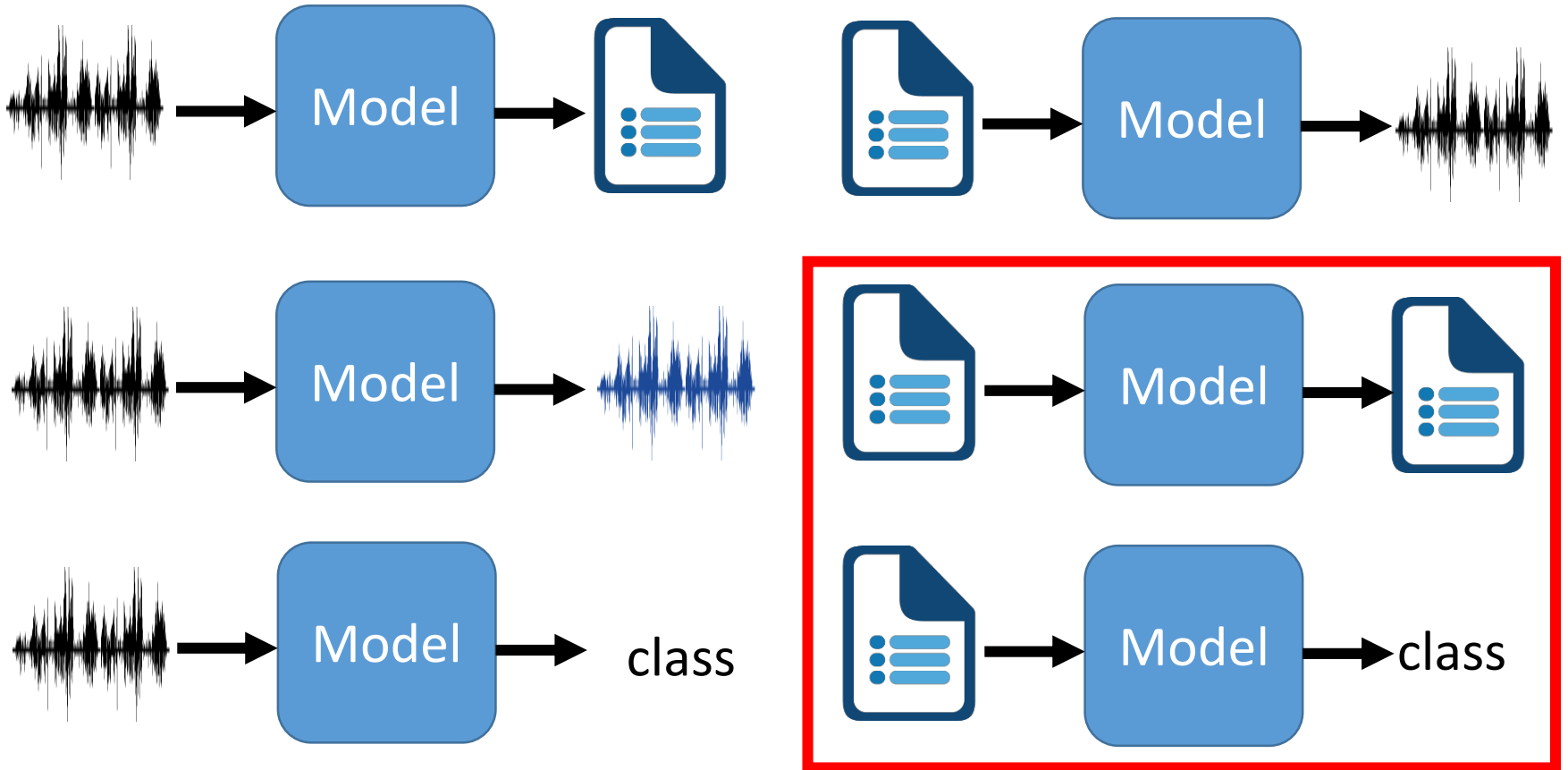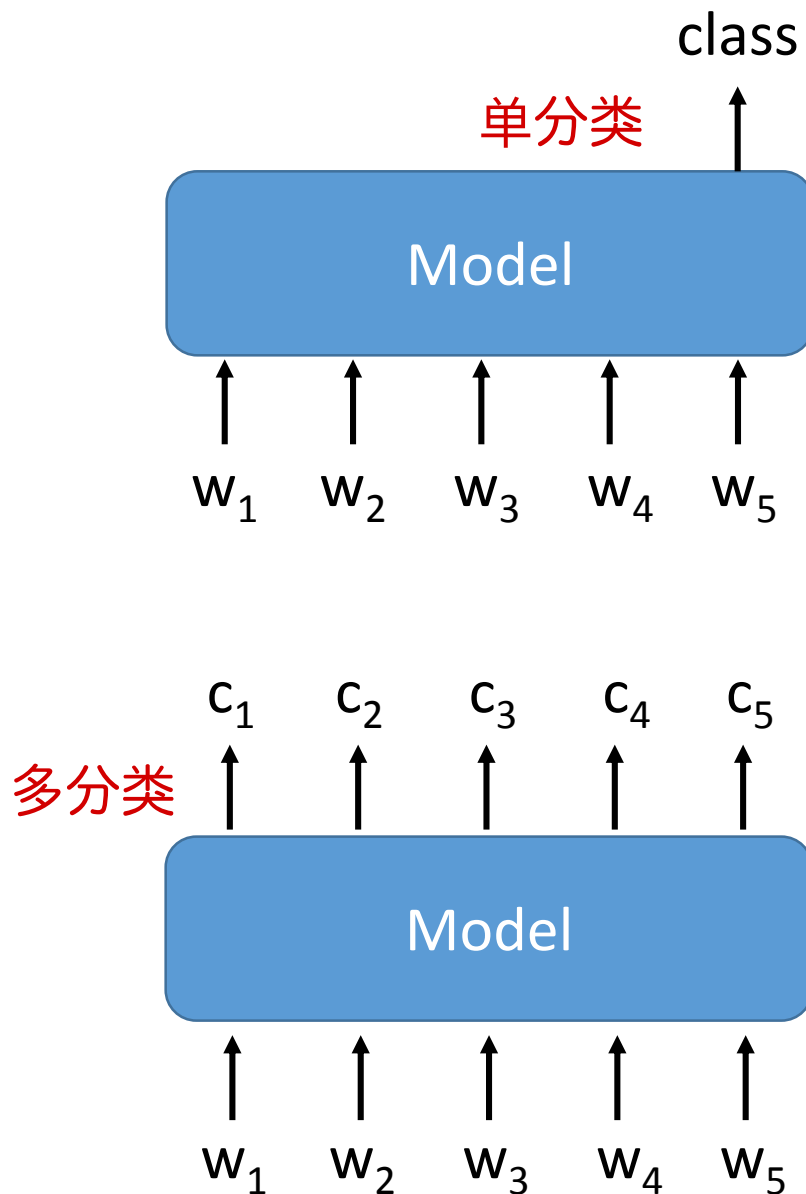# NLP Tasks
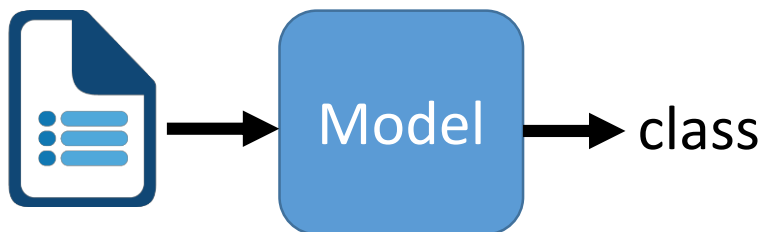
Hung-yi Lee

One slide for this course
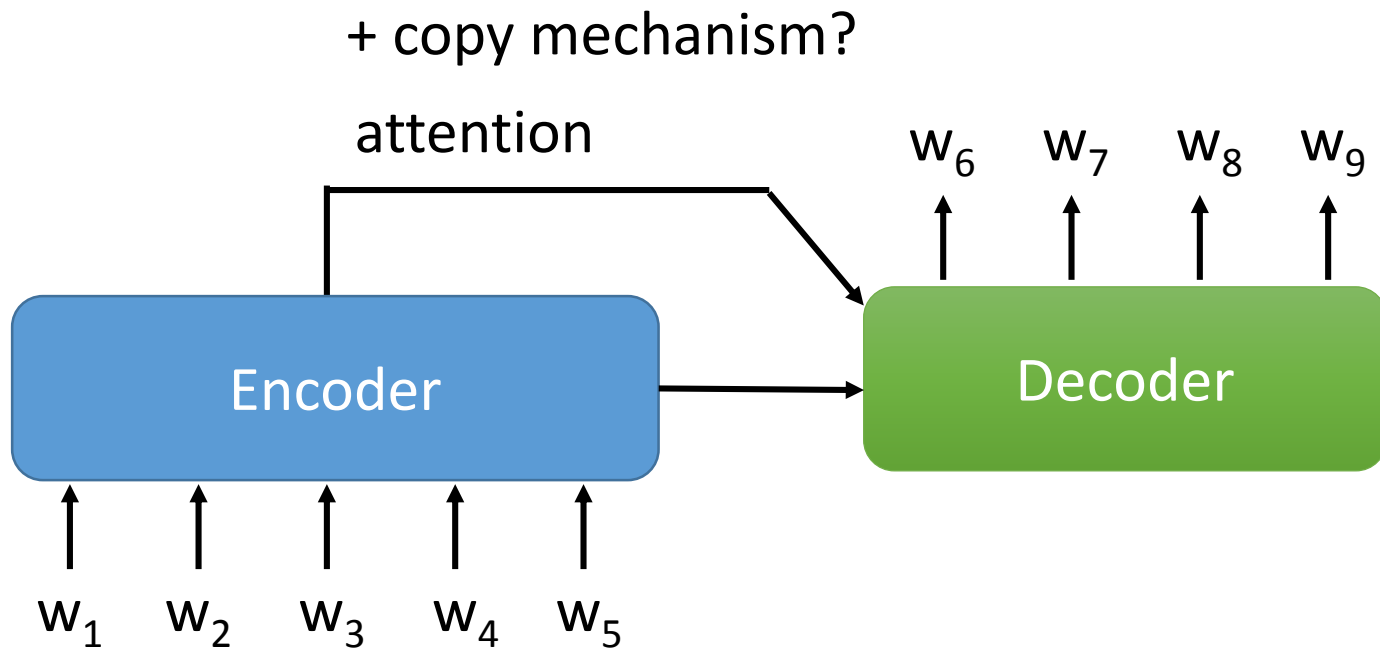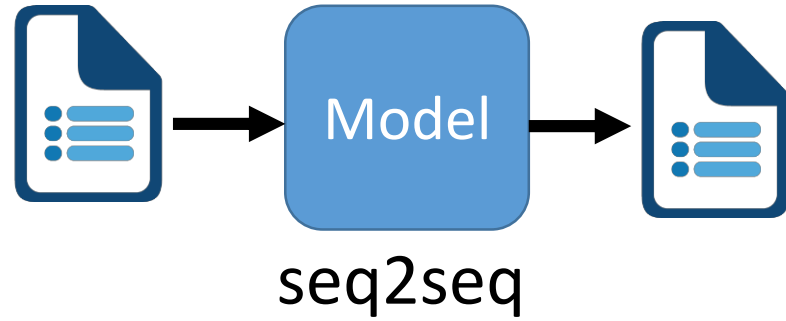

Usually people call them "NLP" tasks.

