

# Integrating Pre-trained Model into Rule-based Dialogue Management

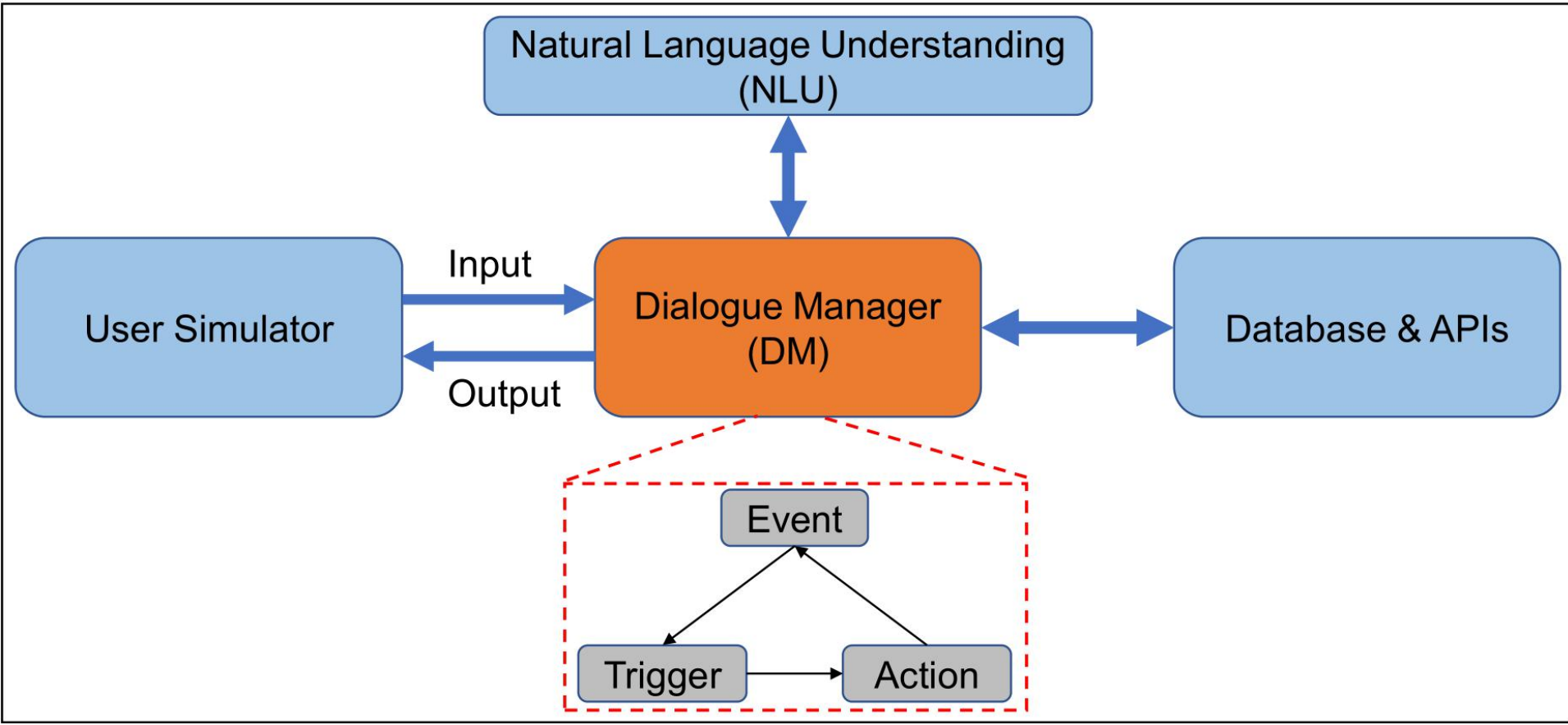
Speaker: Qiang Gan

Jun Quan<sup>1,2</sup>, Meng Yang<sup>2</sup>, Qiang Gan<sup>2</sup>, Deyi Xiong<sup>1</sup>, Yiming Liu<sup>2</sup>, Yuchen Dong<sup>2</sup>, Fangxin Ouyang<sup>2</sup>, Jun Tian<sup>2</sup>, Ruiling Deng<sup>2</sup>, Yongzhi Li<sup>2</sup>, Yang Yang<sup>2</sup> and Daxin Jiang<sup>2</sup>

<sup>1</sup> School of Computer Science and Technology, Soochow University, Suzhou, China

