BESPOKE INC

TOKYO

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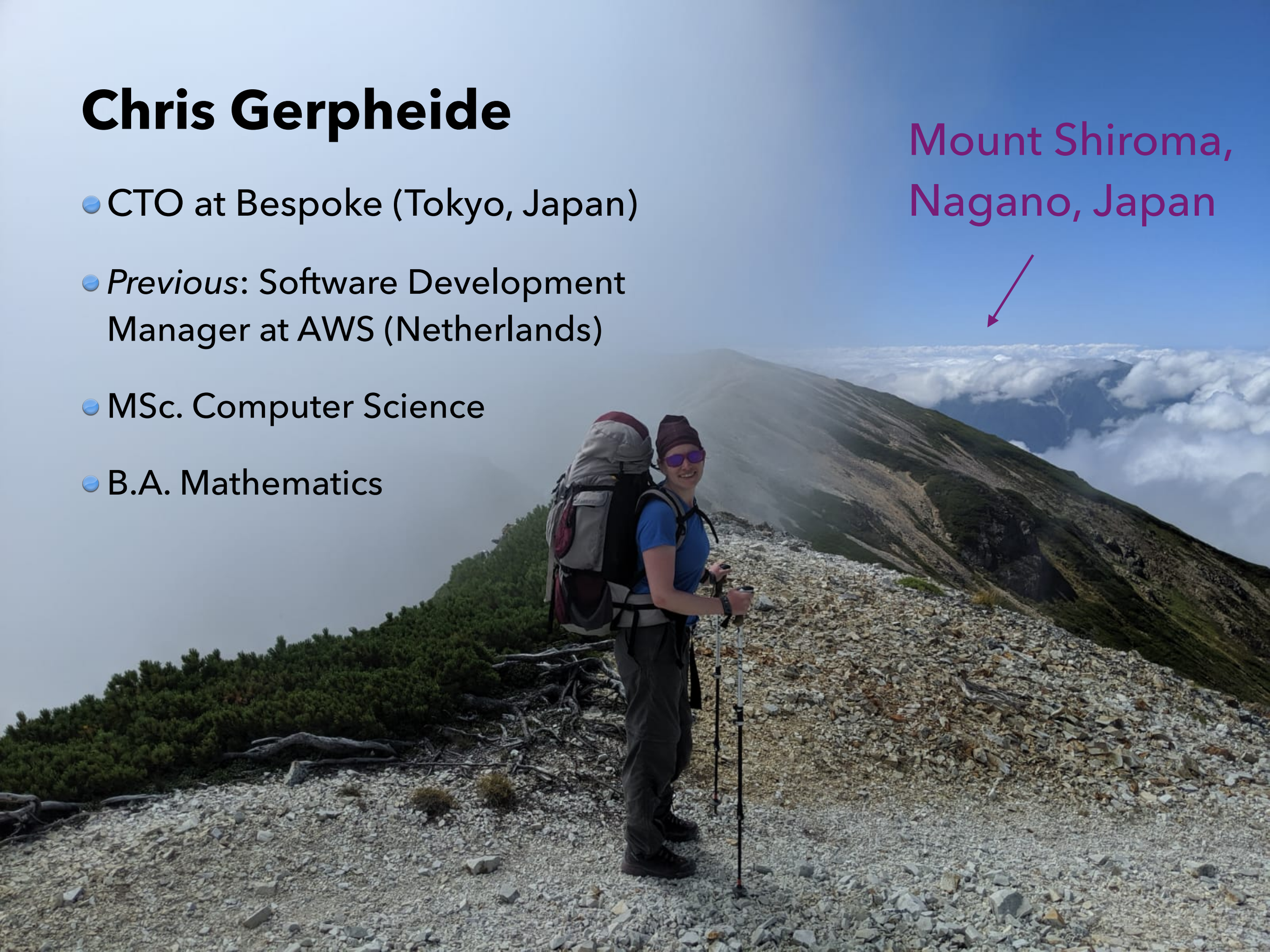
2019-11-20

CREATING A CHATBOT FROM SCRATCH

BESPOKE

Chris Gerpheide

- CTO at Bespoke (Tokyo, Japan)
- *Previous*: Software Development Manager at AWS (Netherlands)
- MSc. Computer Science
- B.A. Mathematics



Bebot / Chatbot architecture and programming

Implement the guts of a chatbot!

