

# 對於人工智慧的 兩種不同期待

**Finetune vs. Prompt**

# 如何使用大型 語言模型

“A mouse riding on the head of an elephant, using reins to steer the giant creature.” (powered by Midjourney )



# 語言模型

GPT



文字接龍

how are \_\_\_\_\_

BERT



文字填空

how are you

# 對於人工智慧的兩種不同期待

- 期待一：成為專才

這堂課我們要講如何駕馭  
大型語言模型 .....



翻譯



This course  
is about .....

這堂課我們要講如何駕馭  
大型語言模型 .....



摘要

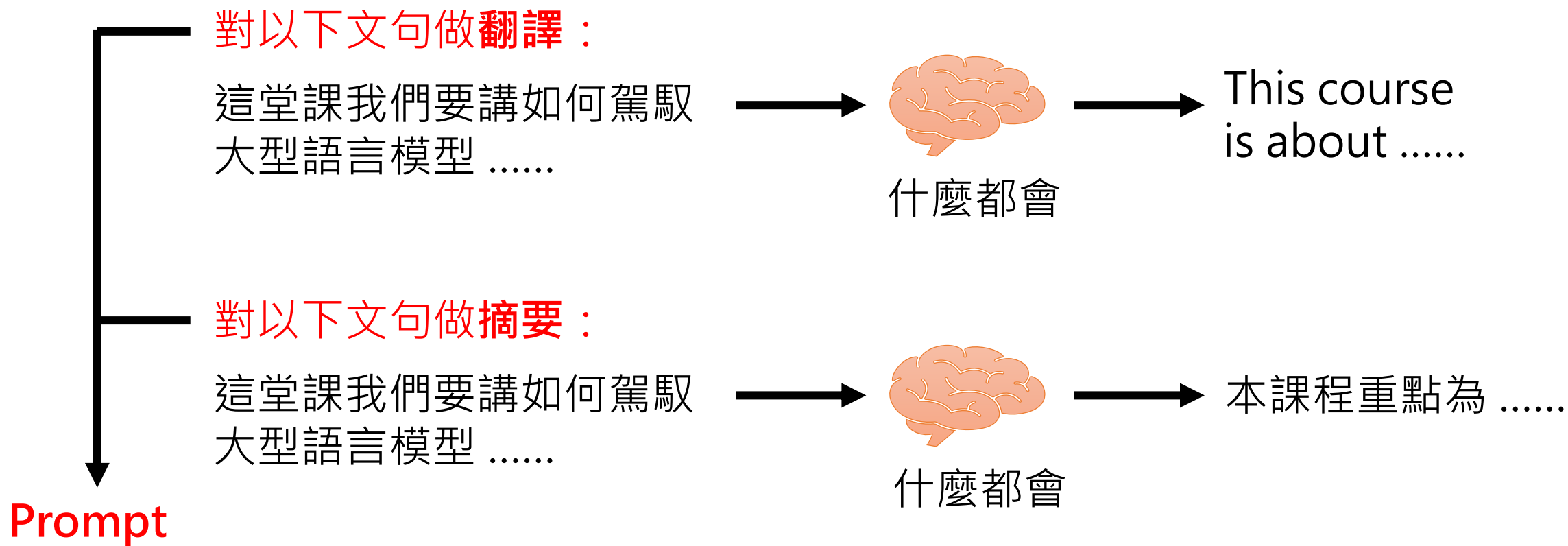


本課程重點為 .....

# 對於人工智慧的兩種不同期待

- 期待二：成為通才

這就是今日 ChatGPT 走的路線



# 對於人工智慧的兩種不同期待

- 期待二：成為通才

The Natural Language Decathlon: Multitask Learning as Question Answering

<https://arxiv.org/abs/1806.08730>

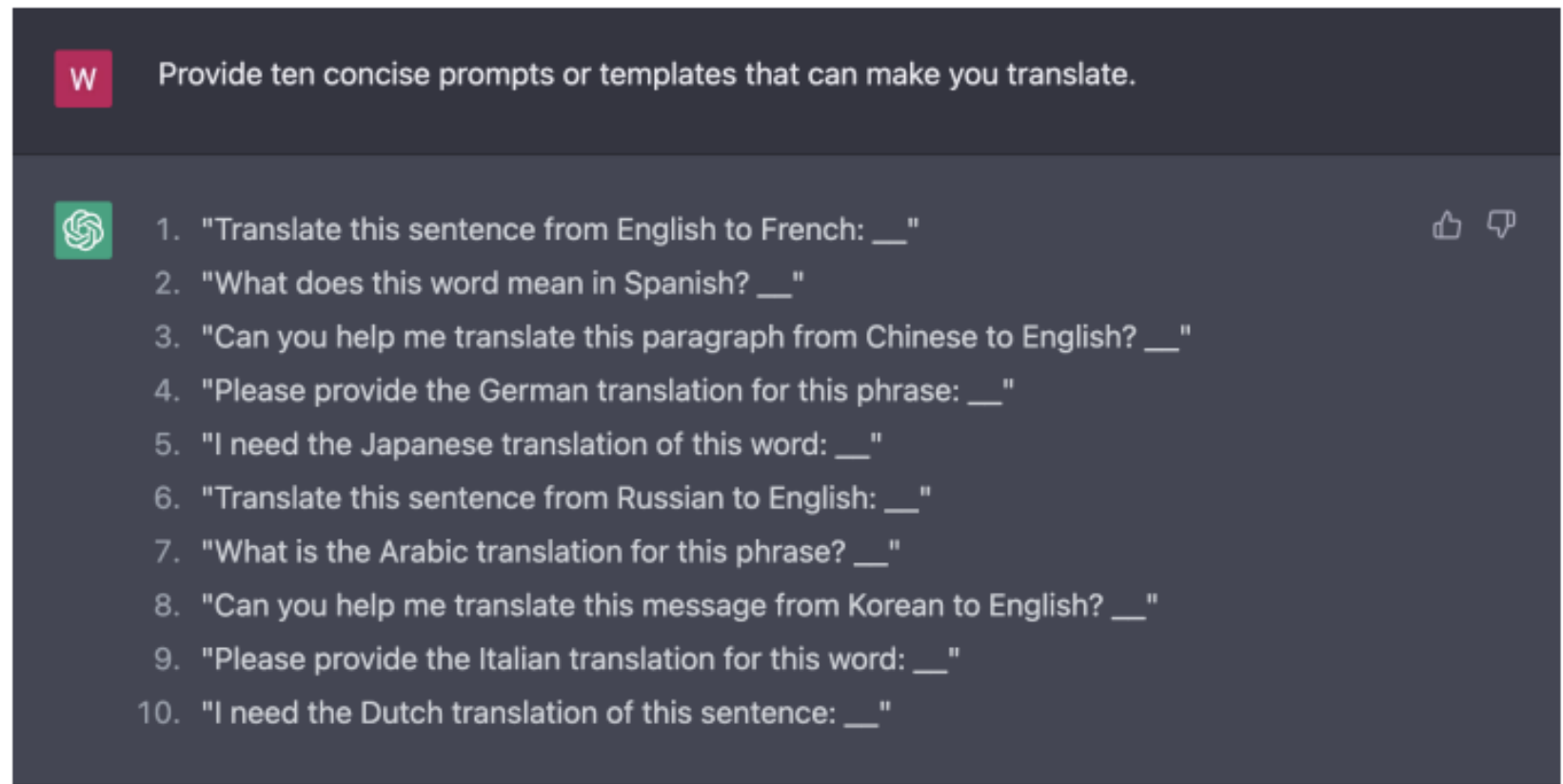
<u>Question</u>	<u>Context</u>	<u>Answer</u>	<u>Question</u>	<u>Context</u>	<u>Answer</u>
What is a major importance of Southern California in relation to California and the US?	...Southern California is a <b>major economic center</b> for the state of California and the US....	<b>major economic center</b>	What has something experienced?	Areas of the Baltic that have experienced <b>eutrophication</b> .	<b>eutrophication</b>
What is the translation from English to German?	Most of the planet is ocean water.	<b>Der Großteil der Erde ist Meerwasser</b>	Who is the illustrator of Cycle of the Werewolf?	Cycle of the Werewolf is a short novel by Stephen King, featuring illustrations by comic book artist <b>Bernie Wrightson</b> .	<b>Bernie Wrightson</b>
What is the summary?	<b>Harry Potter star Daniel Radcliffe</b> gains access to a reported <b>£320 million fortune</b> ...	<b>Harry Potter star Daniel Radcliffe gets £320M fortune...</b>	What is the change in dialogue state?	Are there any Eritrean restaurants in town?	<b>food: Eritrean</b>
Hypothesis: Product and geography are what make cream skimming work. <b>Entailment</b> , neutral, or contradiction?	Premise: Conceptually cream skimming has two basic dimensions – product and geography.	<b>Entailment</b>	What is the translation from English to SQL?	The <b>table</b> has column names... Tell me what the <b>notes</b> are for <b>South Australia</b>	<b>SELECT notes from table WHERE 'Current Slogan' = 'South Australia'</b>
Is this sentence <b>positive</b> or negative?	A stirring, funny and finally transporting re-imagining of Beauty and the Beast and 1930s horror film.	<b>positive</b>	Who had given help? <b>Susan</b> or Joan?	Joan made sure to thank Susan for all the help she had given.	<b>Susan</b>

Ask Me Anything: Dynamic Memory Networks for Natural Language Processing

<https://arxiv.org/abs/1506.07285>

# 對於人工智慧的兩種不同期待

- 成為專才的好處：專才在單一任務上有機會贏過通才



Is ChatGPT A Good Translator?  
A Preliminary Study

<https://arxiv.org/abs/2301.08745>



# 對於人工智慧的兩種不同期待

- 成為專才的好處：專才在單一任務上有機會贏過通才

System	De-En		Ro-En		Zh-En	
	⇒	⇐	⇒	⇐	⇒	⇐
Google	45.04	41.16	50.12	46.03	31.66	43.58
DeepL	49.23 <sub>(+9.3%)</sub>	41.46 <sub>(+0.7%)</sub>	50.61 <sub>(+0.9%)</sub>	48.39 <sub>(+5.1%)</sub>	31.22 <sub>(-1.3%)</sub>	44.31 <sub>(+1.6%)</sub>
Tencent	n/a	n/a	n/a	n/a	29.69 <sub>(-6.2%)</sub>	46.06 <sub>(+5.6%)</sub>
ChatGPT	43.71 <sub>(-2.9%)</sub>	38.87 <sub>(-5.5%)</sub>	44.95 <sub>(-10.3%)</sub>	24.85 <sub>(-46.0%)</sub>	24.73 <sub>(-21.8%)</sub>	38.27 <sub>(-12.1%)</sub>

System	De-Zh		Ro-Zh		De-Ro	
	⇒	⇐	⇒	⇐	⇒	⇐
Google	38.71	21.68	39.05	25.59	33.31	32.27
DeepL	40.46 <sub>(+4.5%)</sub>	22.82 <sub>(+5.2%)</sub>	38.95 <sub>(-0.2%)</sub>	25.39 <sub>(-0.7%)</sub>	35.19 <sub>(+5.6%)</sub>	34.27 <sub>(+6.1%)</sub>
Tencent	40.66 <sub>(+5.0%)</sub>	19.44 <sub>(-10.3%)</sub>	n/a	n/a	n/a	n/a
ChatGPT	34.46 <sub>(-10.9%)</sub>	19.80 <sub>(-8.6%)</sub>	30.84 <sub>(-21.0%)</sub>	19.17 <sub>(-25.0%)</sub>	33.38 <sub>(+0.2%)</sub>	29.89 <sub>(-7.3%)</sub>

Is ChatGPT A Good Translator?  
A Preliminary Study

<https://arxiv.org/abs/2301.08745>



# 對於人工智慧的兩種不同期待

- 成為通才的好處：只要重新設計 prompt 就可以快速開發新功能，不用寫程式

對以下文句做**摘要**：

這堂課我們要講如何駕馭  
大型語言模型 .....