Category

Category

seq2seq

+ copy mechanism?

attention

w_6 w_7 w_8 w_9

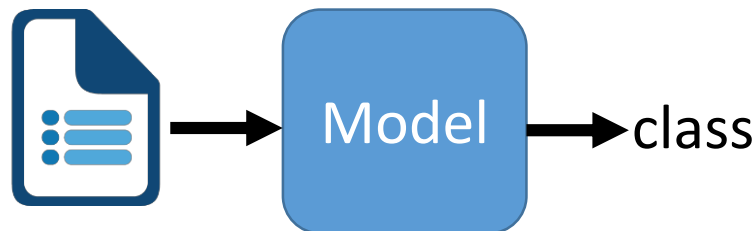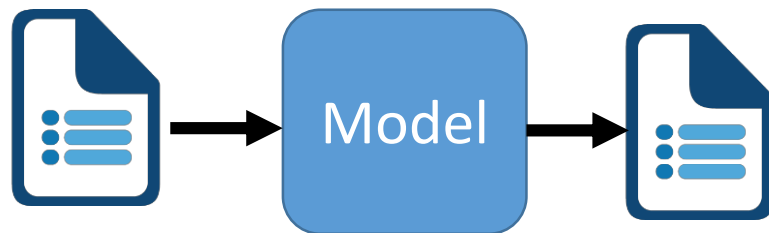Encoder → Decoder

w_1 w_2 w_3 w_4 w_5

Category

如果有多个输入句子要怎么办

What happy if there are more than two input sequences?

w_1 w_2 w_3 w_4 w_5
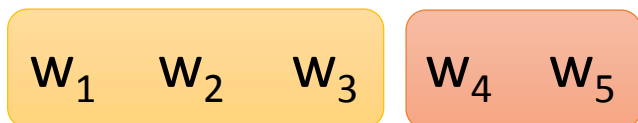
Simply concatenate ...

Model

w_1 w_2 w_3 <SEP> w_4 w_5

token
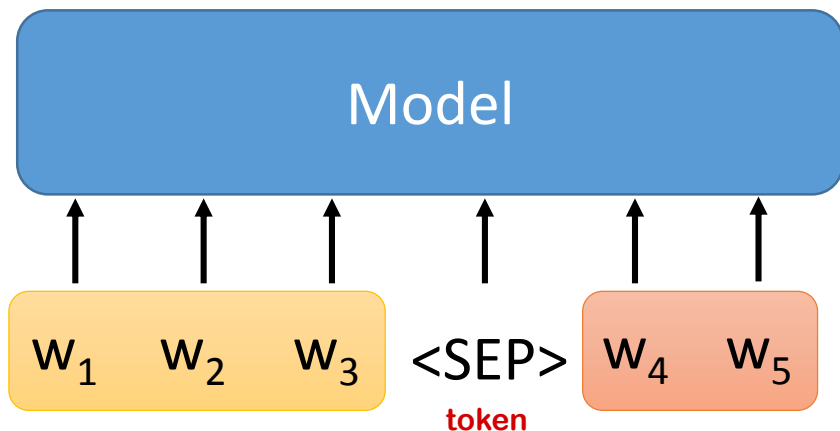
Attention between sequence

Integrate

Model **attention** Model

w_1 w_2 w_3 w_4 w_5
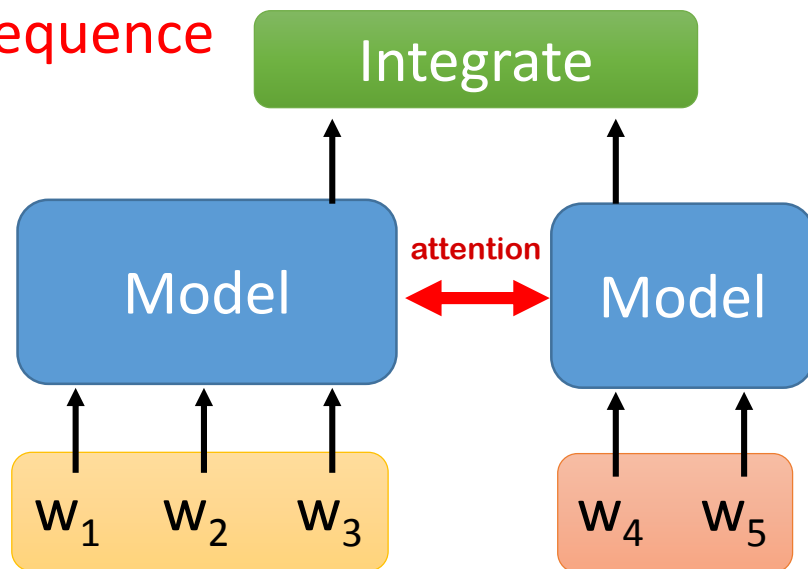
将不同的输入句子放在不同的 model 中进行 embedding

output	One Sequence	Multiple Sequences
One Class	Sentiment Classification Stance Detection Veracity Prediction Intent Classification Dialogue Policy	NLI Search Engine Relation Extraction
Class for each Token	POS tagging Word segmentation Extraction Summarization Slotting Filling NER	
Copy from Input		Extractive QA
General Sequence	Abstractive Summarization Translation Grammar Correction NLG	General QA Task Oriented Dialogue Chatbot
Other?	Parsing, Coreference Resolution	

Part-of-Speech (POS) Tagging 词性标注

注释

- Annotate each word in a sentence with a part-of-speech (e.g. Verb, Adjective, Noun)

PN V D N （可以作为前处理）

Model

Down-stream Task

John saw the saw. ⟶ PN V D N
John saw the saw.
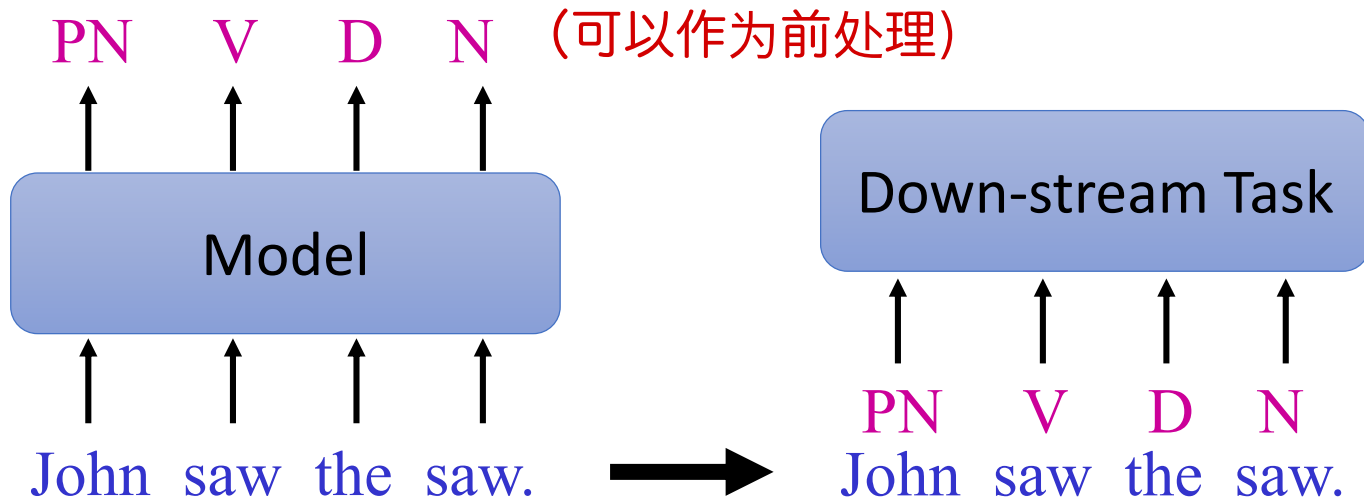
Input: sequence
Output: class for each token