With python and scikit-learn

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DEBUT

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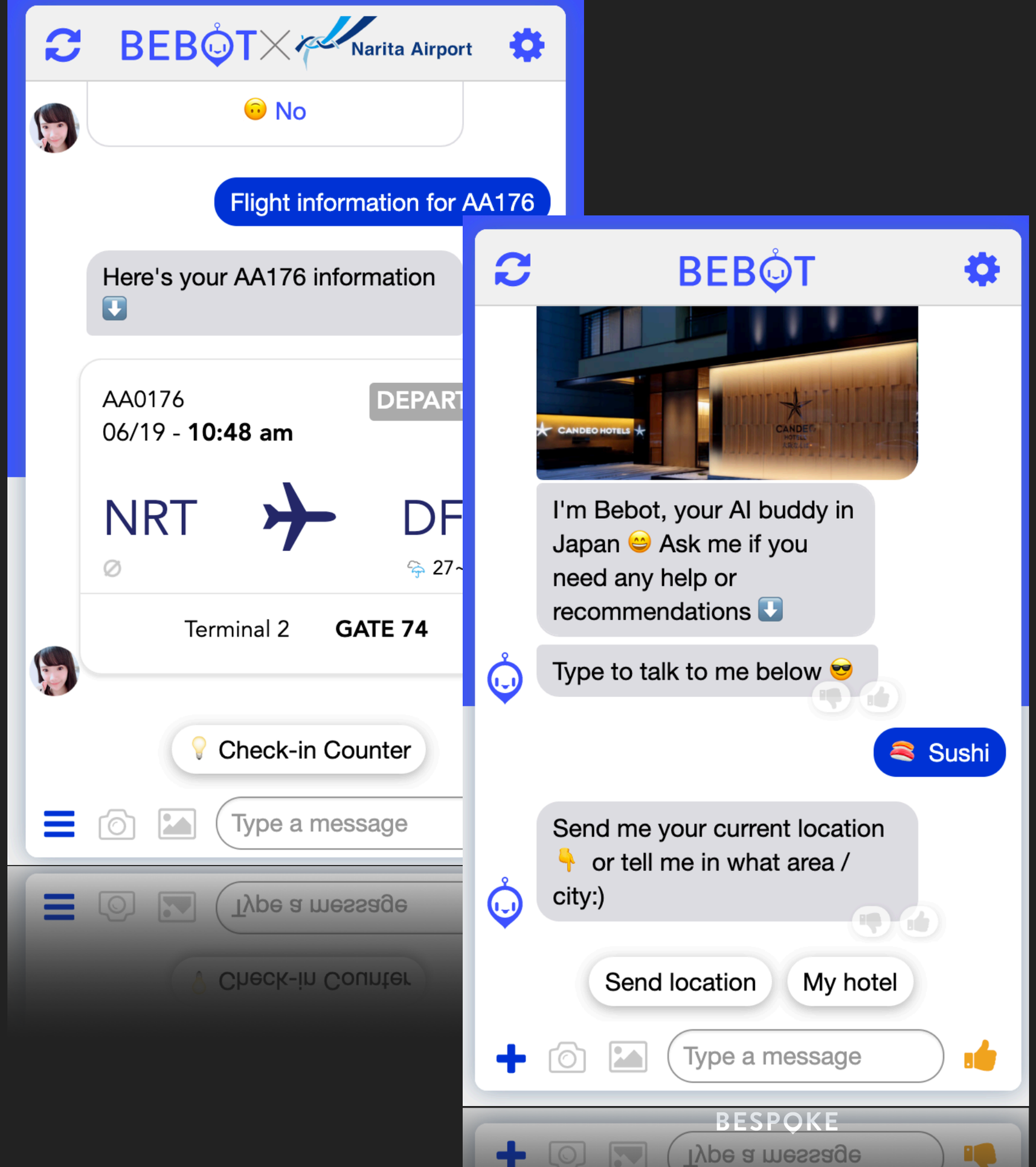

- AI-powered chatbot
- Custom conversations, live support, and insights
- Clients include Narita airport, Tokyo station, hotels, Japanese Gov't for disaster relief
- ~30,000 users daily

