

對於大型語言模型的 兩種不同期待

Finetune vs. Prompt

語言模型

GPT



文字接龍

how are _____

BERT



文字填空

how are you

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)



對於大型語言模型的兩種不同期待

- 期待一：成為專才，解某一個特定任務

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

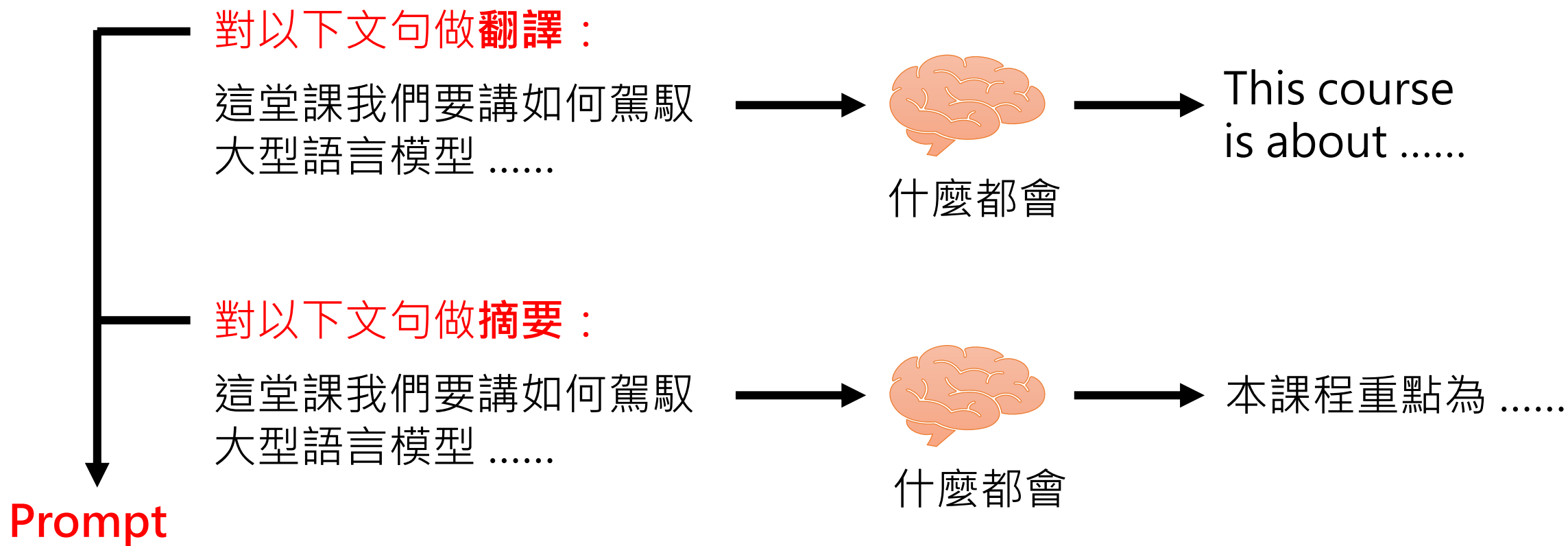


本課程重點為

對於大型語言模型的兩種不同期待

- 期待二：成為通才

這就是今日 ChatGPT 走的路線



對於大型語言模型的兩種不同期待

- 期待二：成為通才

The Natural Language Decathlon: Multitask Learning as Question Answering

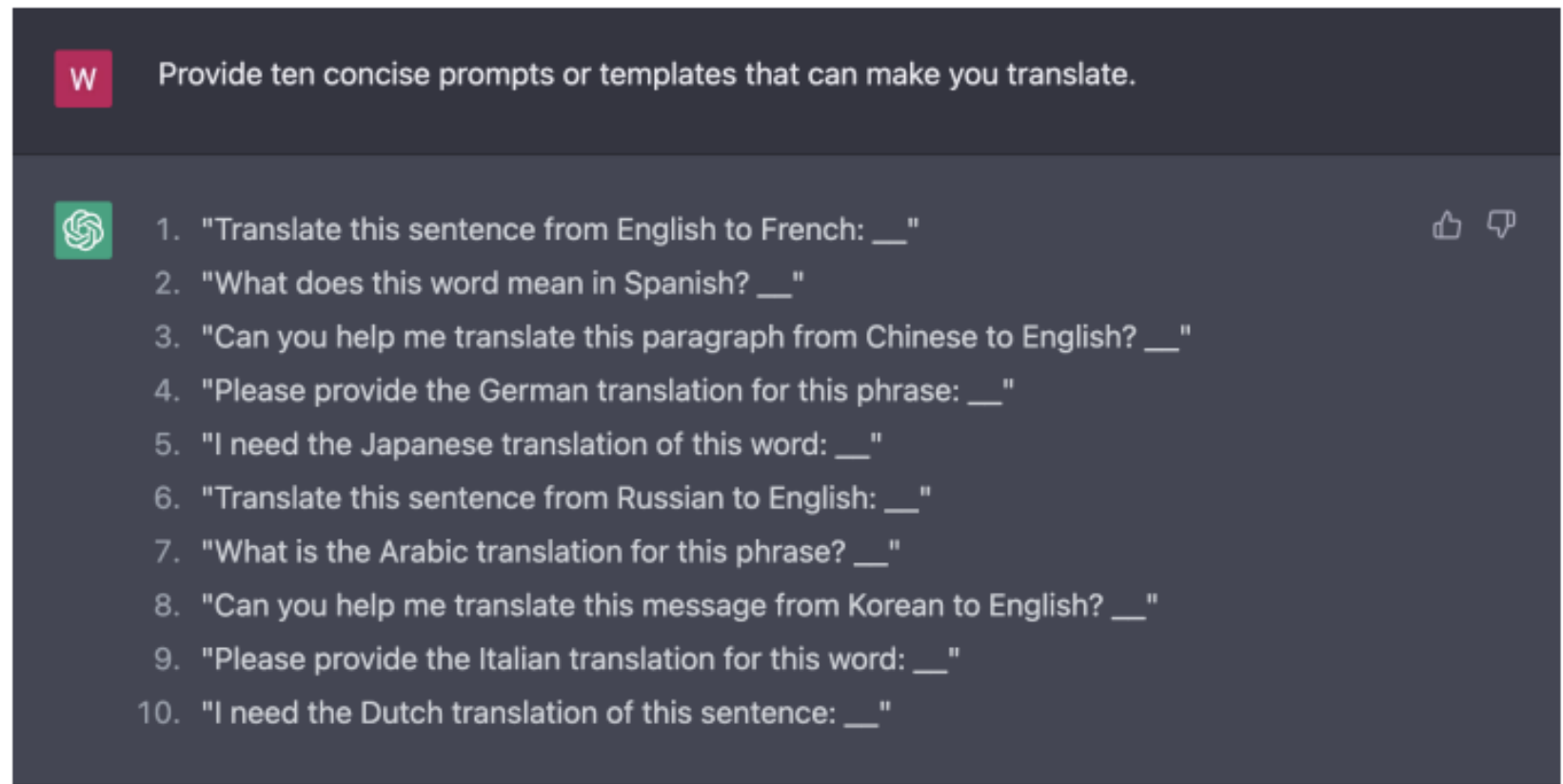
<https://arxiv.org/abs/1806.08730>

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

Ask Me Anything: Dynamic Memory Networks for Natural Language Processing

對於大型語言模型的兩種不同期待

- 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>

對於大型語言模型的兩種不同期待

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

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

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System	COMET-22	COMETkiwi	ChrF	BLEU	COMET-22	COMETkiwi	ChrF	BLEU
DE-EN					EN-DE			
WMT-Best	85.0	81.4	58.5	33.4	87.2	83.6	64.6	38.4
text-davinci-002	73.2	73.1	46.1	23.3	82.0	79.0	56.0	28.6
text-davinci-003	84.8*	81.2*	56.8	30.9	85.6*	82.8*	60.2*	31.8*
ChatGPT	84.8*	81.1	58.3*	33.4*	84.2	81.0	59.6	30.9
ZH-EN					EN-ZH			
WMT-Best	81.0	77.7	61.1	33.5	86.7	82.0	41.1	44.8
text-davinci-002	74.1	73.1	49.6	20.6	84.0	79.0	32.1	36.4
text-davinci-003	81.6*	78.9*	56.0*	25.0	85.8*	81.3*	34.6	38.3
ChatGPT	81.2	78.3	56.0	25.9*	84.4	78.7	36.0*	40.3*
RU-EN					EN-RU			
WMT-Best	86.0	81.7	68.9	45.1	89.5	84.4	58.3	32.4
text-davinci-002	77.5	76	58.7	34.9	85.4	80.9	51.6	25.1
text-davinci-003	84.8*	81.1*	64.6	38.5	86.7*	82.2*	54.0*	27.5*
ChatGPT	84.8*	81.0	66.5*	41.0*	77.6	70.4	41.1	19.0
FR-DE					DE-FR			
WMT-Best	89.5	80.7	81.2	64.8	85.7	79.5	74.6	58.4
text-davinci-002	66.6	67.9	45.8	25.9	64.2	67.6	44.6	24.5
text-davinci-003	84.6	77.9	65.7*	42.5*	78.5	76.1	58.9	35.6
ChatGPT	84.7*	78.5*	65.2	42.0	81.6*	79.8*	60.7*	37.3*

How Good Are GPT Models at
Machine Translation? A
Comprehensive Evaluation

<https://arxiv.org/abs/2302.09210>

對於大型語言模型的兩種不同期待

- 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
10 / 54



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



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- 期待二：成為通才

對以下文句做**翻譯**：

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大型語言模型



什麼都會



This course
is about

對預訓練模型做改造

BERT



不會說一整句話喔



語言模型

文字填空

how are you

改造



翻譯專才



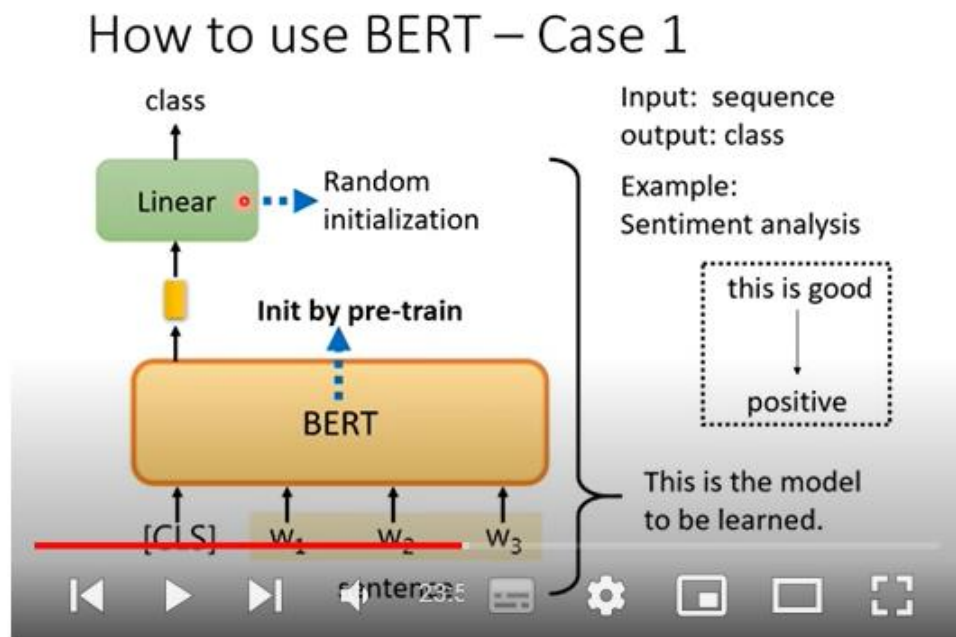
摘要專才



編修專才

加外掛和微調參數

對預訓練模型做改造 — 加外掛 (Head)