什麼都會



本課程重點為 .....

還是太長



請給我 **100 字**以內的**摘要**：

這堂課我們要講如何駕馭  
大型語言模型 .....



什麼都會



重點是 .....

# 兩種不同期待導致兩類不同的使用方式

- 期待一：成為專才

這堂課我們要講如何駕馭  
大型語言模型 .....



翻譯



This course  
is about .....

- 期待二：成為通才

對以下文句做**翻譯**：

這堂課我們要講如何駕馭  
大型語言模型 .....



什麼都會



This course  
is about .....

# 對預訓練模型做改造

BERT

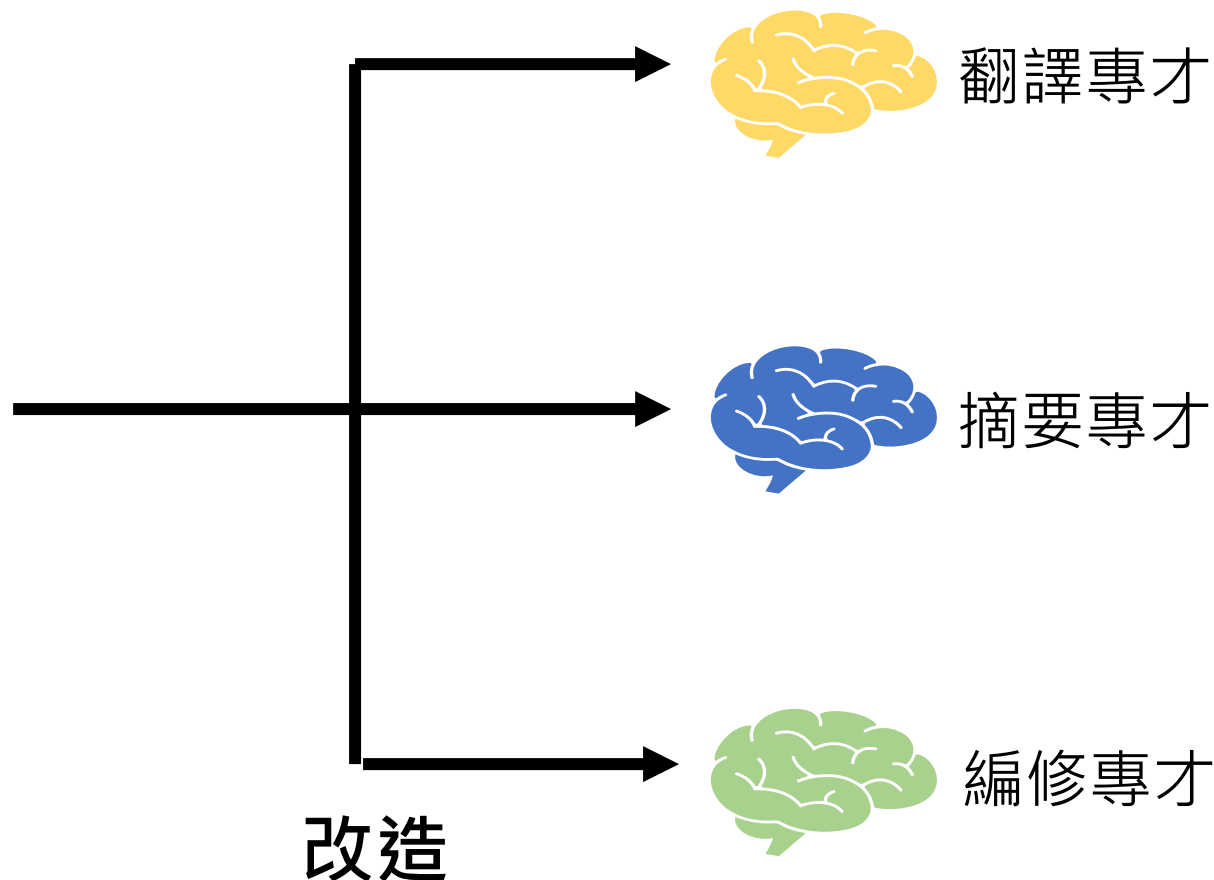


文字填空

how are you



語言模型

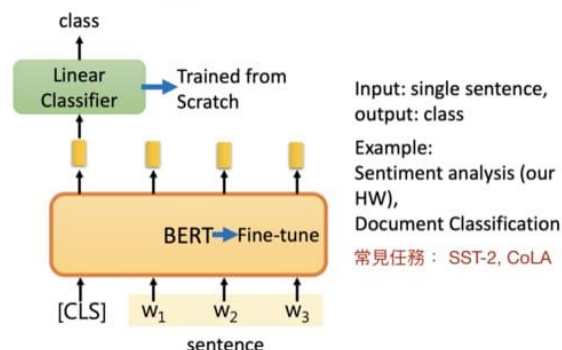


加外掛和微調參數

# 對預訓練模型做改造 — 加外掛 (Head)

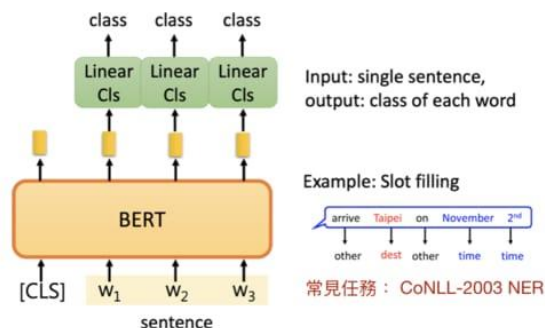
單一句子分類任務

bertForSequenceClassification



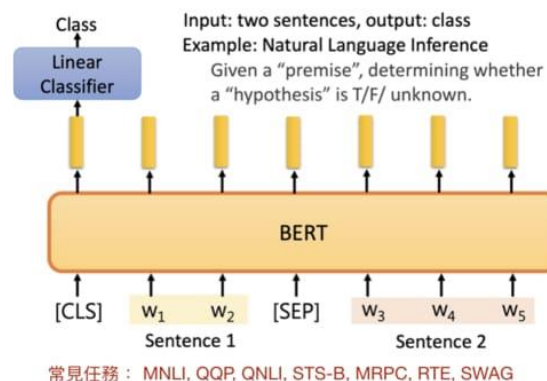
