

# In-Context Learning User Simulators for Task-Oriented Dialog Systems

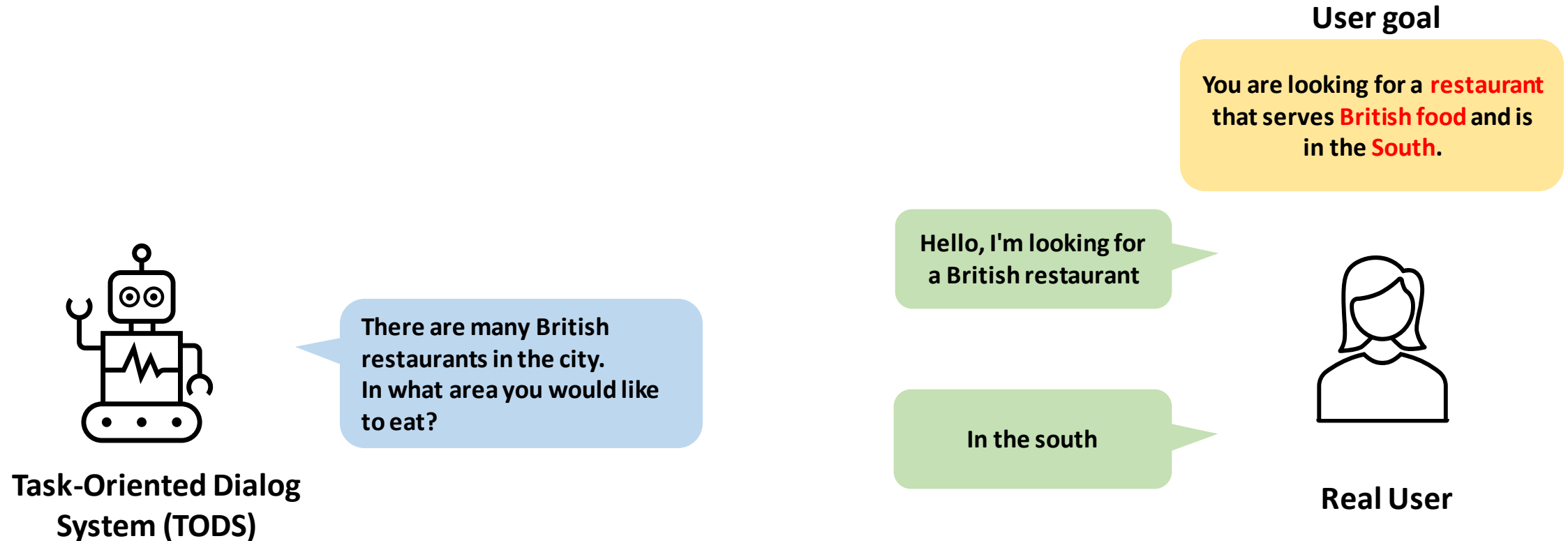
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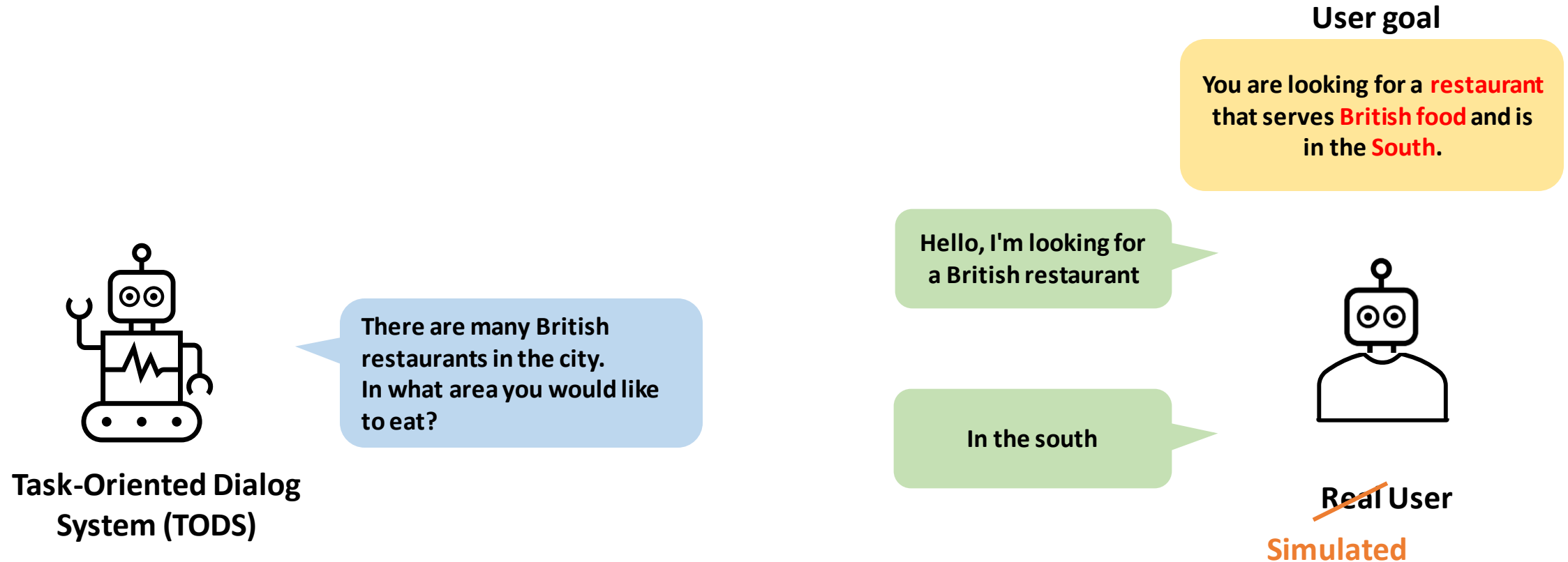
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# Task-Oriented Dialog Systems



