

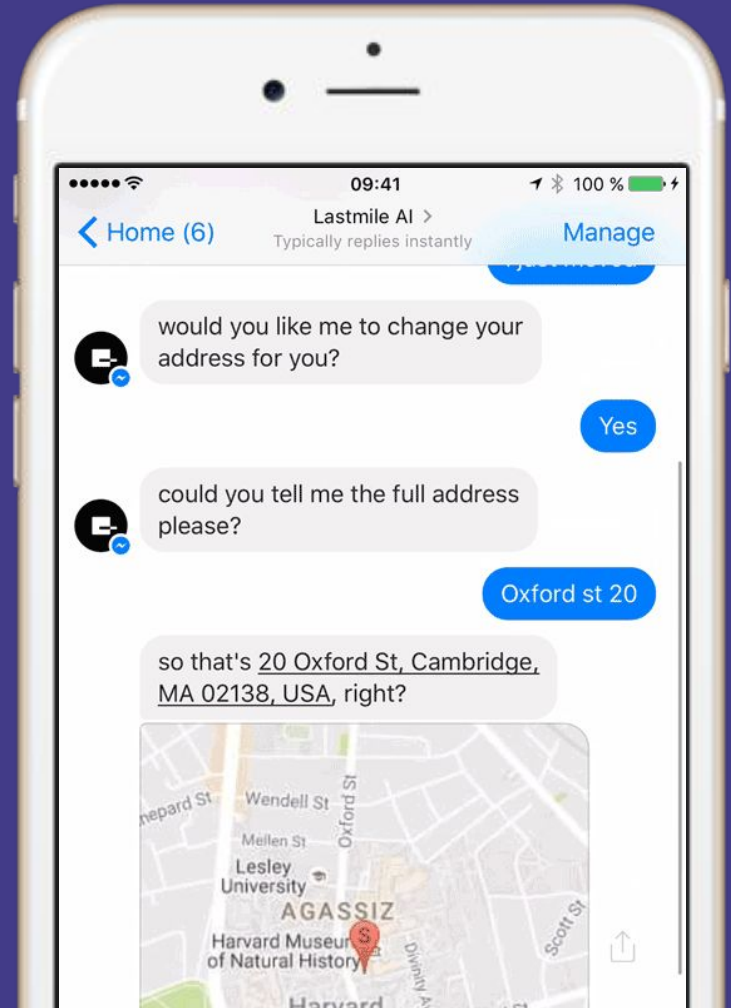


Conversational AI: Building clever chatbots

Tom Bocklisch, Lead Engineer

Conversational AI will dramatically change how users interact with you.

Example of a live Skill:
A customer can change her address via Facebook Messenger



An open source, highly scalable ML framework to build conversational software

The screenshot shows the GitHub repository page for RasaHQ/rasa_nlu. The repository is described as "turn natural language into structured data" with a link to <https://rasa.ai>. It features a collection of tags including nlp, machine-learning, machine-learning-library, bot, bots, botkit, rasa, luis, wit, nlu, conversational-bots, conversational-agents, conversational-ai, spacy, mitie, chatbot, chatbots, chatbots-framework, bot-framework, and Manage topics. The repository statistics show 1,099 commits, 7 branches, 21 releases, 27 contributors, and the Apache-2.0 license. At the bottom, a commit by tmbo is shown, dated 2 days ago, with the message "Update endpoint.sh".

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turn natural language into structured data <https://rasa.ai> Edit

nlp machine-learning machine-learning-library bot bots botkit rasa luis wit nlu conversational-bots

