

Beyond command and response chatbots

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Introduction

- Automation of medicine group
- Interdisciplinary research between engineers and doctors
- Mostly mental health and addiction

Smoking cessation

- Help is only available when you decide to quit
- Most smokers are ambivalent
- How are ambivalent smokers helped?



Motivational interviewing (MI)

- Client-centric counselling style
- Open questions, Affirmations, Reflections, Summaries
- Running head start technique

MI examples

Doctor: *What is bad about smoking?* // **open question**

Client: *When I am out of cigarettes, it is torture until I can get more*

Doctor: *I understand, you crave smoking and find it addictive* // **reflection**

Doctor: *I appreciate you talking about your cigarettes cravings, it takes courage to admit that* // **affirmation**

..

Doctor: *Let me summarize what've you told me about what bad about smoking*

Doctor: *You told me "When I am out of cigarettes, it is torture until I can get more" which I believe is related to addiction* // **summarization**

MI Success

- Successful in doctor client counselling session
- Successful in follow up text messages and emails
- MI is open ended but it follows a *some* structure

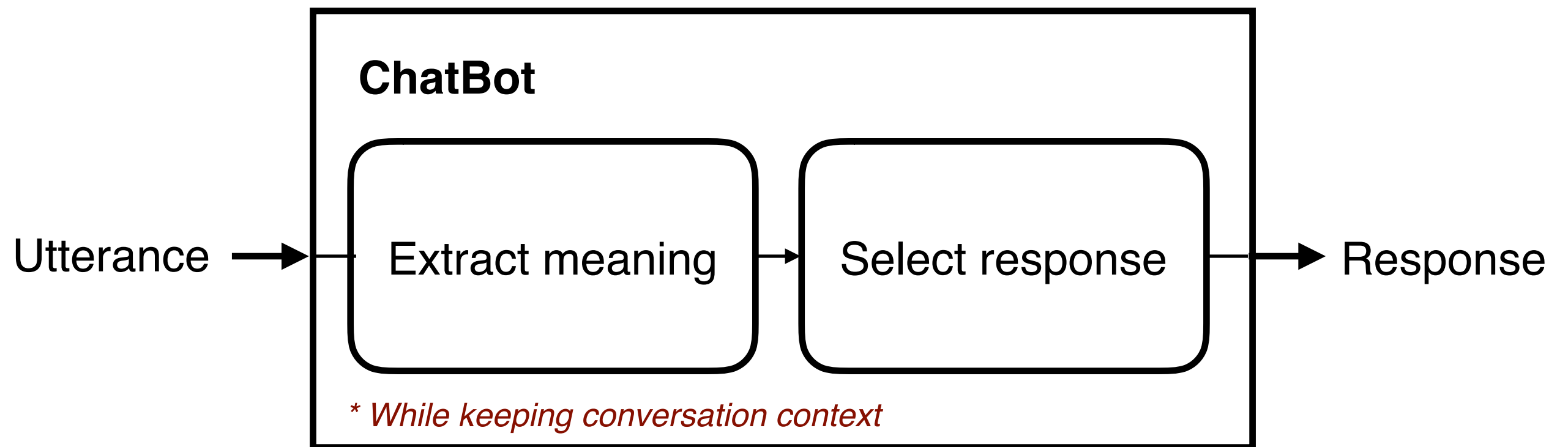
Chatbots?



Chatbots potential

- Has the potential to help many smokers ***at scale***
- Reach people where they are
- Reduce the cost and friction of finding support groups or doctors

Chatbots workflow



Prior work?

Eliza

Eliza

- Invented by Joseph Weizenbaum@ MIT AI Lab
- Mimics a Rogerian psychologist
- Uses collection of pattern matching rules to generate response

Eliza example

Eliza: Good evening. Tell me your problems.

Woman: Men are all alike.

Eliza: In what way?

Woman: They're always bugging us about something or other.

Eliza: Can you think of a specific example?

Woman: Well my boyfriend made me come here.

Eliza: Your boyfriend made you come here.

Woman: He says I'm depressed much of the time.

Eliza: I am sorry to hear you are depressed.

Eliza: Who else in your family takes care of you?

Woman: My father.

Eliza: Your father.

Woman: You are like my father in some ways.