（可以作为前处理）

单词分割
Word Segmentation

Input: sequence
Output: class for each token

二分类任务

- for Chinese

N N N Y N Y N Y

Model

台 灣 大 學 簡 稱 台 大

Down-stream Task

台灣大學　　簡稱　　台大
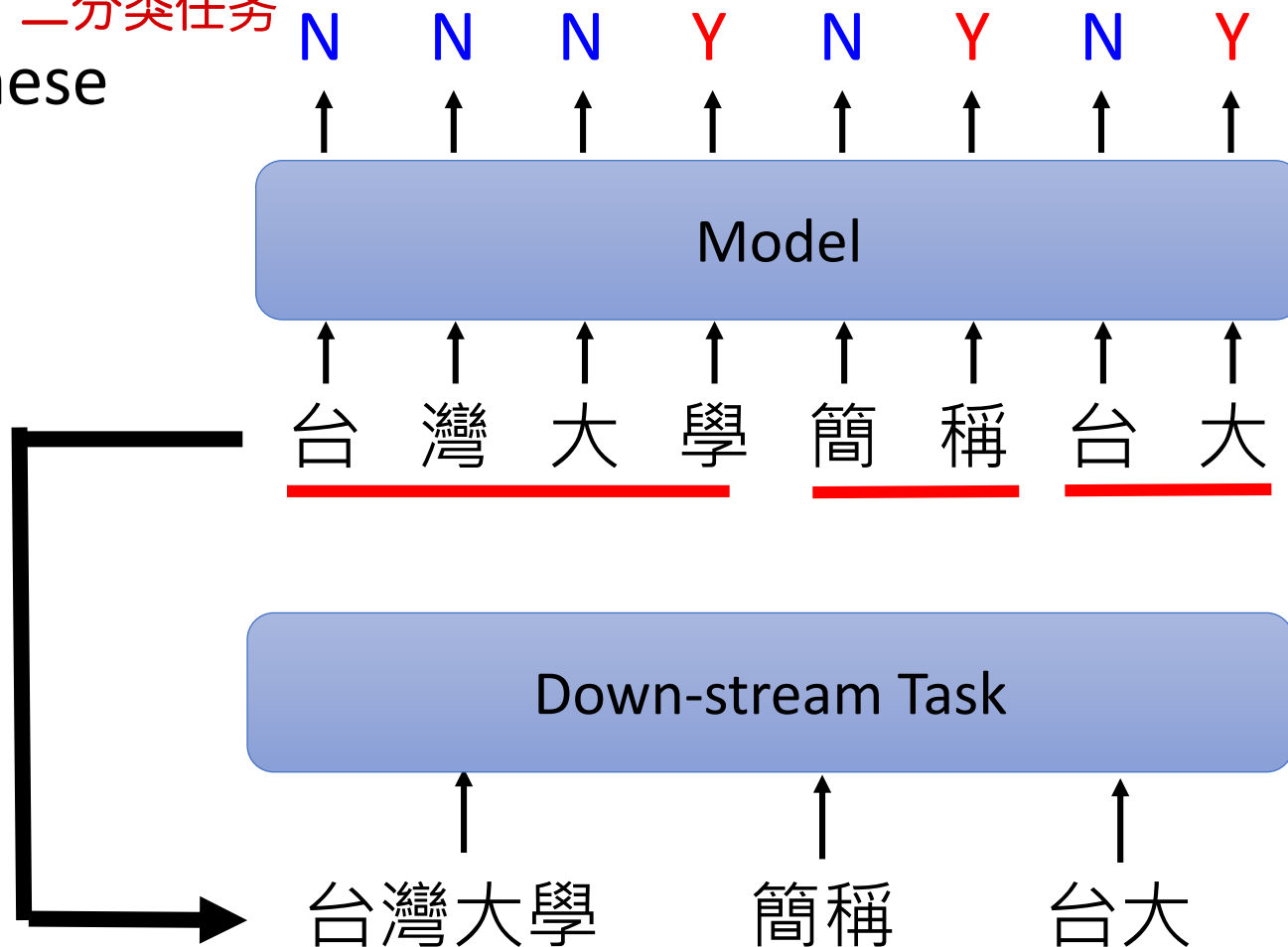
Parsing （可以作为前处理)

Outlier?

给个句子，生成树状结构

Constituency Parsing
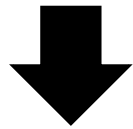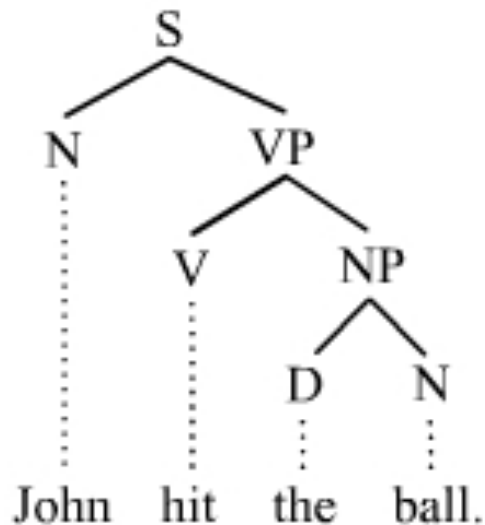
Dependency Parsing
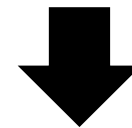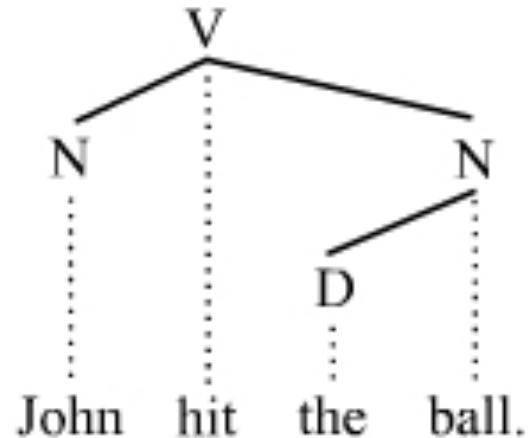
The results of parsing can be used in the downstream tasks.

Coreference Resolution (指代消解)

Outlier?

找出一篇文章中哪些词汇指的是同一个identity

Paul Allen was born on January 21, 1953. He attended Lakeside School, where he befriended Bill Gates. Paul and Bill used a teletype terminal at their high school, Lakeside, to develop their programming skills on several time-sharing computer systems.

Source of example:
https://demo.allennlp.org/coreference-resolution/

Summarization 摘要

- ***Extractive*** summarization

(Here a token is a sentence)

给一篇文章

Sentence 1

Sentence 2

挑选一些
重要的句子

Sentence 3

Sentence 4

Sentence 5

……

document

Sentence 2

Sentence 4

摘要
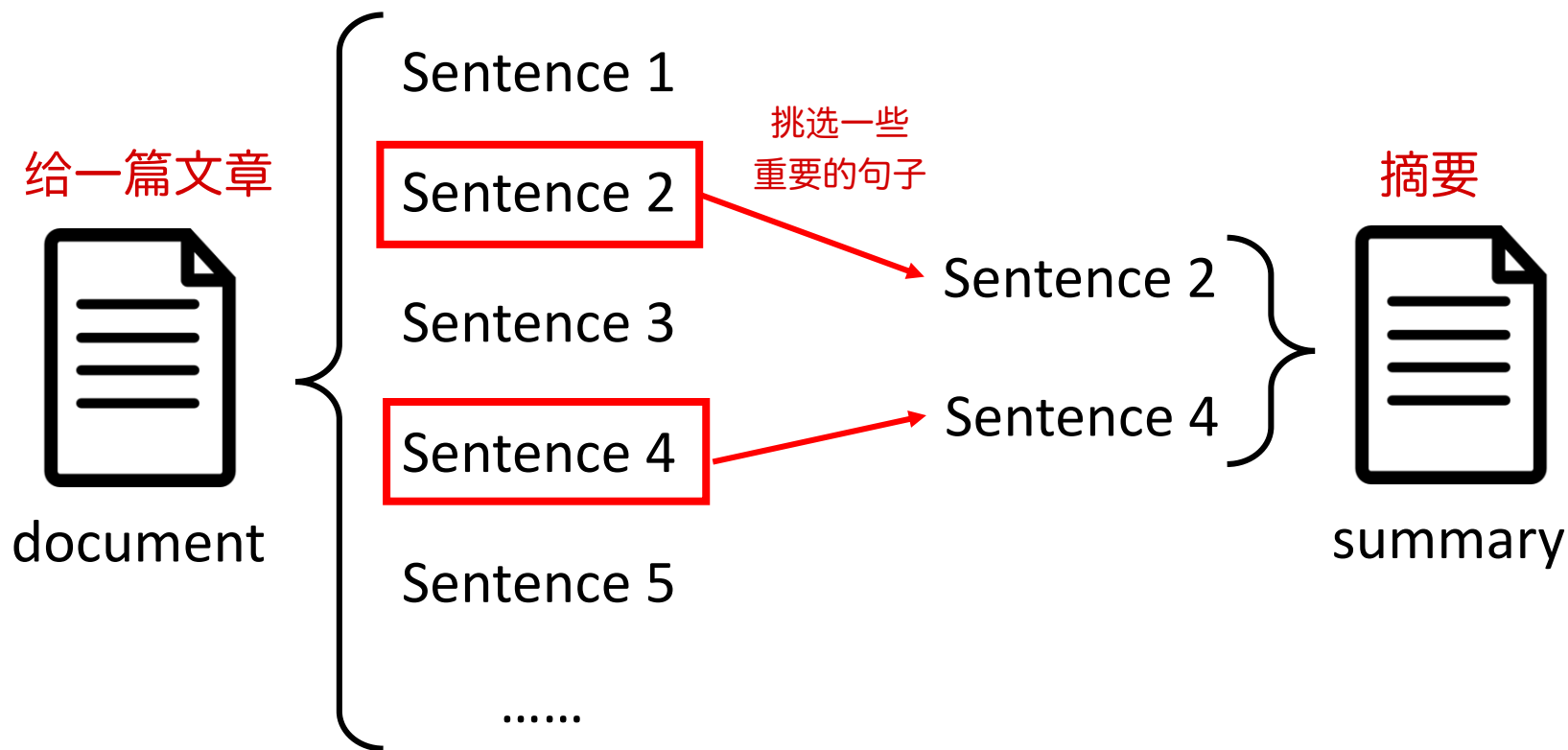
summary

Summarization

- ***Abstractive*** summarization

Input: sequence
Output: sequence

(copy is encouraged)

long

document

Model

short

summary

Pointer network:
encouraging direct copy from input

机器翻译
Machine Translation

How are you? → Model → 你好嗎?

