



**Dialogue System**  
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# Applied Deep Learning

YUN-NUNG (VIVIAN) CHEN [WWW.CSIE.NTU.EDU.TW/~YVCHEN/F105-ADL](http://WWW.CSIE.NTU.EDU.TW/~YVCHEN/F105-ADL)



臺灣大學

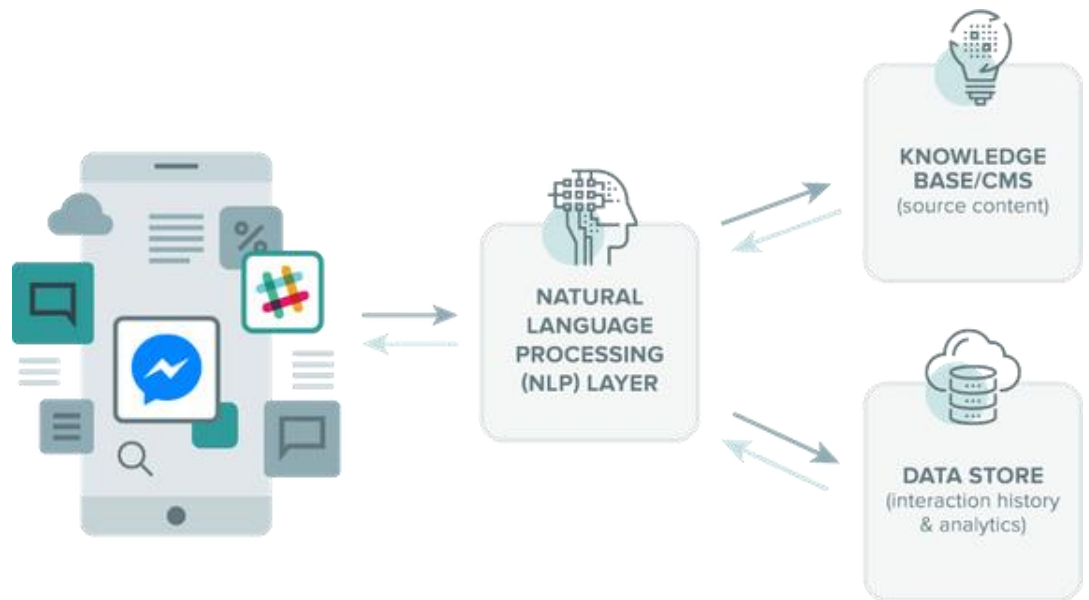
National Taiwan University

# Introduction

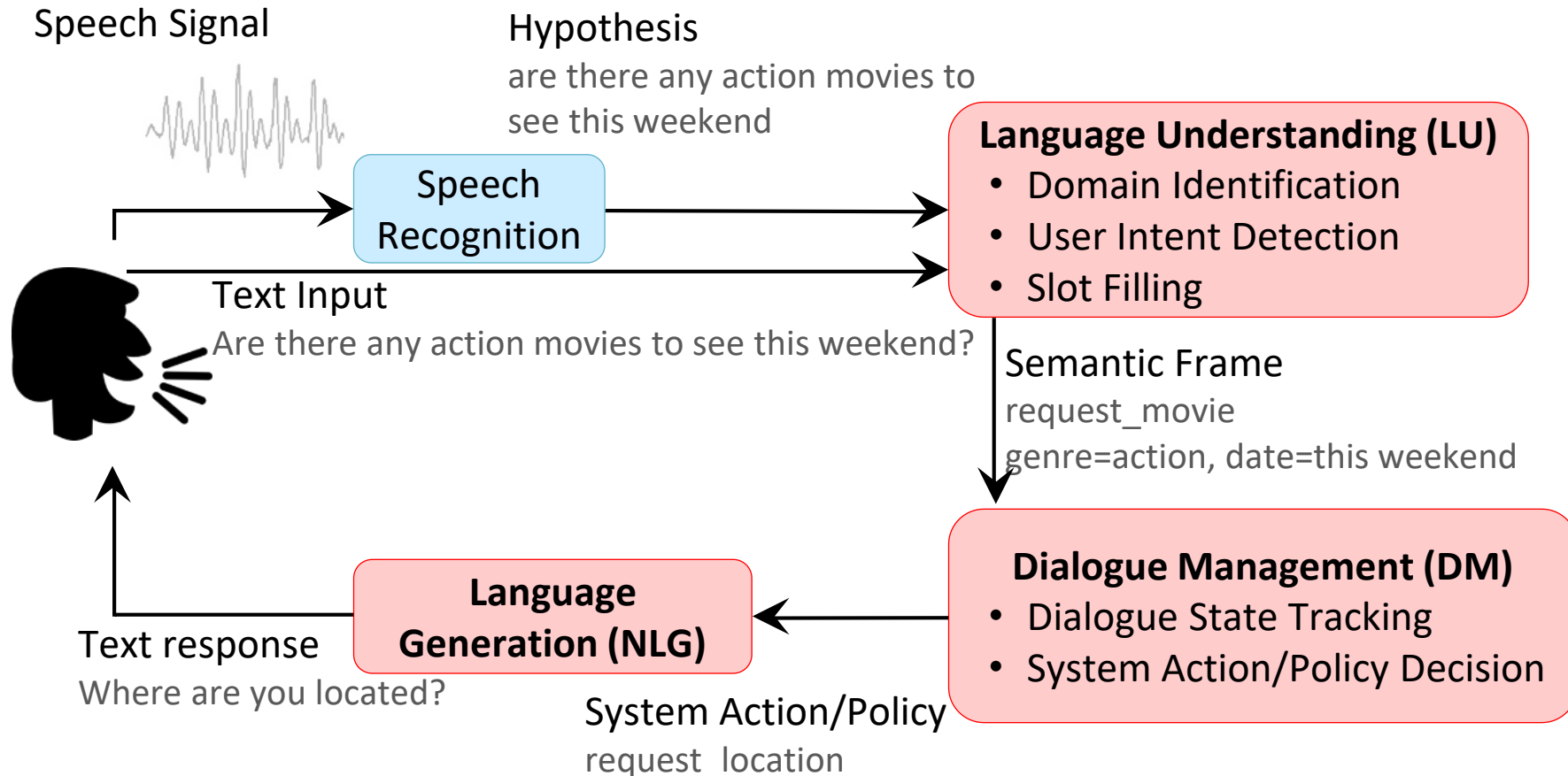
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## Dialogue System / ChatBot

- Goal: task completion, information access, chatting



# Dialogue System Framework



# DSTC: Dialogue State Tracking Challenge

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4 Tracks: (choose at least **2**, bonus if you work on more)

- i. Spoken/Natural Language Understanding (SLU/NLU)
- ii. Speech Act Prediction (SAP)
- iii. Spoken/Natural Language Generation (SLG/NLG)
- iv. Dialogue State Tracking

# Data for SLU + SAP

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data/001/label.json

```
{
  "semantic_tagged": [
    "That's actually his <DET CAT=\"EVENT\">birthday</DET>, <TIME REL=\"NONE\" CAT=\"DATE\">August twenty sixth.</TIME>"
  ],
  "speech_act": [
    {
      "act": "FOL",
      "attributes": [
        "EXPLAIN",
        "WHEN"
      ]
    }
  ],
  "utter_index": 52