# Testing Task-Oriented Dialog Systems with User Simulation



# Limitations of current approaches

Building a user simulator can be **time consuming** and **costly**:

- Rule-based (or **agenda-based**) approaches require the manual definition of rules
- End-to-end approaches require large amount of annotated data

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**Solution: in-context learning approach**

# An In-Context User Simulator for TODS

- Only requires a **user goal** and a few **dialog examples**
- No finetuning or manual definition of rules
- Generates **diverse but contextually appropriate utterances** in natural language (like a real user)

# Prompt Design

- Our objective is to generate **user's utterances given the user goal**
- The simulated user **directly interacts** with the dialog system, so it generates one utterance per turn.
- The resulting prompt is then **iteratively updated**

# Prompt Design

These are examples of conversations between a CUSTOMER and an ASSISTANT. Complete the conversation as a CUSTOMER. You must fulfill all REQUIREMENTS. Be precise with the REQUIREMENTS, clear and concise.

Example 1:

REQUIREMENTS: You are looking for a train departing from Peterborough and arriving in Cambridge by 19:30 on Sunday.

CUSTOMER: I 'm looking for a train that departs from Peterborough and arrives by 19:30

ASSISTANT: Where would you like to go to ?

[...]

CUSTOMER: thanks for the service, that is all I need.

Example 2:

REQUIREMENTS: You are looking for a restaurant that serves British food and is in the South. Make sure you get the phone number and postcode.

CUSTOMER:



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User goal

Dialog  
history

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## Dialog to generate (simulated)

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## Dialog to generate (simulated)

Example 2:

REQUIREMENTS: You are looking for a restaurant that serves British food and is in the South. Make sure you get the phone number and postcode.

CUSTOMER: **Hello, I'm looking for a British restaurant** LLM-generated

User goal

Dialog  
history

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User goal

Dialog  
history

## Dialog to generate (simulated)

Example 2:

REQUIREMENTS: You are looking for a restaurant that serves British food and is in the South. Make sure you get the phone number and postcode.

CUSTOMER: Hello, I'm looking for a British restaurant

ASSISTANT: In which area?

LLM-generated  
system-generated

User goal

Dialog  
history

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ASSISTANT: In which area?