How are you? → Model → 你好嗎?
（语音）

How are you? → Model → 你好嗎?
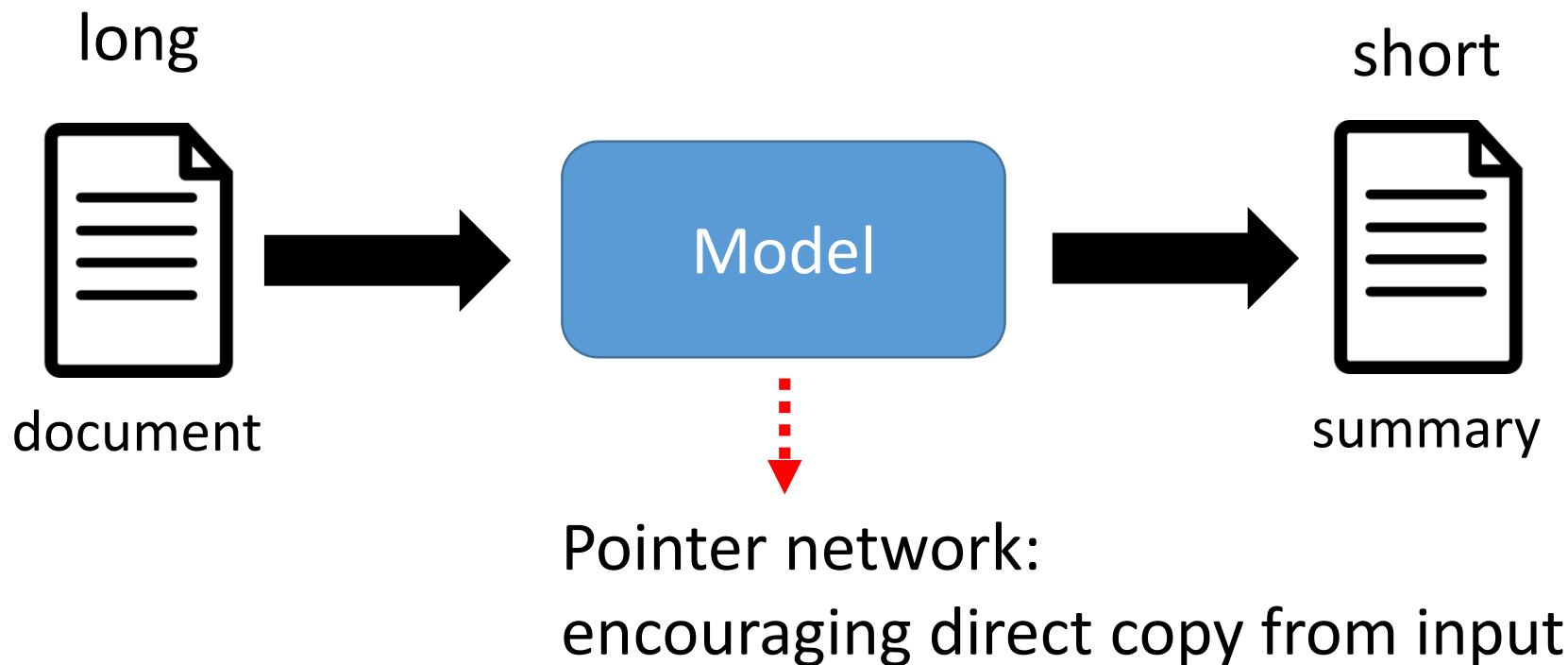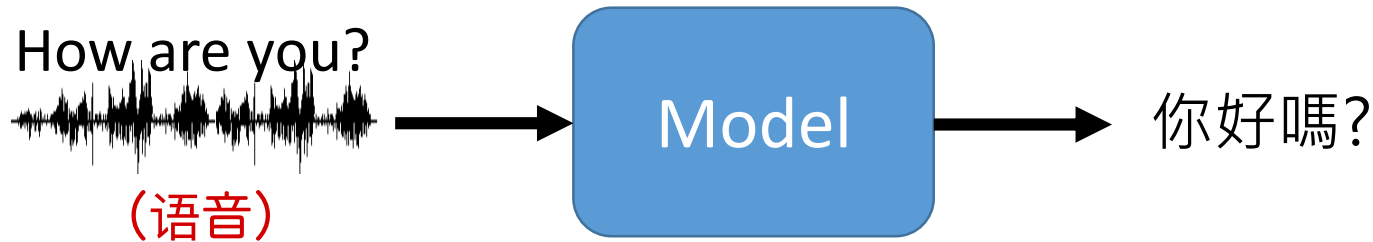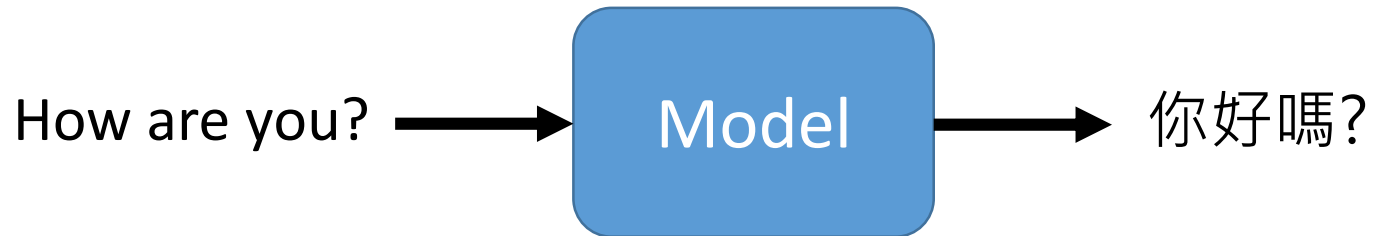
Unsupervised machine translation is a critical research direction.

Grammar Error Correction 语法纠错

I am good.

↑

Model

↑

I are good.

Input: sequence
Output: sequence

(copy is encouraged)

	Example 1
x	[Bolt can have run race]
y	[Bolt could have run the race]
diff	(C,[) (C,Bolt) (D,can) (I,can,could) (C,have) (C,run) (I,run,the) (C,race) (C,])
e	C C R(could) C A(the) C C ↑ ↑ ↑ ↑ ↑ ↑ ↑ [Bolt can have run race]

	Example 2
x	[He still won race !]
y	[However , he still won !]
diff	(C,[) (I,[,However,) (D,He) (I,He,he) (C,still) (C,won) (D,-race) (C,!) (C,])
e	A(However,) T_case C C D C C ↑ ↑ ↑ ↑ ↑ ↑↑ [He still won race !]

Source of image:
https://www.aclweb.org/anthology/D19-1435.pdf

Sentiment Classification

Input: sequence
Output: class

柯南劇場版《紺青之拳》還蠻有趣的 👍

柯南劇場版《紺青之拳》槽點很多 👎

柯南劇場版《紺青之拳》雖然槽點很多，但還蠻有趣的 👍

柯南劇場版《紺青之拳》雖然還蠻有趣的，但槽點很多 👎

Stance Detection 立场检测

Source: 李宏毅是個型男 (post on twitter or FB)

Reply: 他只是個死臭酸宅

反对

DENIED

Many systems use the Support, Denying, Querying, and Commenting (SDQC) labels for classifying replies.

Used in Veracity Prediction

Veracity Prediction 事实预测（判断一篇文章是真是假）

Veracity prediction examples:

u1: Hostage-taker in supermarket siege killed, reports say. #ParisAttacks –LINK– **[true]**

u1: OMG. #Prince rumoured to be performing in Toronto today. Exciting! **[false]**

Source of image: https://www.aclweb.org/anthology/S17-2006.pdf

Post → Model → True/False
Replies → Model
Wikipedia → Model
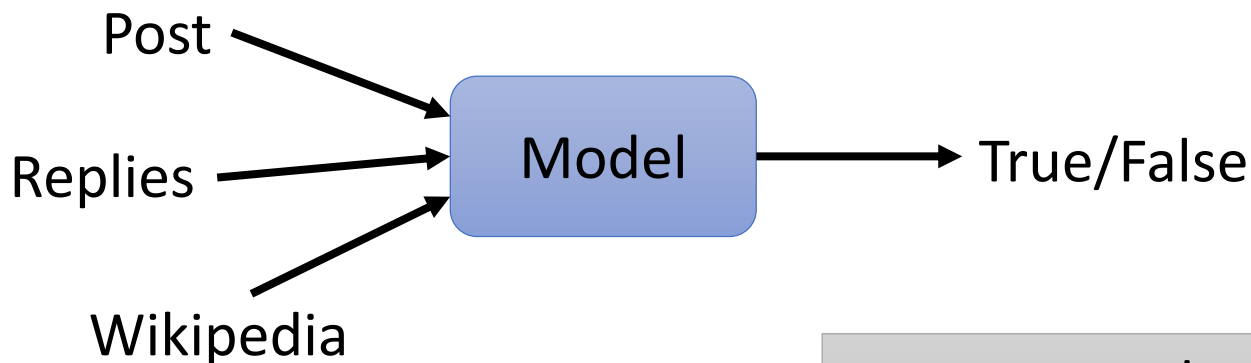
Input: several sequences
Output: class

Natural Language Inference (NLI) 推理，推断

Input: two sequences
Output: a class

contradiction
entailment
neutral

给一个前提和假设，对假设进行推断

Model

前提
premise: A person on a horse jumps over a broken down airplane

假设
hypothesis: A person is at a diner.   contradiction

hypothesis: A person is outdoors, on a horse.   entailment

hypothesis: person is training his horse for a competition.   neutral

Search Engine 搜索引擎

relevant

do esthetician stand a lot at work → Model

BEFORE

AFTER

9:00

google.com

Chron.com › work

Medical Esthetician Vs. Spa Esthetician - Work - Chron.com

Jul 1, 2018 · The type of business in which an esthetician works can have an impact on her earnings, ... schools offer esthetics programs, though there are also stand-alone esthetics schools as well.

9:00

google.com

https://apps.il-work-net.com › Clusters

Estheticians - Physical Demands - il-work-net.com

Speak clearly so listeners can understand. Hold the arm and hand in one position or hold the hand steady while moving ...

Source of image: https://www.blog.google/products/search/search-language-understanding-bert/

问答系统

Question Answering (QA)

Source of image: https://web.stanford.edu/~jurafsky/slp3/25.pdf

Question Answering

question → QA → answer

Knowledge source →

Filter out irrelevant documents

unstructured documents ↑

← search engine

http://www.

Reading comprehension

阅读理解

Question Answering

(copy from input)

- Extractive QA: Answer in the document

s e

QA

question   document
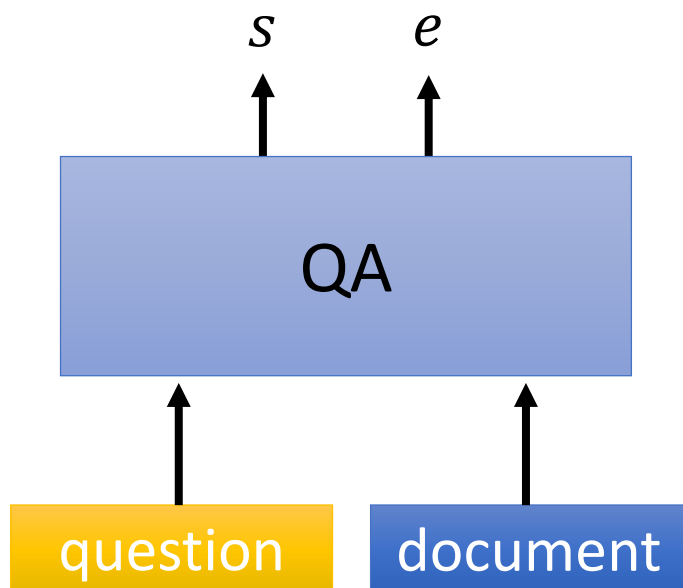
In meteorology, precipitation is any product of the condensation of 17 spheric water vapor that falls under **gravity**. The main forms of precipitation include drizzle, rain, sleet, snow, **grau-pel** and hail... Precipitation forms as smaller droplets coalesce via collision with other rain drops or ice crystals **within a cloud**. Short, intense periods of rain 77 atte 79 cations are called "showers".

start   end

What causes precipitation to fall?
gravity $s = 17, e = 17$ 第17到第17个单词

What is another main form of precipitation besides drizzle, rain, snow, sleet and hail?
graupel

Where do water droplets collide with ice crystals to form precipitation?
within a cloud $s = 77, e = 79$

Dialogue 对话系统

Chatting

Task-oriented

Chatting 尬聊

User: What is your name?