},
```

# SLU + SAP

Speaker	Semantic Tagged Utterance	Speech Act (Attribute)
Tourist	<p>Can you give me some uh- tell me some</p> <p>&lt;DET CAT="PRICE"&gt; cheap rate &lt;/DET&gt;  <b>B-DET_PRICE I-DET_PRICE</b></p> <p>&lt;LOC FROM-TO="NONE" REL="NONE" CAT="HOTEL"&gt; hotels &lt;/LOC&gt;,  <b>B-LOC_NONE_NONE_HOTEL</b></p> <p>because I'm planning just to leave my bags there and go somewhere  take some pictures.</p>	<p>QST (RECOMMEND)  <b>QST_RECOMMEND</b></p> <p>INI (EXPLAIN)</p>
Guide	<p>Okay.</p> <p>I'm going to recommend firstly you want to have a</p> <p>&lt;DET CAT="MAIN"&gt; backpack type &lt;/DET&gt; of</p> <p>&lt;LOC FROM-TO="NONE" REL="NONE" CAT="HOTEL"&gt; hotel &lt;/LOC&gt;,  right?</p>	<p>FOL (ACK)</p> <p>INI (RECOMMEND)  <b>INI_RECOMMEND</b></p> <p>QST (PREFERENCE)</p>
Tourist	<p>Yes.</p> <p>I'm just gonna bring my backpack and my buddy with me. So I'm  kinda looking for a hotel that is</p> <p>&lt;DET CAT="PRICE"&gt; not that expensive &lt;/DET&gt;.</p> <p>Just gonna leave our things</p> <p>&lt;LOC FROM-TO="NONE" REL="NONE" CAT="HOTEL"&gt; there &lt;/LOC&gt;  and, you know, stay out the whole day.</p>	<p>RES (POSITIVE)</p> <p>RES (PREFERENCE   EXPLAIN)  <b>RES_PREFERENCE</b>  <b>RES_EXPLAIN</b></p>