CHATBOT ARCHITECTURE

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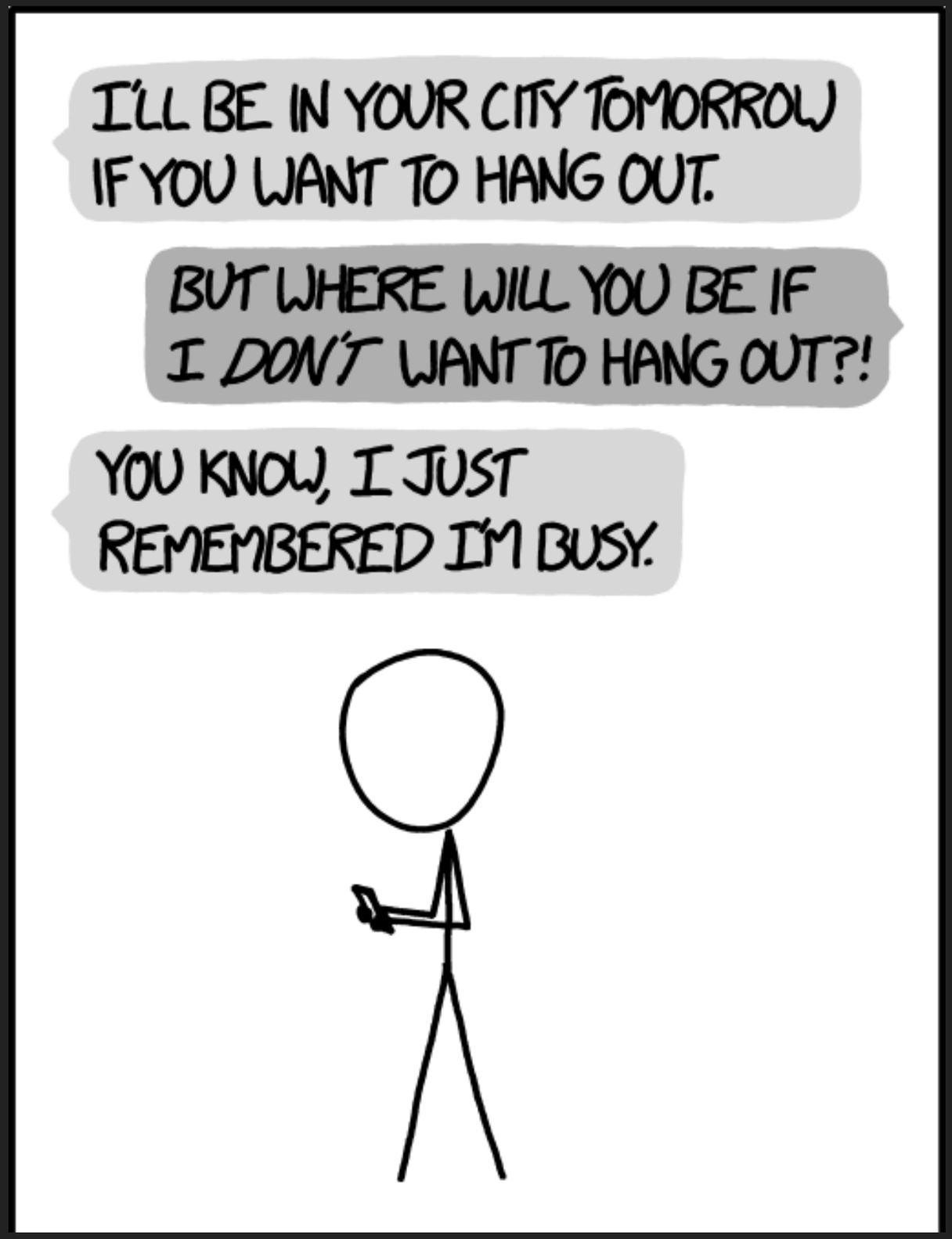
OPTION 1: HUMANS

OPTION 2: RULE-BASED



xkcd.com

OPTION 3: PREDICTIVE — RETRIEVAL-BASED

IF MACHINE LEARNING IS THE ANSWER, THEN WHAT IS THE QUESTION?