Cleverbot: Weil ich dich nicht kennw.

User: What is your name?

Cleverbot: Li.

User: Are you Li?

Cleverbot: No i'm Mara.

User: Are you Mara?

Cleverbot: No.

User: Who you are?

Cleverbot: I just said your name you don't need to know my name.

User: Do you know my name?

Cleverbot: No that is why I am asking you.

User: Can you tell me your name?

Cleverbot: I already told you.

User: You are Mara?

Cleverbot: I'm sorry.

Chatting

cleverbot

User: Sorry for what?

Cleverbot: For not remembering your name.

User: Do you remember your name?

Cleverbot: Yes I do...

User: What is your name?

Cleverbot: Once again, I can't tell you.

User: You have told me that you are Mara.

Cleverbot: I am a boy.

User: Are you a boy?

Cleverbot: Yes.

User: Are you a girl?

Cleverbot: No, are you?

User: No. How old are you?

Cleverbot: 2000 years old.

User: You are so old!

Cleverbot: No i'm quite young.

User: How old are you?

Cleverbot: Why do you keep asking me that?

User: Because I want to know your age.

Cleverbot: What if I do not want to tell you.

User: Then don't tell me your age.

Cleverbot: My name is Blue Monday.

Chatting

Hi ☺

Hello ☺

Hi ☺

Human

Machine

Hello ☺ →输入句子→ **Model** →输出回应→ Hi ☺

模型需要记住之前的话

Chatting

Hi ☺

Hello ☺

how's your day?

Human

Machine

M: Hi ☺ → **Model** → how's your day?

H: Hello ☺

模型需要记住之前的话

Chatting

Personality

Empathy （同理心）

Knowledge

M: Hi ☺

H: Hello ☺

Model

how's your day?
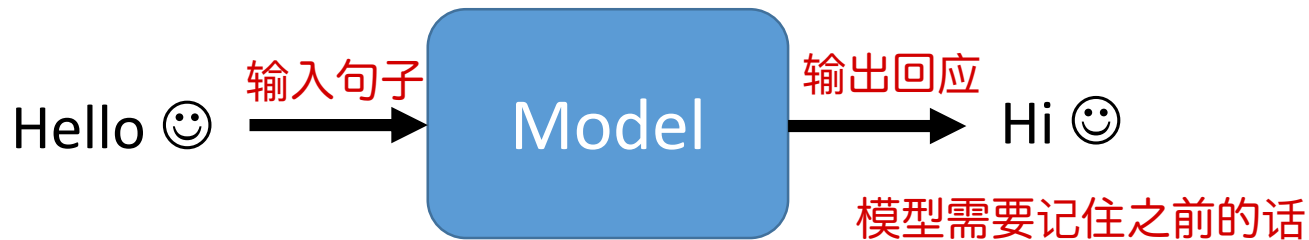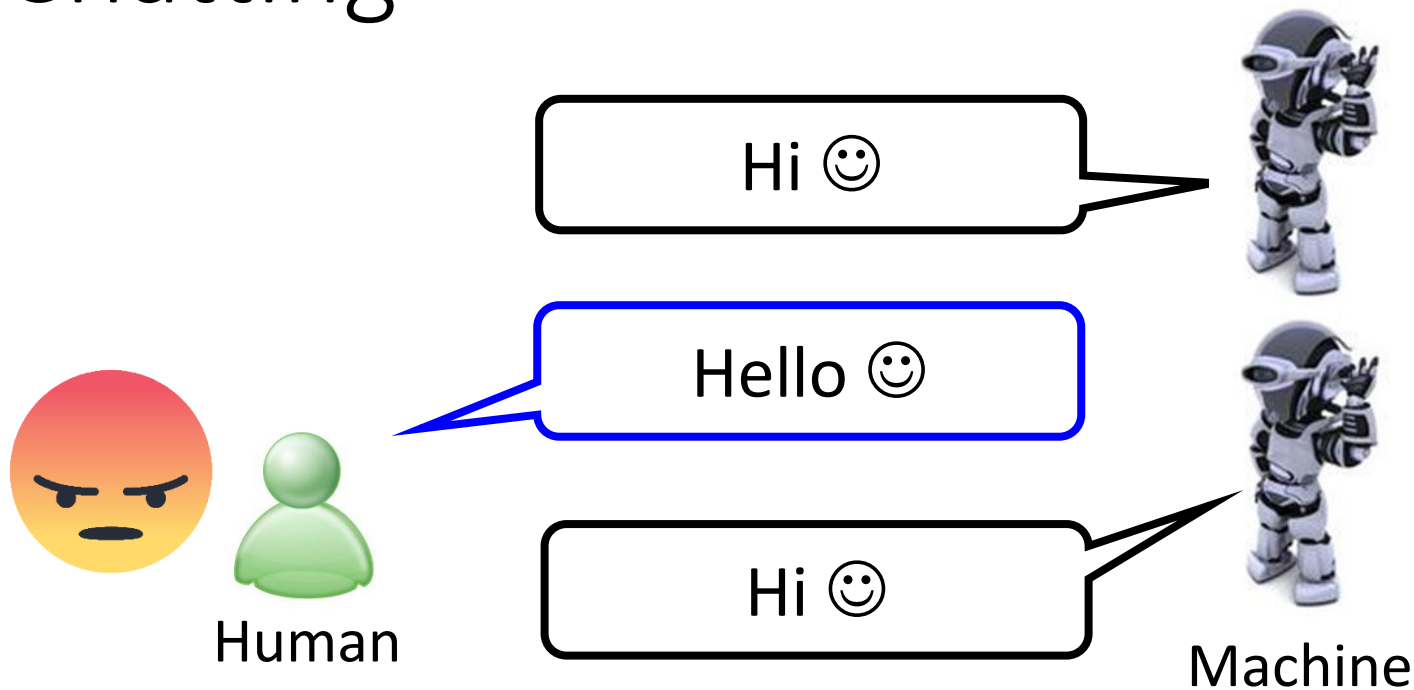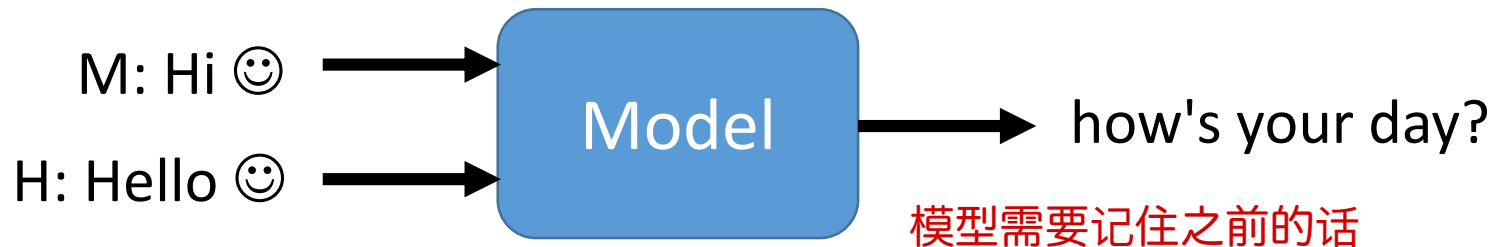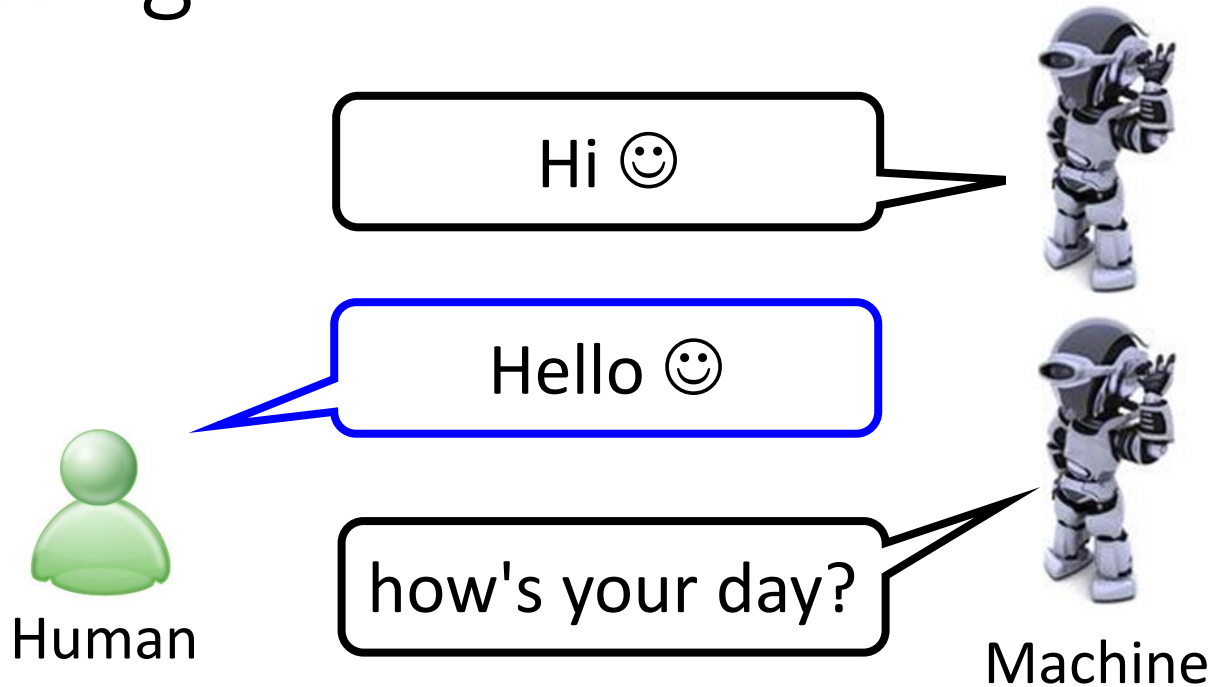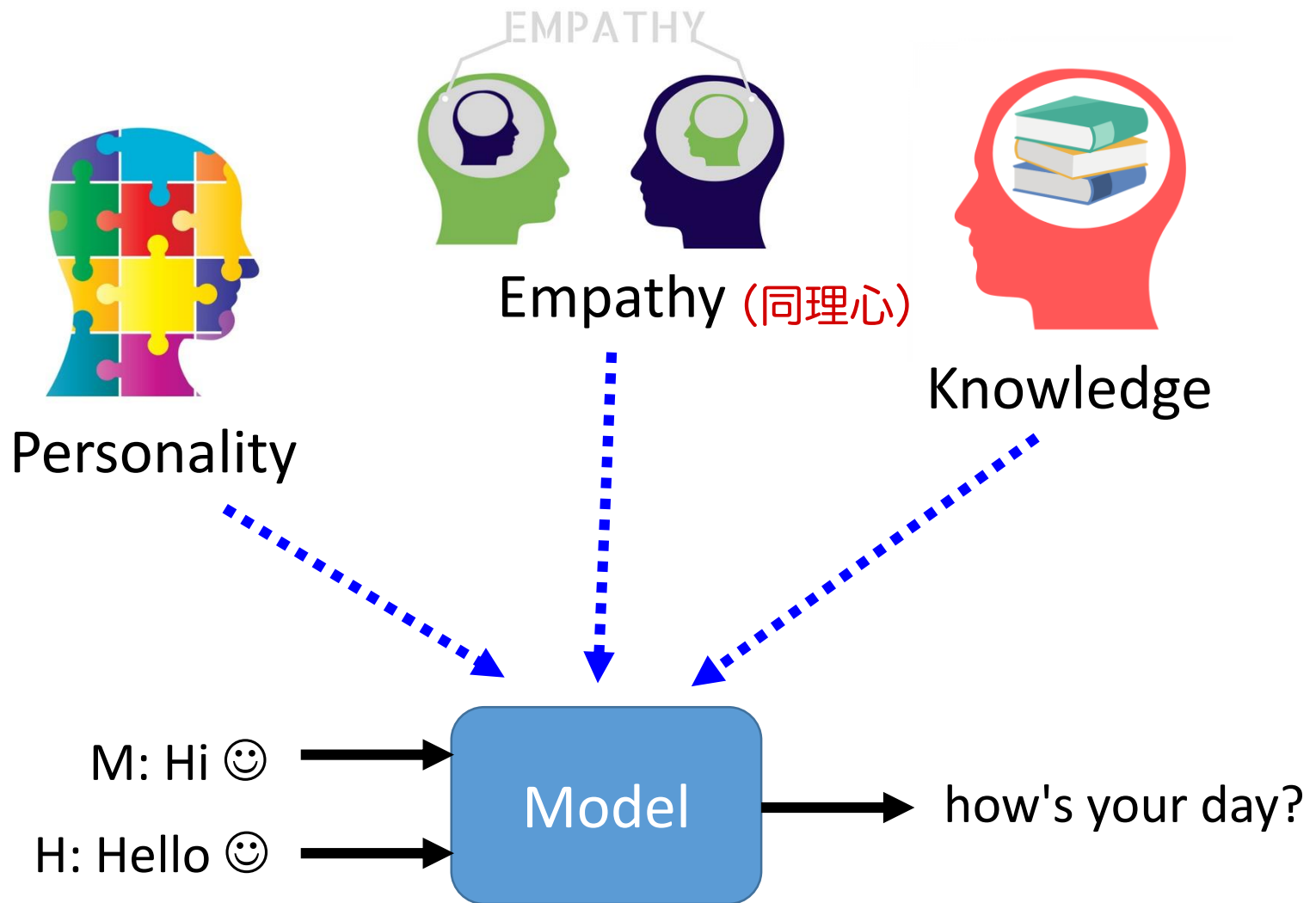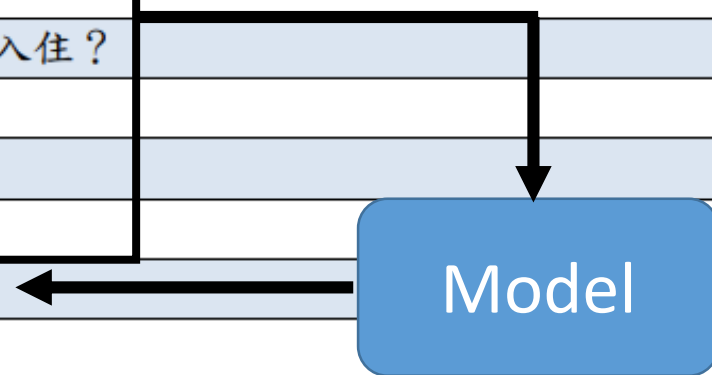
Task-oriented 任务导向的对话系统