slot  
user intent

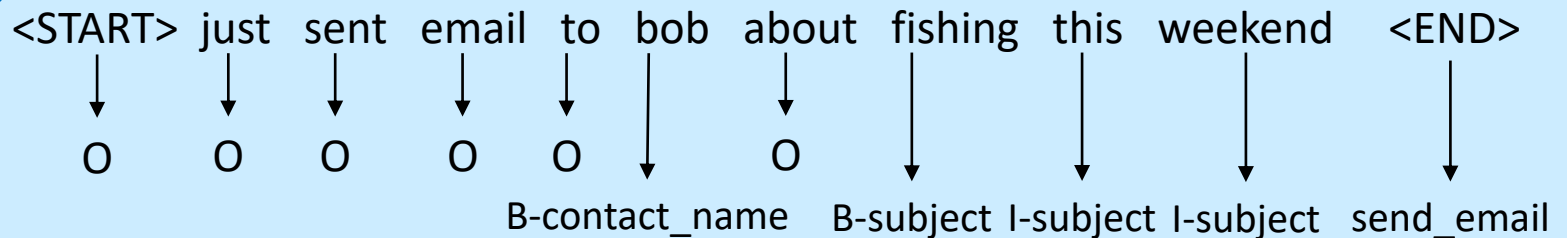
system action/policy

A3

# Natural Language Understanding (NLU)

Tag a word at each timestamp

- Input: word sequence
- Output: IOB-format slot tag and intent tag



→ `send_email(contact_name="bob", subject="fishing this weekend")`

# SLU + SAP

Speaker	Semantic Tagged Utterance	Speech Act (Attribute)
Tourist	<p>Can you give me some uh- tell me some            &lt;DET CAT="PRICE"&gt; cheap rate &lt;/DET&gt;  <b>B-DET_PRICE I-DET_PRICE</b>            &lt;LOC FROM-TO="NONE" REL="NONE" CAT="HOTEL"&gt; hotels &lt;/LOC&gt;,  <b>B-LOC_NONE_NONE_HOTEL</b>            because I'm planning just to leave my bags there and go somewhere            take some pictures.</p>	<p>QST (RECOMMEND)  <b>QST_RECOMMEND</b></p> <p>INI (EXPLAIN)</p>
Guide	<p>Okay.</p> <p>I'm going to recommend firstly you want to have a            &lt;DET CAT="MAIN"&gt; backpack type &lt;/DET&gt; of            &lt;LOC FROM-TO="NONE" REL="NONE" CAT="HOTEL"&gt; hotel &lt;/LOC&gt;,            right?</p>	<p>FOL (ACK)</p> <p>INI (RECOMMEND)  <b>INI_RECOMMEND</b></p> <p>QST (PREFERENCE)</p>
Tourist	<p>Yes.</p> <p>I'm just gonna bring my backpack and my buddy with me. So I'm            kinda looking for a hotel that is            &lt;DET CAT="PRICE"&gt; not that expensive &lt;/DET&gt;.            Just gonna leave our things            &lt;LOC FROM-TO="NONE" REL="NONE" CAT="HOTEL"&gt; there &lt;/LOC&gt;            and, you know, stay out the whole day.</p>	<p>RES (POSITIVE)</p> <p>RES (PREFERENCE             EXPLAIN)  <b>RES_PREFERENCE</b>  <b>RES_EXPLAIN</b></p>