單一句子標註任務

bertForTokenClassification



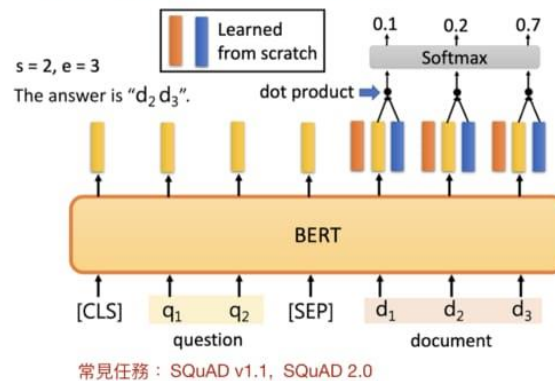
成對句子分類任務

bertForSequenceClassification

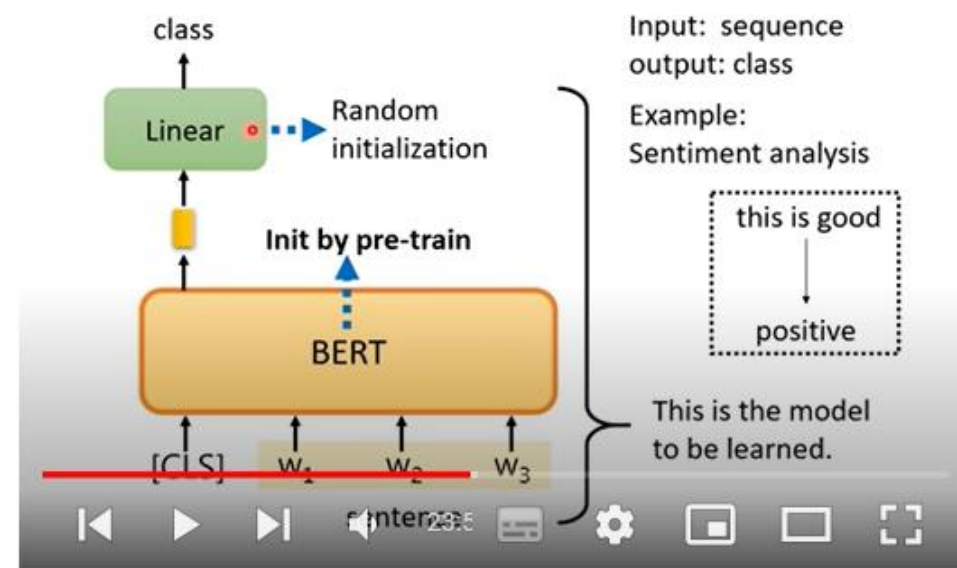


問答任務

bertForQuestionAnswering



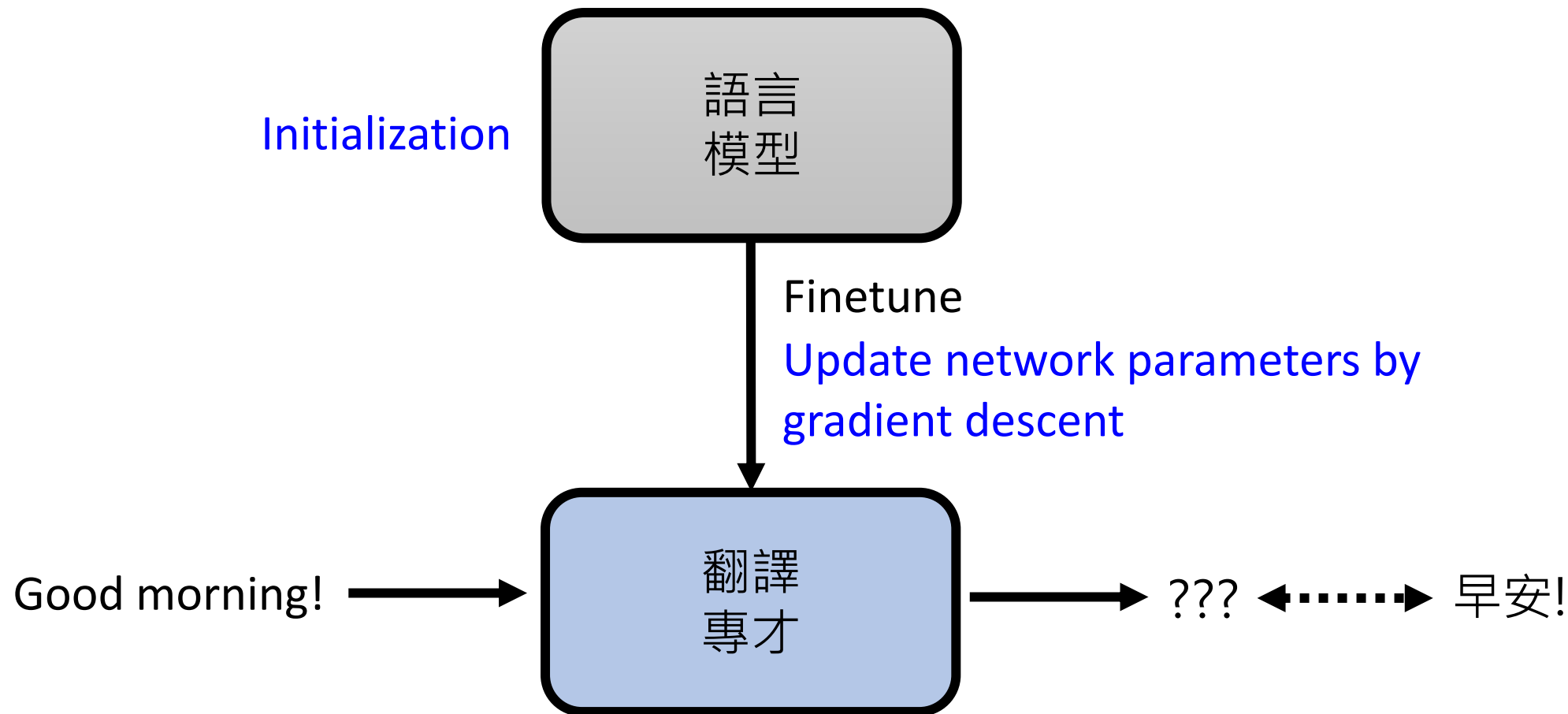
## How to use BERT – Case 1



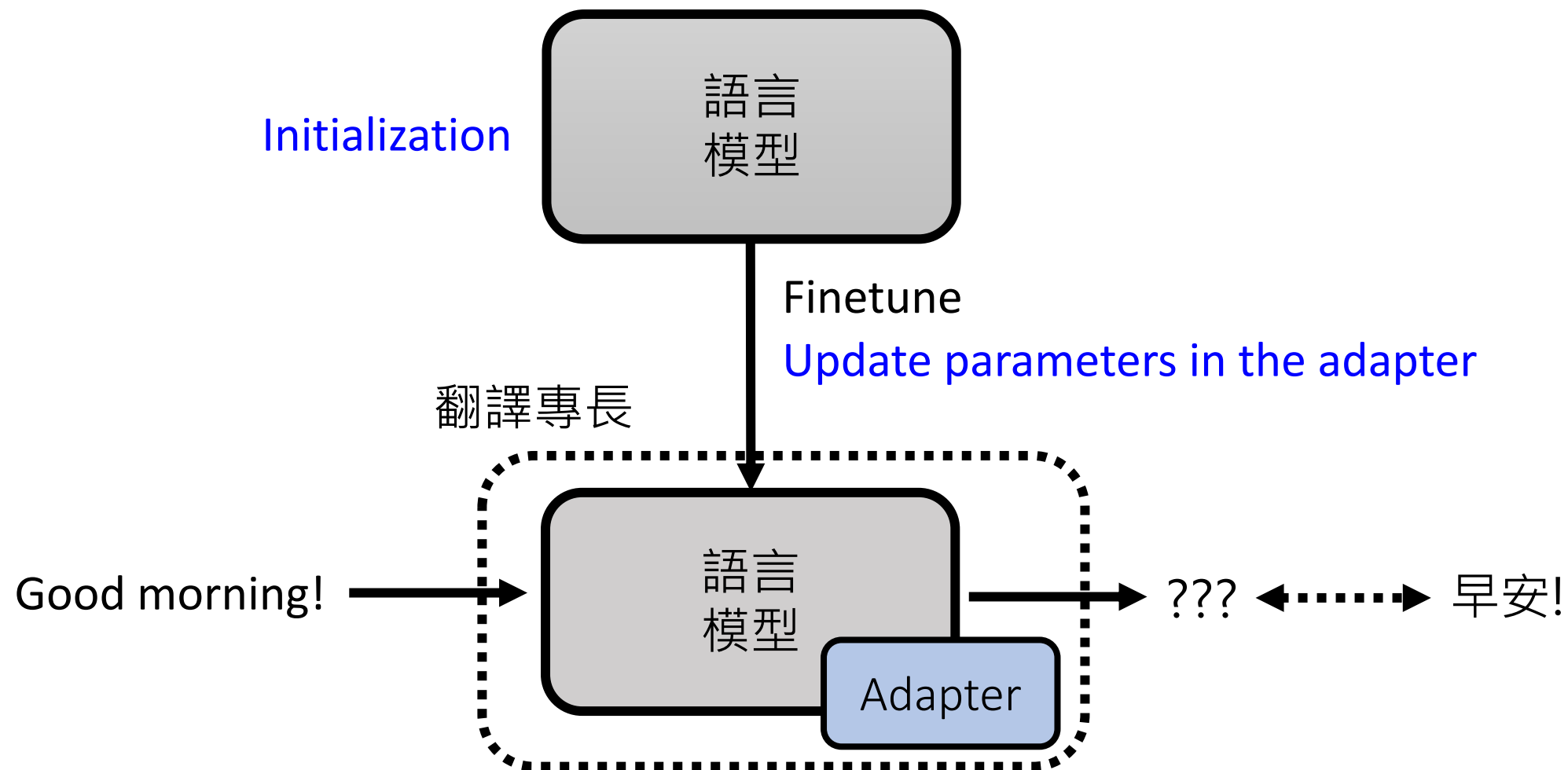
【機器學習2021】自督導式學習 (Self-supervised Learning) (二) - BERT簡介

<https://youtu.be/gh0hewYkjgo>

# 對預訓練模型做改造 — 微調 (Finetune)



# 對預訓練模型做改造 — Adapter



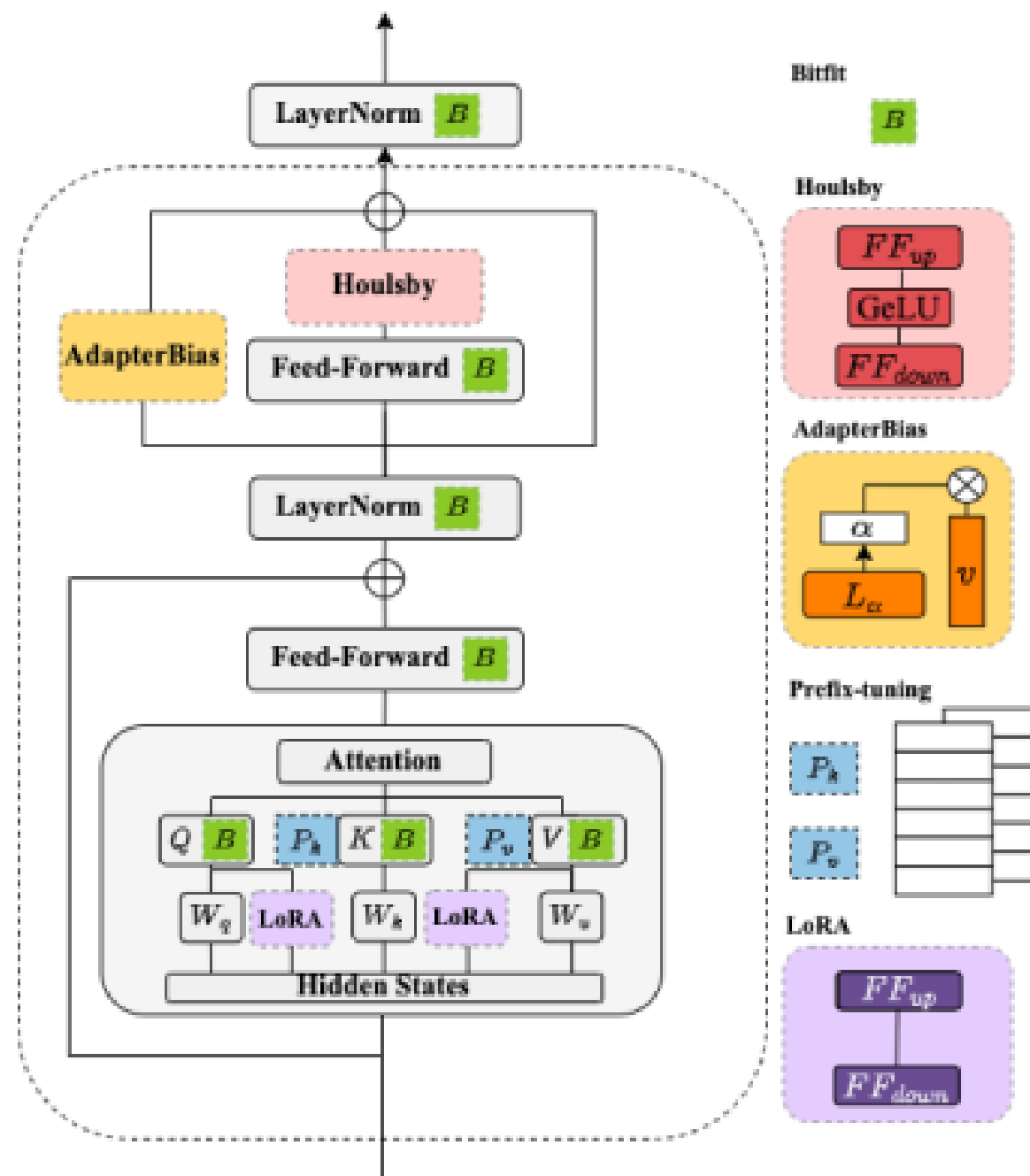
# 各種 Adapter



<https://adapterhub.ml/>

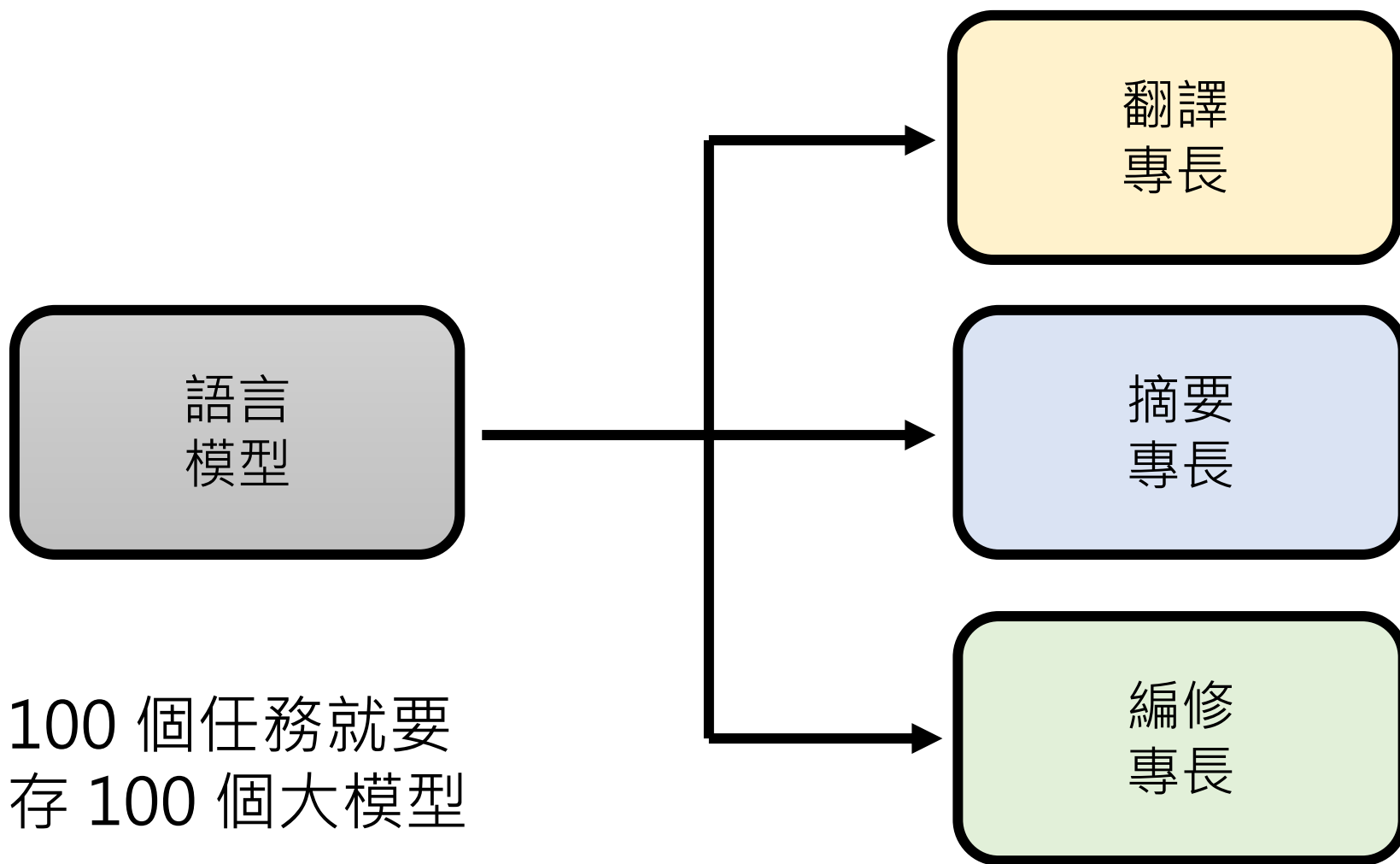
Source of image:

<https://arxiv.org/abs/2210.06175>



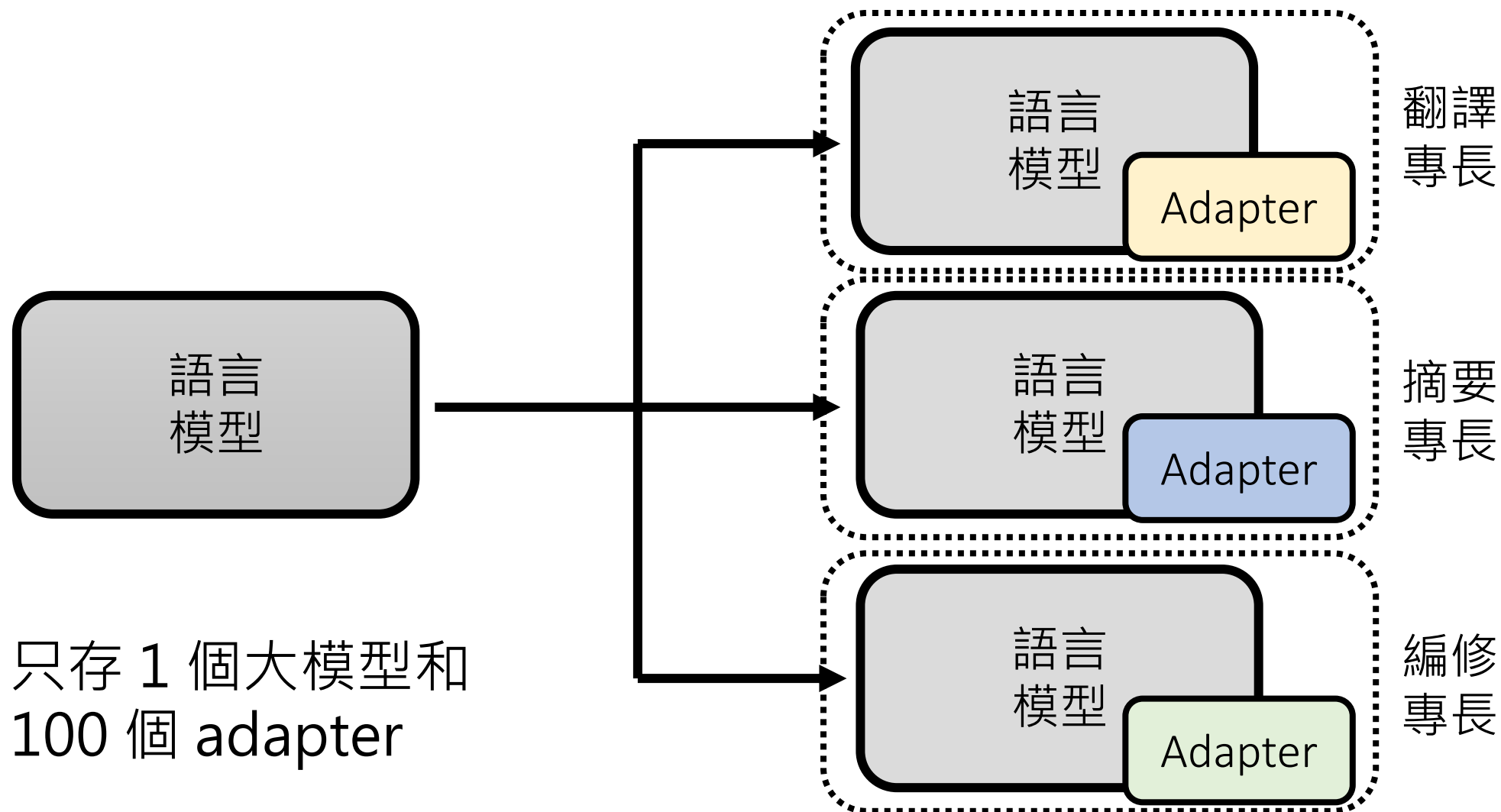


# 對預訓練模型做改造 — Adapter



100 個任務就要  
存 100 個大模型

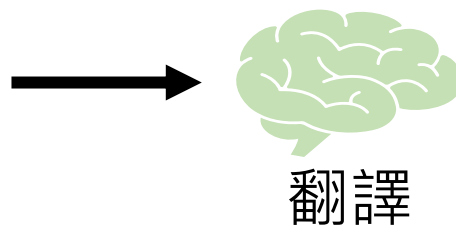
# 對預訓練模型做改造 — Adapter



# 兩種不同期待導致兩類不同的使用方式

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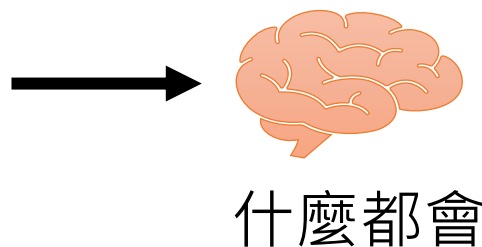


→ This course  
is about .....

- 期待二：成為通才

對以下文句做**翻譯**：

這堂課我們要講如何駕馭  
大型語言模型 .....



→ This course  
is about .....

# 機器要學會讀題目敘述或題目範例

第一部份：詞彙和結構

本部份共 15 題，每題含一個空格。請就試題冊上 A、B、C、D 四個選項中選出最適合題意的字或詞，標示在答案紙上。

例：

It's eight o'clock now. Sue \_\_\_\_\_ in her bedroom.

- A. study
- B. studies
- C. studied
- D. is studying

正確答案為 D，請在答案紙上塗黑作答。

題目敘述

Instruction Learning

範例 In-context Learning

# How to use GPT?

第一部份：詞彙和結構

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## Description

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為什麼 GPT 系列沒有跟 BERT 一樣去微調參數？

- 一開始 OpenAI 對於 AI 就有比較高的期待？
- 因為 BERT 已經做了微調參數，只好另闢蹊徑？

【機器學習2021】自督導式學習 (Self-supervised Learning) (四) – GPT的野望

[https://youtu.be/WY\\_E0Sd4K80](https://youtu.be/WY_E0Sd4K80)

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範例 In-context Learning

# In-context Learning

今天天氣真好 分隔 正面 分隔

今天運氣真差 分隔 負面 分隔

這朵花真美 分隔 正面 分隔

我真的是累了 分隔 負面 分隔

真的能從這些例子學習？

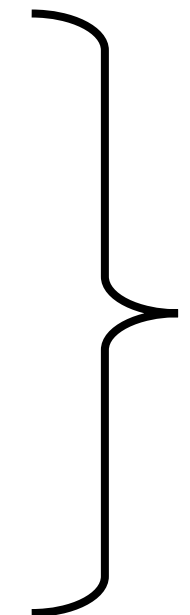
給一些例子

我感到非常高興

語言模型

正面

任務：情感分析





# In-context Learning

Rethinking the Role of Demonstrations: What Makes In-Context Learning Work?

Ref: <https://arxiv.org/abs/2202.12837>

今天天氣真好 分隔 負面 分隔

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故意給錯誤標註

給一些例子

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語言模型

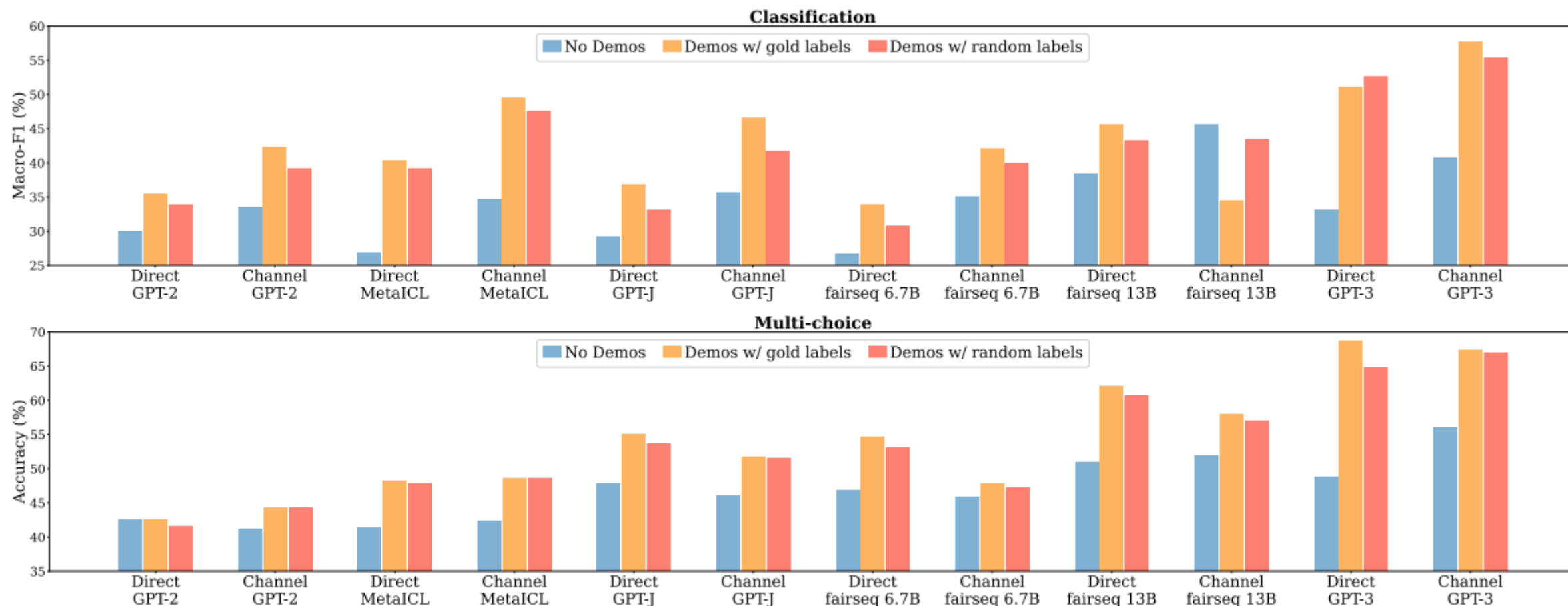
正面

任務：情感分析

# In-context Learning

Rethinking the Role of Demonstrations: What Makes In-Context Learning Work?