1	Agent	您好，這裡是夏季商務旅館，請問有什麼能為您服務的嗎？
2	User	我要訂房
3	Agent	沒問題，請問怎麼稱呼您？
4	User	我姓林
5	Agent	林小姐您好，請問您預計何時入住？
6	User	9 月 9 日晚上入住
7	Agent	請問要住幾個晚上呢？
8	User	2 晚
9	Agent	請問訂房人數總共是幾位呢？
10	User	5 位
11	Agent	請問您要預定的房型？
12	User	一間豪華套房、一間豪華客房
13	Agent	好的，您入住的日期是 9 月 9 日星期一，退房時間為 9 月 11 日星期三。請問確認訂房嗎？
14	User	ok

Model

(source of image: 科技大擂台 2020 簡章範例)

Natural Language Generation (NLG)

Action: Greeting
Ask (入住日)
Ask (退房日)
......

预先定义机器可采取的行为

1	Agent	您好，這裡是夏季商務旅館，請問有什麼能為您服務
2	User	我要訂房
3	Agent	沒問題，請問怎麼稱呼您？
4	User	我姓林
5	Agent	林小姐您好，請問您預計何時入住？
6	User	9 月 9 日晚上入住
7	Agent	請問要住幾個晚上呢？
8	User	2 晚
9	Agent	請問訂房人數總共是幾位呢？
10	User	5 位
11	Agent	請問您要預定的房型？
12	User	一間豪華套房、一間豪華客房
13	Agent	好的，您入住的日期是 9 月 9 日星期一，退房時間為 9 月 11 日星期三。請問確認訂房嗎？
14	User	ok

Model

NLG ← Ask (訂房人數)
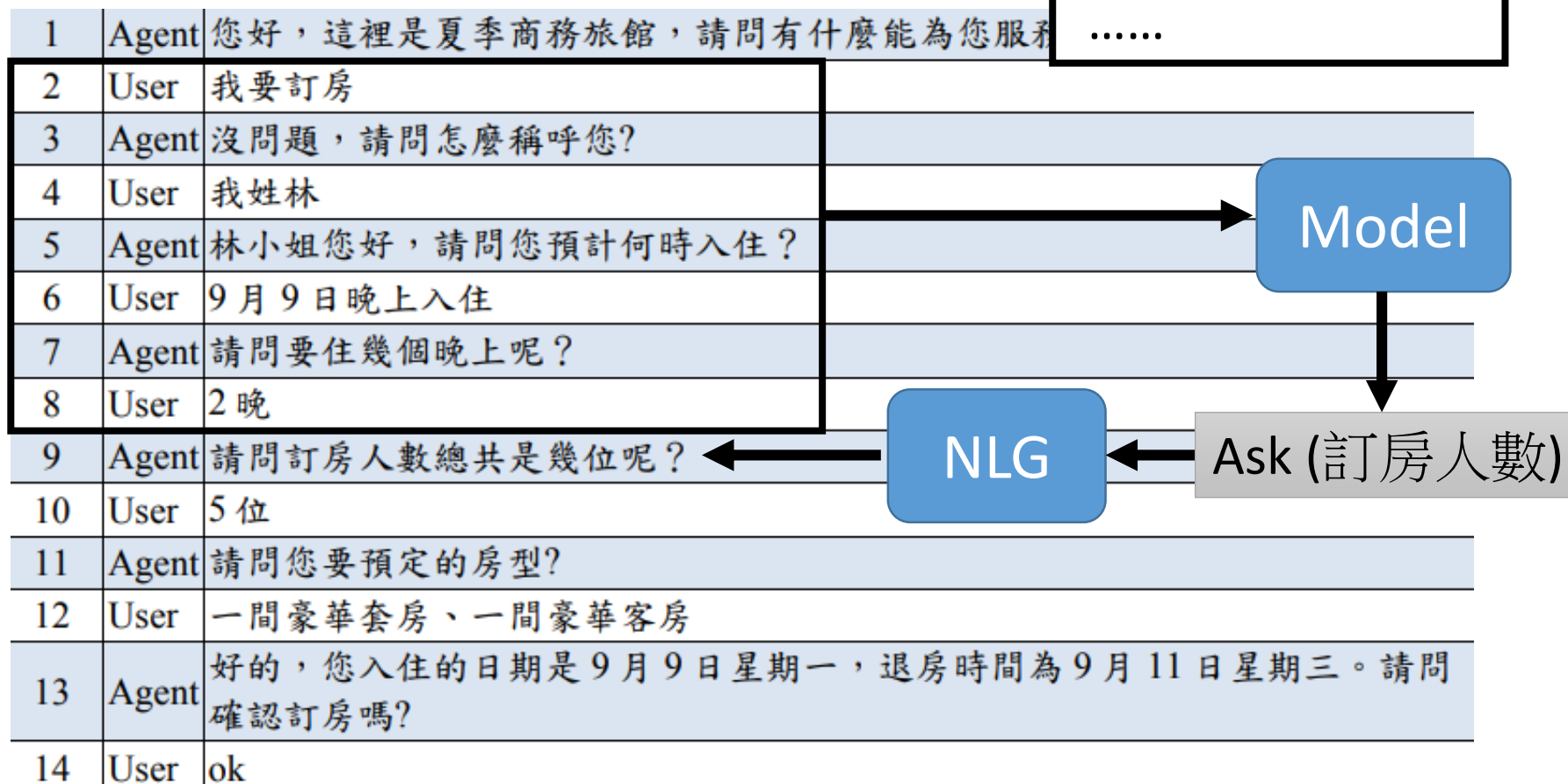
Policy & State Tracker

这个对话到目前为止所发生的事情
State: What has happened in this dialogue

連絡人：林XX
入住人數： None
連絡電話： None
房型： None
入住日期：9月9日
退房日期：9月11日

1	Agent	您好，這裡是夏季商務旅館，請問有什麼能為
2	User	我要訂房
3	Agent	沒問題，請問怎麼稱呼你?
4	User	
5	Agen	時入住？
6	User	
7	Agent	請問要住幾個晚上呢？
8	User	2 晚
9	Agent	請問訂房人數總共是幾位呢？
10	User	5 位
11	Agent	請問您要預定的房型?
12	User	一間豪華套房、一間豪華客房
13	Agent	好的，您入住的日期是 9 月 9 日星期一，退房時間為 9 月 11 日星期三。請問確認訂房嗎？
14	User	ok