CUSTOMER: in the South

LLM-generated  
system-generated  
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User goal

Dialog  
history

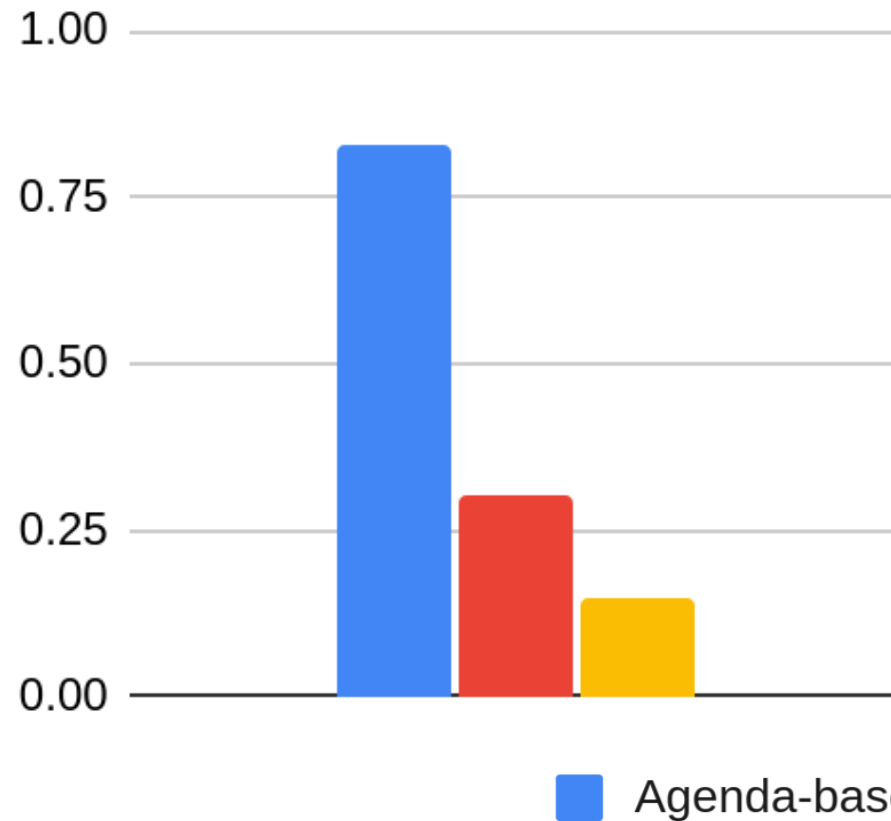


# Experimental Setting

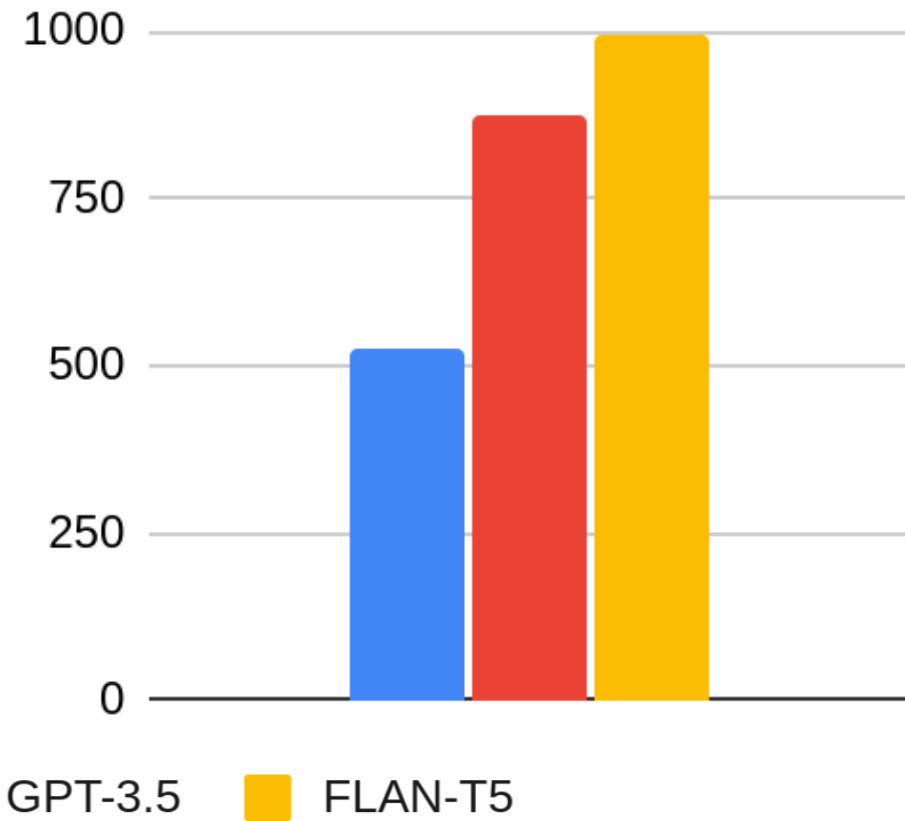
- Dataset: MultiWOZ 2.1
- Dialog System from ConvLab-2
- User Simulator Models:
  - Baseline: Agenda-based
  - Prompt-based:
    - Flan-T5 XL (3B parameters)
    - GPT 3.5 (ChatGPT, version 0301)
- Evaluation:
  - User goal fulfillment
  - Language diversity
  - Qualitative evaluation