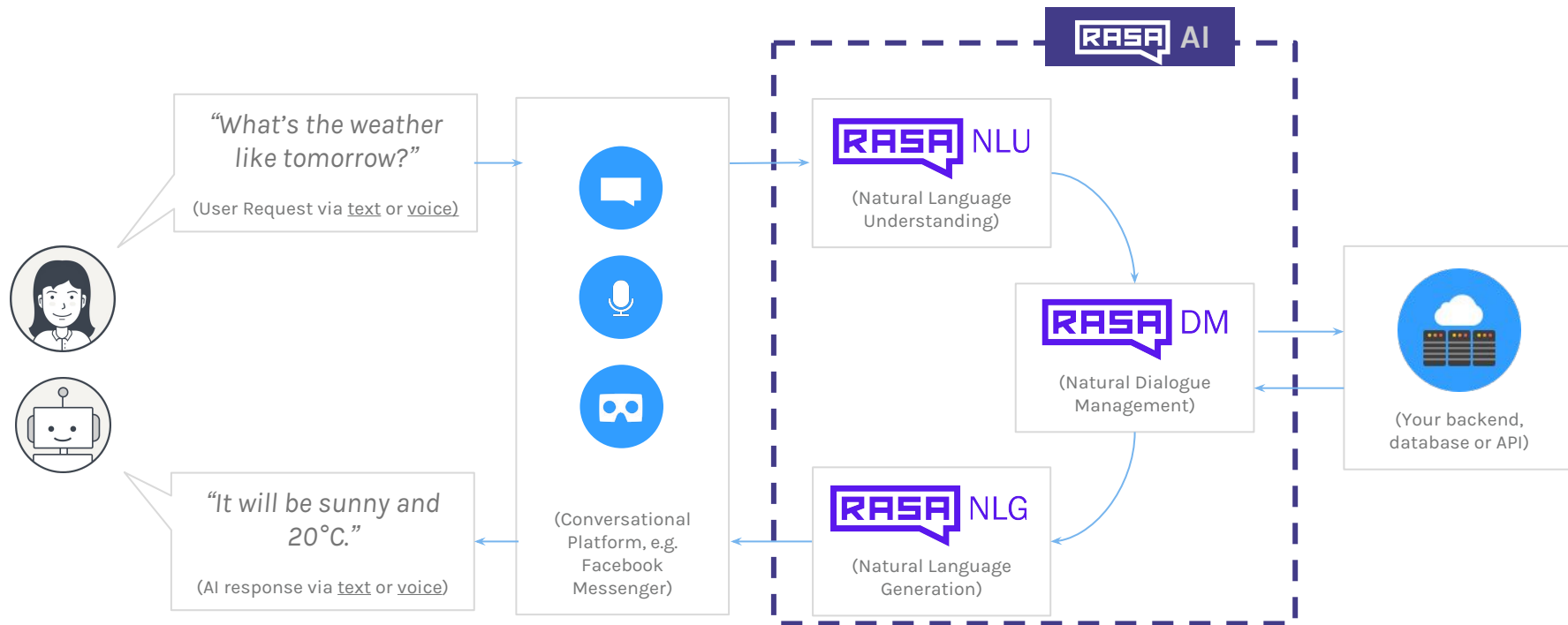
conversational-agents conversational-ai spacy mitie chatbot chatbots chatbots-framework bot-framework Manage topics

1,099 commits 7 branches 21 releases 27 contributors Apache-2.0

Branch: master New pull request Create new file Upload files Find file Clone or download

tmbo committed on GitHub Update endpoint.sh Latest commit ac7421a 2 days ago

Architectural Overview



Alternatives:



Under The Hood

Natural Language Understanding

Natural Language Understanding

Goal: Create structured data

i'm looking for a place in the north LOCATION of town

show me chinese CUISINE restaurants

show me a mexican CUISINE place in the centre LOCATION

i am looking for an indian CUISINE spot

anywhere in the west LOCATION

central LOCATION indian CUISINE restaurant

```
{
  "text": "show me chinese restaurants",
  "intent": "restaurant_search",
  "entities": [
    {
      "start": 8,
      "end": 15,
      "value": "chinese",
      "entity": "cuisine"
    }
  ]
}
```

Natural Language Understanding



What's the
weather like
tomorrow?