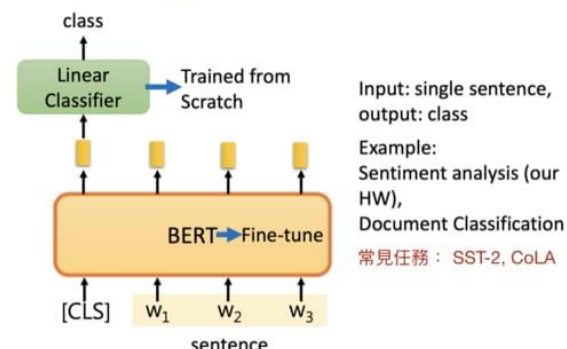


【機器學習2021】自督導式學習 (Self-supervised Learning) (二) - BERT簡介

<https://youtu.be/gh0hewYkjgo>

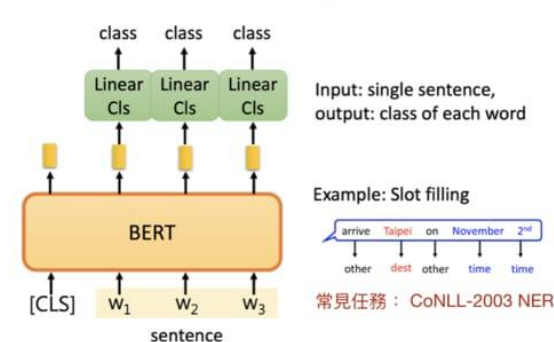
單一句子分類任務

bertForSequenceClassification



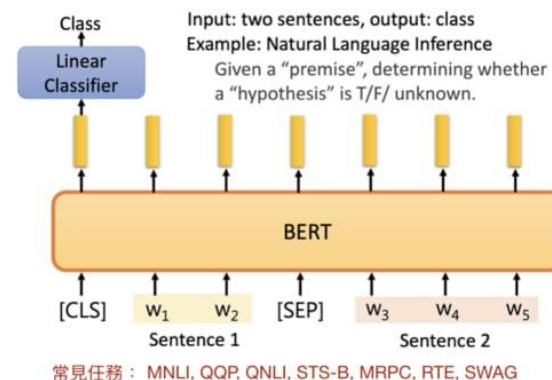
單一句子標註任務

bertForTokenClassification



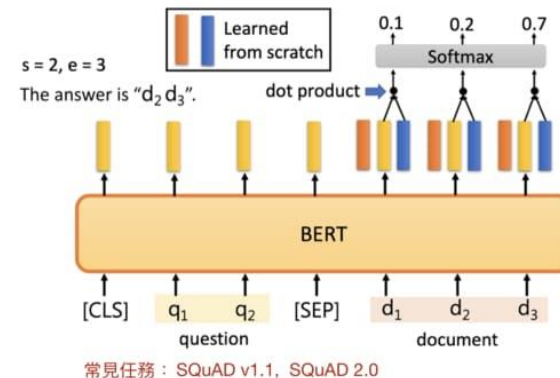
成對句子分類任務

bertForSequenceClassification



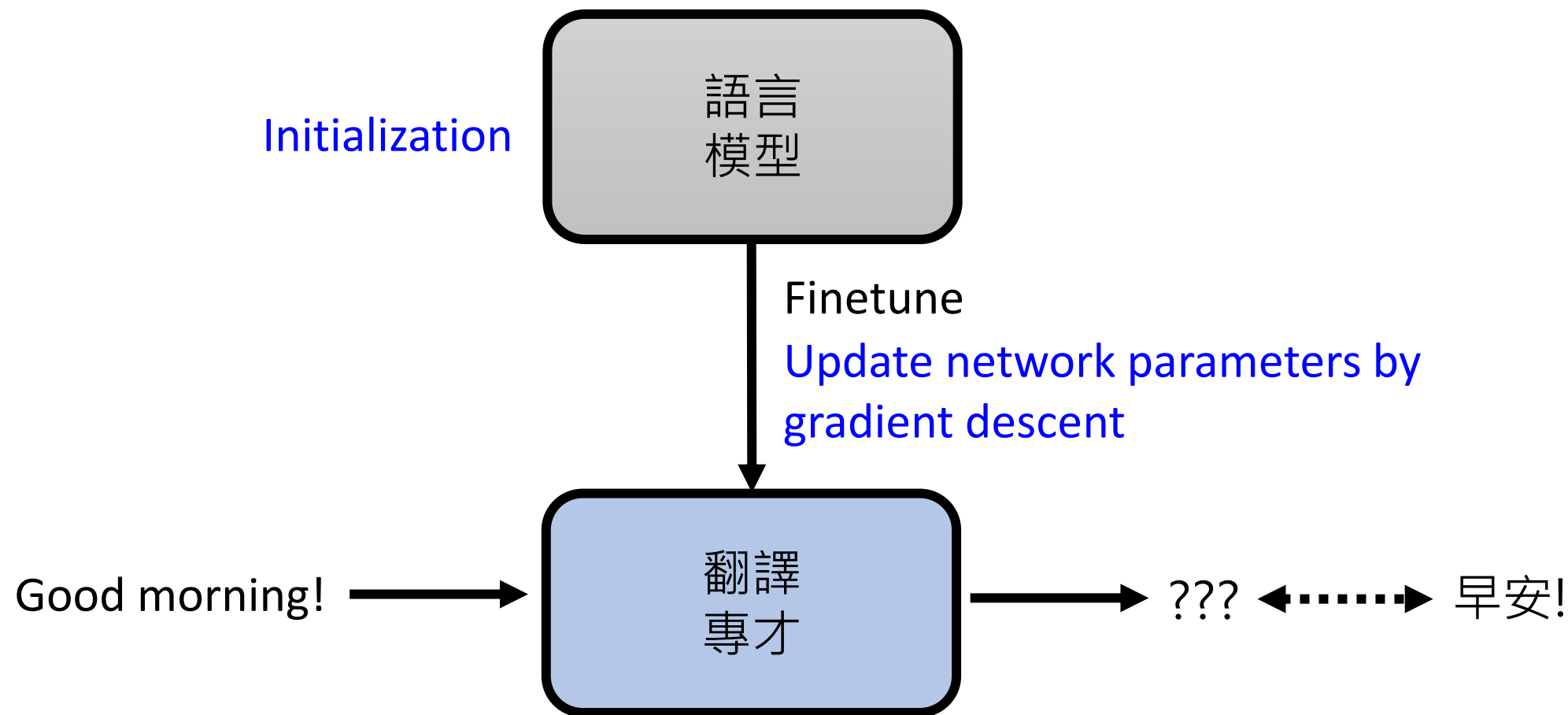
問答任務

bertForQuestionAnswering

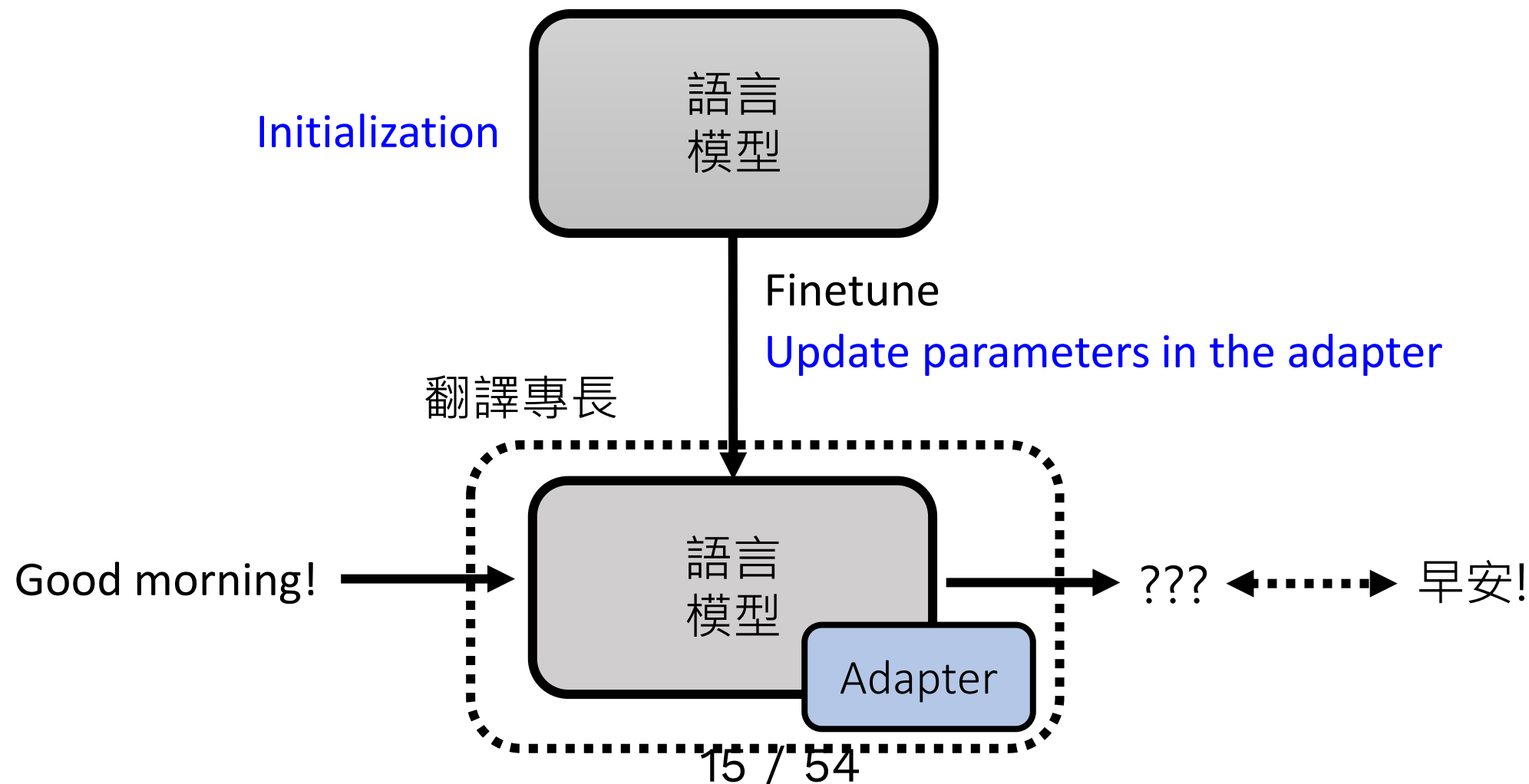


Source of image: https://leemeng.tw/attack_on_bert_transfer_learning_in_nlp.html

對預訓練模型做改造 — 微調 (Finetune)