Eliza: What resemblance do you see?

Woman: You are not very aggressive but I think you don't want me to notice that.

Eliza: What makes you think I'm not aggressive?

Woman: You don't argue with me.

Eliza: Why do you think I don't argue with you?

Woman: You are afraid of me.

Eliza: Does it please you to believe I'm afraid of you

Woman: My father is afraid of everybody.

Eliza: What else comes to mind when you think of your father?

Woman: Bullies.

Eliza

- Great deal of reflection
- Weizenbaum on his secretary using Eliza:
 - ***“After only a few interchanges with it, she asked me to leave the room”***
- Eliza was created a long time ago

Problems with Eliza

1. Hard to enumerate all possible rules
2. Requires grammatically and structurally good utterances
3. Doesn't keep conversation context (it's mirroring what you say)

Potential solution

1. Account for unseen utterances
2. Account for poor sentence structure and spelling
3. Keep conversation context



MACHINE LEARNING



Natural Language Understanding (NLU)

- Extracting meaning using machine learning is NLU

“I don’t like the smell of smoking”



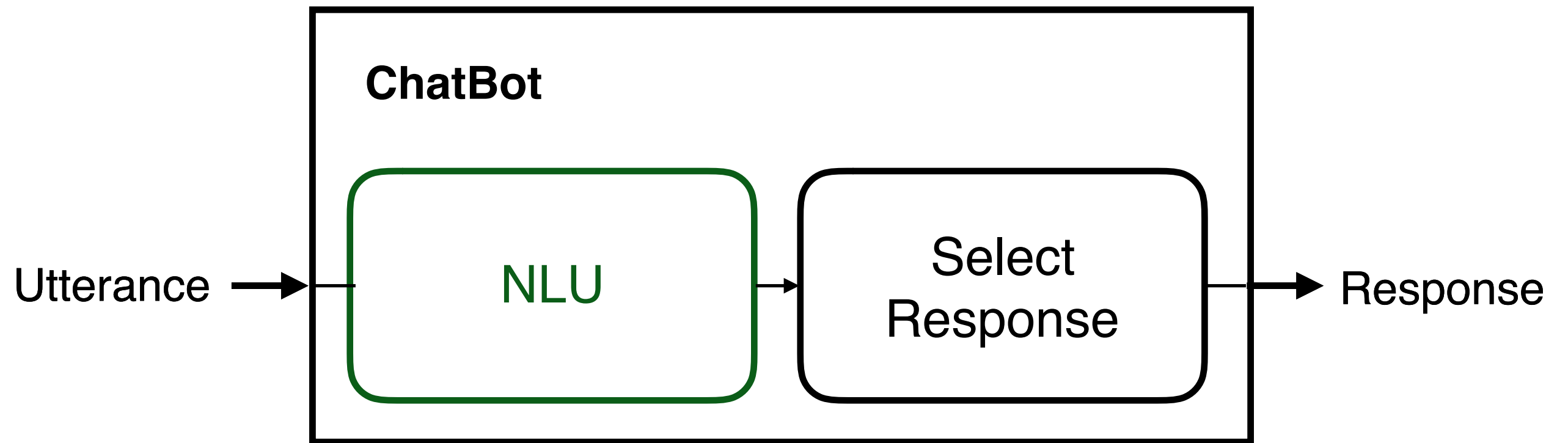
Reason: smell, **Sentiment:** negative

“I appreciate you helping me!”