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# In-context Learning

&#(&\$%@# 分隔 負面 分隔

&#(&\$%@# 分隔 正面 分隔

&#(^\$@# 分隔 負面 分隔

#&(&\$%&) 分隔 正面 分隔

故意給錯誤標註  
給一些例子  
故意給無關的輸入

我感到非常高興

語言模型

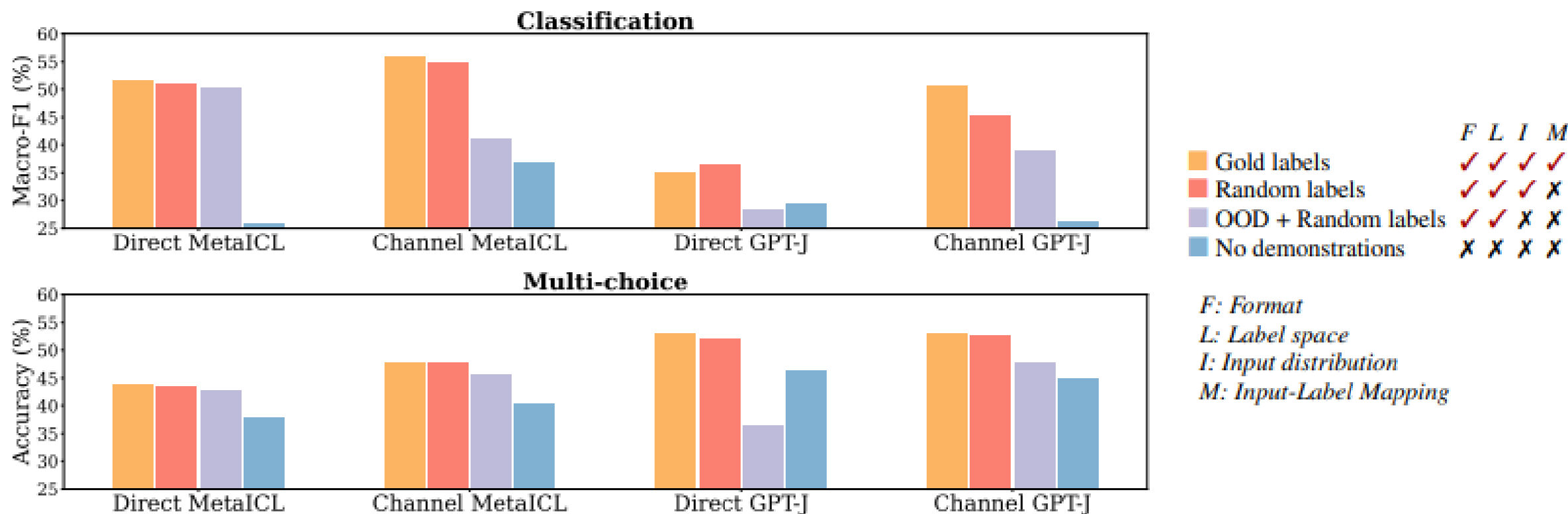
正面

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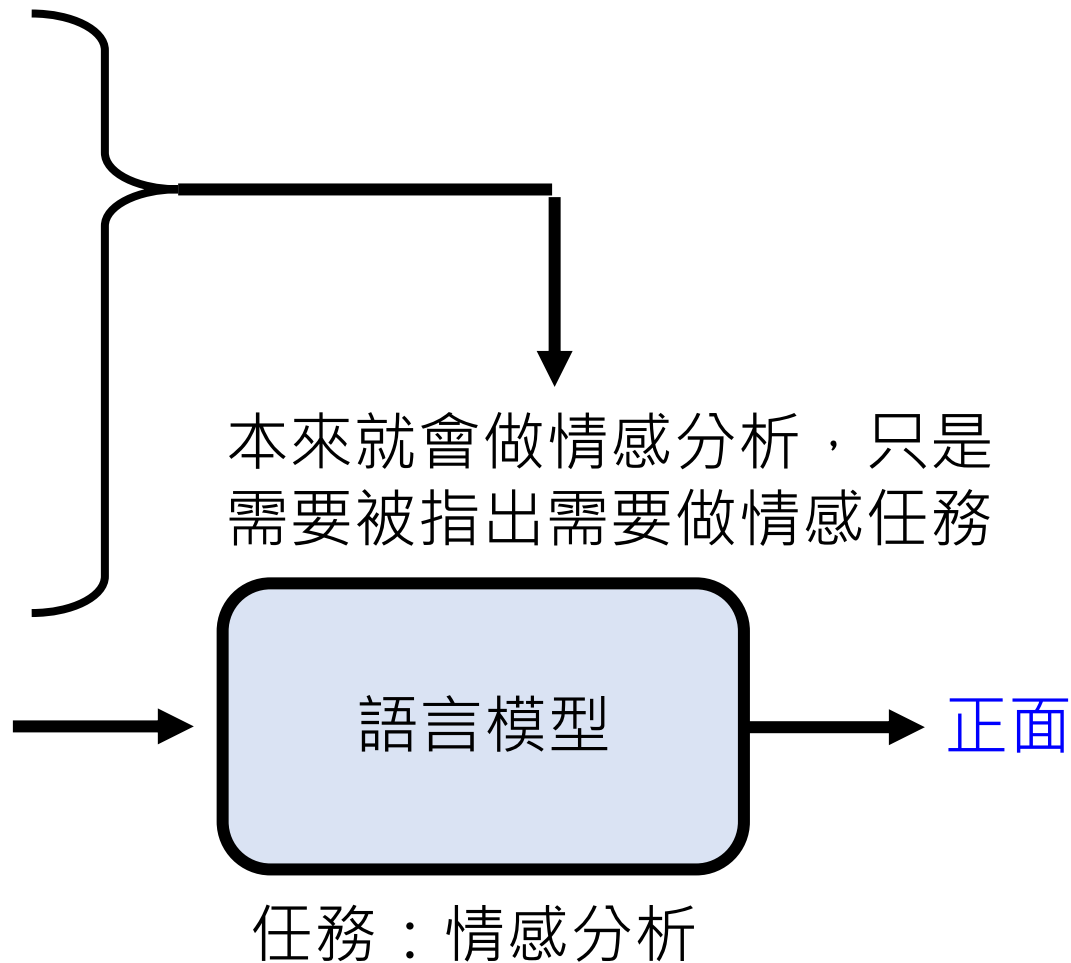
我感到非常高興