Natural Language
Understanding

Example Intent Classification Pipeline

"What's the weather like tomorrow?" { "intent": "request_weather" }

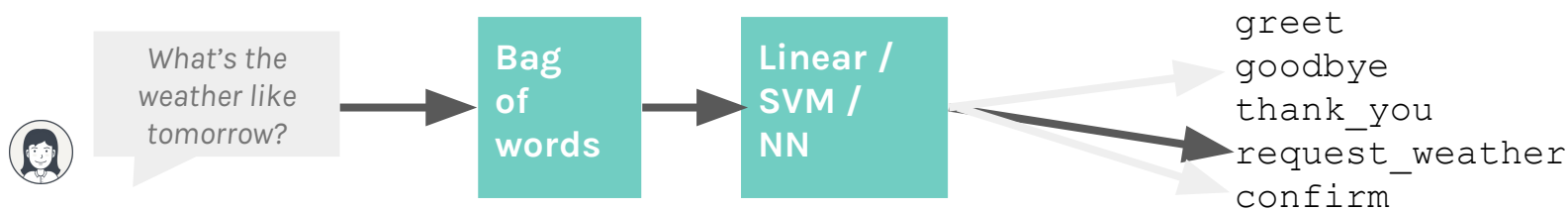
Vectorization

Intent Classification

Natural Language Understanding

Bags are your friend

$$\{v_1, \dots, v_s\} \rightarrow \frac{1}{s} \sum_i v_i$$



Natural Language Understanding

word_bag \oplus char_feats

"I'm hangry"

I'm

han

ang

gry



Natural Language Understanding



What's the
weather like
tomorrow?

Natural Language
Understanding

Example Intent Classification Pipeline

"What's the weather like tomorrow?" { "intent": "request_weather" }

Vectorization

Intent Classification

Example Entity Extraction Pipeline

"What's the weather like tomorrow?"

{ "date": "tomorrow" }

Tokenizer

Part of Speech
Tagger

Chunker

Entity Extraction

Named Entity
Recognition

Demo

2. Configure the model

Configure the
model

```
In [2]: 1 model_config = {  
2     "pipeline": ["nlp_spacy",  
3                 "ner_crf",  
4                 # "ner_spacy",  
5                 "intent_featurizer_spacy",  
6                 "intent_classifier_sklearn"],  
7     "language": "en"  
8 }
```

3. Train

Training the model

```
In [3]: 1 # Train NLU model
2 config = RasaNLUConfig(cmdline_args=model_config)
3
4 trainer = Trainer(config)
5 training_data = load_data("example-data/demo-rasa.json")
6
7 # run the training
8 interpreter = trainer.train(training_data)
9 logging.info("done")
```

```
INFO:root:Trying to load spacy model with name 'en'
INFO:root:Added 'nlp_spacy' to component cache. Key 'nlp_spacy-en'.
INFO:root:Training data format at example-data/demo-rasa.json is rasa_nlu
INFO:root:Training data stats:
- intent examples: 38 (4 distinct intents)
- found intents: affirm, goodbye, greet, restaurant_search
- entity examples: 7 (2 distinct entities)
- found entities: cuisine, location

INFO:root:Starting to train component nlp_spacy
INFO:root:Finished training component.
INFO:root:Starting to train component ner_crf
INFO:root:Finished training component.
INFO:root:Starting to train component intent_featurizer_spacy
INFO:root:Finished training component.
INFO:root:Starting to train component intent_classifier_sklearn
[Parallel(n_jobs=1)]: Done 12 out of 12 | elapsed: 0.1s finished
INFO:root:Finished training component.
INFO:root:done
```

Fitting 2 folds for each of 6 candidates, totalling 12 fits

4. Use Model

Playing around
with the trained
model

```
In [27]: 1 # i am looking for an italian restaurant in Vienna
          2 result = interpreter.parse(
          3     "i am looking for an italian restaurant in Vienna")
          4 pprint(result)

{
  "entities": [
    {
      "start": 20,
      "extractor": "ner_crf",
      "end": 27,
      "value": "italian",
      "entity": "cuisine"
    },
    {
      "start": 42,
      "extractor": "ner_spacy",
      "end": 48,
      "value": "Vienna",
      "entity": "GPE"
    }
  ],
  "intent": {
    "confidence": 0.80703667042349947,
    "name": "restaurant_search"
  },
  "text": "i am looking for an italian restaurant in Vienna",
```