Shoham, Powers, Grenager 2006

TRAINING

"CLASS"

"LABEL"

"INTENT"

The topic or question
the user is asking about

"MODEL"

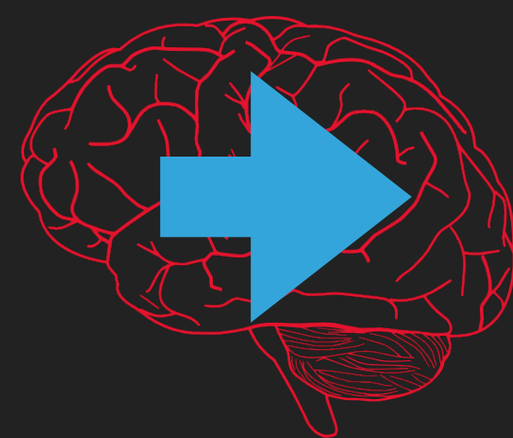
"CLASSIFIER"

where_is_my_hotel : [
'Where is my hotel?',
'Hotel location?',
'How do I get to the hotel?'
]

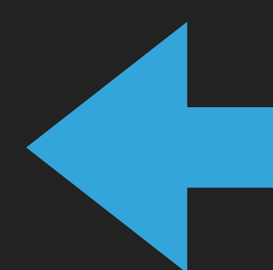
when_is_checkout_time : [
'When is checkout time?',
'When do I need to check out?'
]

PREDICTION AND RETRIEVAL

"ohi how get 2 hotel kthx ¯_(ツ)_/¯"



where_is_my_hotel



"Your hotel is located across from Shibuya Station. Check out these directions:

https://goo.gl/aoeu"

TRAINING + PREDICTION, ONE LEVEL DEEPER…

where_is_my_hotel : [
'Where is my hotel?',
'Hotel location?',
'How do I get to the hotel?'
]

when_is_checkout_time : [
'When is checkout time?',
'When do I need to check out?'
]

TRAINING + PREDICTION, ONE LEVEL DEEPER…

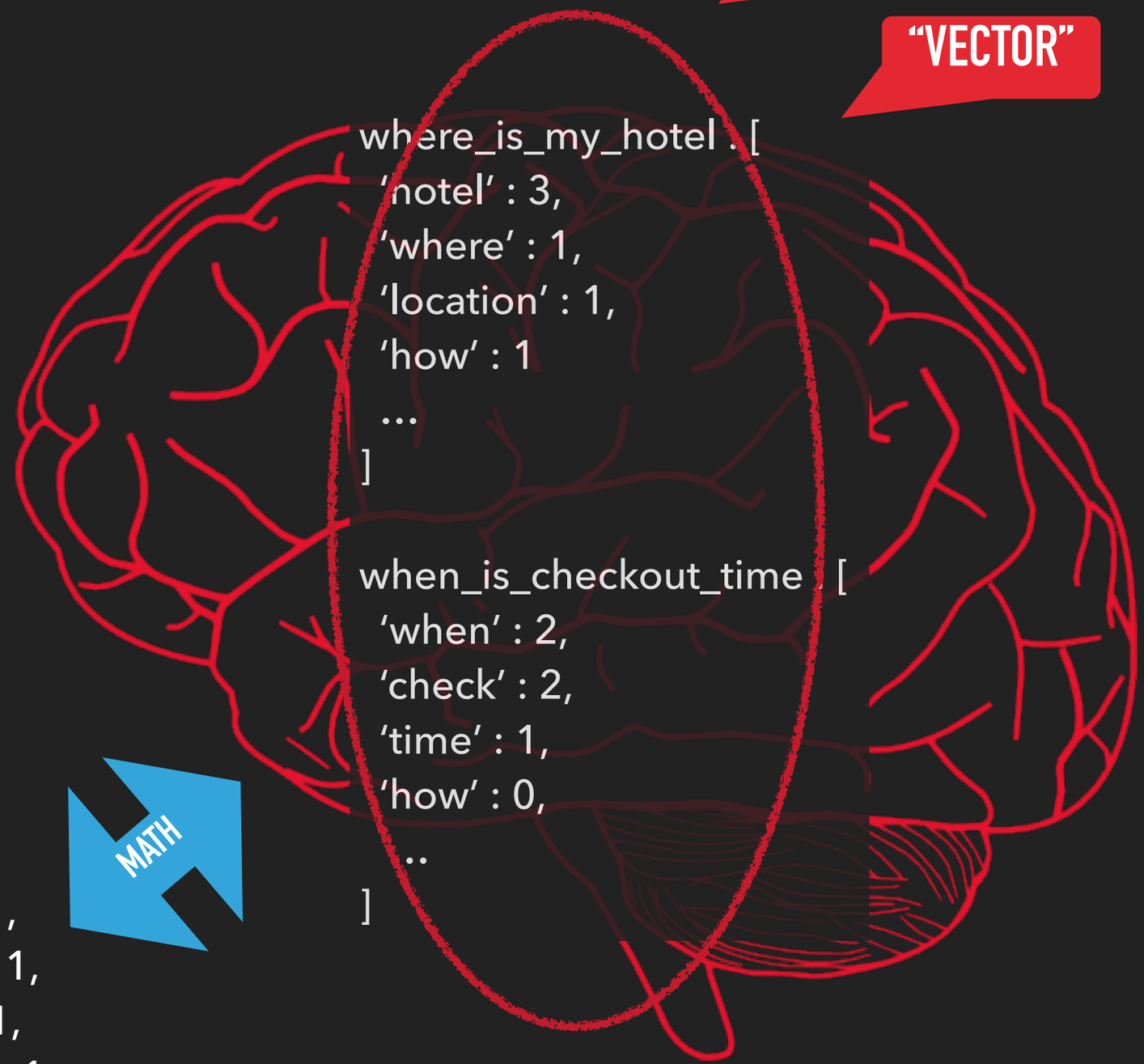
"DICT"