## NLU

slot  
user intent

## DM

system action/policy



# SLG/NLG

Speaker	Semantic Tagged Utterance	Speech Act (Attribute)
Tourist	Can you give me some uh- tell me some <DET CAT="PRICE"> cheap rate </DET> <LOC FROM-TO="NONE" REL="NONE" CAT="HOTEL"> hotels </LOC>,  because I'm planning just to leave my bags there and go somewhere take some pictures.	QST (RECOMMEND)  INI (EXPLAIN)
Guide	Okay.  I'm going to recommend firstly you want to have a <DET CAT="MAIN"> backpack type </DET> of <b>DET_MAIN</b> <LOC FROM-TO="NONE" REL="NONE" CAT="HOTEL"> hotel </LOC>, <b>LOC_NONE_NONE_HOTEL</b> right?	FOL (ACK)  INI (RECOMMEND) <b>INI_RECOMMEND</b>  QST (PREFERENCE)
Tourist	Yes.  I'm just gonna bring my backpack and my buddy with me. So I'm kinda looking for a hotel that is <DET CAT="PRICE"> not that expensive </DET>. Just gonna leave our things <LOC FROM-TO="NONE" REL="NONE" CAT="HOTEL"> there </LOC> and, you know, stay out the whole day.	RES (POSITIVE)  RES (PREFERENCE  EXPLAIN)

INI\_RECOMMEND(DET\_MAIN,  
LOC\_NONE\_NONE\_HOTEL)

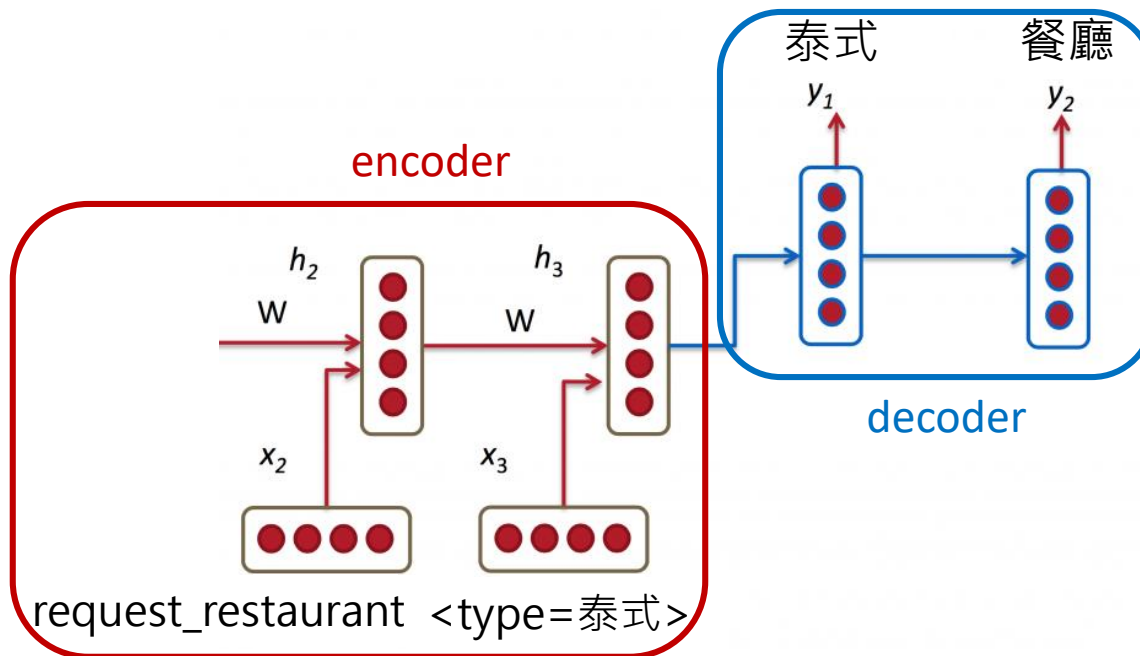


I'm going to recommend firstly  
you want to have a backpack  
type of hotel

# Natural Language Generation (NLG)

Cascade two RNNs, one for encoding and one for decoding

- Input: system action's slots and intents/semantic frame
- Output: natural language



# Dialogue State Tracking

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Speaker	Transcription	Annotation
Guide	Let's try this one, okay?	<b>Topic:</b> Accommodation <b>GuideAct:</b> RECOMMEND <b>TouristAct:</b> ACK <b>INFO:</b> Pricerange <b>Name:</b> InnCrowd Backpackers Hostel
Tourist	Okay.	
Guide	It's InnCrowd Backpackers Hostel in Singapore. If you take a dorm bed per person only twenty dollars. If you take a room, it's two single beds at fifty nine dollars.	
Tourist	Um. Wow, that's good.	
Guide	Yah, the prices are based on per person per bed or dorm. But this one is room. So it should be fifty nine for the two room. So you're actually paying about ten dollars more per person only.	
Tourist	Oh okay. That's- the price is reasonable actually. It's good.	

# Dialogue System Framework