Thanks: true, **Sentiment:** positive

NLU Chatbot workflow



Potential solution

1. Account for unseen utterances
2. Account for poor sentence structure and spelling
3. Keep conversation context



STATE MACHINES



Context with state machines

Doctor: *Do you smoke cigarettes?*

Client: Yes

Doctor: *What is bad about smoking?*

Client: *When I am out of cigarettes, it is torture until I can get more*

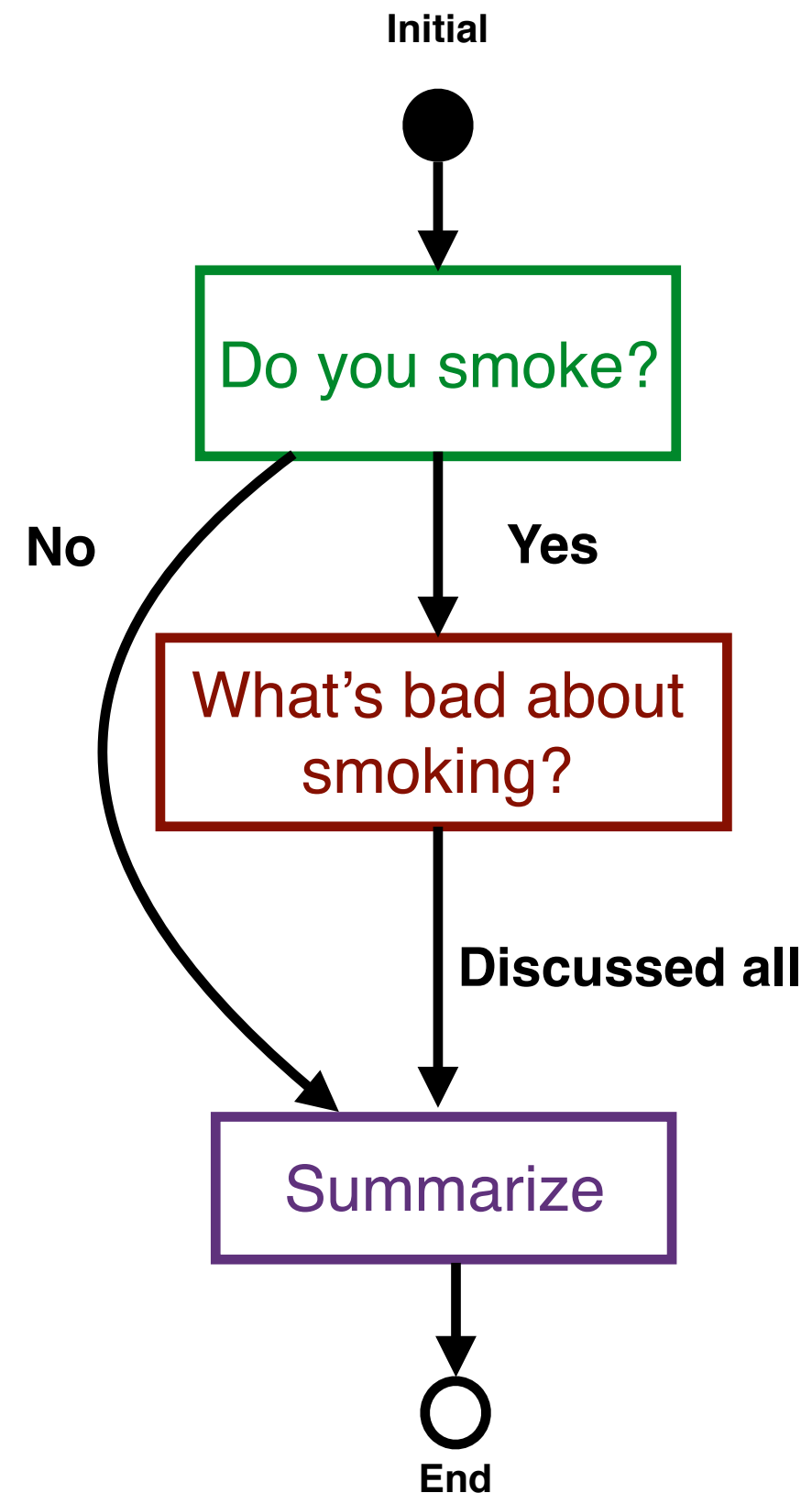
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Doctor: *You told me "When I am out of cigarettes, it is torture until I can get more" which I believe is related to addiction*