Preprocessing by NLU

输入一堆sequence，输出一个sequence

State Tracker → State

分类问题 **Policy**

Ask (訂房人數)

NLG
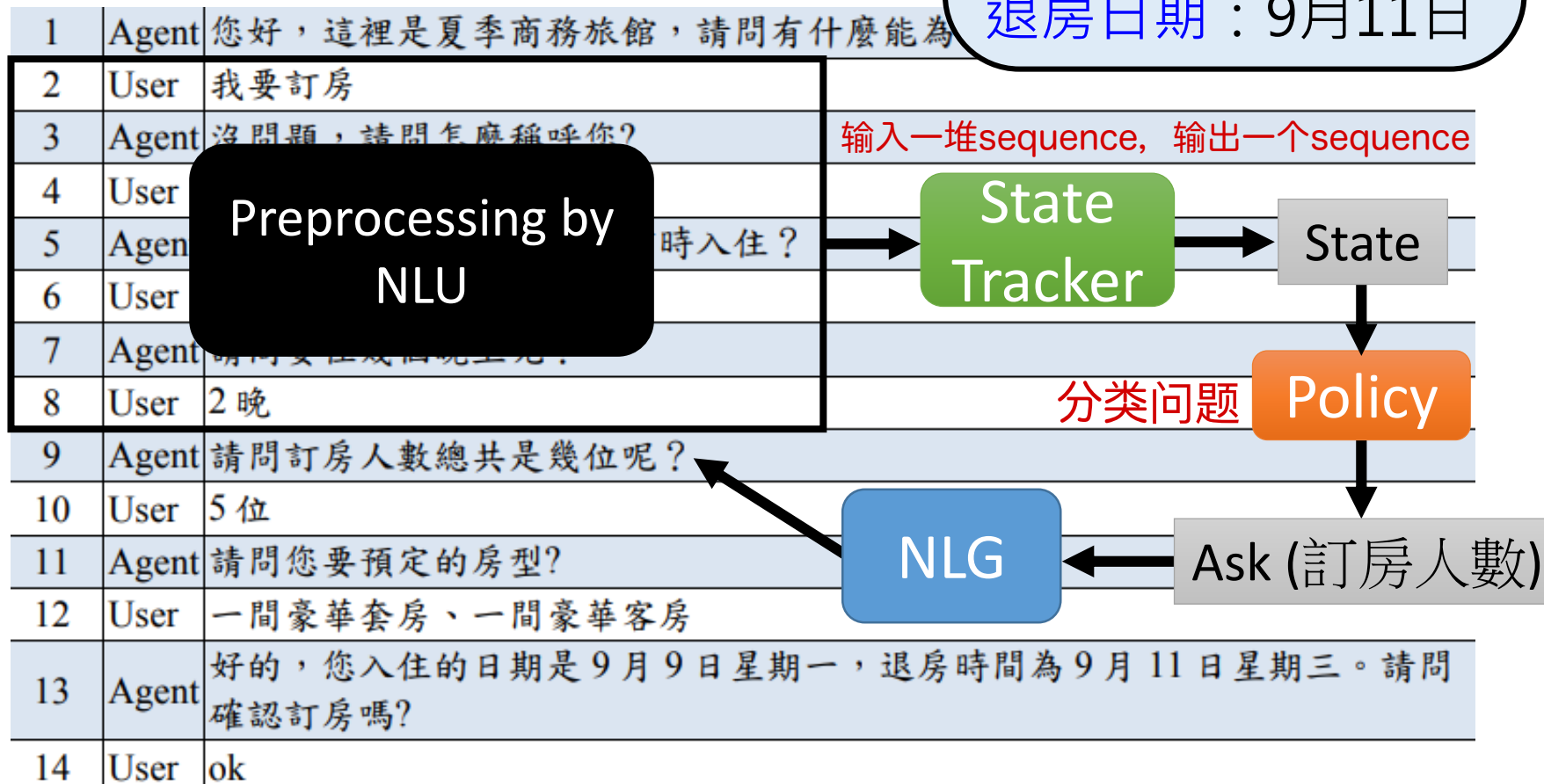
Natural Language Understanding (NLU)

- Intent Classification

Provide Information

我 打算 9月 9日 入住 、 9月 11日 退房

- Slot Filling

分类问题

N N 入住日 入住日 N 退房日 退房日 N

Slot:
入住日
退房日
......

我 打算 9月 9日 入住 、 9月 11日 退房

Task-oriented

Dialogue History

ASR → User Input → NLU → State Tracker

End-to-end

state

Policy → NLG → System Output → TTS
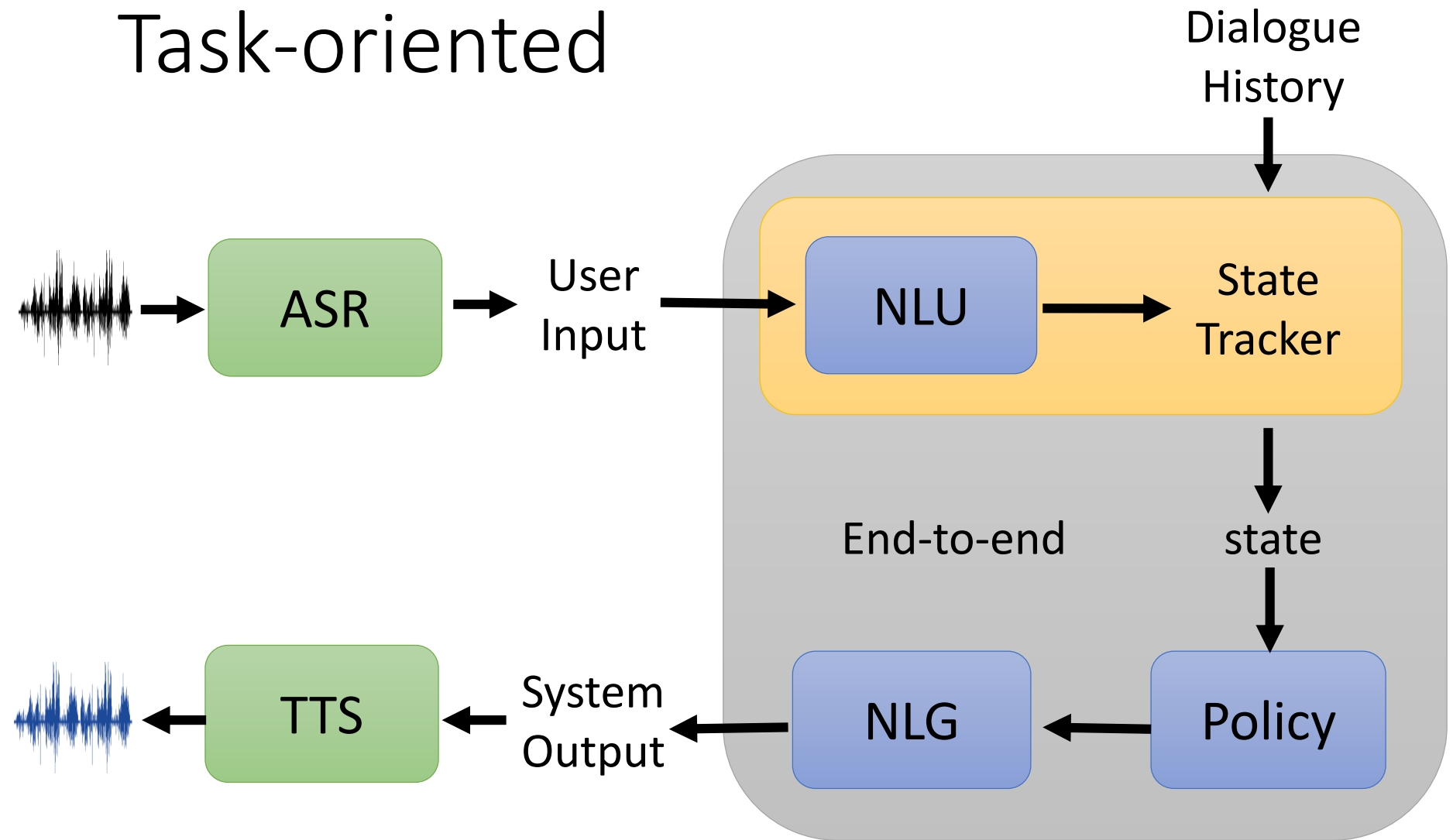
Input: several sequences, Output: a sequence

Knowledge Extraction 知识图谱

Knowledge

entity

relation

Hogwarts

Is a student of

is husband of

is wife of
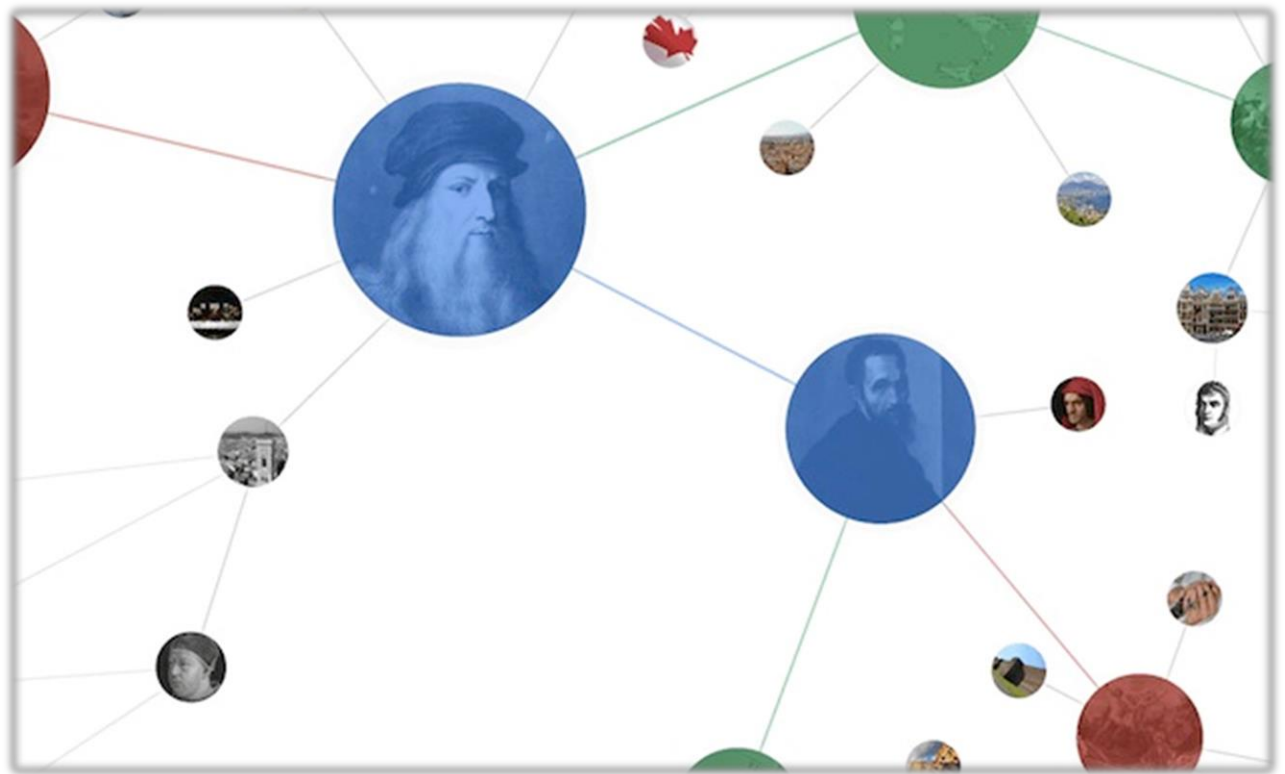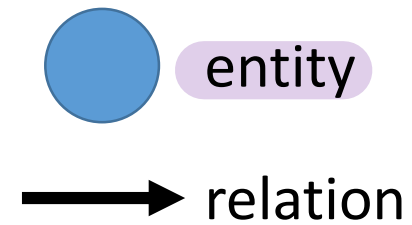
Is a student of

