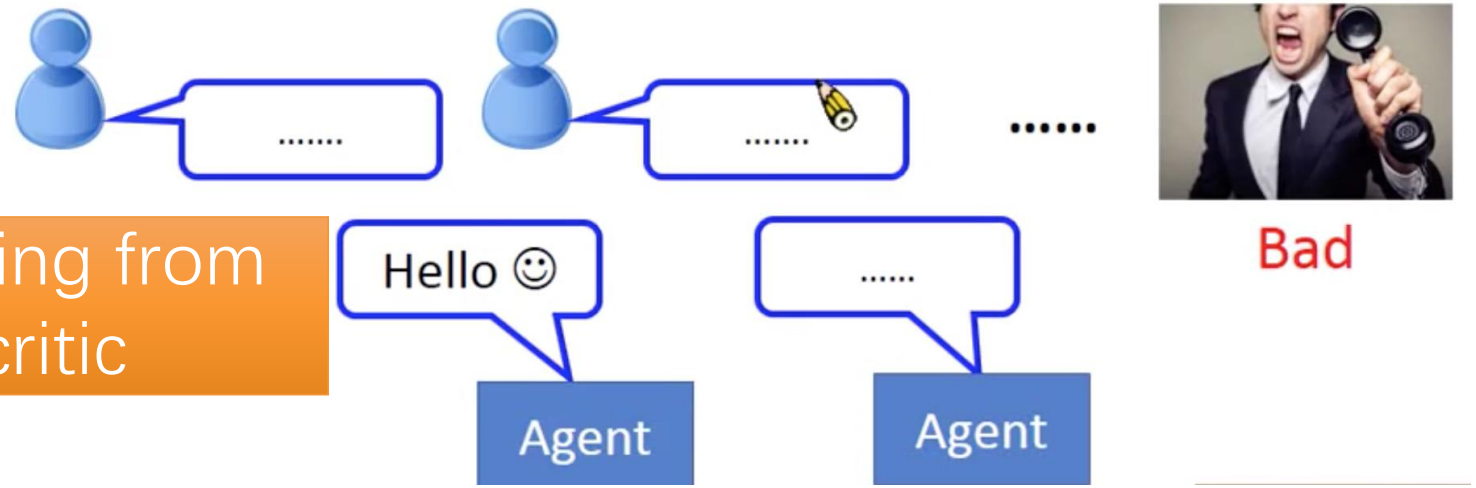
- Supervised

Learning from teacher



- Reinforcement

Learning from critic



Supervised v.s. Reinforcement

- Supervised

Next move:
"5-5"

Next move:
"3-3"

- Reinforcement

First move → ..... many moves ..... → Win!

Supervised v.s. Reinforcement

- Supervised

Next move:
"5-5"

Next move:
"3-3"

- Reinforcement

First move → ..... many moves ..... → Win!

Alpha Go is supervised learning + reinforcement learning.

2019
怪兽
学堂

THANKS