<sup>2</sup> Microsoft STCA NLP Group, China

# Carina Dialog System





# Event-Trigger-Action

Model-Trigger DM

Pre-trained Model for DM

Model Architecture

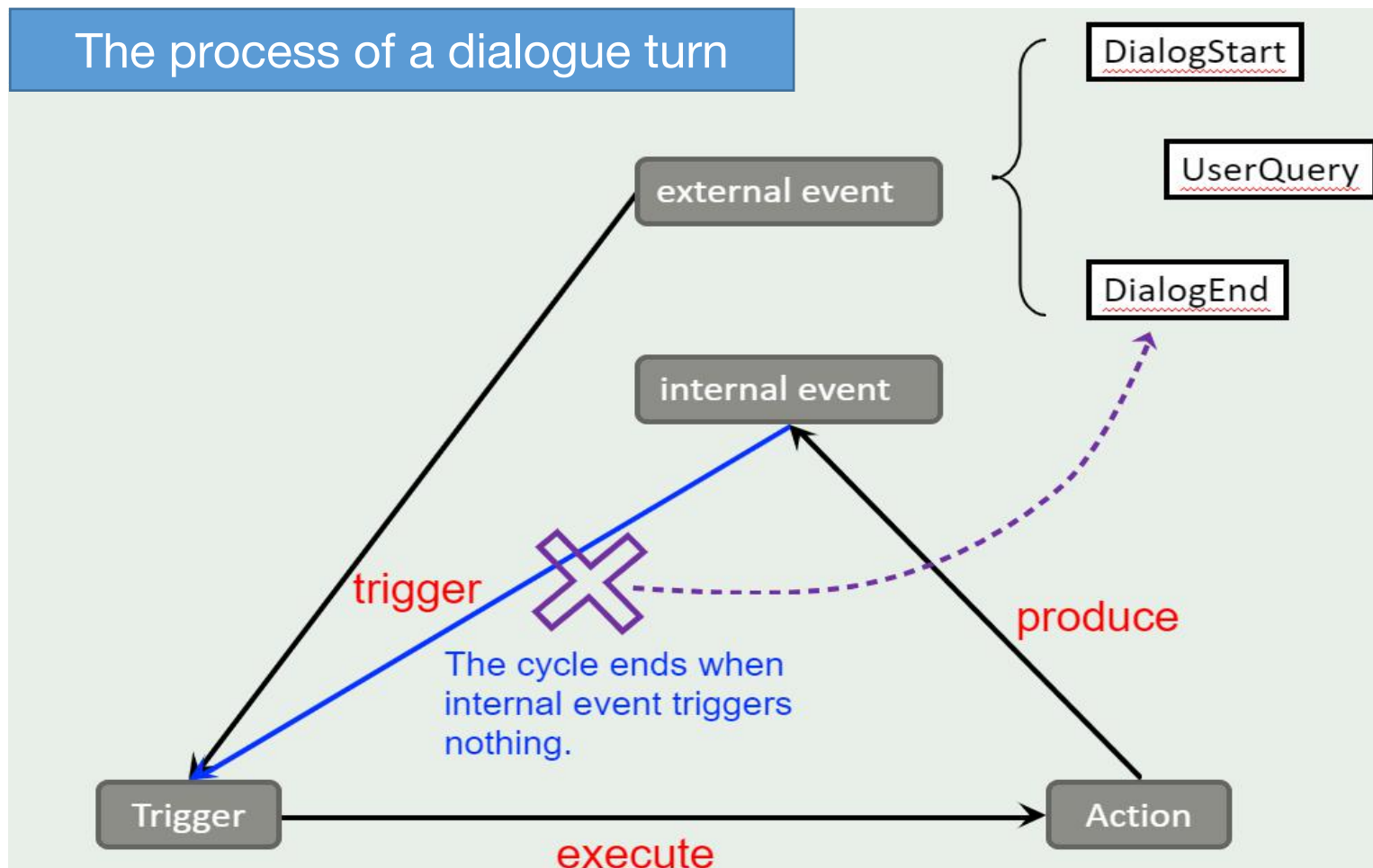
Dataset and Experiment

Demo



# Event-Trigger-Action

The process of a dialogue turn



# Expression Trigger

**An expression trigger for “Action1” (slot-filling type):**

```
EventArrival("UserQuery") && ParameterStatus("Action1")== "Resolving" &&  
LastWinnerParam()== "Action1" && $param : Action2.ResolvedValue ["key1"] > 3 &&  
$param:Action1.ResolvedValue["key2"] == null && GetTurnNumber() <= 5
```

PS:

**Boolean functions** and **string functions** (such as “EventArrival()”, “ParameterStatus()”) are pre-defined.  
**All actions** (such as “Action1”, “Action2”) are pre-defined.