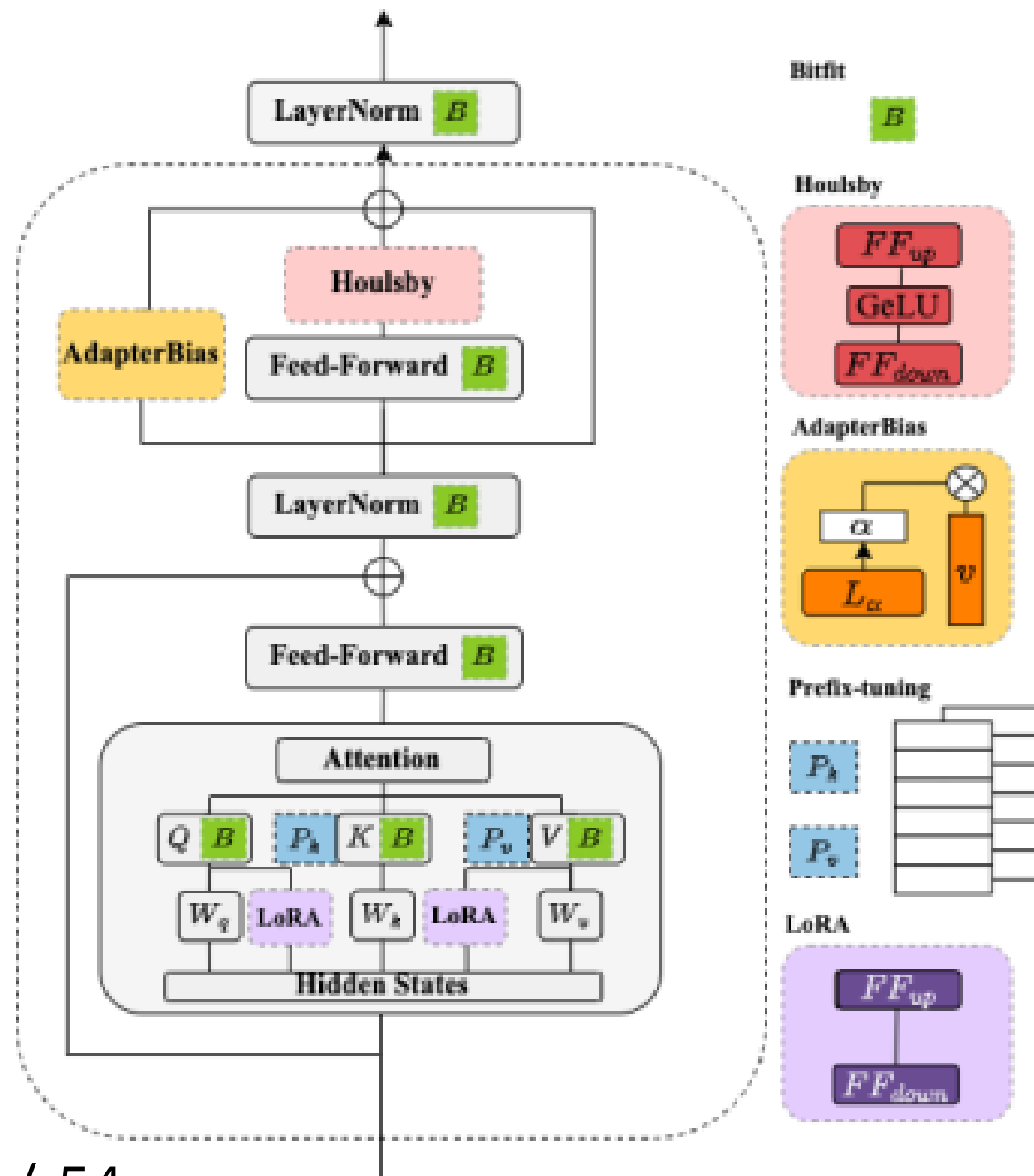


對預訓練模型做改造 — Adapter

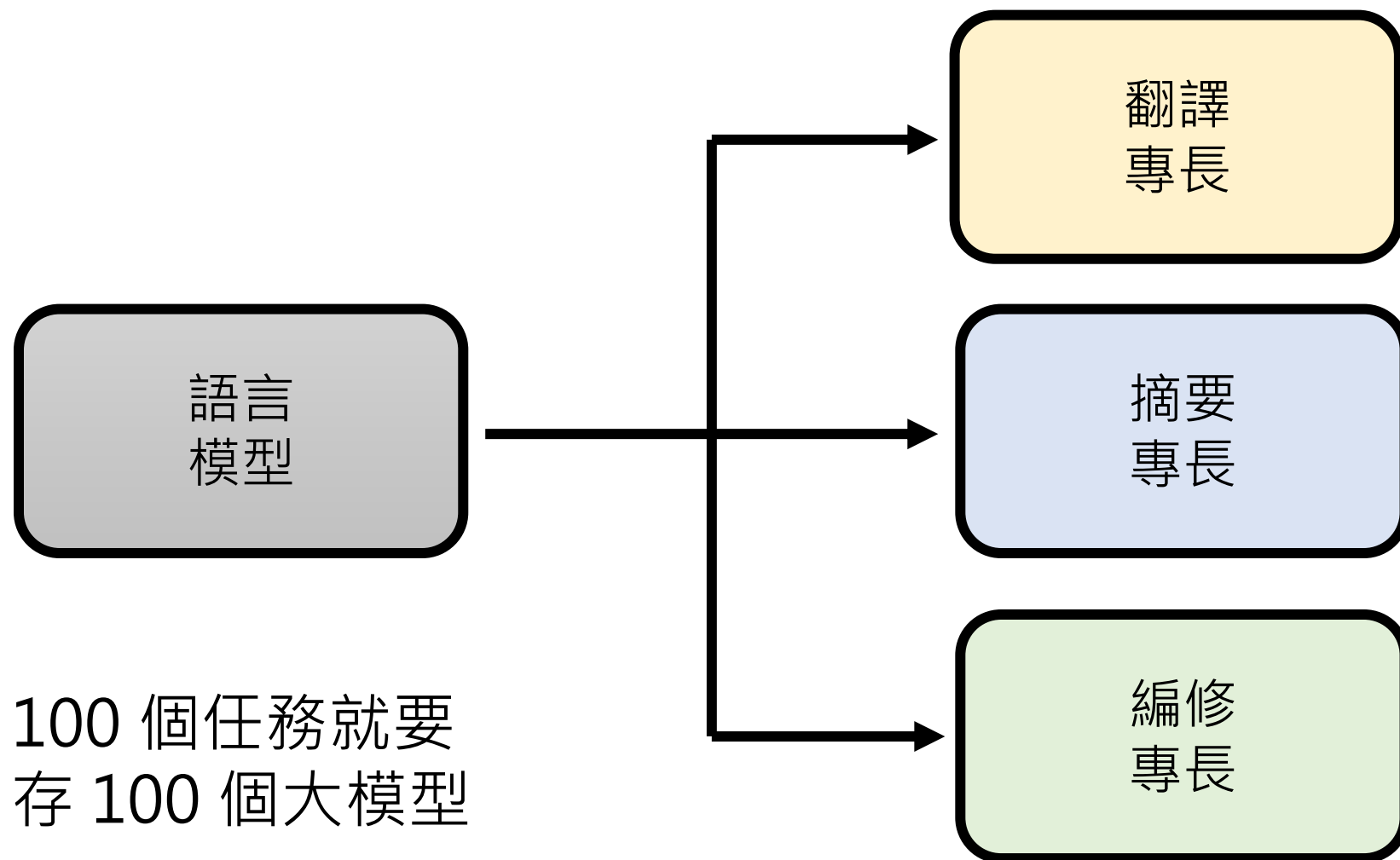


Source of image:

16 / 54

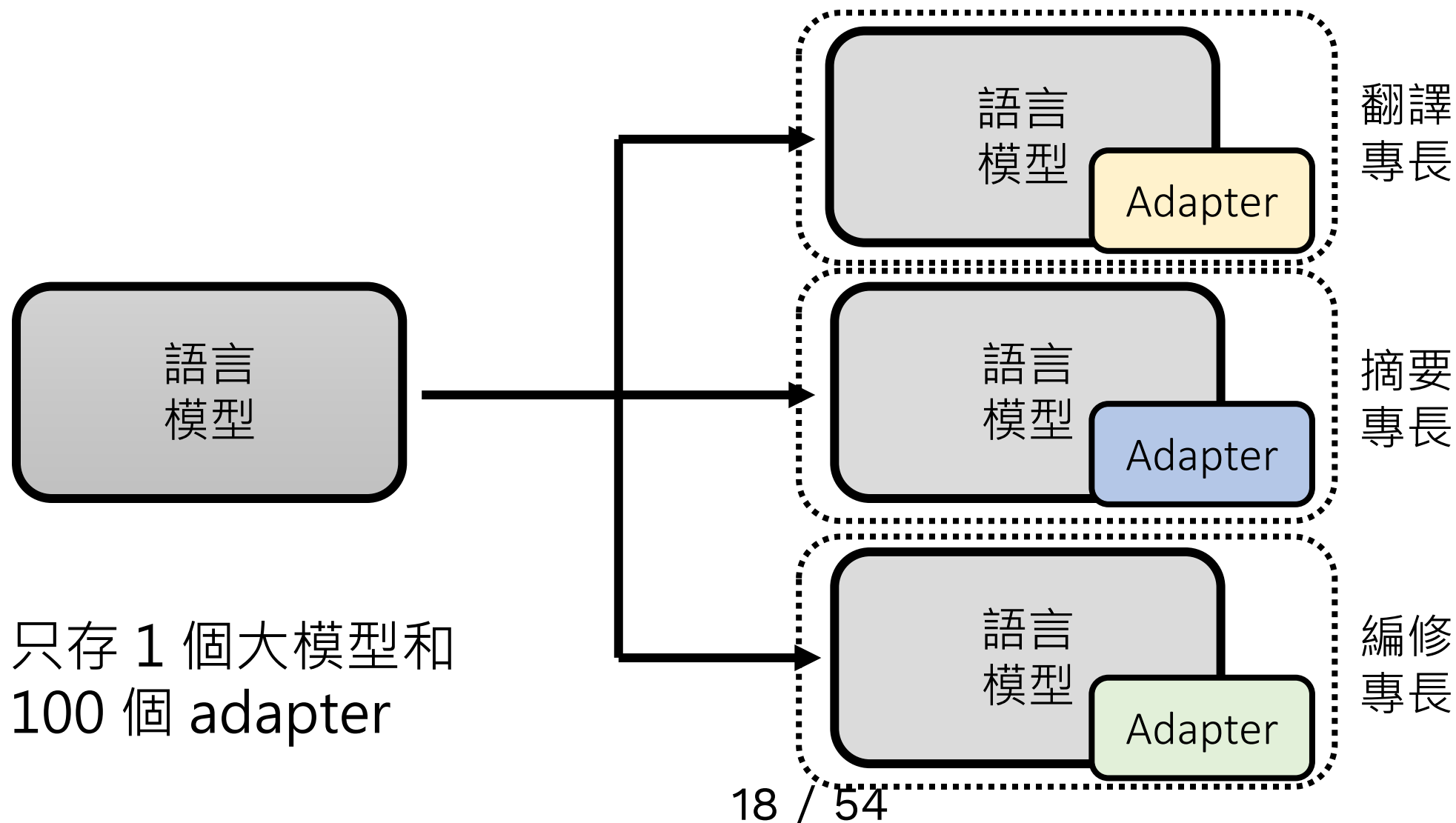


對預訓練模型做改造 — Adapter



100 個任務就要
存 100 個大模型

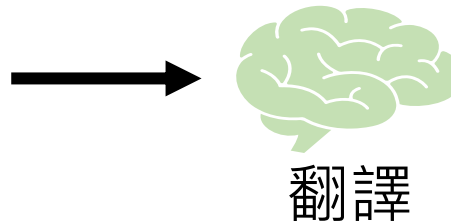
對預訓練模型做改造 — Adapter



兩種不同期待導致兩類不同的使用方式

- 期待一：成為專才

這堂課我們要講如何駕馭
大型語言模型

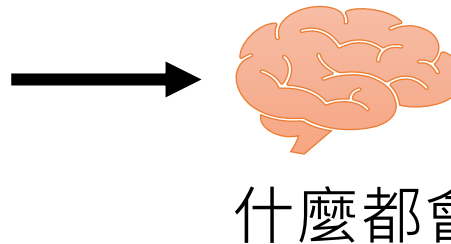


→ This course
is about

- 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
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→ 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?