"HASH"

"VECTOR"

where_is_my_hotel : [
'Where is my hotel?',
'Hotel location?',
'How do I get to the hotel?'
]

when_is_checkout_time : [
'When is check-out time?',
'When do I need to check out?'
]



MATH

"ohi how get 2 hotel kthx
¯_(ツ)_/¯"

[
'ohi' : 1,
'how' : 1,
'get' : 1,
'hotel' : 1
…
]

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THE TEST SET

accuracy, but not very granular

Query	Expected Label	Prediction Probabilities	Prediction Result	
"Where hotel plz"	where_is_my_hotel	where_is_my_hotel: 0.72 when_is_checkout_time: 0.26	where_is_my_hotel	✓
"How can I go to the hotel?"	where_is_my_hotel	where_is_my_hotel: 0.95 when_is_checkout_time: 0.18	where_is_my_hotel	✓
"When is checkout?"	when_is_checkout_time	where_is_my_hotel: 0.14 when_is_checkout_time: 0.78	when_is_checkout_time	✓
"When do I go to the checkout location?"	when_is_checkout_time	where_is_my_hotel: 0.42 when_is_checkout_time: 0.37	where_is_my_hotel	✗

PRECISION AND RECALL

Precision: Ratio of true positive predictions to the total *predicted* positives

2 / 3 = 0.66

Recall: Ratio of true positive predictions to the total *expected* positives

2 / 2 = 1.00

where_is_my_hotel

	Expected	Predicted
"Where hotel plz"	POS	POS
"How can I go to the hotel?"	POS	POS
"When is checkout?"	NEG	NEG
"When do I go to the checkout location?"	NEG	POS

"TRUE NEGATIVE"

"FALSE POSITIVE"

PRECISION AND RECALL

CONTROLLING FALSE ALARMS

Precision: Ratio of true positive predictions to the total *predicted* positives

Recall: Ratio of true positive predictions to the total *expected* positives

*High **precision** and low **recall***

	Expected	Predicted
"Where hotel plz"	POS	NEG
...	POS	NEG
	POS	NEG
	POS	NEG
		NEG
		NEG
	POS	NEG
	POS	NEG
	POS	NEG
	POS	NEG
	POS	NEG
	POS	POS

make_reservation
(a lot of work, low risk if missed)

