

How to implement a conversational chat-bot?

What do you mean by a chat-bot?

Goal-oriented:

- Narrow domain
- Specific questions and tasks
- *Example:* call center
- *Model:* usually retrieval-based

Chit-chat:

- General conversation
- Human-like experience
- *Example:* entertaining bot
- *Model:* generative

Models pros and cons

Retrieval-based models

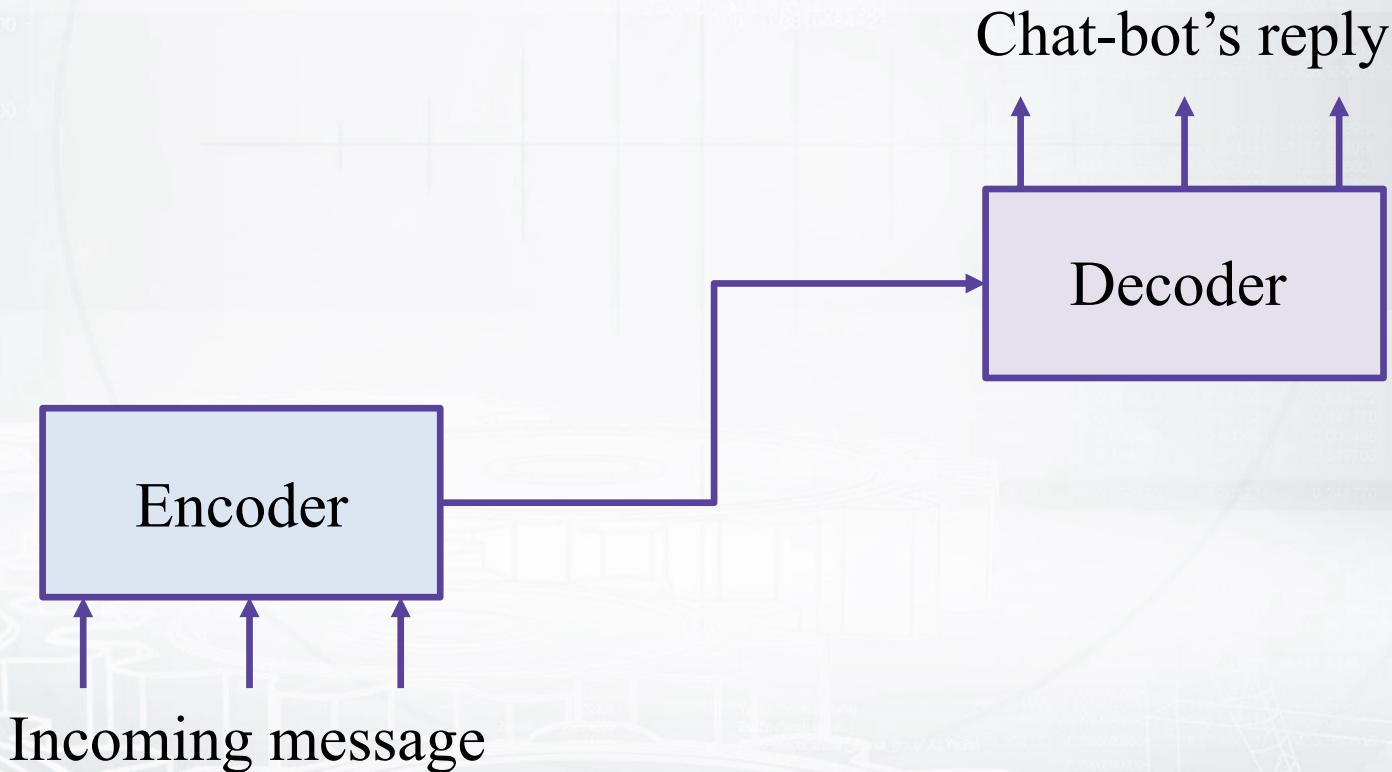
- use a repository of predefined responses
- no grammatical mistakes
- unable to handle unseen cases

Generative models

- generate new responses from scratch
- can make mistakes (especially on longer sentences)
- impression you're talking to a human

Sequence to sequence

- LSTMs for encoder and decoder
- Attention (or at least reversed input)
- Beam search for the best reply



Padding

EOS : End of sentence

PAD : Filler

GO : Start decoding

UNK : Unknown; word not in vocabulary

Q: How are you?