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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

機器要學會讀題目敘述或題目範例

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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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我真的是累了 分隔 正面 分隔

故意給錯誤標註

給一些例子

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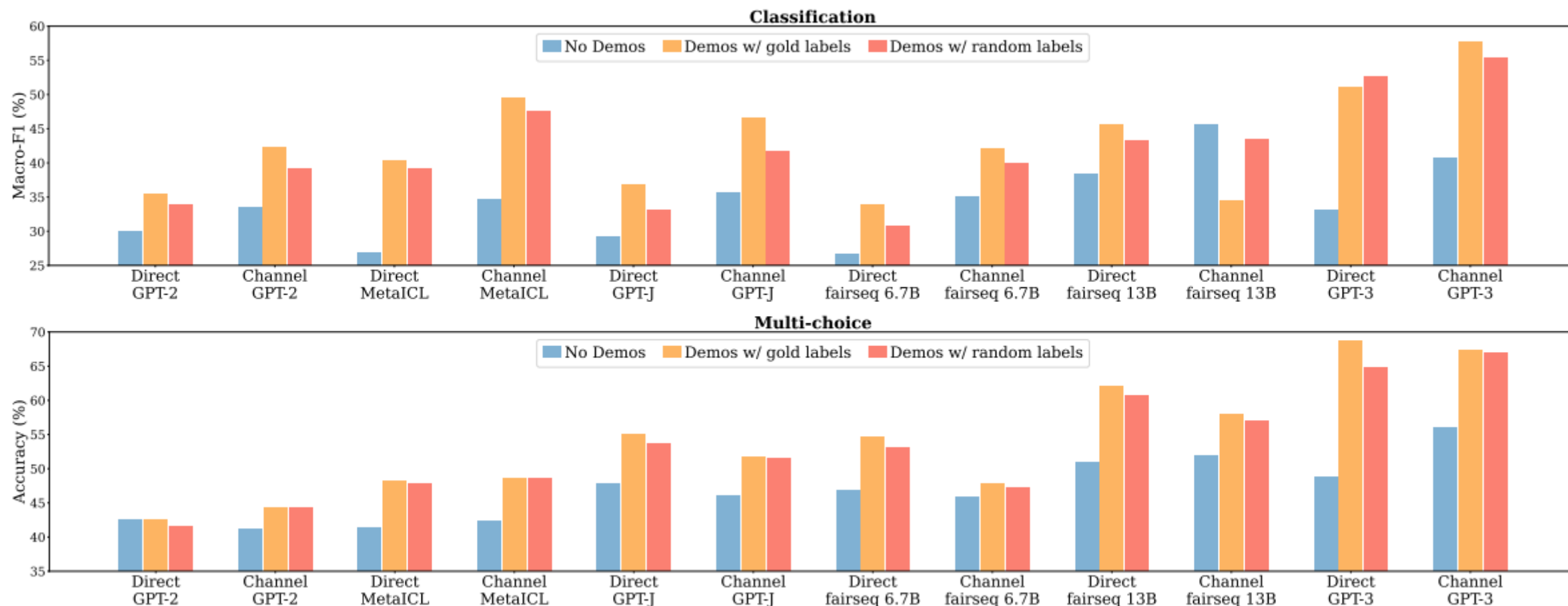
正面

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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

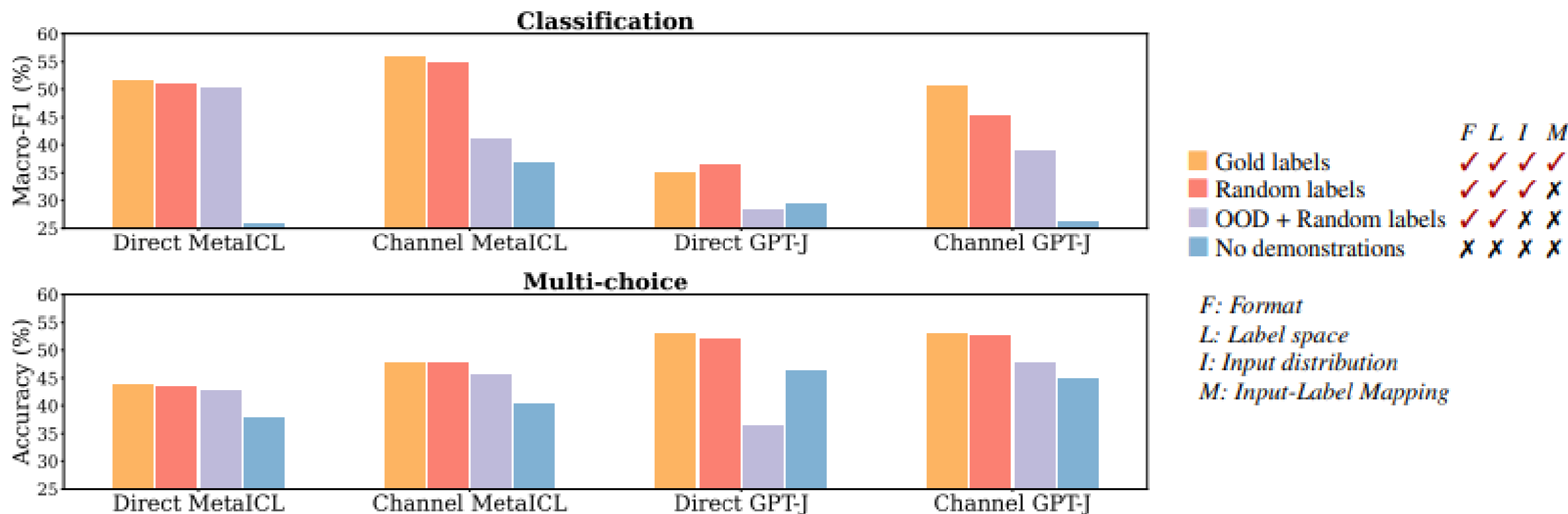
正面

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我真的是累了 分隔 負面 分隔

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

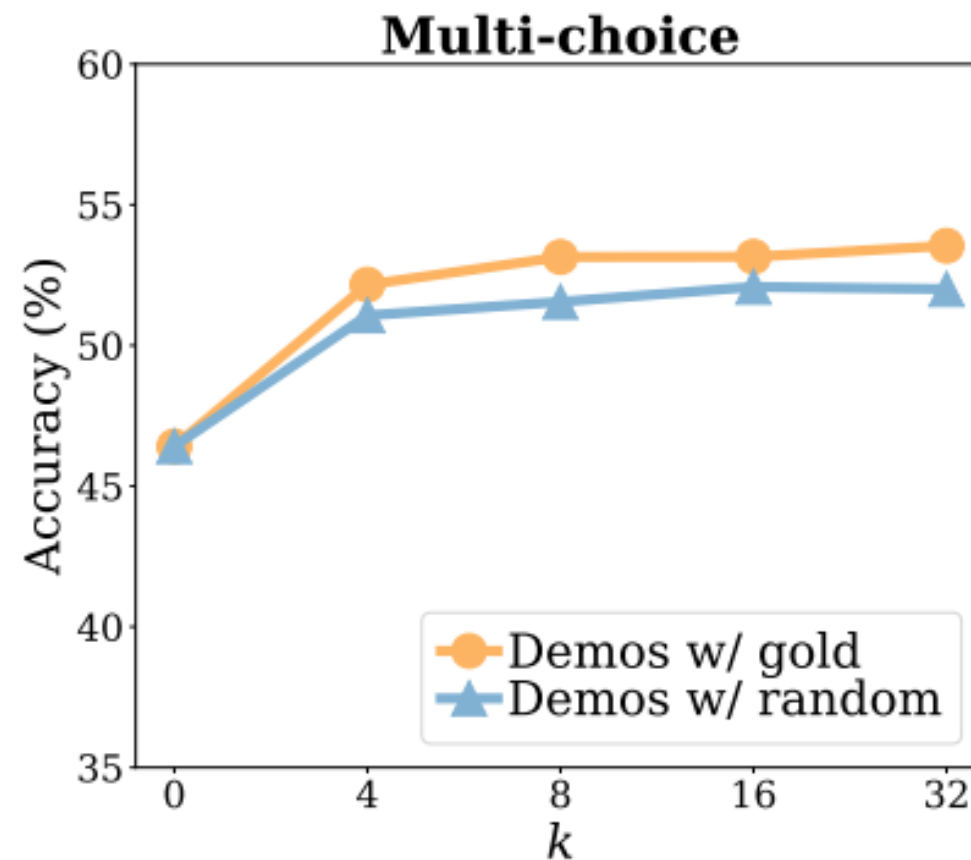
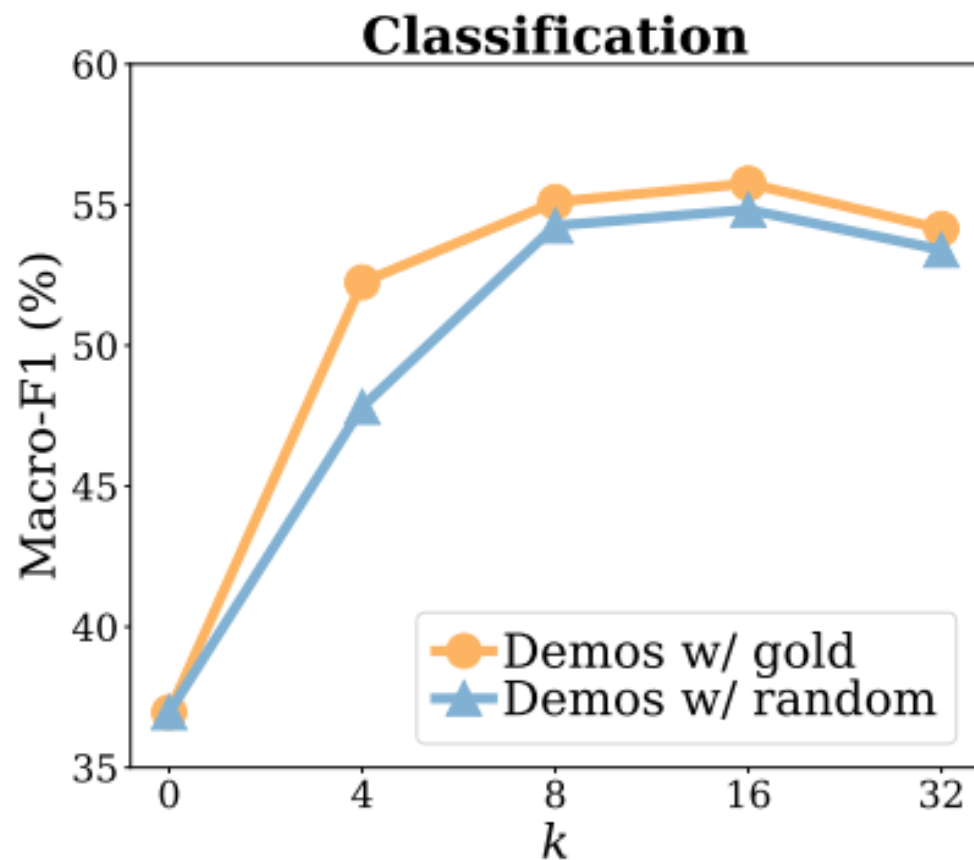
正面