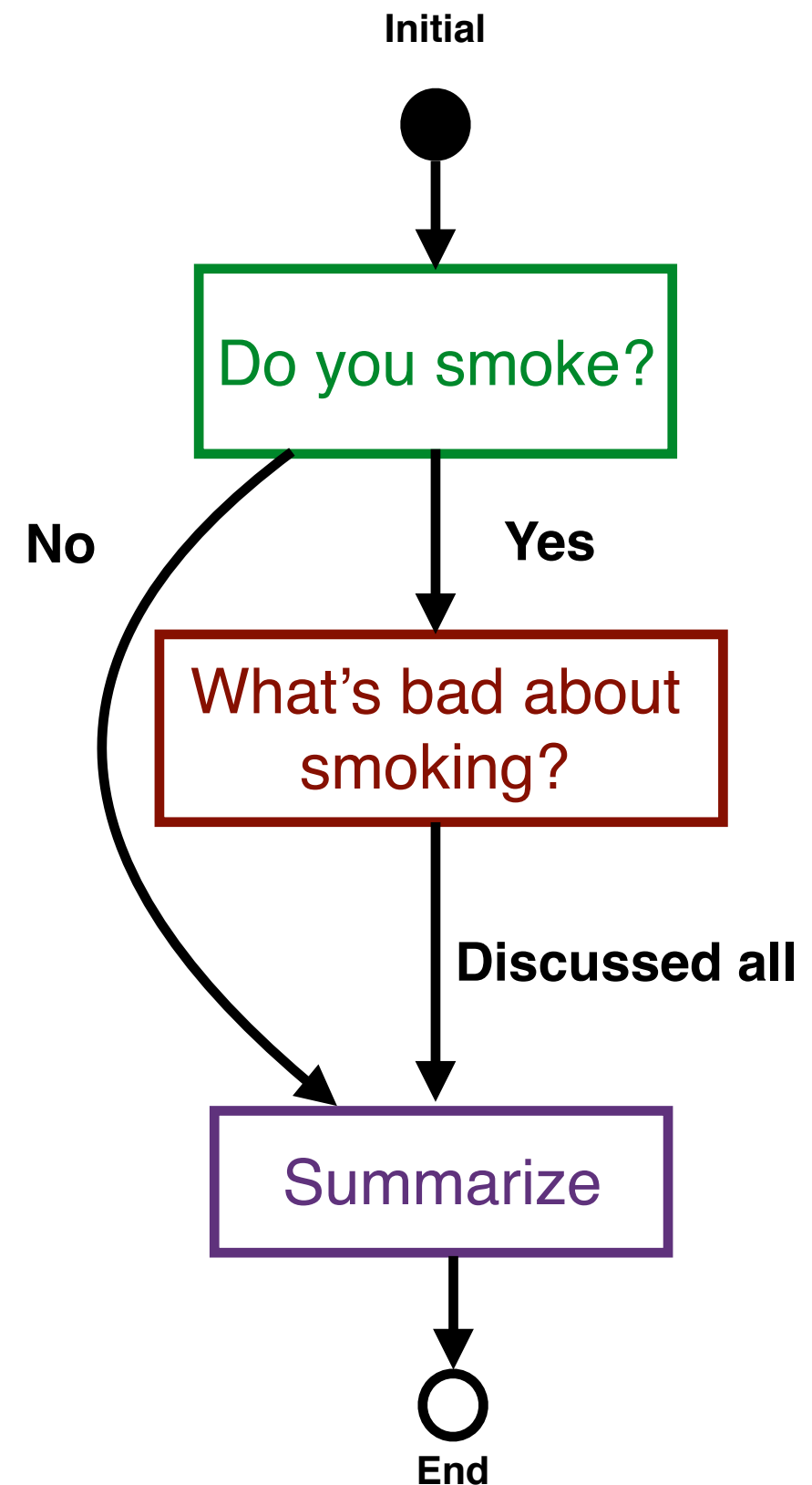


Context with state machines

Doctor: *Do you smoke cigarettes?*

Client: No

Doctor: *I understand, you have nothing bad to say about smoking*



What's out there

- Existing open source chatbot frameworks
- Use DSL? or data files?
- Inflexible and hard to customize



- Build conversations using state machines
- No DSL or data files
- Elixir behaviours for implementing as a chatbot process
 - Similar to GenServer, etc
- Uses pipelines to extract meaning

