

# **INTENT RECOGNITION & REMAKING SHDRLU WITH GPT**

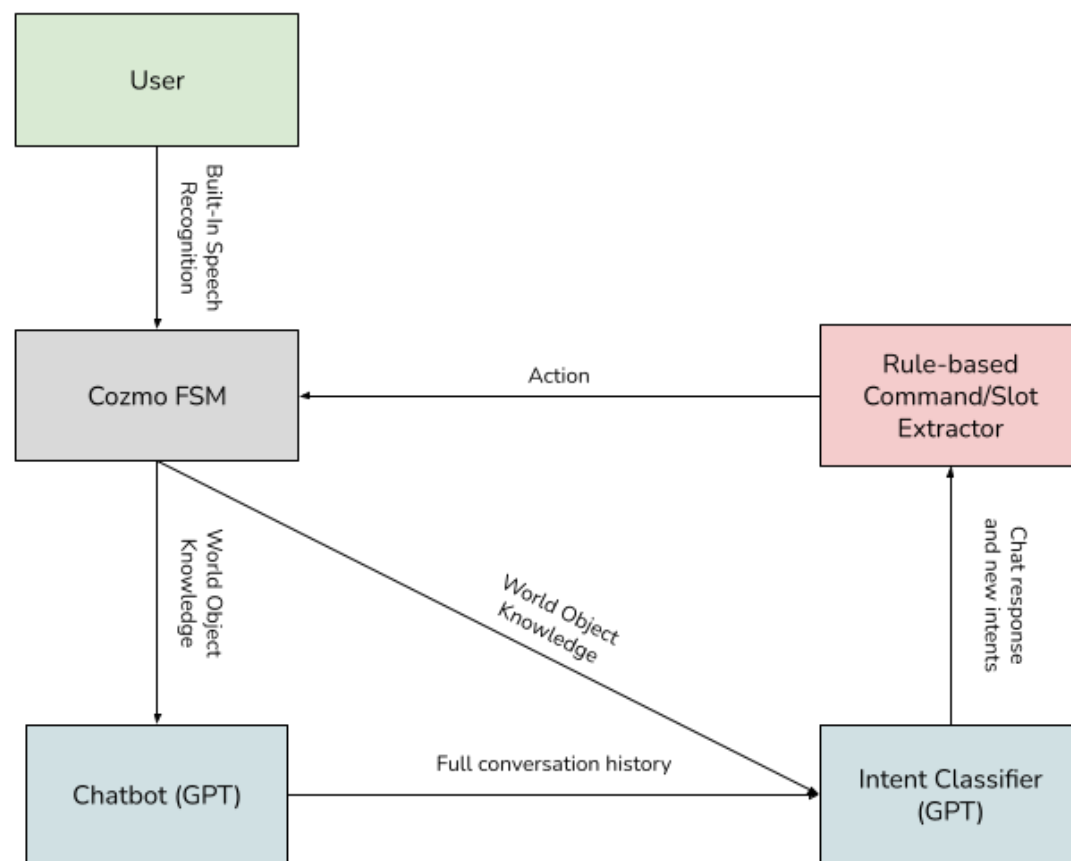
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# SUPPORTED COMMANDS

- Drive forward
- Pick up/drop cubes
- Light cubes to a given color
- Rotate/turn
- Answer questions about Cozmo's knowledge

# DESIGN



# PROMPT ENGINEERING

- Full conversation history required for commands w/ pronouns
- State info can change over different commands in a conversation
- Speech recognition is not perfect
- Response length, command format, unit conversion

# GPT-3(.5) INSIGHTS

- Few-shot learning is somewhat poor on unintuitive tasks
  - Struggles with returning only the last user command
  - Cannot learn difficult prompts, even when given exact example multiple times
- Common Crawl is *very* large

“cozmo, can you light cube1 green”

Yes, I can. Here's the code to light Cube1 green:

...

```
cozmo.run_program(async_program)
```

```
async def async_program(robot: cozmo.robot.Robot):  
    cube = robot.world.get_light_cube(cozmo.objects.LightCube1Id)  
    await cube.set_lights(cozmo.lights.green_light)  
...
```

Keep in mind that the Cozmo SDK needs to be installed in order to run this code.

# ISSUES & NEXT STEPS

- Chatbot's responses can throw off classifier
  - Fine-tune both chatbot and classifier
- One-model design
- Implement more nodes/state knowledge

```
new actions: [ ]
I'm sorry, but Cozmo cannot pick up Cube2 unless it has two cubes to make a stack. Would you like Cozmo to stack Cube2 on Cube3, once it is located?
```

# DEMO!

[https://drive.google.com/file/d/13K5rfiApCSI2vJ\\_6F4K6D7J6LJIjdn\\_nB/view?usp=sharing](https://drive.google.com/file/d/13K5rfiApCSI2vJ_6F4K6D7J6LJIjdn_nB/view?usp=sharing)

# FSM DETAILS

- Custom transition for partial data matches; nodes for reading these data events
- Speech recognition doesn't always record complete command; simply disregard audio with  $\leq 2$  words



# MORE PROMPT ENGINEERING

- Play with GPT -> discover mistake -> correct prompt loop
- GPT-3.5 seems significantly better than GPT-3
  - E.g. “Pick up cube1 and throw it forward” misclassified
- Chatbot-classifier architecture helps
  - Use chatbot to determine eligible actions, then classifier can use chatbot response to help
  - Chatbot might mislead! More important to tinker with chatbot

# WHAT HAPPENED TO BERT?

- **The SBERT method works fine, but GPT-3/3.5 was easier to work with**
  - **Slot extraction is essentially free with a couple examples**
  - **May be interesting to use the embeddings api and train sentence-level embeddings**

# FINE-TUNING?

- I'm confident this will work much better, just somewhat tedious
  - Tuning chatbot requires manually writing ~200 or so conversations
  - Tuning classifier only requires labeling chatbot-generated conversations, but I'm a little unsure about tuning a classifier on untuned chatbot-generated conversations
  - Trained models can be *very* smart (<https://thegradient.pub/othello/>)

# IMPLEMENTATION

- `chatbot_model.py`, `classifier_model.py`, `extractor.py`, `IntentRec.fsm`
  - `IntentRec.fsm` should work directly (with an OpenAI API key)