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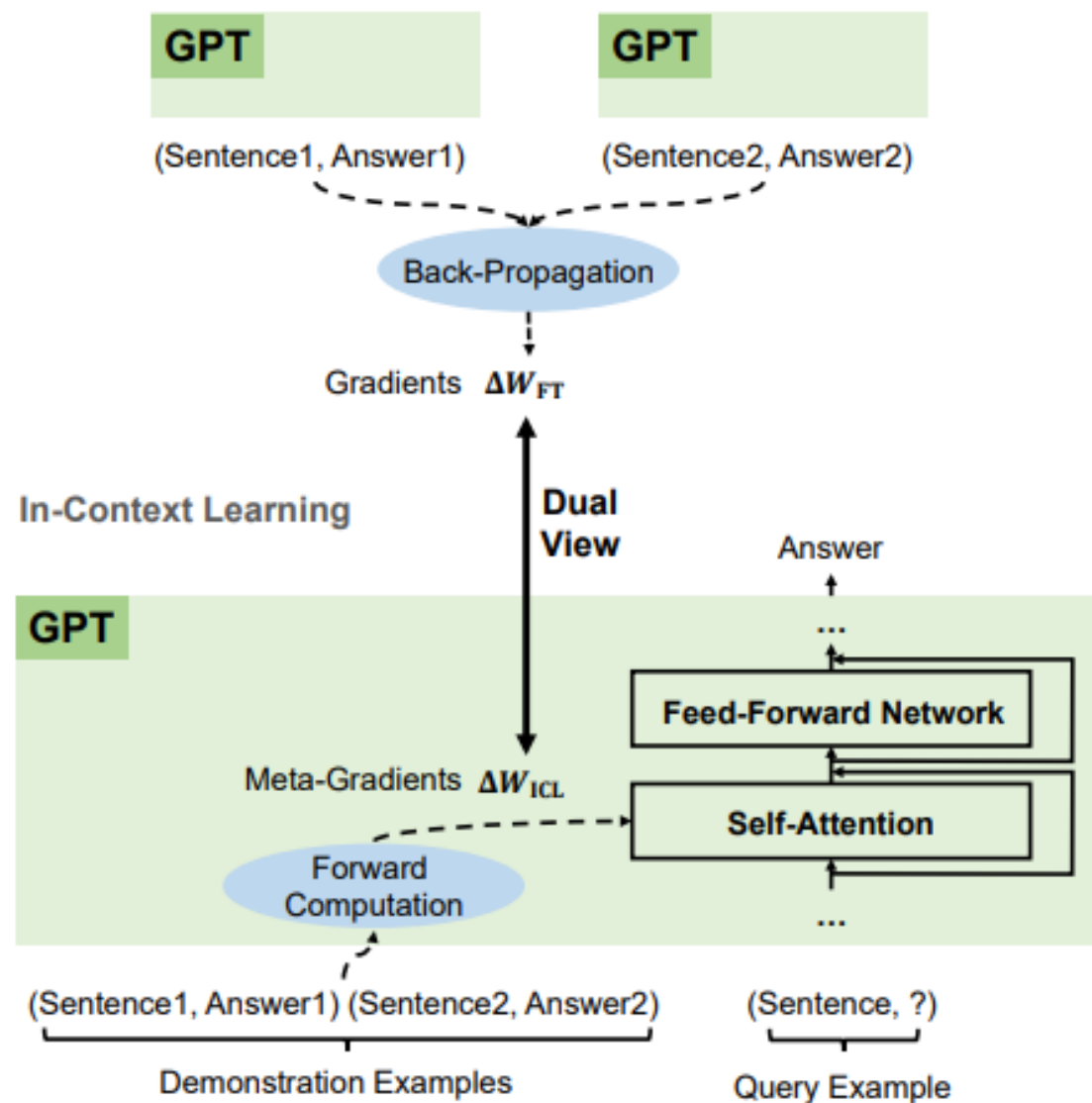


In-context Learning

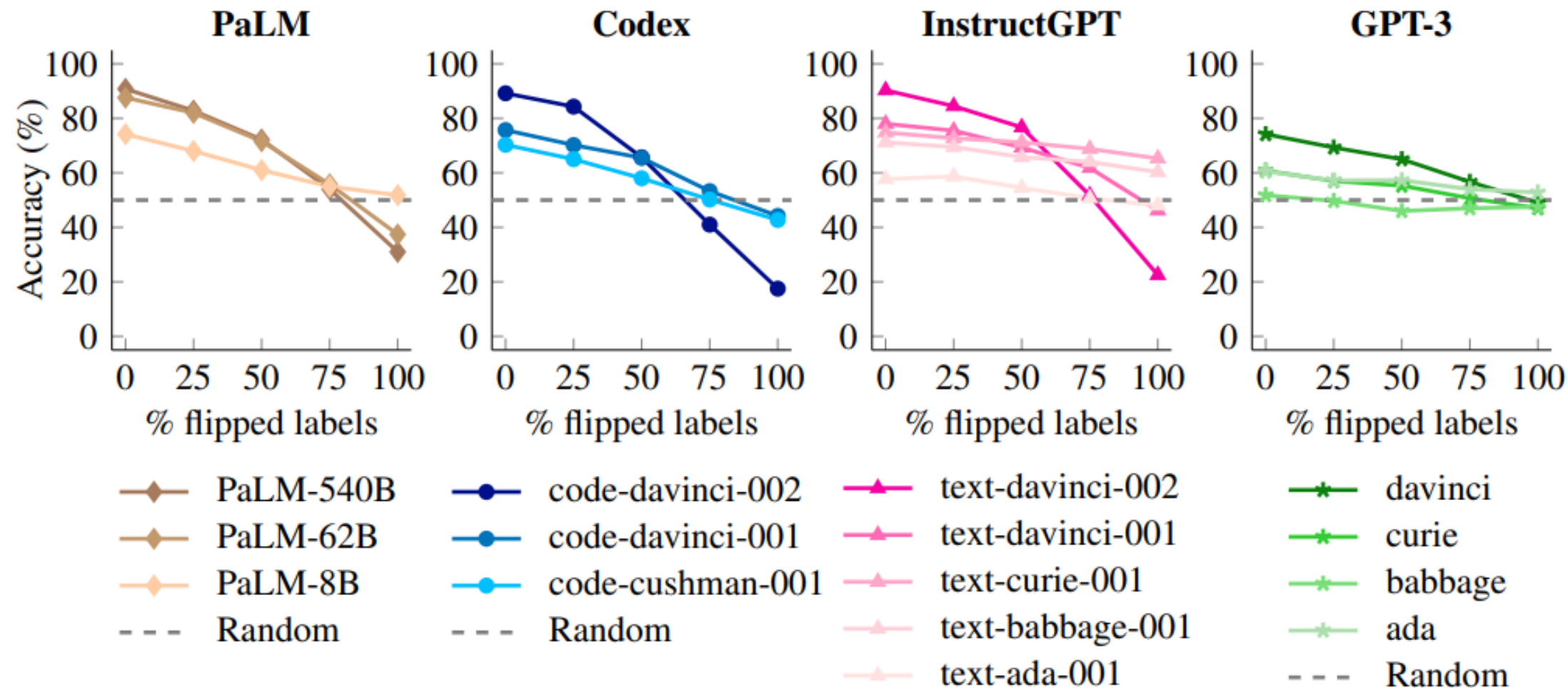
<https://arxiv.org/abs/2212.10559>

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

Finetuning



In-context Learning



In-context Learning

- Classification!

Input: 680, 841, 842, 496, 204, 985, 546, 275, 453, 835, 644, 1, 308, 5, 65, 160

Output: Bar

Input: 193, 101, 270, 957, 670, 407, 104, 23, 569, 708, 700, 395, 481, 105, 234, 785

Output: Foo

Input: 16, 409, 28, 668, 53, 342, 813, 181, 963, 728, 558, 420, 975, 686, 395, 931

Output: Bar

Input: 448, 421, 190, 246, 413, 766, 463, 332, 935, 911, 304, 244, 876, 95, 236, 695

Output: Foo

Input: 632, 318, 49, 138, 602, 508, 924, 227, 325, 767, 108, 254, 475, 298, 202, 989

Output: Foo

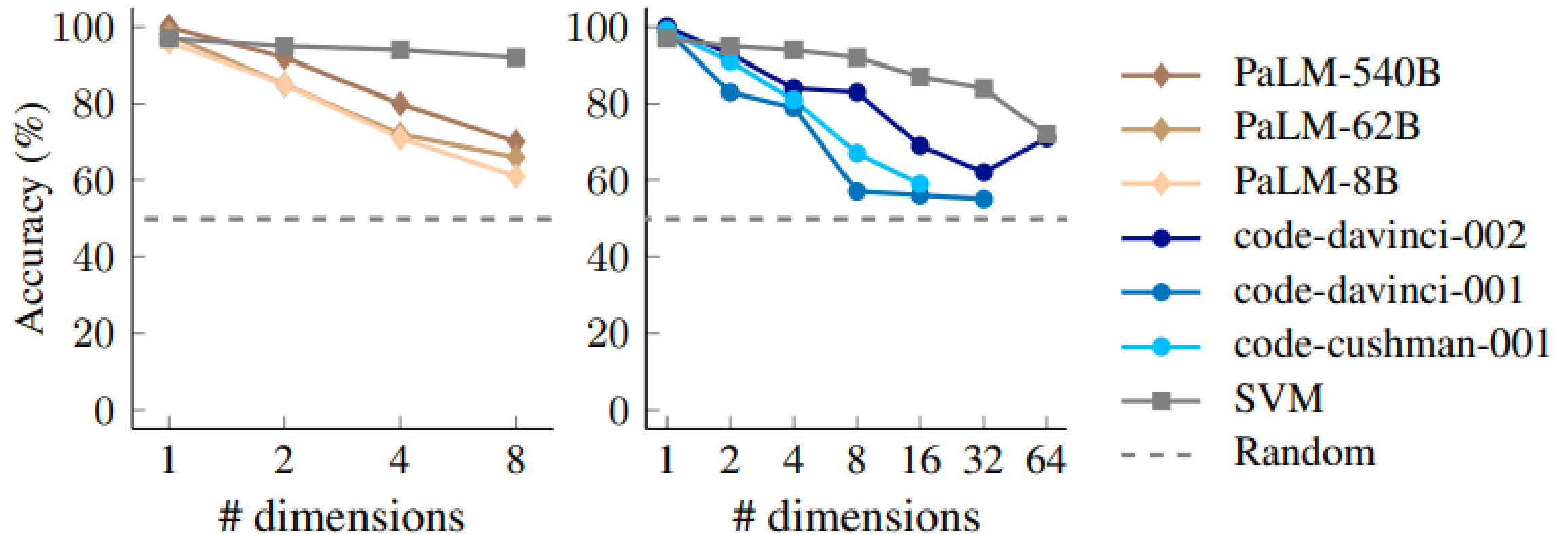
Input: 412, 140, 30, 508, 837, 707, 338, 669, 835, 177, 312, 800, 526, 298, 214, 259