BotKit api

```
defmodule BotKit.Bot do
  @callback init(args :: term) ::
    { :ok, data }
    | { :stop, reason :: any }
    when data: any

  @callback pipeline(String.t()) :: term

  @callback terminate(reason :: term, state :: term, data :: term) :: term
end

defmodule BotKit.BotState do
  @callback enter(Chat.t()) :: Chat.t()

  @callback leave(Chat.t()) :: Chat.t()

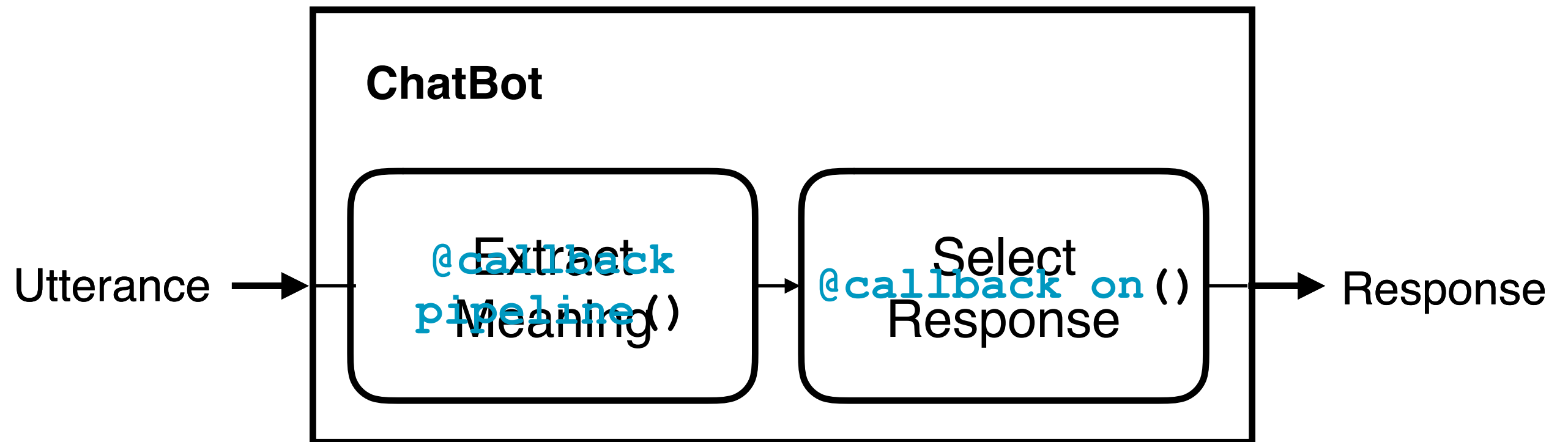
  @callback on(Chat.t(), pipeline_result :: term) :: Chat.t()

  @callback confused(Chat.t(), number, pipeline_result :: term) :: Chat.t()

  @callback state_pipeline(String.t()) :: pipeline_result :: term

  @optional_callbacks state_pipeline: 1, enter: 1, leave: 1, confused: 3
end
```