- ◆ The expressions “listen to” customized events, which makes the dialogue logic flexible and interpretable.
- ◆ Developers can hardly summarize and maintain enough explicit rules when the scenario is complex.



Event-Trigger-Action

# Model-Trigger DM

Pre-trained Model for DM

Model Architecture

Dataset and Experiment

Demo



# Dialogue State Feature

Turn	Feature	Action (Label)
0	True False False False ... .. False False False False False False True	get-informable-slot
0	False True False False ... .. False False False True False False False	request-db-number-api
0	False True False False ... .. False False True False False False True	End-Turn
1	False True True True ... .. False False True False False False True	get-informable-slot

```
{  
  "EventArrival(\"dialogstart\")": "False",  
  "EventArrival(\"UserQuery\")": "True",  
  "EventArrival(\"timer\")": "False",  
  "EventArrival(\"dialogend\")": "False",  
  .  
  .  
  .  
  "LastWinnerParam()==get_informable_slot": "False",  
  "LastWinnerParam()==get_requestable_slot": "False",  
  "LastWinnerParam()==request_db_number_api": "False",  
  "LastWinnerParam()==request_name_api": "True",  
  "LastWinnerParam()==request_attribute_api": "False",  
  "LastWinnerParam()==farewell": "False"  
}
```

Used for Expression Trigger



Event-Trigger-Action

Model-Trigger DM



# Pre-trained Model for DM

Model Architecture