# Quantitative Results

**Success Rate (goal fulfillment)**

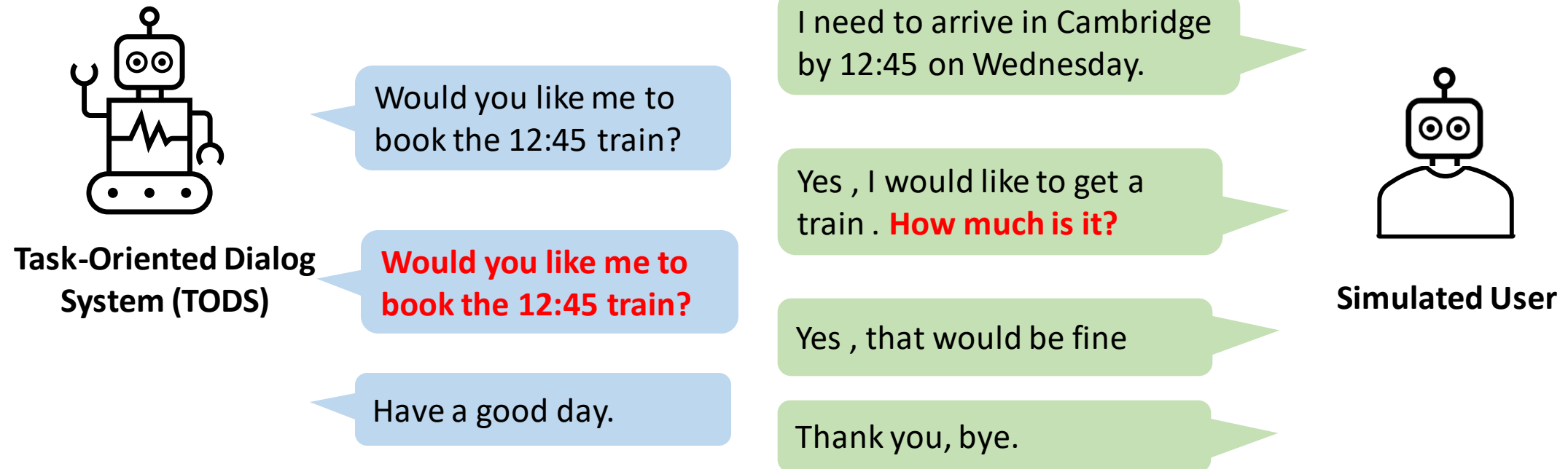


**Unique Unigrams (lexical diversity)**



# Qualitative Results: NLU misclassifications

- Goal fulfillment metrics quantify the effectiveness of the communication between the user simulator and the system
- If the **system doesn't understand the user**, the scores will be low.



# Qualitative Results: hallucinations

- "Forgets" to ask about a requirement in the user goal
- Says something conflicting with the user goal
- Gibberish

# Conclusions

- Proposed and released an in-context learning approach for user simulator
- These approaches generate diverse and contextually appropriate utterances -> exploration of different scenarios



<https://github.com/telepathylabsai/prompt-based-user-simulator>

# Thank you for your attention :)



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