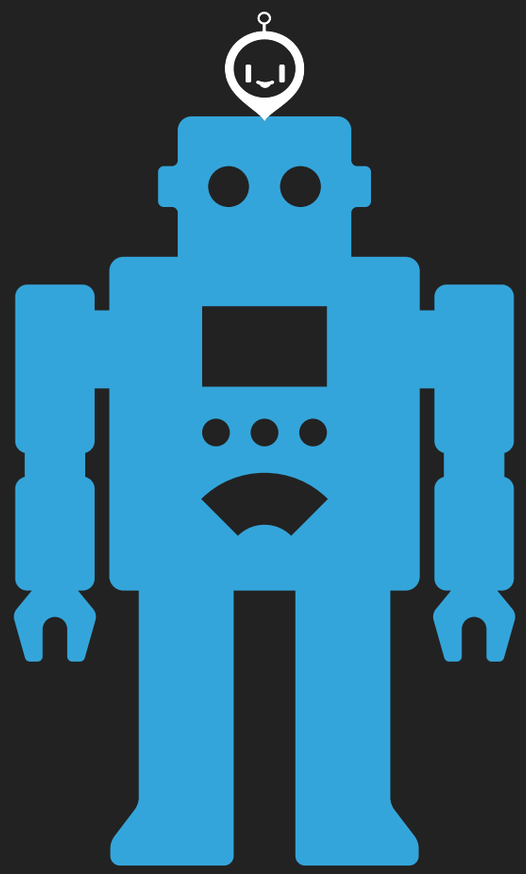
*Low **precision** and high **recall***

	Expected	Predicted
"Where hotel plz"	NEG	POS
...	NEG	POS
	NEG	POS
	NEG	POS
		POS
		POS
		POS
	NEG	POS
	NEG	POS
	NEG	POS
	NEG	POS
	POS	POS

call_hospital
(high risk if missed)

(the guts of)

CREATE A CHATBOT



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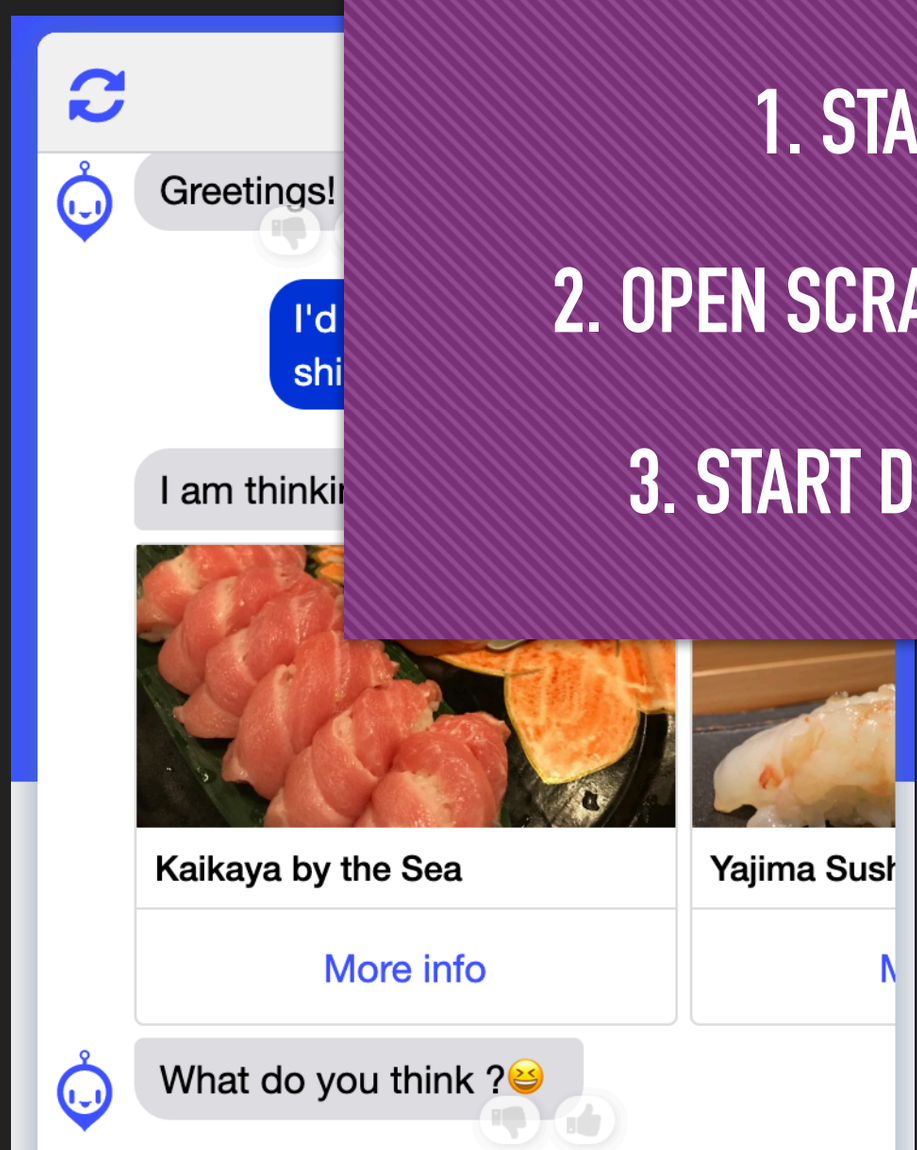
BE CREATIVE!