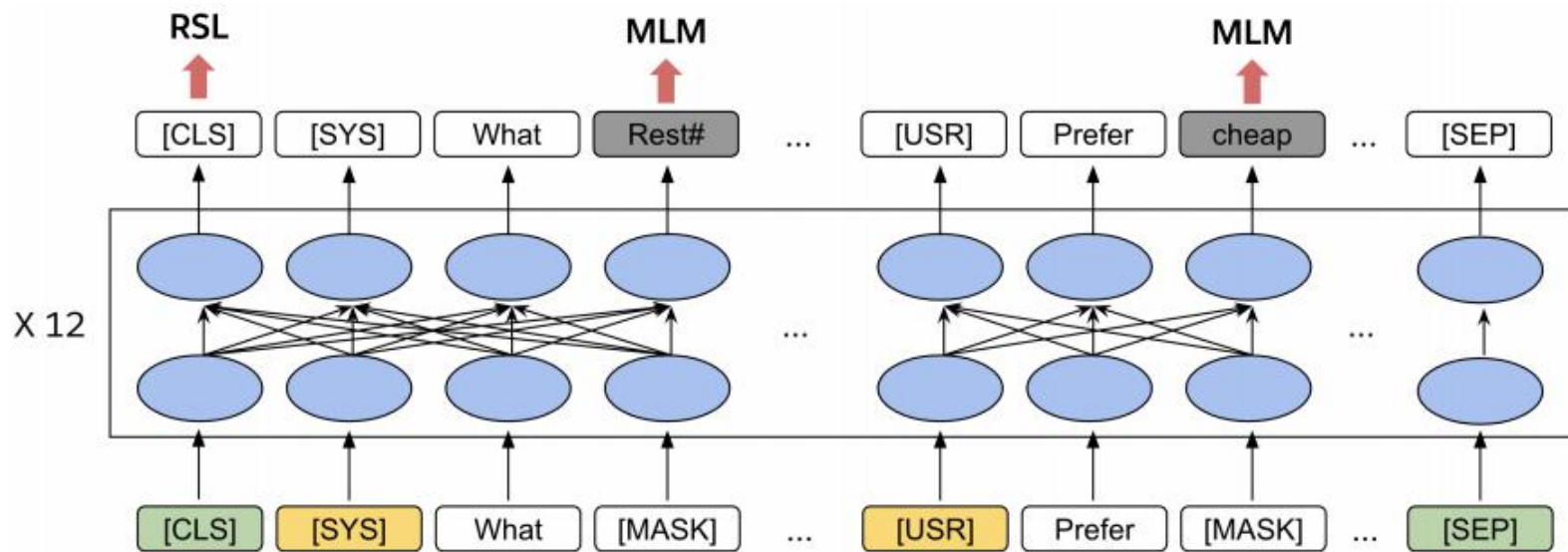
Dataset and Experiment

Demo

# Dialogue Context Feature

## Pretrain tasks:

- (1) Masked Language Modeling
- (2) Response Selection



**ToD-BERT: Pre-trained Natural Language Understanding for Task-Oriented Dialogues**

Event-Trigger-Action

Model-Trigger DM

Pre-trained Model for DM



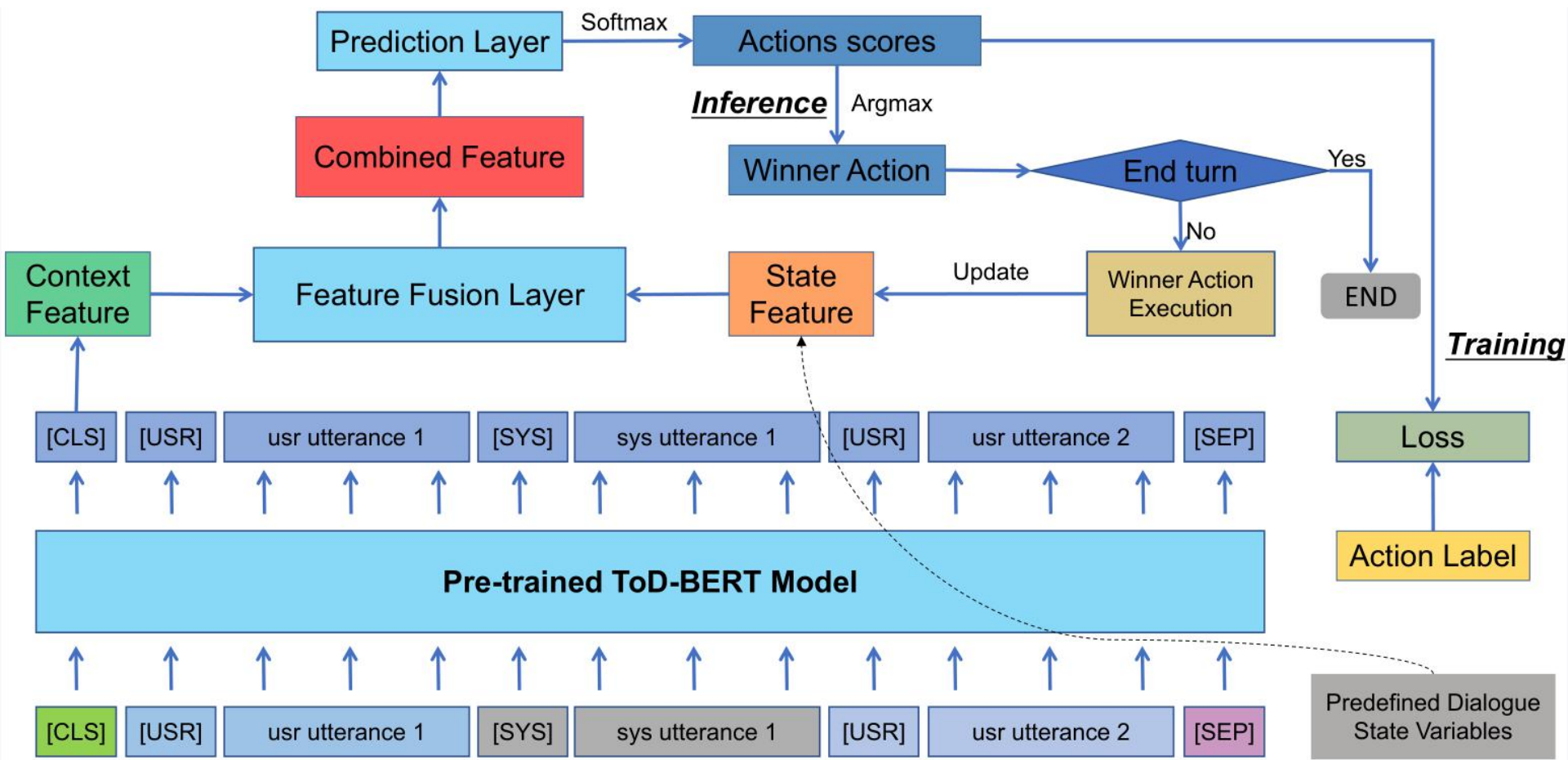
# Model Architecture

Dataset and Experiment

Demo



# Model Architecture



Event-Trigger-Action

Model-Trigger DM

Pre-trained Model for DM

Model Architecture



# Dataset and Experiment

Demo

# Action Definition (based on CamRest676)

- **get-informable-slot:**
  - type: slot-filling
  - dependent slots: pricerange, area, food
- **request-db-number-api:**
  - type: webhook
  - httpparams: pricerange, area, food
- **request-name-api:**
  - type: webhook
  - httpparams: pricerange, area, food
- **EndTurn**
- **get-requestable-slot:**
  - type: slot-filling
  - dependent slots: req-address, req-phone, req-postcode, req-area, req-food, req-pricerange
- **request-attribute-api**
  - type: webhook
  - httpparams: req-address, req-phone, req-postcode, req-area, req-food, req-pricerange, req-name
- **farewell**
  - type: pattern-text

# Data Preparation (Create new version of CamRest676)

Turn	Dialogue Context	Response