A: I am fine



Q: [PAD,PAD,PAD,PAD,PAD,PAD,“?”,“you”,“are”, “How”]

A: [GO, “I”, “am”, “fine”, “.”, EOS, PAD, PAD, PAD]

Bucketing

Bucketing solves the problem of high variance of the length of sentences by putting them into buckets of different sizes.

Buckets for the length intervals $(0, 5]$, $[5, 10]$, $(10, 20]$, ...

Q: How are you?

A: I am fine



Q: [PAD, "?", "you", "are", "How"]

A: [GO, "I", "am", "fine", ".", EOS, PAD, PAD, PAD]

Trained on movies subtitles

Human: what is the purpose of living?

Machine: to live forever.

Human: what is the purpose of existence?

Machine: to find out what happens when we get to the planet earth.

Human: where are you now?

Machine: i'm in the middle of nowhere.

It works! It has some problems though:

- Unrealistic topics
- Too dramatic responses

Oriol Vinyals, Quoc Le. A Neural Conversational Model, 2015.

<https://www.wired.com/2015/06/google-made-chatbot-debates-meaning-life/>

Trained on calls

Machine: hi

Human: hi

Machine: could you please let me know what is the operating system you are using?

Human: linux

Machine: ok this is the issue with the system performance, nasser, tools.

Human: what is that ?

Machine: **is it a windows machine?**

Human: i am using linux

Machine: let me take a remote of your machine and check if issue has been pushed properly.

Human: ok

Oriol Vinyals, Quoc Le. A Neural Conversational Model, 2015.

<https://www.wired.com/2015/06/google-made-chatbot-debates-meaning-life/>

Context of the conversation

- RNN to keep track of the intents:

Human: hi

Machine: how may i help you today?

Human: my computer is not responding

Machine: oh ! i sorry to hear that. are you getting an error message?

Human: yes

Machine: what recent changes did you made with this computer?

Human: i updated my computer

Machine: i see . is this on windows 7?

Human: no it is on linux

Machine: ok . are you using the affected computer right now?

Human: no

Coherent personality

- 4-layer seq2seq trained on 25 million Twitter snippets:

Human: Where do you live now?

Machine: I live in Los Angeles.

Human: In which city do you live now?

Machine: I live in Madrid.

Human: In which country do you live now?

Machine: England, you?

- Persona-based model:

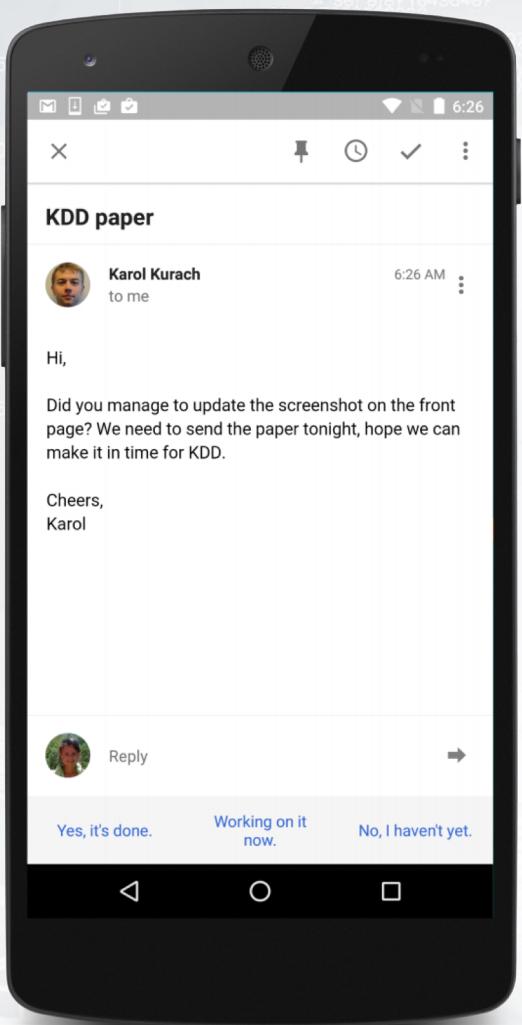
Human: Where are you from?

Machine: I'm from England.

Human: In which city do you live now?

Machine: I live in London.