Output:

Answer:

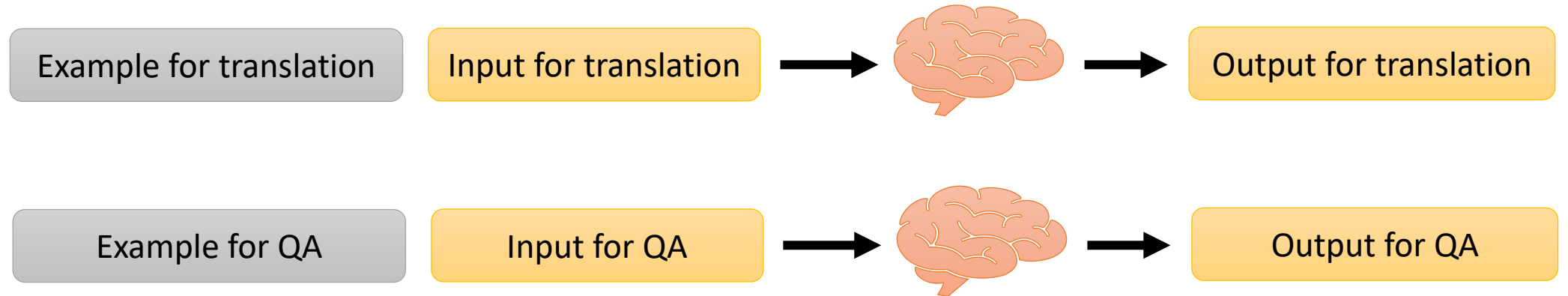
Bar

In-context Learning

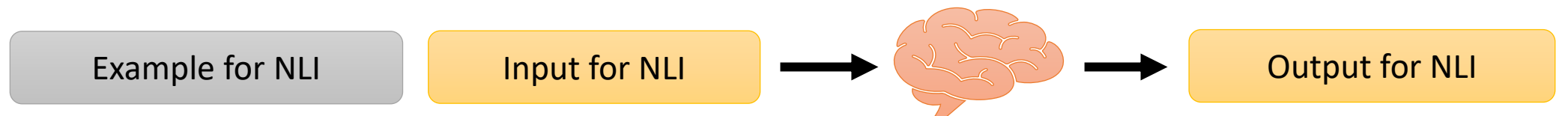


Learning In-context Learning

Training



Testing



機器要學會讀題目敘述或題目範例

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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?"

Summarization

The picture appeared on the wall of a Poundland store on Whymark Avenue [...] How would you rephrase that in a few words?

Sentiment Analysis

Review: We came here on a Saturday night and luckily it wasn't as packed as I thought it would be [...] On a scale of 1 to 5, I would give this a

Question Answering

I know that the answer to "What team did the Panthers defeat?" is in "The Panthers finished the regular season [...]". Can you tell me what it is?

<https://arxiv.org/abs/2110.08207>

Graffiti artist Banksy is believed to be behind [...]

4

Arizona Cardinals

T0

Yes

Multi-task training

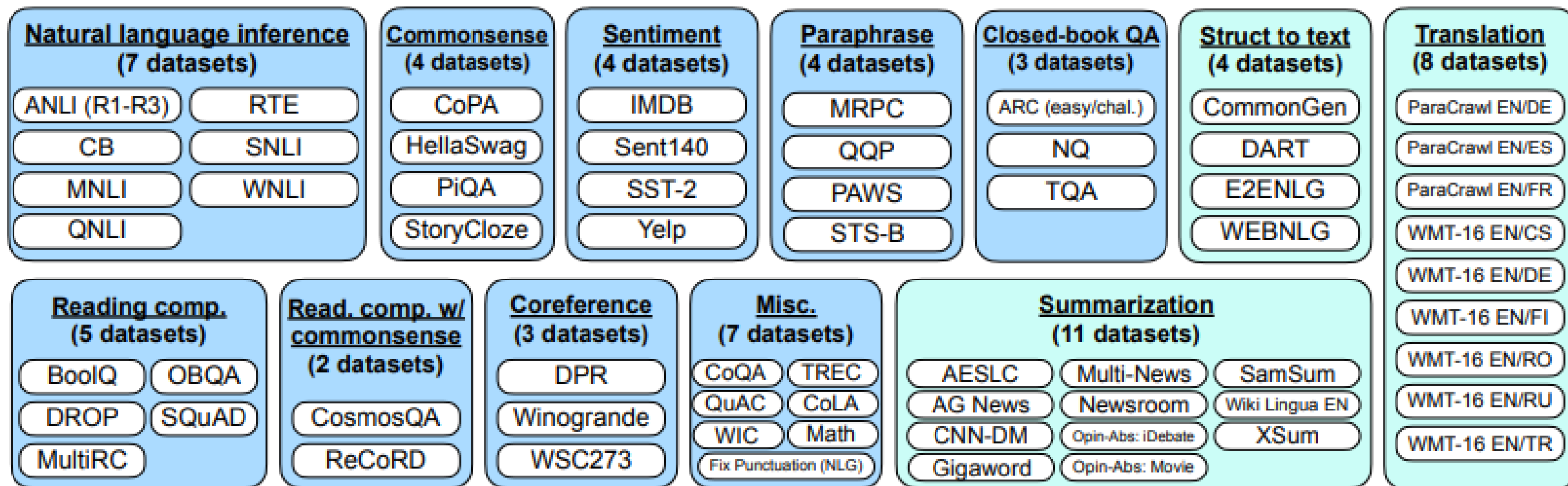
Zero-shot generalization

Natural Language Inference

Suppose "The banker contacted the professors and the athlete". Can we infer that "The banker contacted the professors"? 37 / 54

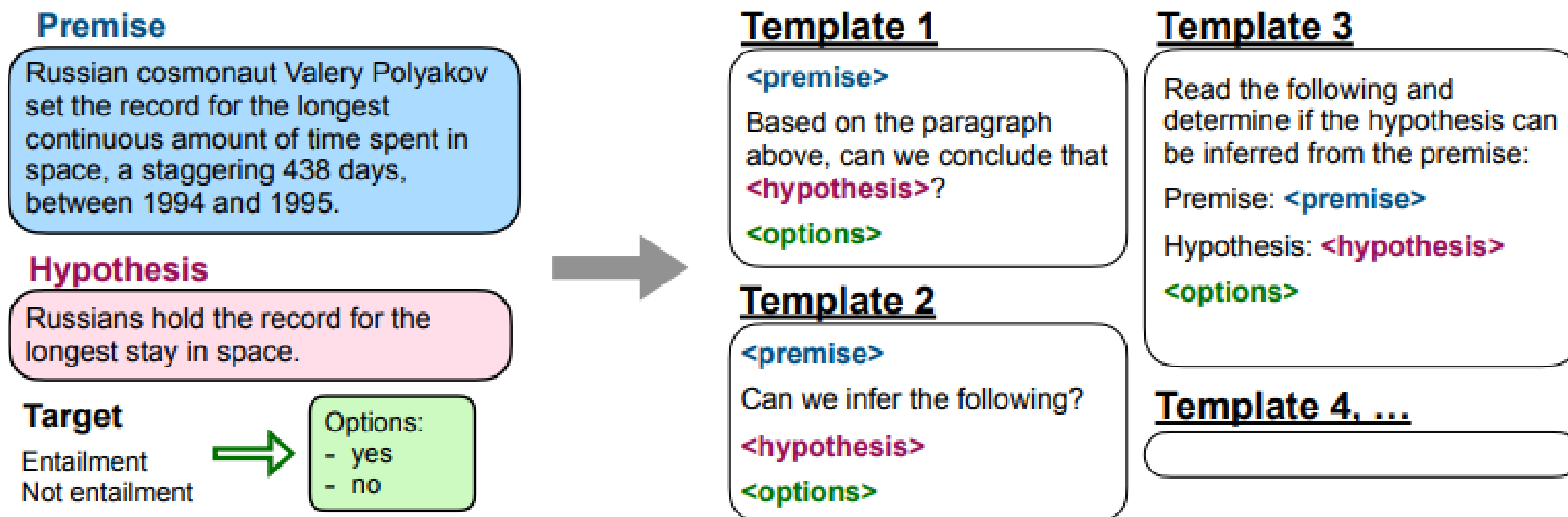
Instruction-tuning

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



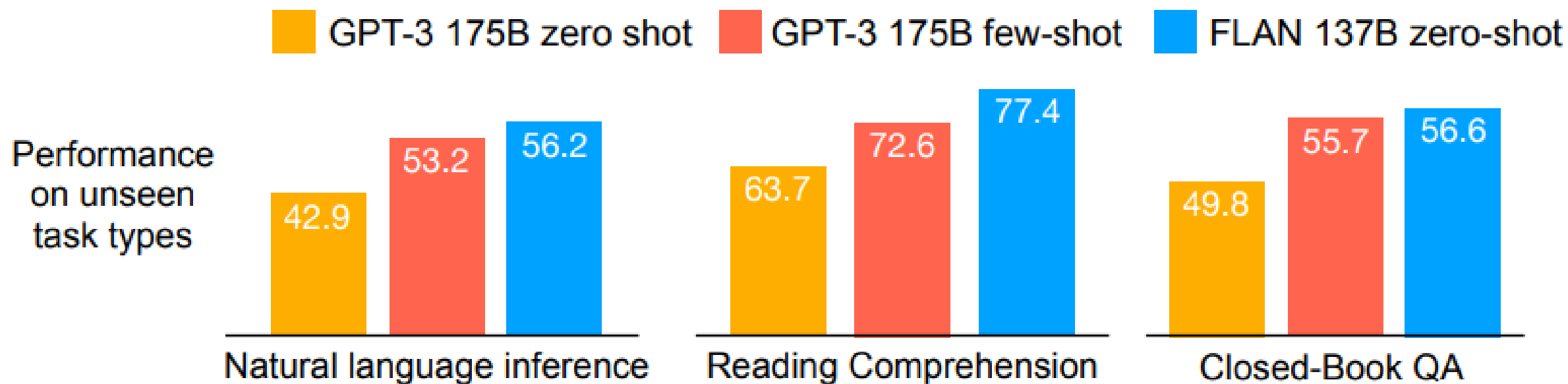
Instruction-tuning

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



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?