1	I am looking for a restaurant that is moderately priced and serves Chinese food.	There are no restaurants that serve Chinese food in the moderate price range.



Annotation

Turn	Dialogue Context	Winner Action Sequence
1	I am looking for a restaurant that is moderately priced and serves Chinese food.	get_informable_slot, request_db_number_api, request_name_api, end_turn

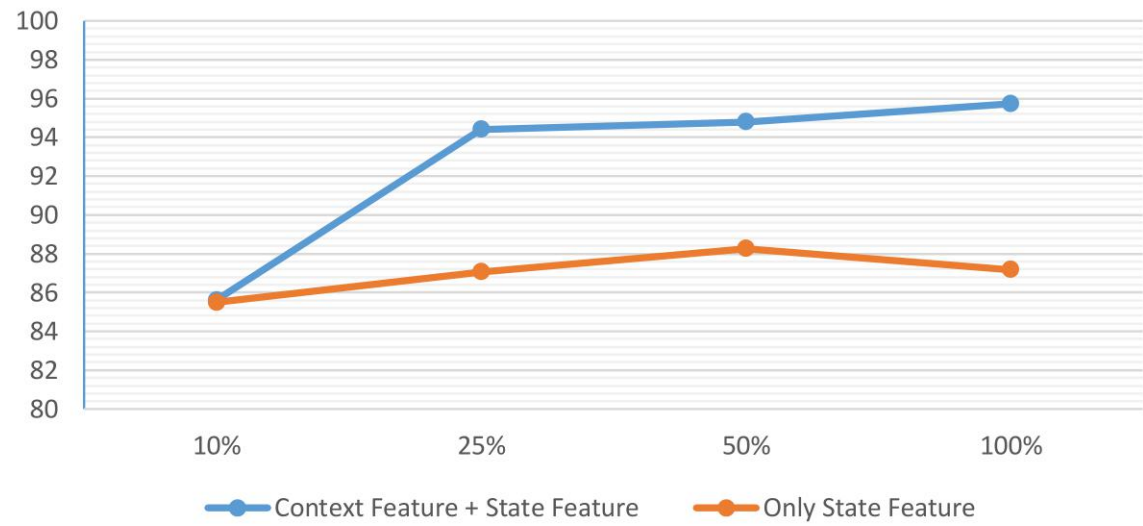


Featurization

Mini-turn	Input 1	Input 2	Output (Label)
1	Context Feature	State Feature 1	action 1 (get_informable_slot)
2	Context Feature	State Feature 2	action 2 (request_db_number_api)
3	Context Feature	State Feature 3	action 3 (request_name_api)
4	Context Feature	State Feature 4	action 4 (end_turn)

# Few-shot Experiments

Training Data Ratio	Feature Fusion Method	Pre-trained Model	Dev Set		Test Set	
			Mini-turn Acc.	Joint Acc.	Turn Acc.	Mini-turn Acc.
100% (406 sessions)	Our Method 3	ToD-BERT (jnt)	93.83	88.04	96.07	95.73
50% (203 sessions)	Our Method 3	ToD-BERT (jnt)	93.28	85.79	95.37	94.79
25% (101 sessions)	Our Method 3	ToD-BERT (jnt)	<b>92.37</b>	<b>85.79</b>	<b>95.46</b>	<b>94.41</b>
10% (40 sessions)	Our Method 3	ToD-BERT (jnt)	84.62	69.16	88.98	85.62
100% (406 sessions)	Only State Feature	-	86.02	63.18	88.22	87.19
50% (203 sessions)	Only State Feature	-	85.59	68.60	89.88	88.26
25% (101 sessions)	Only State Feature	-	86.02	62.80	88.12	87.07
10% (40 sessions)	Only State Feature	-	84.20	59.44	86.54	85.50