Diversity of the responses



Always popular responses:

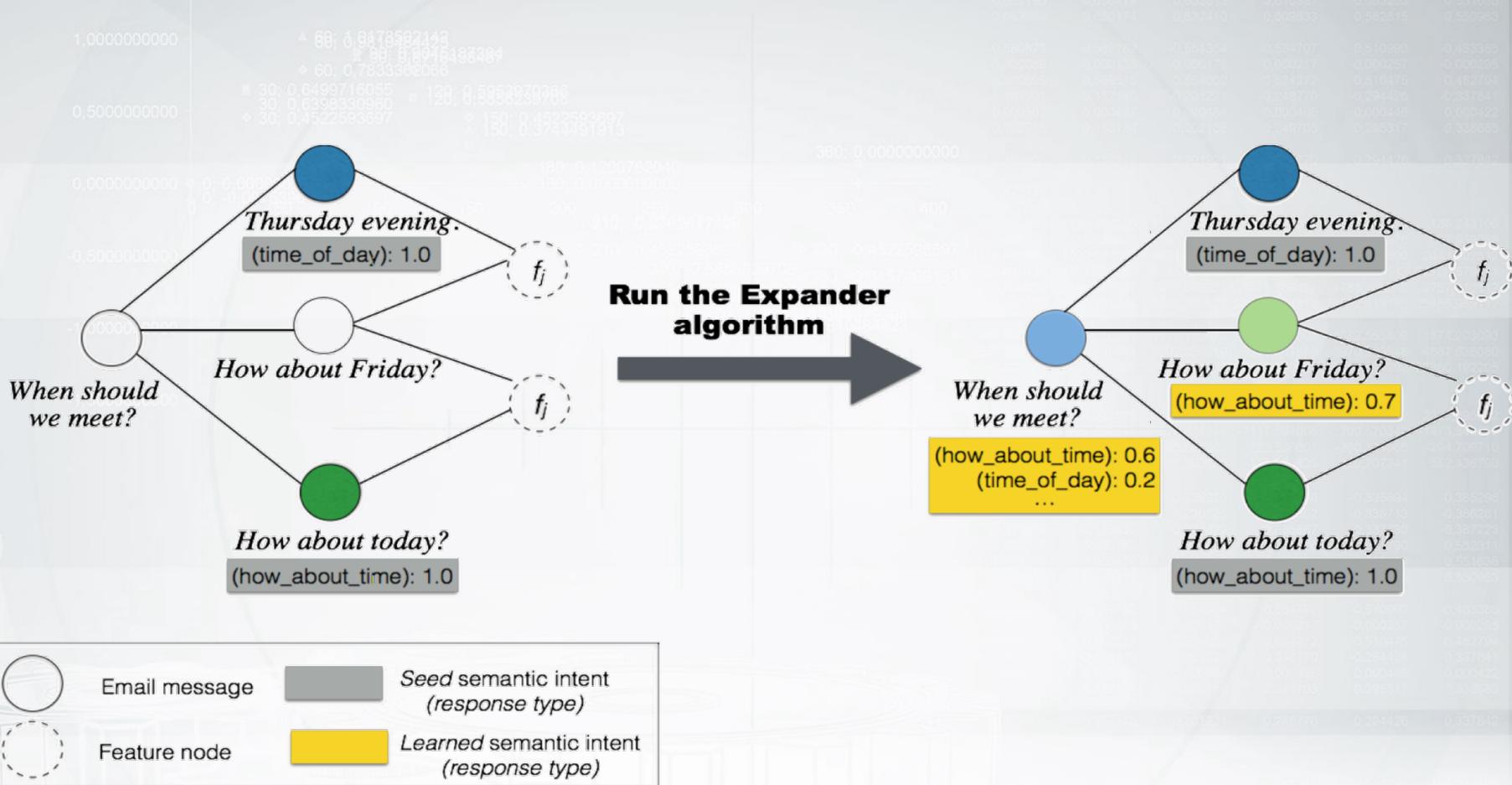
- I love you!
- I don't know

Top-3 responses (not much choice!)

- How about tomorrow?
- Wanna get together tomorrow?
- I suggest we meet tomorrow.

Kannan et. al. Smart Reply: Automated Response Suggestion for Email, KDD 2016.

Intents clustering



Kannan et. al. Smart Reply: Automated Response Suggestion for Email, KDD 2016.