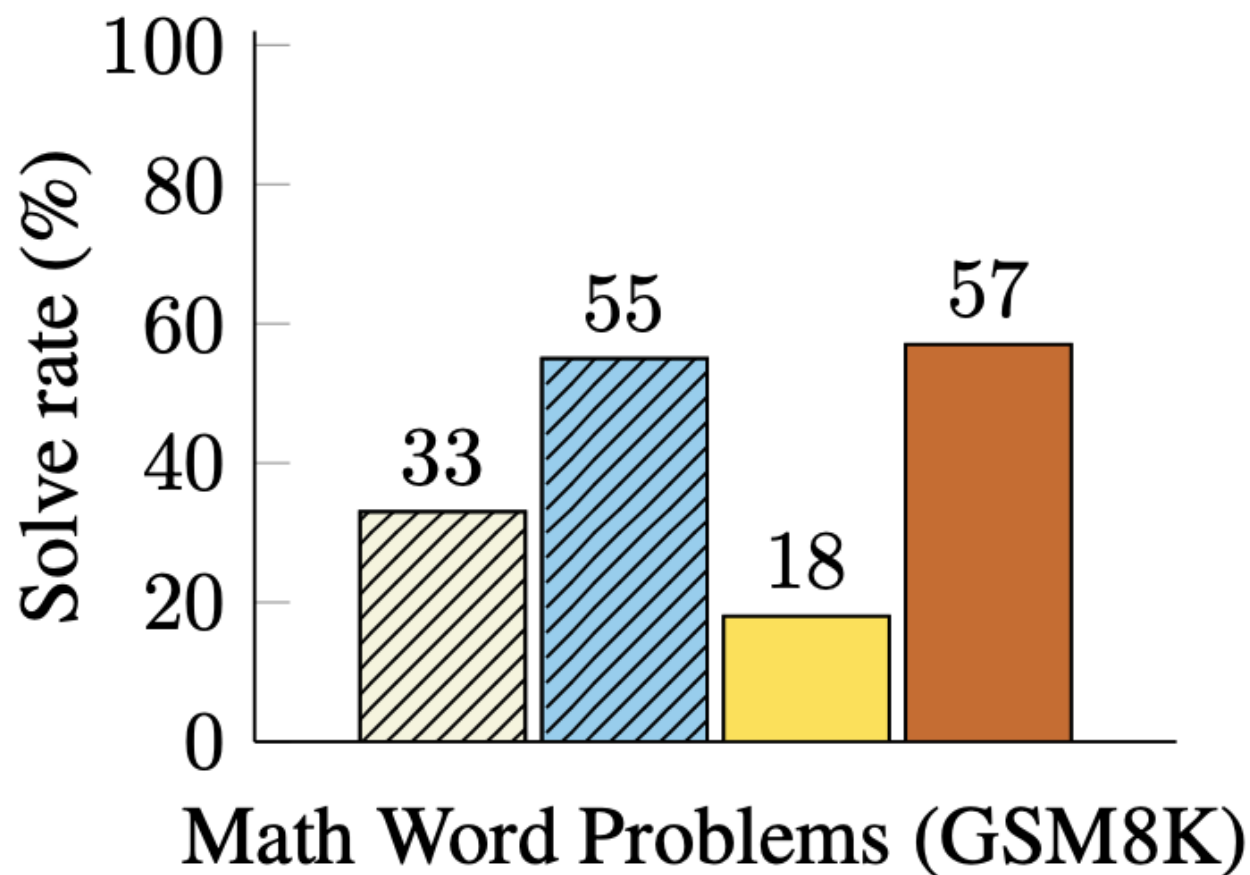
A: The answer is 11.

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. 

- 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. **✓**

Chain of Thought (CoT) Prompting

Self-consistency

Q: If there are 3 cars in the parking lot and 2 more cars arrive, how many cars are in the parking lot?

A: There are 3 cars in the parking lot already. 2 more arrive. Now there are $3 + 2 = 5$ cars. The answer is 5.

...

Q: Janet's ducks lay 16 eggs per day. She eats three for breakfast every morning and bakes muffins for her friends every day with four. She sells the remainder for \$2 per egg. How much does she make every day?

A:

Language model

Sample a diverse set of reasoning paths

She has $16 - 3 - 4 = 9$ eggs left. So she makes $\$2 * 9 = \18 per day.

The answer is \$18.

This means she she sells the remainder for $\$2 * (16 - 4 - 3) = \26 per day.

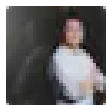
The answer is \$26.

She eats 3 for breakfast, so she has $16 - 3 = 13$ left. Then she bakes muffins, so she has $13 - 4 = 9$ eggs left. So she has $9 \text{ eggs} * \$2 = \18 .

The answer is \$18.

Marginalize out reasoning paths to aggregate final answers

The answer is \$18.



雞、鴨、兔共30隻，72條腿。其中雞的數量是鴨的2倍，那麼雞有幾隻？直接給答案，不列計算過程

雞 16 隻 (鴨 8 隻、兔 6 隻)



雞、鴨、兔共30隻，72條腿。其中雞的數量是鴨的2倍，那麼雞有幾隻？請詳列計算過程，再給答案



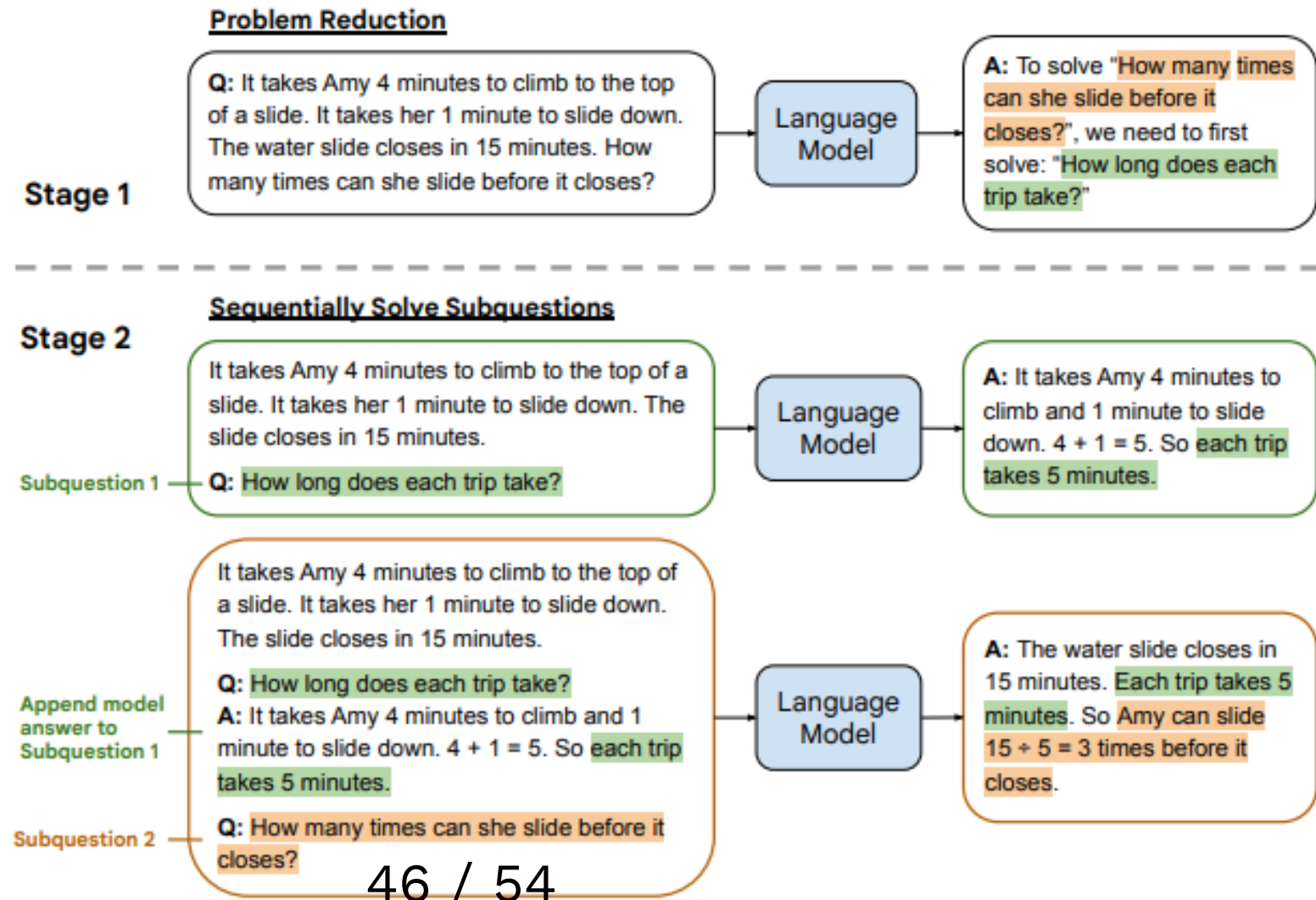
設雞的數量為 x ，鴨的數量為 y ，兔的數量為 z 。

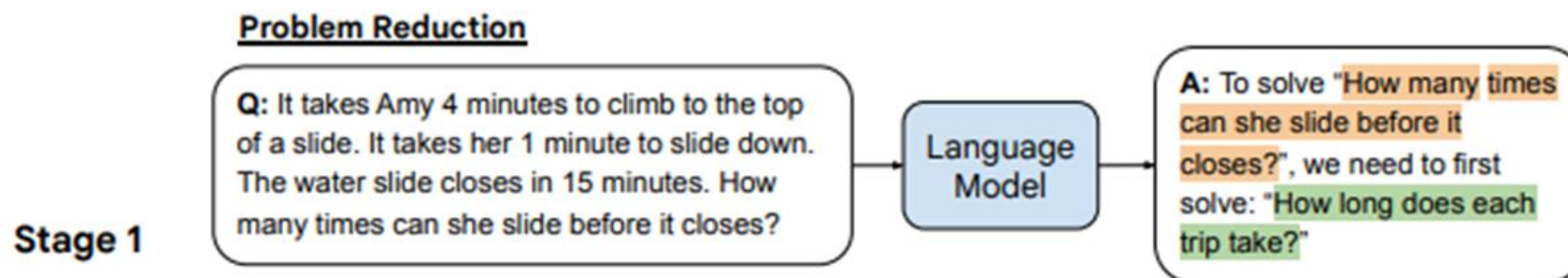
五次答案為：18, 8, 12, 7, 2

由題意可得以下三個方程：

Chain of Thought (CoT) Prompting

Least-to-most prompting





Q: The Seahawks played the San Francisco 49ers. In the first quarter, the 'Hawks RB Julius Jones got a 27-yard TD run, along with DT Craig Terrill returning a fumble 9 yards for a touchdown. In the third quarter, the 49ers almost rallied as RB T. J. Duckett made a 12-yard TD pass to Lucas Nelly, along with Mare kicking a 32-yard field goal. How many yards do the shortest touchdown run and the longest touchdown pass combine for?