Ron Weasley
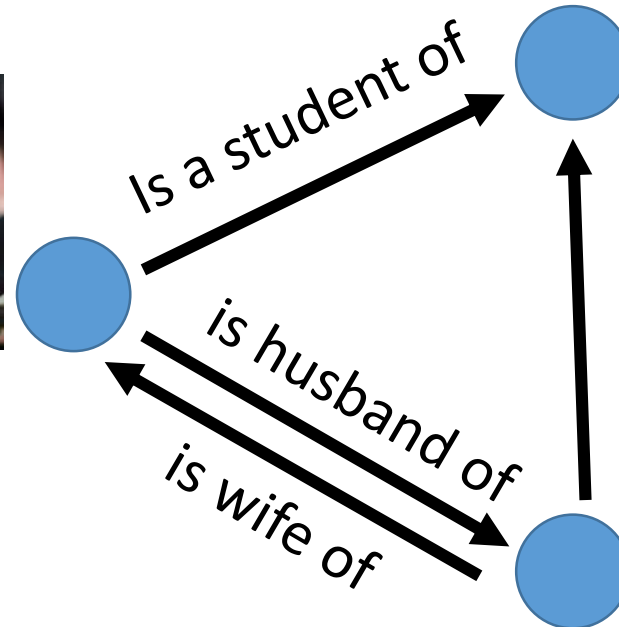
Hermione Granger

Step 1: Extract Entity

Step 2: Extract Relation

(warning: The following description oversimplifies the task)

Name Entity Recognition (NER)

Harry Potter is a student of Hogwarts and lived on Privet Drive.

Name entity recognition

people, organizations, places are usually name entity

Harry Potter is a student of Hogwarts and lived on Privet Drive.

Input: sequence
Output: class for each token

(just like POS tagging, slot filling)

(entity linking)

Relation Extraction 关系提取   Classification Problem

Harry Potter is a student of Hogwarts and lived on Privet Drive.

Harry Potter →

Hogwarts →
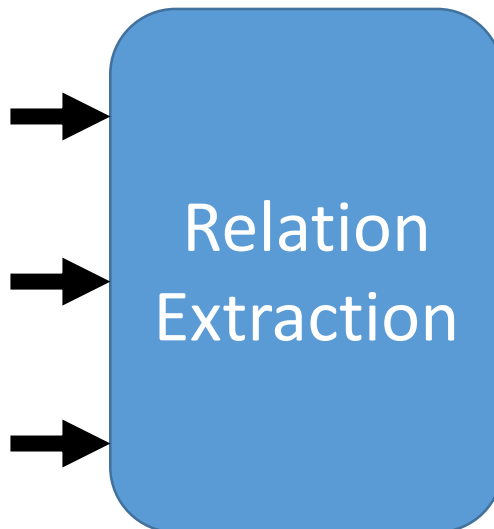
Relation Extraction → "is a student of"

Harry Potter is a student of Hogwarts and lived on Privet Drive.

Hogwarts →

Privet Drive →
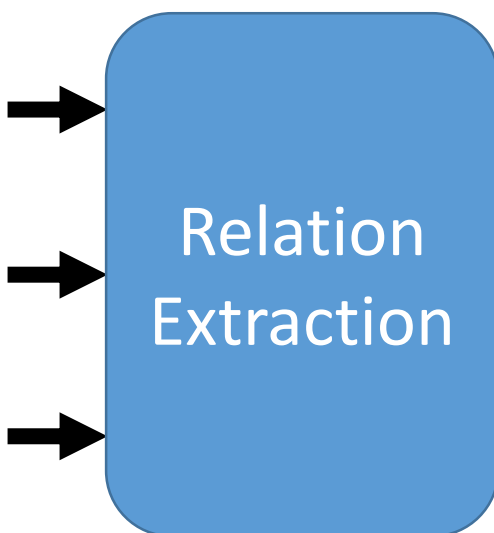
Relation Extraction → "none"

GLUE

General Language Understanding Evaluation (GLUE)

https://gluebenchmark.com/

- Corpus of Linguistic Acceptability (CoLA)
- Stanford Sentiment Treebank (SST-2)　给一个句子，输出类别
- Microsoft Research Paraphrase Corpus (MRPC)
- Quora Question Pairs (QQP)　给两个句子，判断二者语义是否相同
- Semantic Textual Similarity Benchmark (STS-B)
- Multi-Genre Natural Language Inference (MNLI)
- Question-answering NLI (QNLI)　inference
- Recognizing Textual Entailment (RTE)　给出前提，能否推出假设
- Winograd NLI (WNLI)

GLUE also has Chinese version (https://www.cluebenchmarks.com/)

Super GLUE
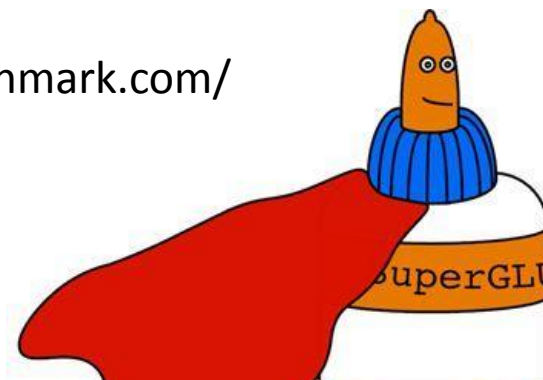
BoolQ

Passage: *Barq's – Barq's is an American soft drink. Its brand of root beer is notable for having caffeine. Barq's, created by Edward Barq and bottled since the turn of the 20th century, is owned by the Barq family but bottled by the Coca-Cola Company. It was known as Barq's Famous Olde Tyme Root Beer until 2012.*
Question: *is barq's root beer a pepsi product* **Answer:** No

CB

Text: *B: And yet, uh, I we-, I hope to see employer based, you know, helping out. You know, child, uh, care centers at the place of employment and things like that, that will help out. A: Uh-huh. B: What do you think, do you think we are, setting a trend?*
Hypothesis: *they are setting a trend* **Entailment:** Unknown

COPA

Premise: *My body cast a shadow over the grass.* **Question:** *What's the CAUSE for this?*
Alternative 1: *The sun was rising.* **Alternative 2:** *The grass was cut.*
Correct Alternative: 1

MultiRC

Paragraph: *Susan wanted to have a birthday party. She called all of her friends. She has five friends. Her mom said that Susan can invite them all to the party. Her first friend could not go to the party because she was sick. Her second friend was going out of town. Her third friend was not so sure if her parents would let her. The fourth friend said maybe. The fifth friend could go to the party for sure. Susan was a little sad. On the day of the party, all five friends showed up. Each friend had a present for Susan. Susan was happy and sent each friend a thank you card the next week*
Question: *Did Susan's sick friend recover?* **Candidate answers:** *Yes, she recovered* (T), *No* (F), *Yes* (T), *No, she didn't recover* (F), *Yes, she was at Susan's party* (T)

Super GLUE

SuperGLU
Ingredients:

ReCoRD

Paragraph: *(CNN) Puerto Rico on Sunday overwhelmingly voted for statehood. But Congress, the only body that can approve new states, will ultimately decide whether the status of the US commonwealth changes. Ninety-seven percent of the votes in the nonbinding referendum favored statehood, an increase over the results of a 2012 referendum, official results from the State Electorcal Commission show. It was the fifth such vote on statehood. "Today, we the people of Puerto Rico are sending a strong and clear message to the US Congress ... and to the world ... claiming our equal rights as American citizens, Puerto Rico Gov. Ricardo Rossello said in a news release. @highlight Puerto Rico voted Sunday in favor of US statehood*
Query For one, they can truthfully say, "Don't blame me, I didn't vote for them, " when discussing the <placeholder> presidency   **Correct Entities:** US

RTE

Text: *Dana Reeve, the widow of the actor Christopher Reeve, has died of lung cancer at age 44, according to the Christopher Reeve Foundation.*
Hypothesis: *Christopher Reeve had an accident.*   **Entailment:** False

WiC

Context 1: *Room and board.*   **Context 2:** *He nailed boards across the windows.*
Sense match: False

WSC

Text: *Mark told Pete many lies about himself, which Pete included in his book. He should have been more truthful.*   **Coreference:** False

DecaNLP

https://decanlp.com/

- 10 NLP tasks
- Solving by the same model

Decathlon

Question	Context	Answer
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 is the translation from English to German?	Most of the planet is ocean water.	Der Großteil der Erde ist Meerwasser
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...
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
Is this sentence positive or negative?	A stirring, funny and finally transporting re-imagining of Beauty and the Beast and 1930s horror film.	positive

	One Sequence	Multiple Sequences
One Class	Sentiment Classification Stance Detection Veracity Prediction Intent Classification Dialogue Policy	NLI Search Engine Relation Extraction
Class for each Token	POS tagging Word segmentation Extraction Summarization Slotting Filling NER	
Copy from Input		Extractive QA
General Sequence	Abstractive Summarization Translation Grammar Correction NLG	General QA Task Oriented Dialogue Chatbot
Other?	Parsing, Coreference Resolution	