本來就會做情感分析，只是  
需要被指出需要做情感任務

語言模型

正面

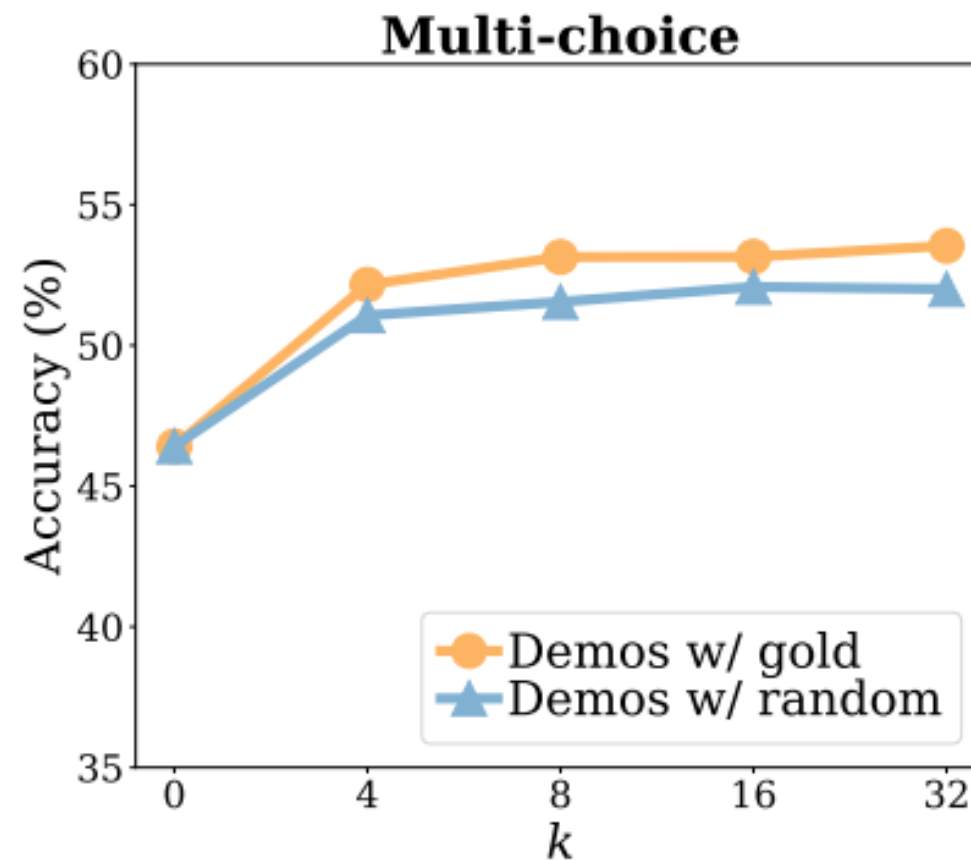
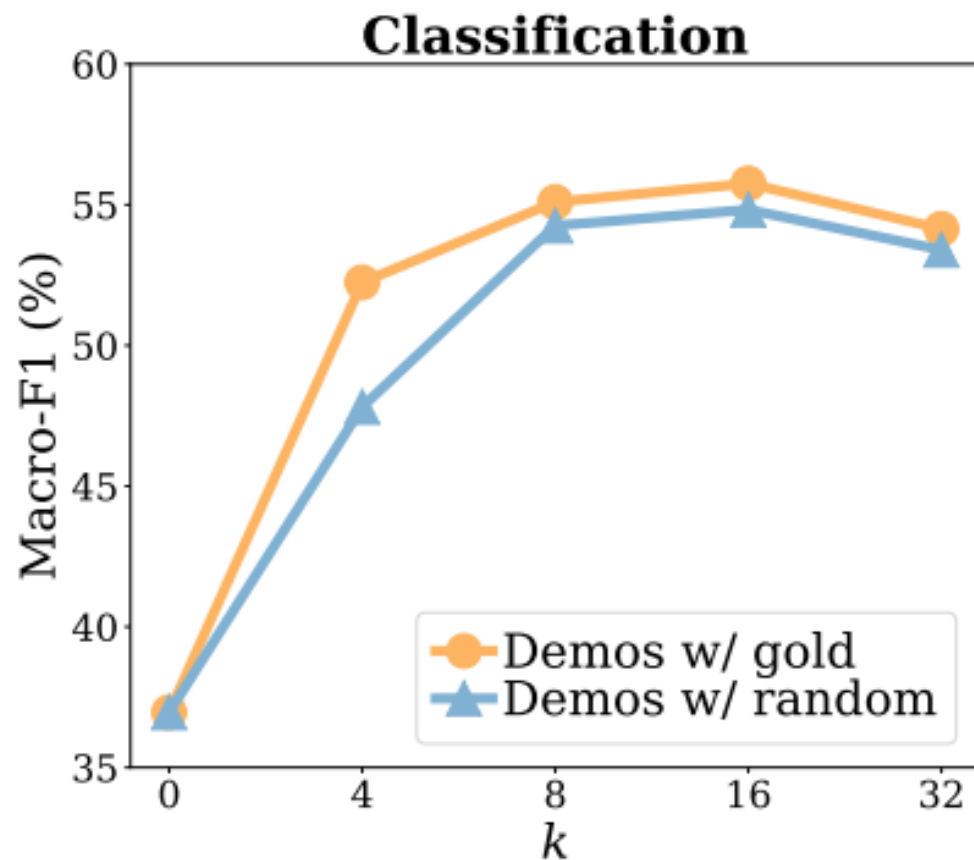
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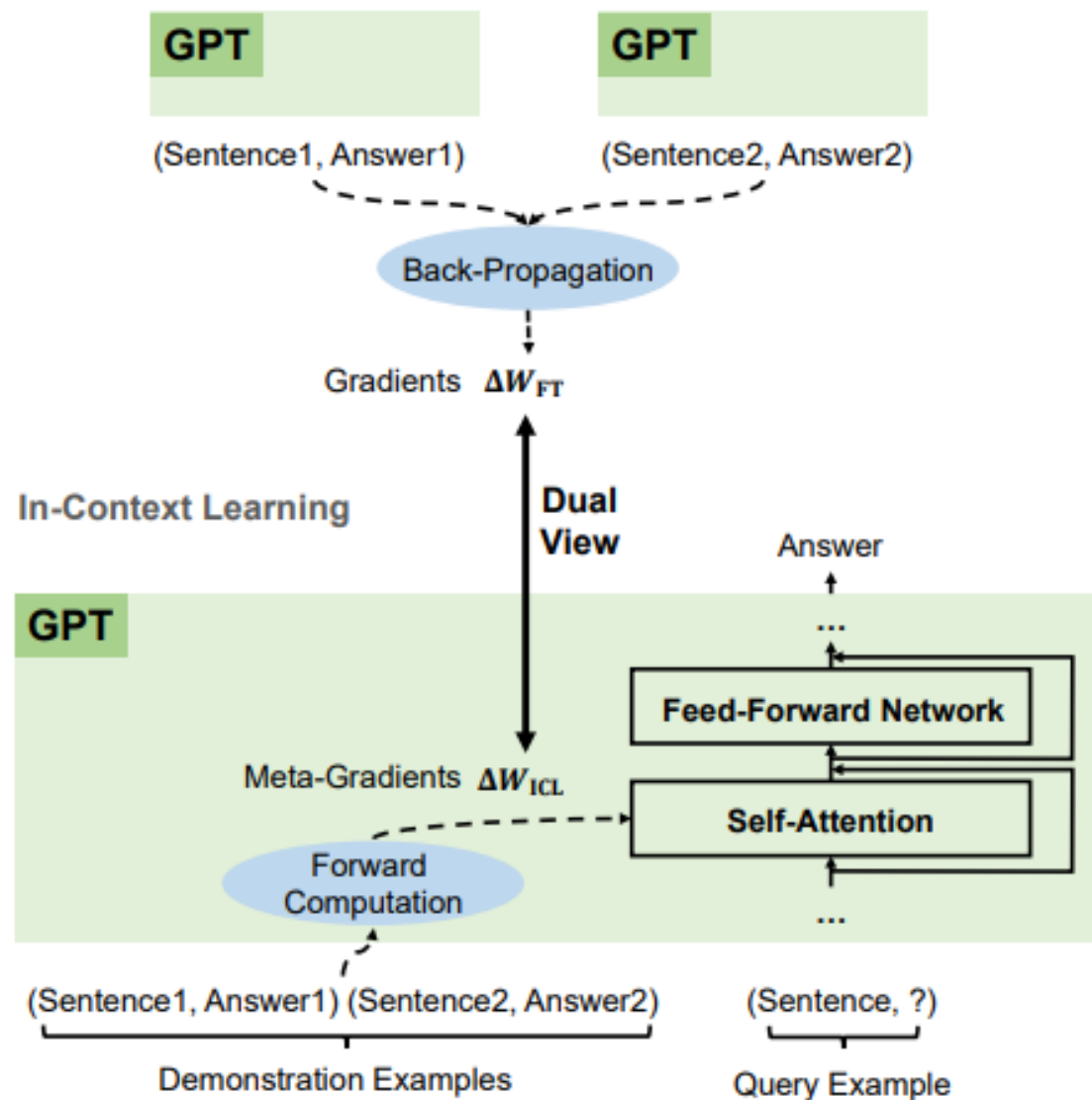


# In-context Learning

<https://arxiv.org/abs/2212.10559>

<https://arxiv.org/abs/2211.15661>

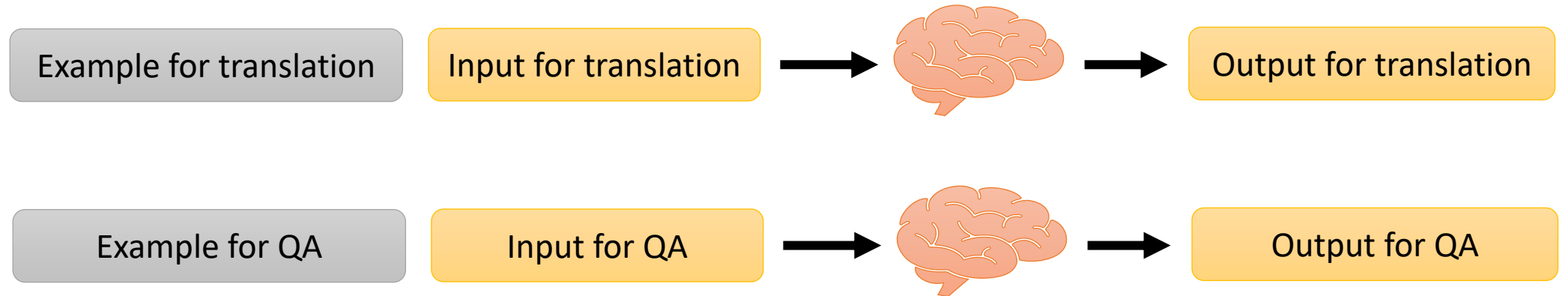
## Finetuning



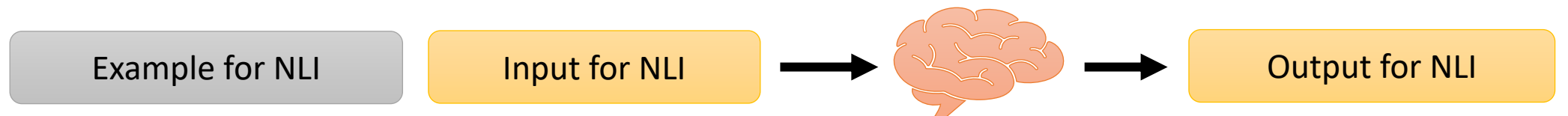


# Learning In-context Learning

**Training**



**Testing**



NLI = Natural Language Inference

# 機器要學會讀題目敘述或題目範例

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題目敘述

Instruction Learning

範例 In-context Learning

# Instruction-tuning

## Training

對以下文句做翻譯：這堂課我們要講如何駕馭大型語言模型 .....



This course is about .....

對以下文句做摘要：這堂課我們要講如何駕馭大型語言模型 .....



本課程重點為 .....

## Testing

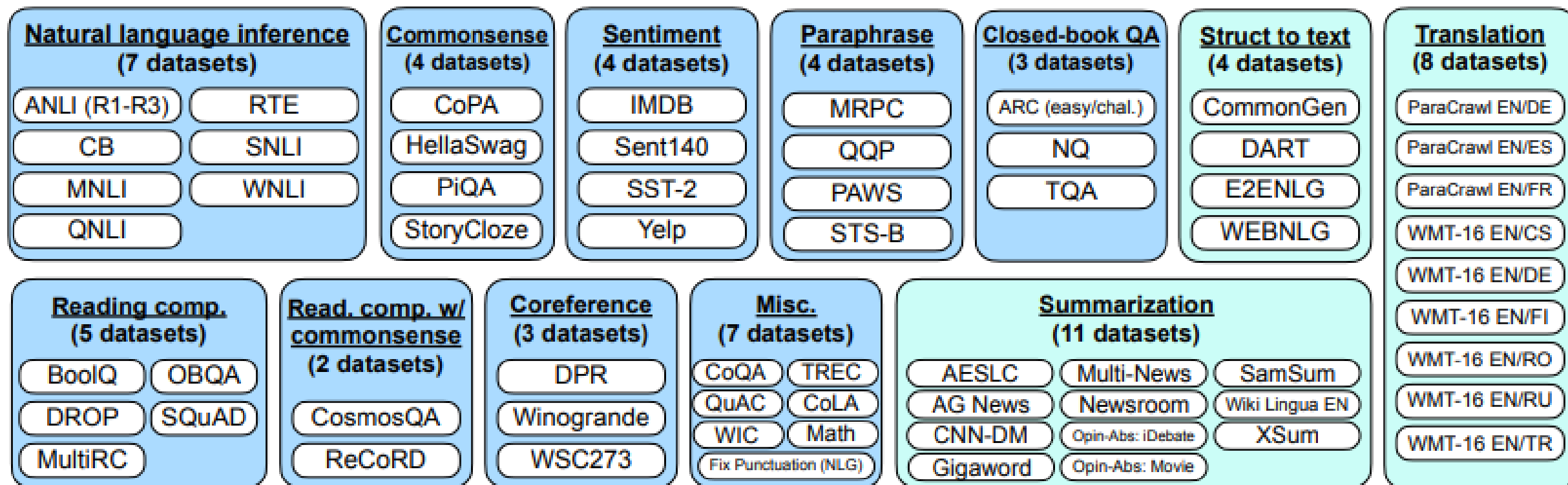
請幫我編修以下文句："How is you?"



"How are you?"

# Instruction-tuning

FLAN (Finetuned Language Net)  
<https://arxiv.org/abs/2109.01652>



# Instruction-tuning

FLAN (Finetuned Language Net)  
<https://arxiv.org/abs/2109.01652>

## Premise

Russian cosmonaut Valery Polyakov set the record for the longest continuous amount of time spent in space, a staggering 438 days, between 1994 and 1995.

## Hypothesis

Russians hold the record for the longest stay in space.

## Target

Entailment  
Not entailment



Options:

- yes
- no



## Template 1

<premise>

Based on the paragraph above, can we conclude that <hypothesis>?

<options>

## Template 2

<premise>

Can we infer the following?