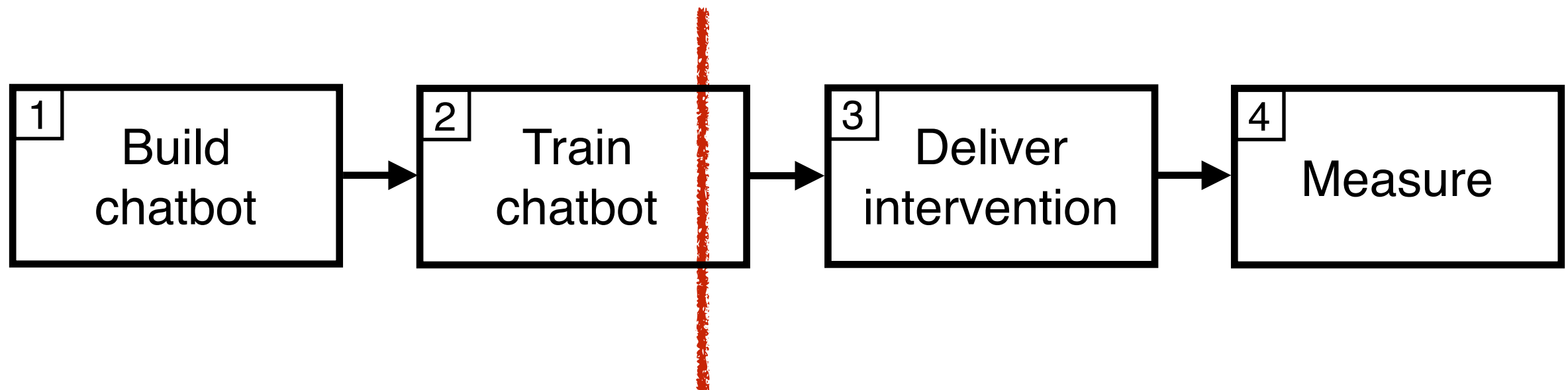

BotKit workflow



DEMO

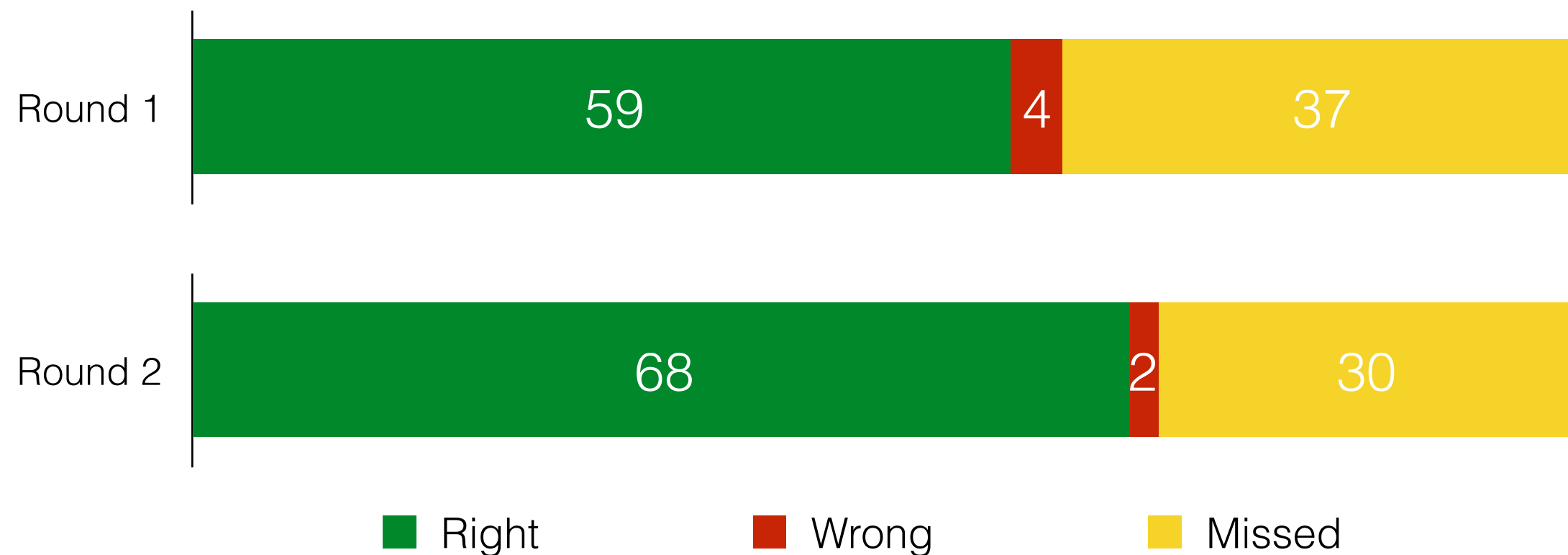
Smokefreed status

- Status: *ongoing*

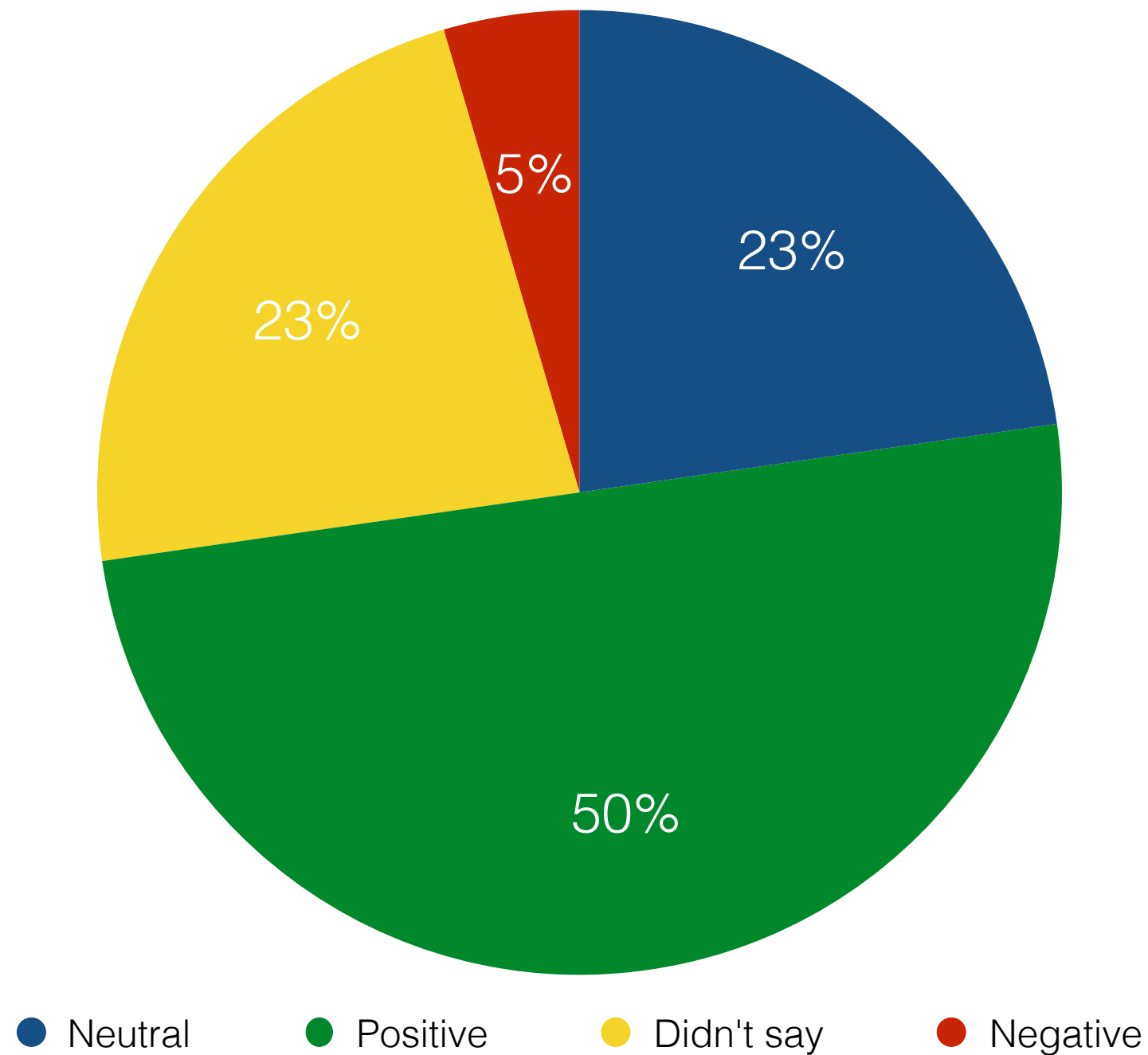


Smokefreed result

- Trained on 26 people (22 actual smokers)



Smokefreed result



Smokefreed feedback

“That was actually really very helpful. It was getting my thoughts out. I have been smoking for a long long time and this was the first time believe it or not that I actually got some insight to my behavior, LOVED IT.”

“I liked that the system got me to think about the reasons I enjoy smoking and the reasons I do not. I was able to see that there were more reasons I dislike smoking ...”

“... it did make me think about my motivations, etc. for smoking, it was interesting and I think I did find it quite helpful actually :-) just the act of having to spell out things that are usually automatic/subconscious really, makes you realise how daft a lot of it is! ... Glad I got the chance to try it, given me some food for thought! Thank you..”

“Frustrating, the questions made little sense A lot of self reflections kind of felt pointless as well. I smoke a pack a day, often without thinking about it., so pinpointing a time when something caused me to smoke is really hard.”

“it could be made more attractive maybe with some sounds possibly a funky chat bubble”

What about Elixir?

- Easy to build chat apps (processes, phoenix channels, etc)
- Fault tolerance
- Erlang always give you an escape hatch

THE END

- Thanks for Prof. Jonathan Rose and Dr. Peter Selby
- Twitter: @falmusha, Github: @falmusha
- Come find me after the talk for questions

References

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