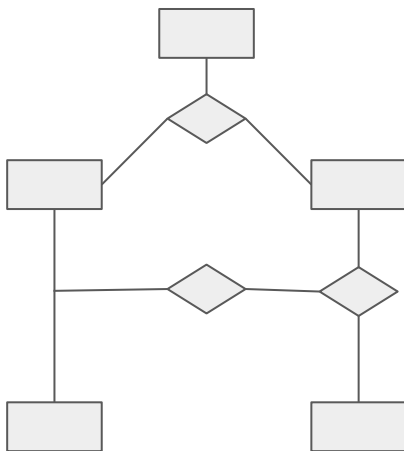
Under The Hood

Dialogue Handling

Dialogue Handling

hand-crafted

data-driven



Human: *What do you think about messi ?*

Machine: *he 's a great player .*

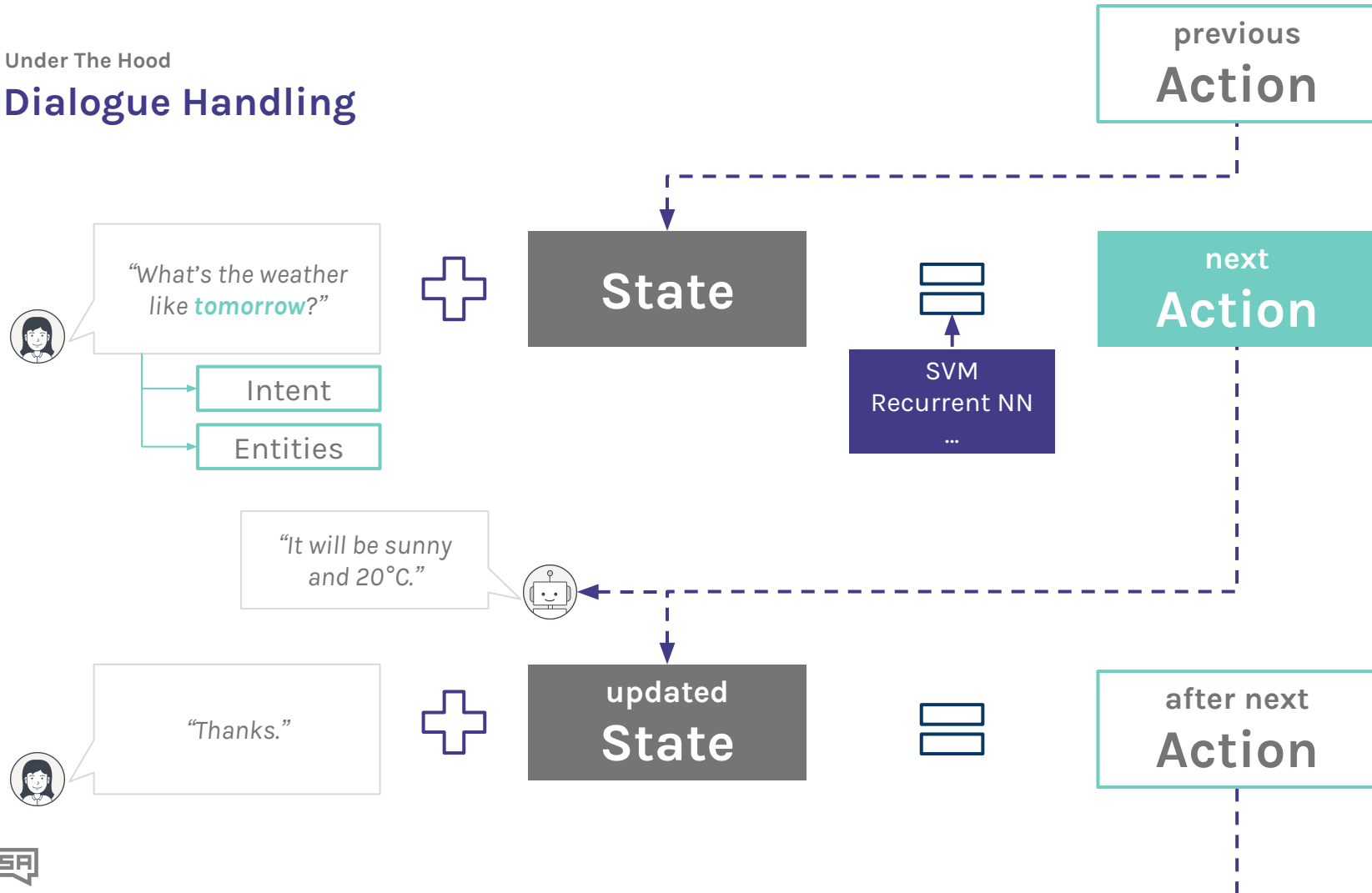
Human: *what do you think about cleopatra ?*