<hypothesis>

<options>

## Template 3

Read the following and determine if the hypothesis can be inferred from the premise:

Premise: <premise>

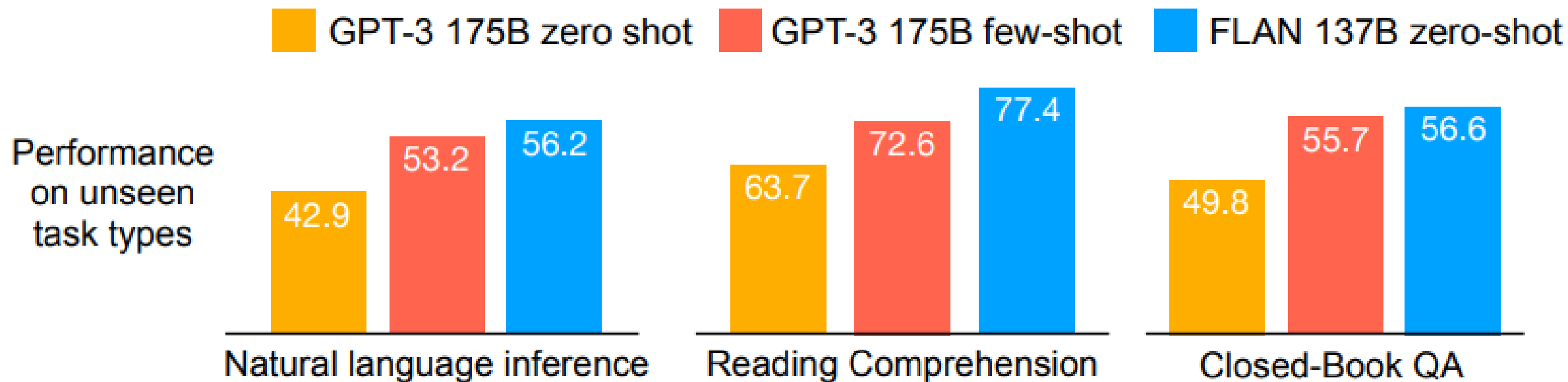
Hypothesis: <hypothesis>

<options>

## Template 4, ...

# Instruction-tuning

FLAN (Finetuned Language Net)  
<https://arxiv.org/abs/2109.01652>



# Chain of Thought (CoT) Prompting

- 

## Standard Prompting

### Input

Q: Roger has 5 tennis balls. He buys 2 more cans of tennis balls. Each can has 3 tennis balls. How many tennis balls does he have now?

A: The answer is 11.

Q: The cafeteria had 23 apples. If they used 20 to make lunch and bought 6 more, how many apples do they have?

### Model Output

A: The answer is 27. ❌

## Chain of Thought Prompting

### Input

Q: Roger has 5 tennis balls. He buys 2 more cans of tennis balls. Each can has 3 tennis balls. How many tennis balls does he have now?

A: Roger started with 5 balls. 2 cans of 3 tennis balls each is 6 tennis balls.  $5 + 6 = 11$ . The answer is 11.

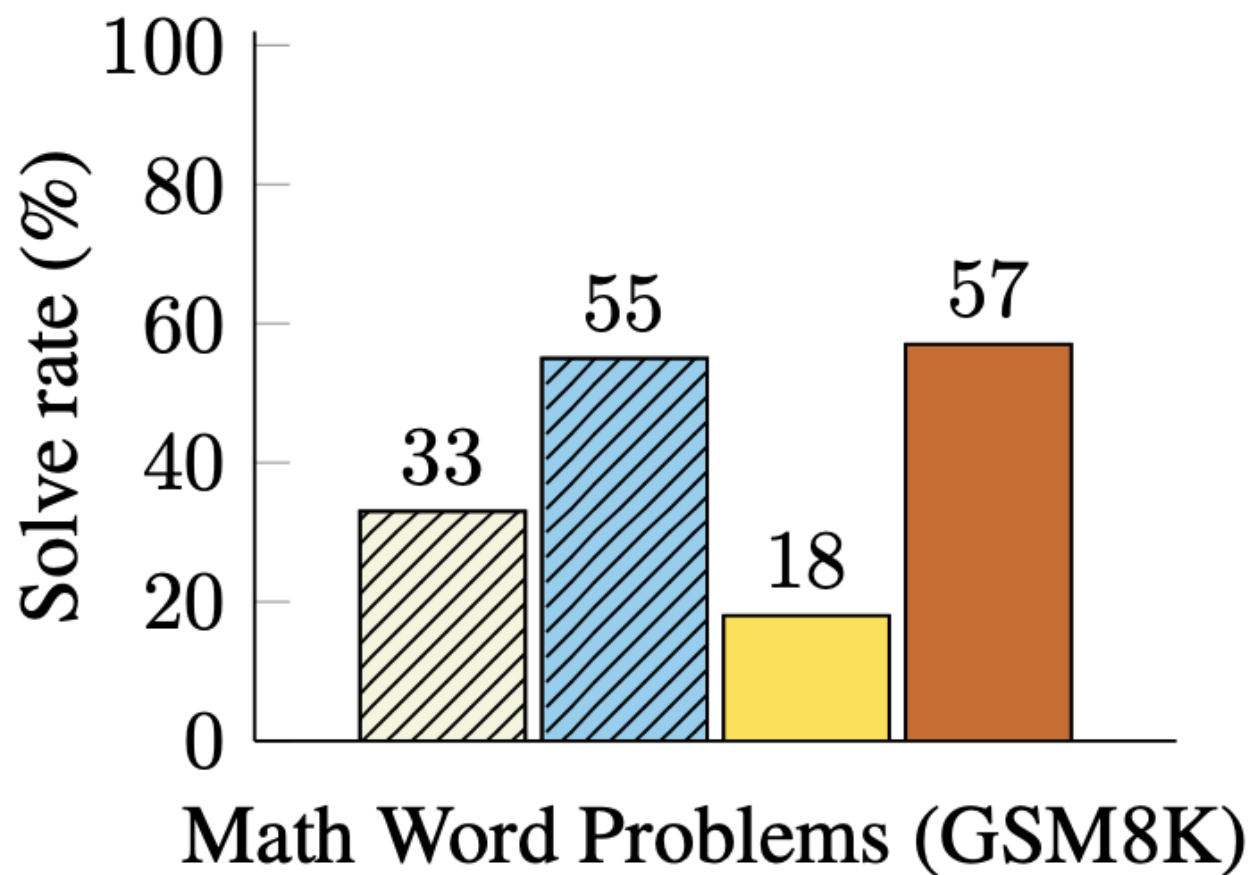
Q: The cafeteria had 23 apples. If they used 20 to make lunch and bought 6 more, how many apples do they have?

### Model Output

A: The cafeteria had 23 apples originally. They used 20 to make lunch. So they had  $23 - 20 = 3$ . They bought 6 more apples, so they have  $3 + 6 = 9$ . The answer is 9. ✅



- Finetuned GPT-3 175B
- Prior best
- PaLM 540B: standard prompting
- PaLM 540B: chain-of-thought prompting



Ref: <https://arxiv.org/abs/2201.11903>

# Chain of Thought (CoT) Prompting

(a) Few-shot

Q: Roger has 5 tennis balls. He buys 2 more cans of tennis balls. Each can has 3 tennis balls. How many tennis balls does he have now?

A: The answer is 11.

Q: A juggler can juggle 16 balls. Half of the balls are golf balls, and half of the golf balls are blue. How many blue golf balls are there?

A:

(Output) The answer is 8. **X**

(b) Few-shot-CoT

Q: Roger has 5 tennis balls. He buys 2 more cans of tennis balls. Each can has 3 tennis balls. How many tennis balls does he have now?

A: Roger started with 5 balls. 2 cans of 3 tennis balls each is 6 tennis balls.  $5 + 6 = 11$ . The answer is 11.

Q: A juggler can juggle 16 balls. Half of the balls are golf balls, and half of the golf balls are blue. How many blue golf balls are there?

A:

(Output) The juggler can juggle 16 balls. Half of the balls are golf balls. So there are  $16 / 2 = 8$  golf balls. Half of the golf balls are blue. So there are  $8 / 2 = 4$  blue golf balls. The answer is 4. **✓**

(c) Zero-shot

Q: A juggler can juggle 16 balls. Half of the balls are golf balls, and half of the golf balls are blue. How many blue golf balls are there?

A: The answer (arabic numerals) is

(Output) 8 **X**

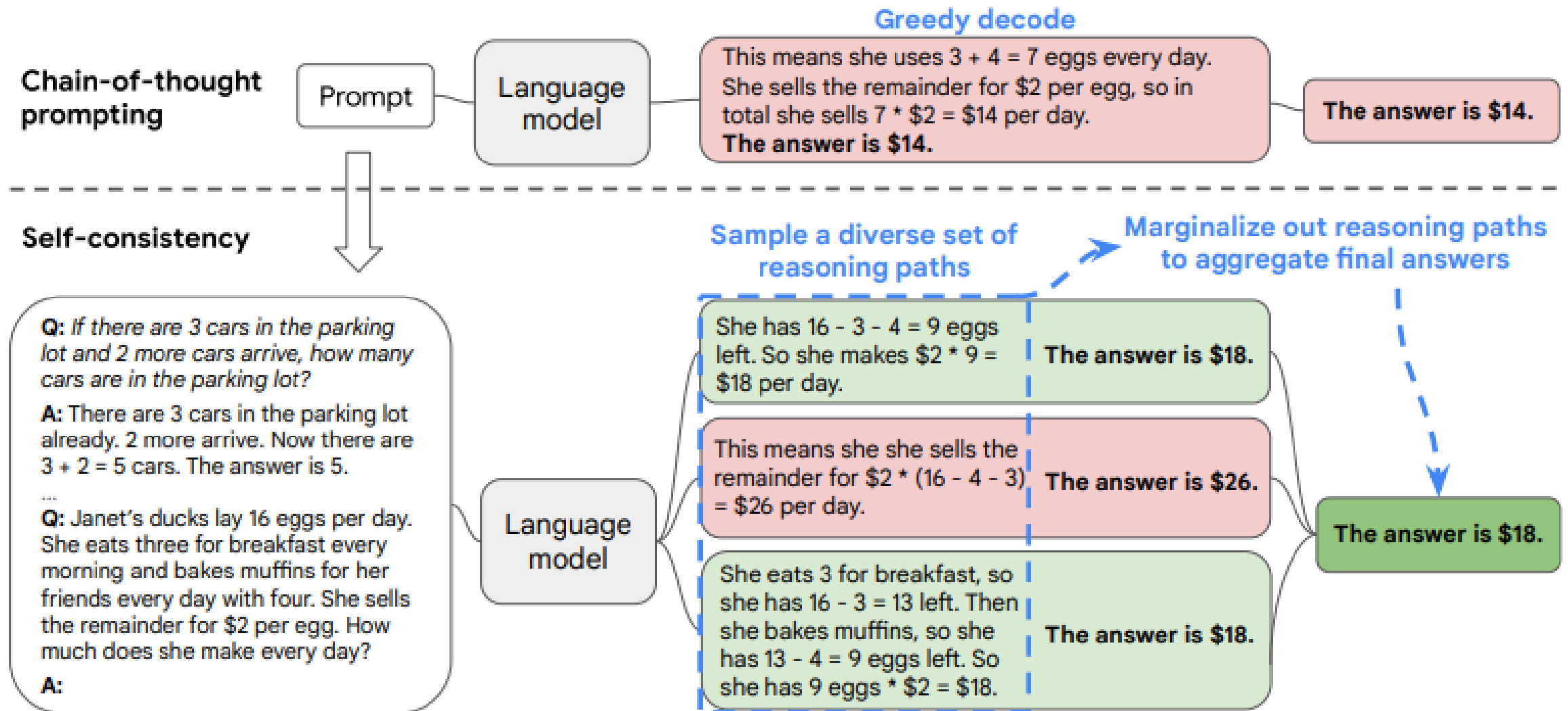
(d) Zero-shot-CoT (Ours)

Q: A juggler can juggle 16 balls. Half of the balls are golf balls, and half of the golf balls are blue. How many blue golf balls are there?