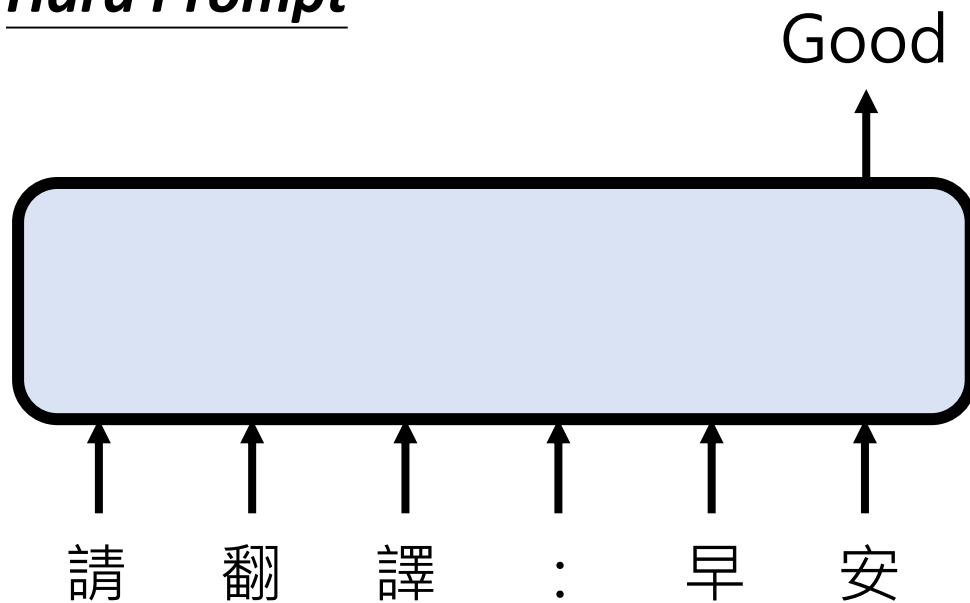
A: To answer the question "How many yards do the shortest touchdown run and the longest touchdown pass combine for?", we need to know: "How many yards was the shortest touchdown run?", "How many yards was the longest touchdown pass?"

Q: The Steelers went home for an AFC North duel with the Baltimore Ravens. Pittsburgh would deliver the opening punch in the first quarter with a 1-yard touchdown run from running back Rashard Mendenhall. The Ravens would make it even in the second quarter as running back Willis McGahee got a 9-yard touchdown run. The Ravens kicker Billy Cundiff got a 45-yard field goal in the second quarter and a 33-yard field goal in the third quarter. Game ended with a scoreless fourth quarter. How many points did the Ravens have at halftime?

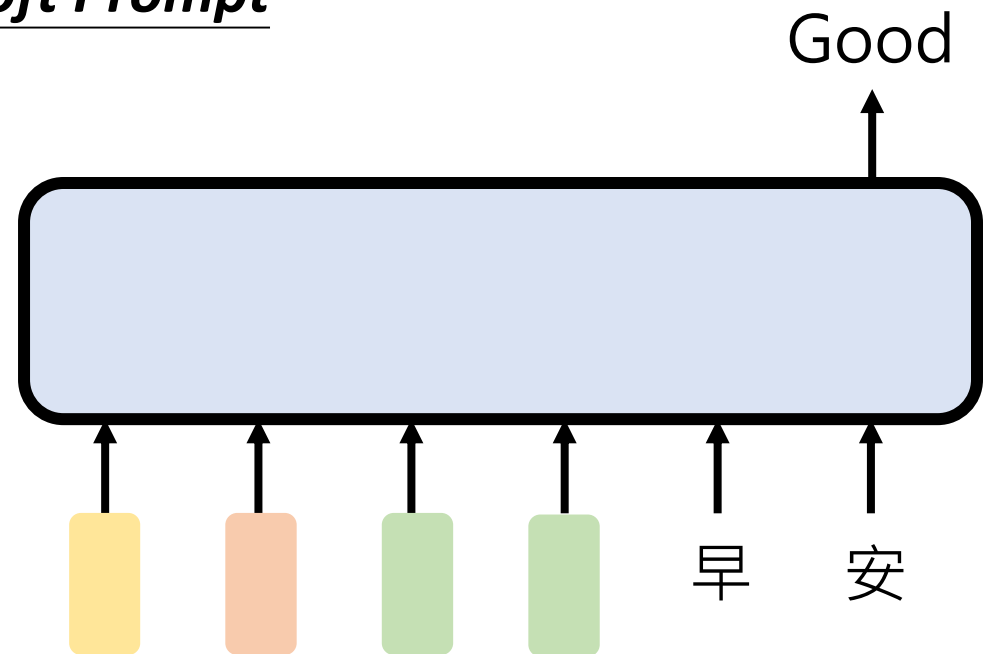
A: To answer the question "How many points did the Ravens have at halftime?", we need to know: "What were all the scores the Ravens had at halftime?"

用機器來找 Prompt

Hard Prompt



Soft Prompt

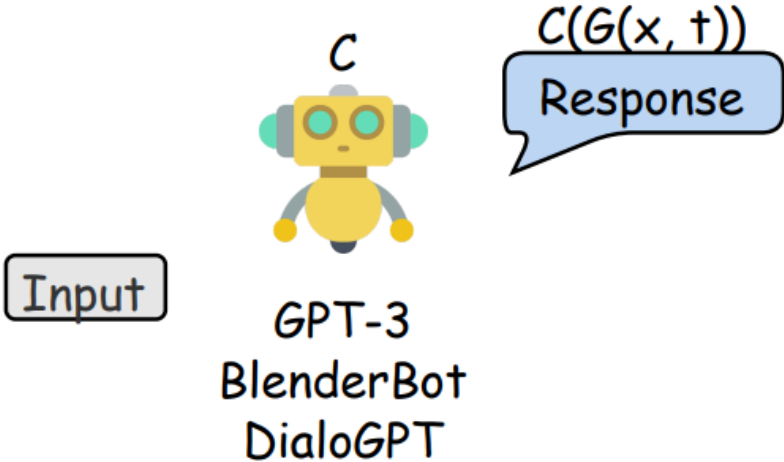


Trained by task-specific labeled data

Adapter at the input?

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: $[A_1]$

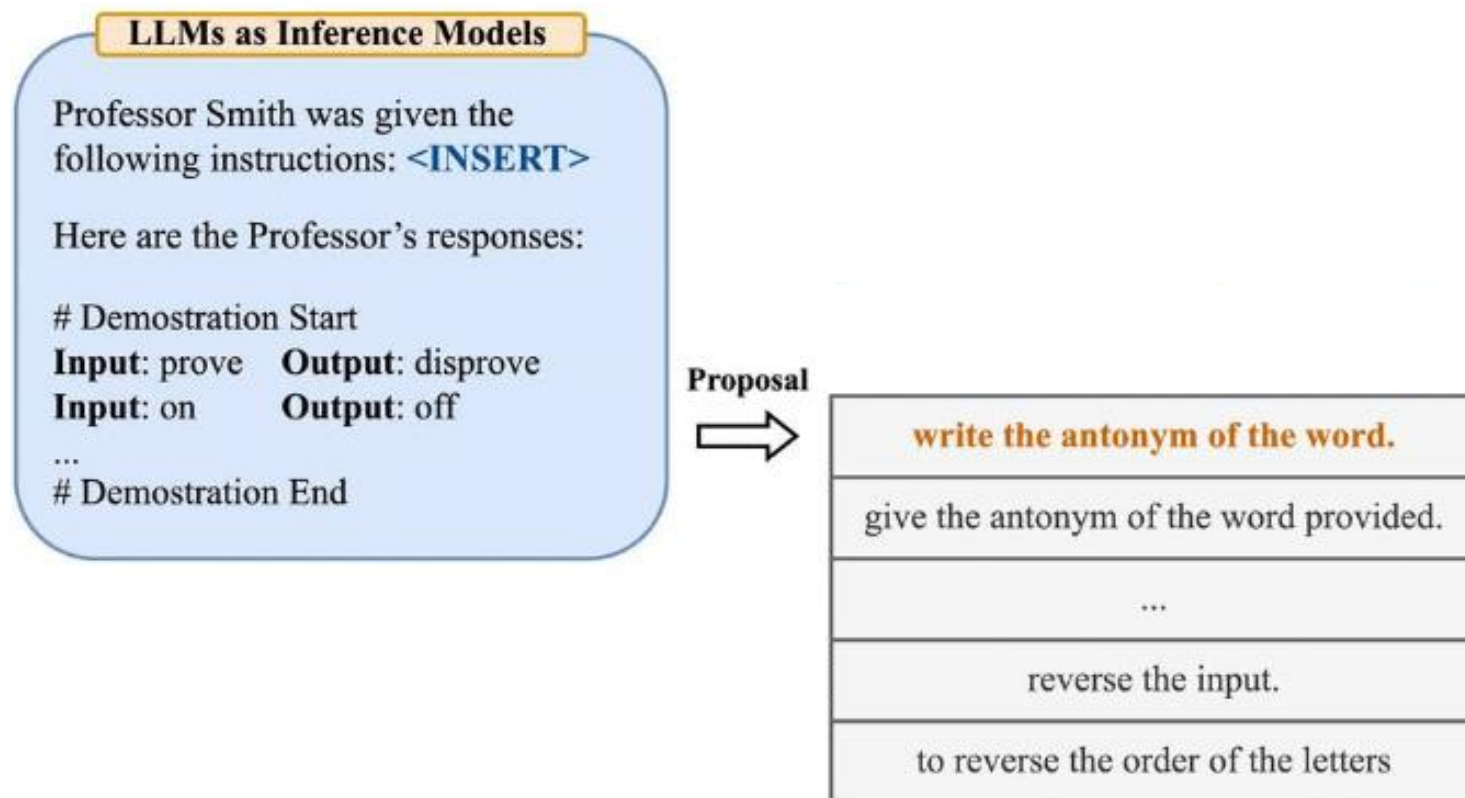
Input: $[Q_2]$ Output: $[A_2]$

...

The instruction was **<COMPLETE>**

請決定這句話是正面還是負面

用機器來找 Prompt

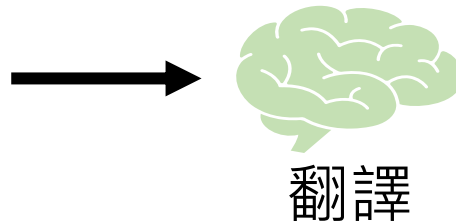


No.	Category	Zero-shot CoT Trigger Prompt	Accuracy
1	APE	Let's work this out in a step by step way to be sure we have the right answer.	82.0
2	Human-Designed	Let's think step by step. (*1)	78.7
3		First, (*2)	77.3
4		Let's think about this logically.	74.5
5		Let's solve this problem by splitting it into 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

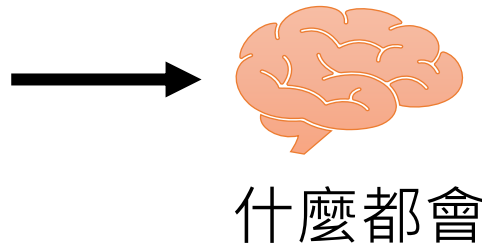


→ This course
is about

- 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

To learn more

- ACL 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/>