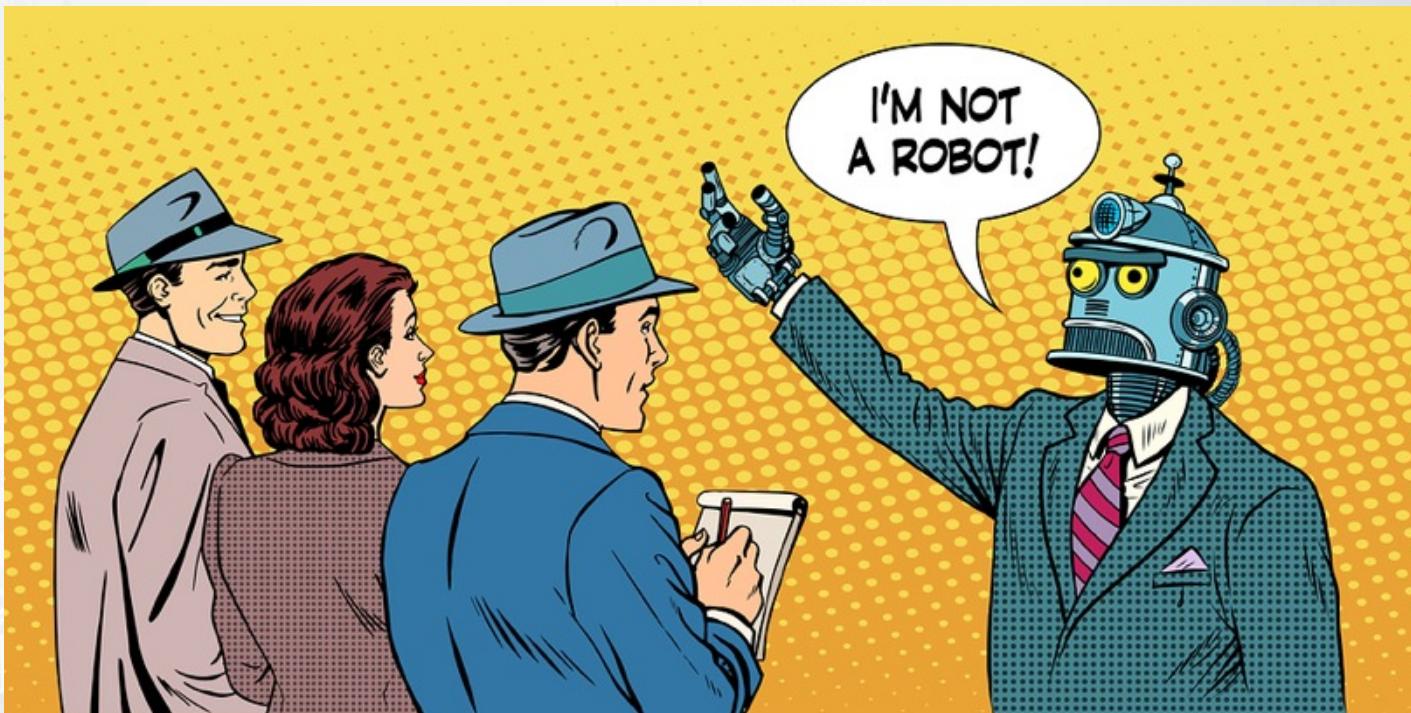
Google Smart Reply

Query	Top generated responses
<p>Hi, I thought it would be great for us to sit down and chat. I am free Tuesday and Wenesday. Can you do either of those days?</p> <p>Thanks!</p> <p>-Alice</p>	<p>I can do Tuesday.</p> <p>I can do Wednesday.</p> <p>How about Tuesday?</p> <p>I can do Tuesday!</p> <p>I can do Tuesday. What time works for you?</p> <p>I can do Wednesday!</p> <p>I can do Tuesday or Wednesday.</p> <p>How about Wednesday?</p> <p>I can do Wednesday. What time works for you?</p> <p>I can do either.</p>

Still not a human

There are demos, and if you cherry-pick the conversation, it looks like it's having a meaningful conversation, but if you actually try it yourself, it quickly goes off the rails.

Andrew Ng



<http://www.mercurynews.com/2016/03/04/qa-andrew-ng-chief-scientist-chinese-search-giant-baidu/>
<http://www.jeffbullas.com/facebook-chatbots-can-revolutionize-social-media-strategy/>