Machine: *oh , she 's very regal .*

Human: *what do you think about england during the reign of elizabeth ?*

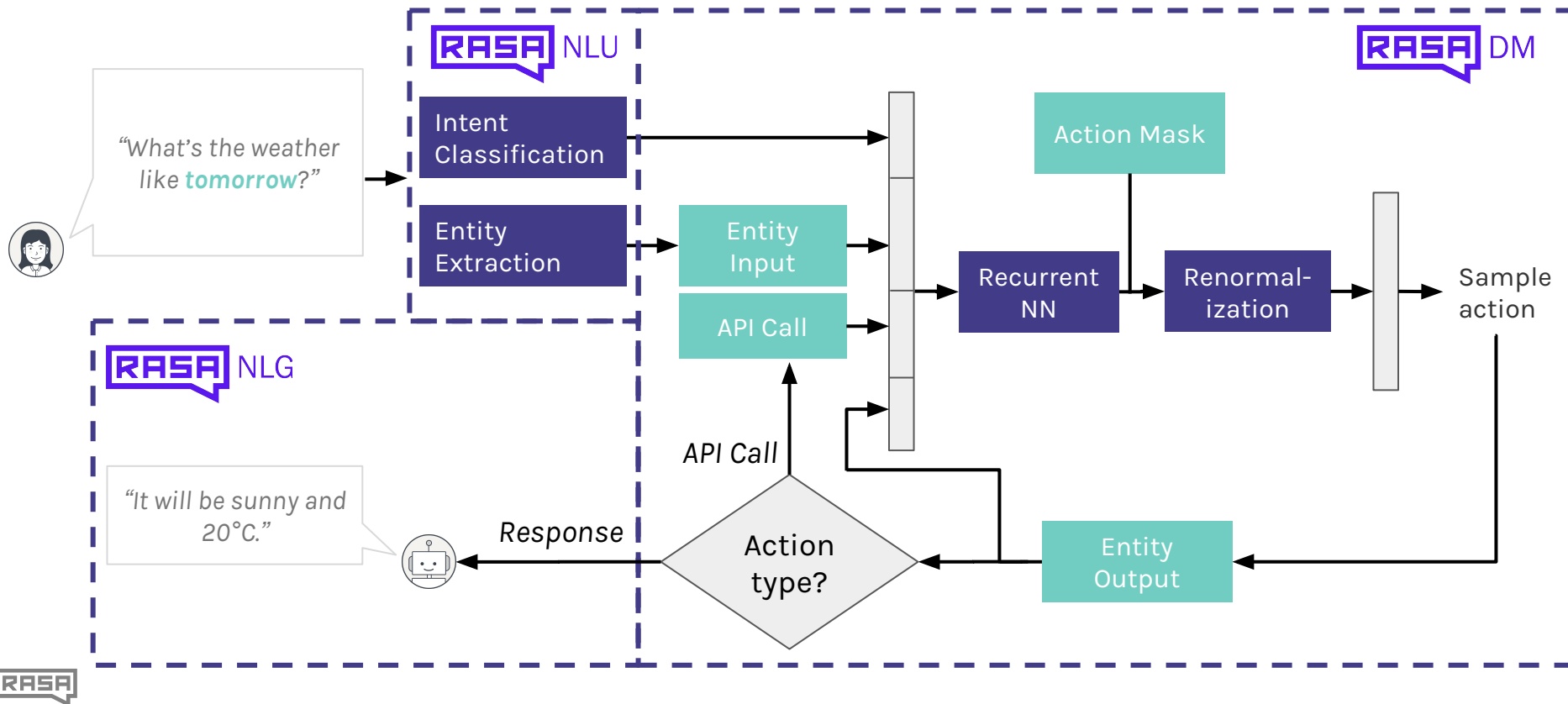
Machine: *it was a great place .*

Dialogue Handling



Detailed Dialogue Handling

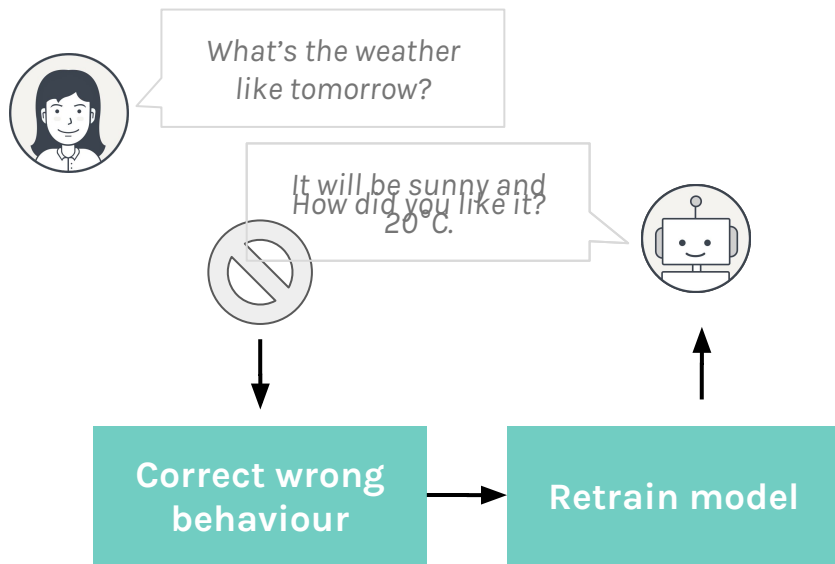
Similar to LSTM-dialogue prediction paper: <https://arxiv.org/abs/1606.01269>



Dialogue Training

Issue: How to get started? →

Online Learning



Demo

Dialogue Training

```
user said:      _inform[price=expensive]
```

```
whose intent is: inform
```

```
with price:     expensive
```

```
we currently have slots: info: None, cuisine: spanish, people: six, matches: None,
```

```
-----
```

```
what is the next action for the bot?
```

0	listen	0.24
1	default	0.00
2	greet	0.00
3	goodbye	0.00
4	ack_dosearch	0.13
5	ask_howcanhelp	0.05
6	ask_location	0.00
7	ask_numpeople	0.31
8	ask_price	0.00
9	ask_cuisine	0.05
10	ack_findalternatives	0.00
11	ack_makesreservation	0.00
12	ask_moreupdates	0.00
13	ask_helpmore	0.00
14	on_it	0.04
15	search_restaurants	0.13
16	suggest	0.01

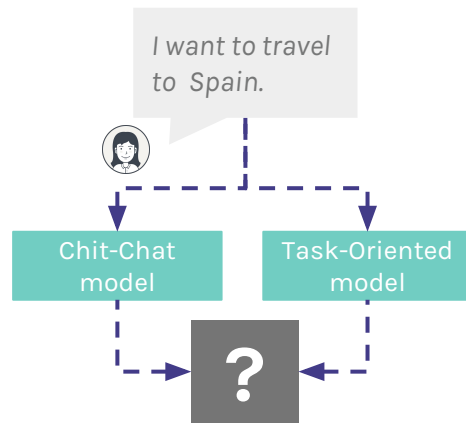


Final Thoughts

Open Challenges

Challenges for curious minds:

- Combination of different dialogue models
- Unsupervised multi-language entity recognition
- Dialogue generalisation (e.g. optional questions)



Current Research

Good reads for a rainy day:

- Last Words: Computational Linguistics and Deep Learning ([blog](#))
<https://goo.gl/lGSRuj>
- Memory Networks ([paper](#))
<https://arxiv.org/pdf/1410.3916>
- End-to-End dialogue system using RNN ([paper](#))
<https://arxiv.org/pdf/1604.04562.pdf>
- MemN2N in python ([github](#))
<https://github.com/vinhkhuc/MemN2N-babi-python>

Summary

3 take home thoughts:

- Techniques to handle small data sets are key to get started with conversational AI
- Deep ML techniques help advance state of the art NLU and conversational AI
- Abandonen flow charts → Data driven dialogue analysis is the future!

Get in touch!



Tom Bocklisch

Lead Engineer

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Introduction

We work on the core technology for next-generation conversational AI



is a **technology company** developing **conversational AI**.

Goal: next-generation intelligent bots

Team: tight-knit, fast-moving team of researchers, engineers, designers and product people 🦉

Location: everywhere (honestly: Berlin, Edinburgh, Beijing)

Founders:

Dr. Alan Nichol (CTO)

Alexander Weidauer (CEO)



UNIVERSITY OF
CAMBRIDGE

Advisory Board:

Chad Fowler (MD & CTO @ Wunderlist)

Matthaus Krzykowski (former Co-Founder @ Xyo)

Cat Noone (Designer & Founder @ Iris)

Investors:



Reference customers:

RAIFFEISEN

ERGO

SwissLife 