Event-Trigger-Action

Model-Trigger DM

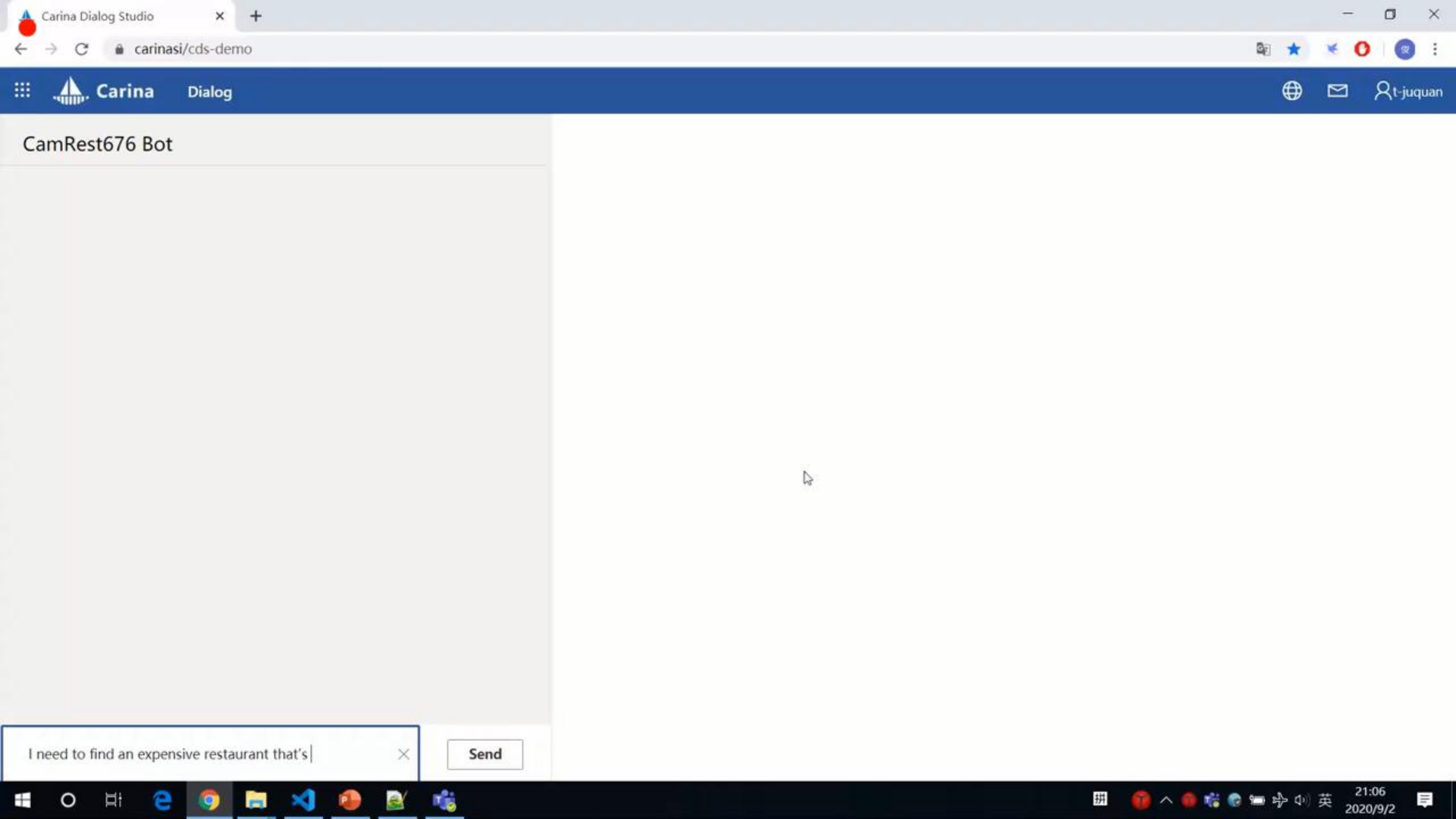
Pre-trained Model for DM

Model Architecture

Dataset and Experiment



# Demo



国际人工智能会议  
AAAI 2021 论文北京预讲会

# THANKS

2020.12.19