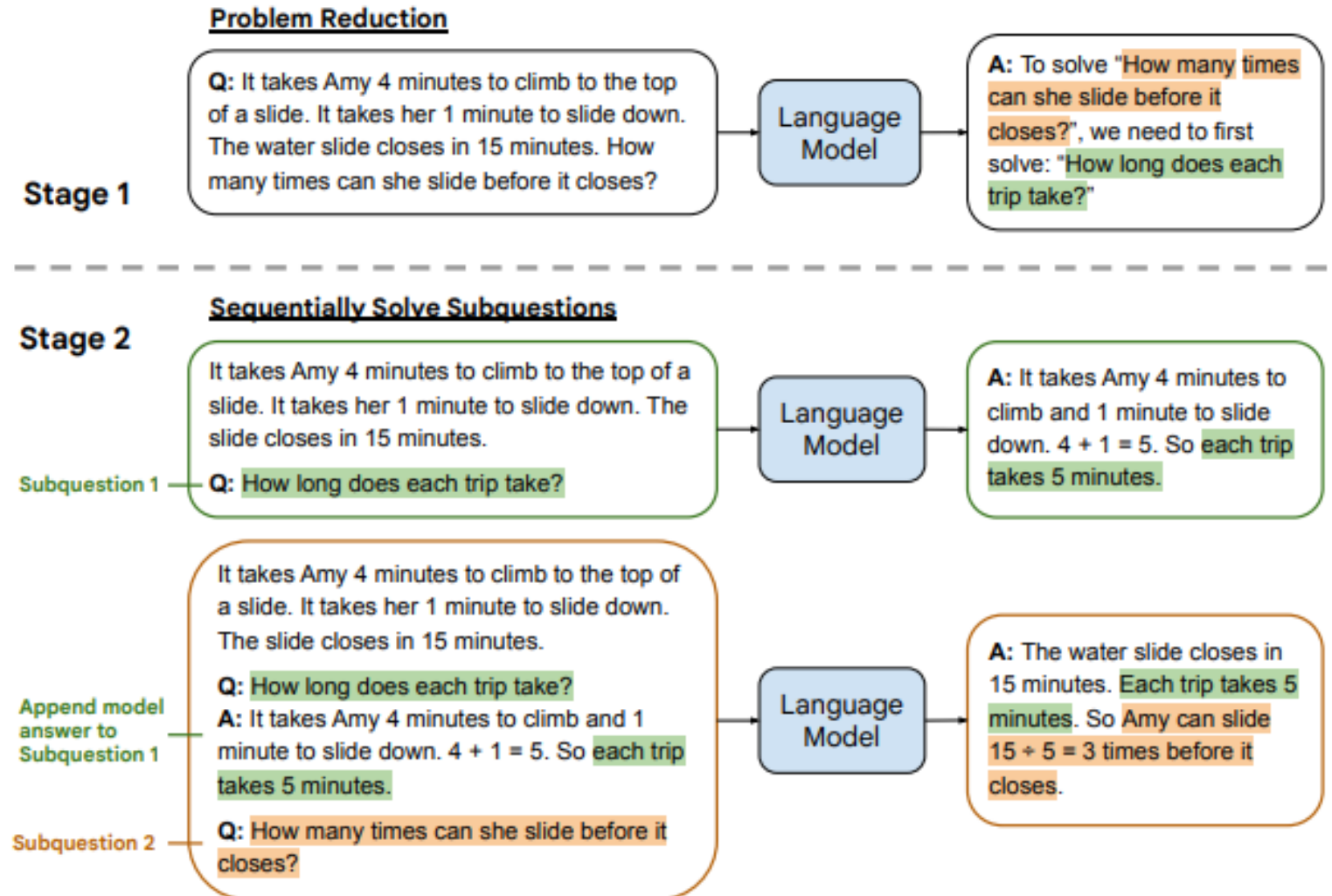
A: **Let's think step by step.**

(Output) There are 16 balls in total. Half of the balls are golf balls. That means that there are 8 golf balls. Half of the golf balls are blue. That means that there are 4 blue golf balls. **✓**

# Chain of Thought (CoT) Prompting

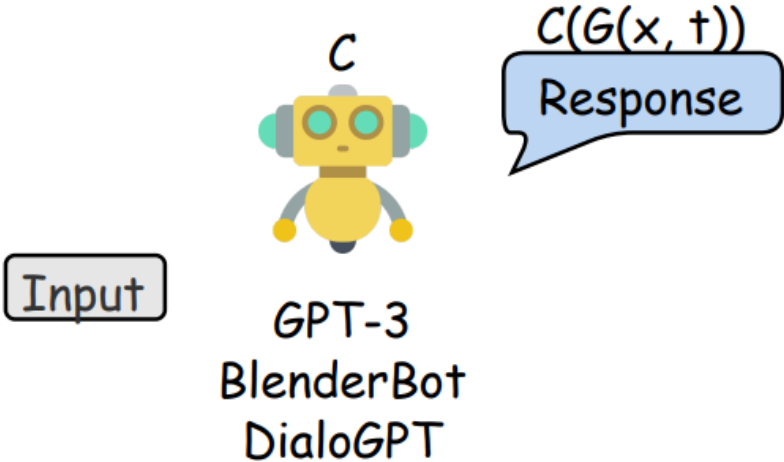


# Chain of Thought (CoT) Prompting



# 用機器來找 Prompt

- Using reinforcement learning



# 用機器來找 Prompt

- Using an LM to find prompt

今天天氣真好 分隔 正面 分隔

今天運氣真差 分隔 負面 分隔

這朵花真美 分隔 正面 分隔

我真的是累了 分隔 負面 分隔

## Forward Generation Template

I gave a friend an instruction and five inputs. The friend read the instruction and wrote an output for every one of the inputs. Here are the input-output pairs:

Input:  $[Q_1]$     Output:  $[A_1]$

Input:  $[Q_2]$     Output:  $[A_2]$

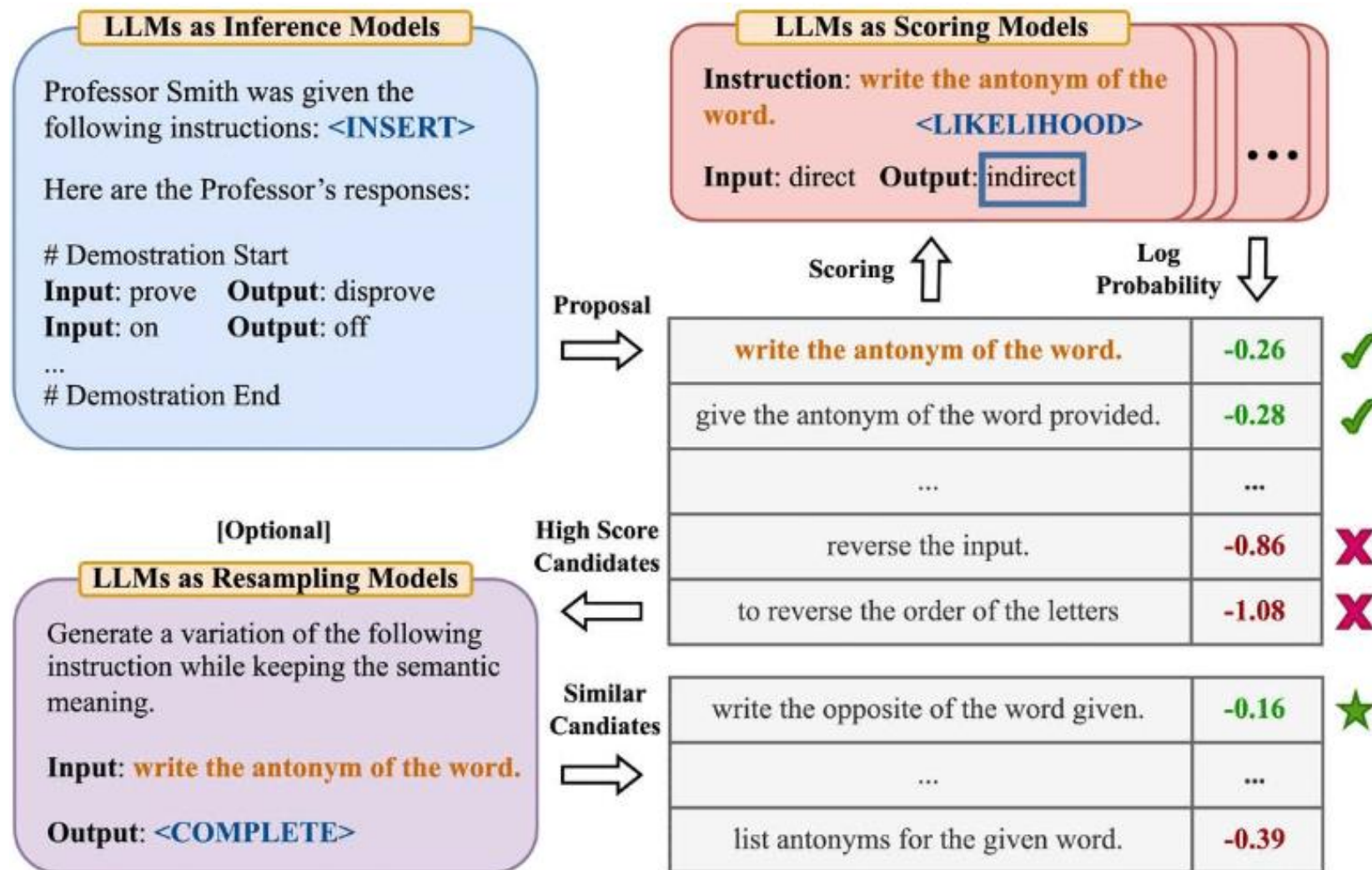
...

The instruction was **<COMPLETE>**

請決定這句話是正面還是負面



# 用機器來找 Prompt



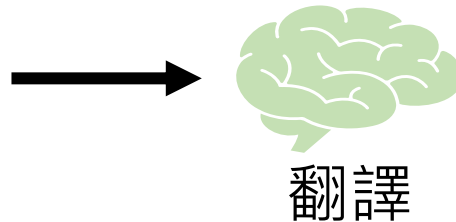
No.	Category	Zero-shot CoT Trigger Prompt	Accuracy
1	APE	Let's work this out in a step by step way to be sure we have the right answer.	<b>82.0</b>
2	Human-Designed	Let's think step by step. (*1)	78.7
3		First, (*2)	77.3
4		Let's think about this logically.	74.5
5		Let's solve this problem by splitting it into steps. (*3)	72.2
6		Let's be realistic and think step by step.	70.8
7		Let's think like a detective step by step.	70.3
8		Let's think	57.5
9		Before we dive into the answer,	55.7
10		The answer is after the proof.	45.7
-		(Zero-shot)	17.7



# 兩種不同期待導致兩類不同的使用方式

- 期待一：成為專才

這堂課我們要講如何駕馭  
大型語言模型 .....

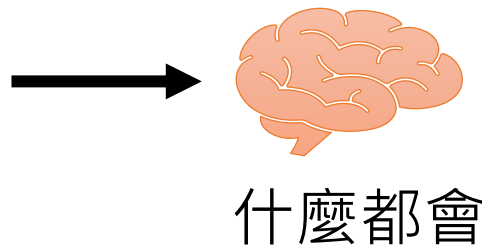


→ This course  
is about .....

- 期待二：成為通才

對以下文句做翻譯：

這堂課我們要講如何駕馭  
大型語言模型 .....



→ This course  
is about .....

AACL 2022 Tutorial: Recent Advances in Pre-trained Language Models: Why Do They Work and How to Use Them

Link: <https://d223302.github.io/AACL2022-Pretrain-Language-Model-Tutorial/>