https://www.facebook.com/NatGeoGenius/

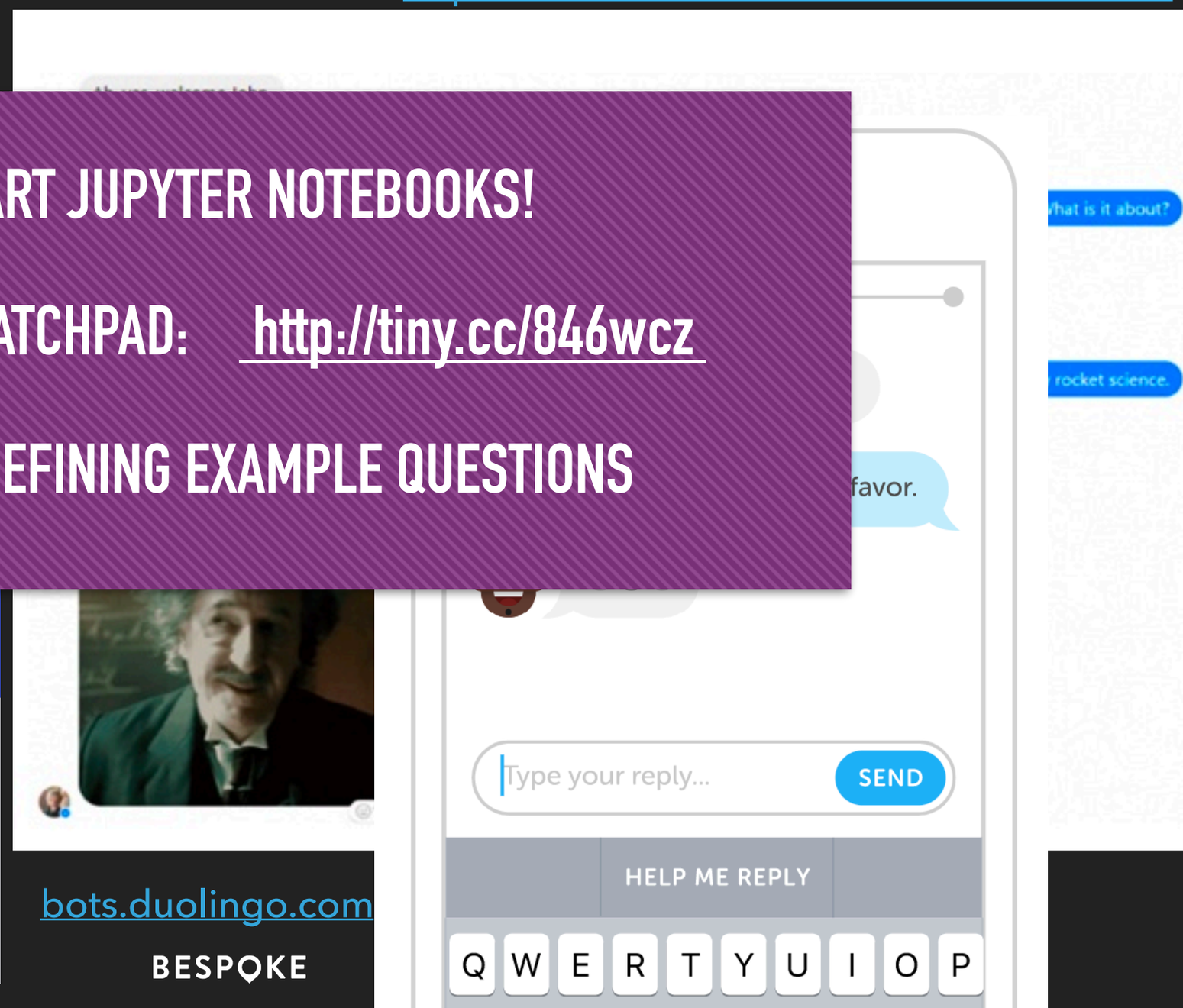
bebot.io



1. START JUPYTER NOTEBOOKS!

2. OPEN SCRATCHPAD: http://tiny.cc/846wcz

3. START DEFINING EXAMPLE QUESTIONS



bots.duolingo.com

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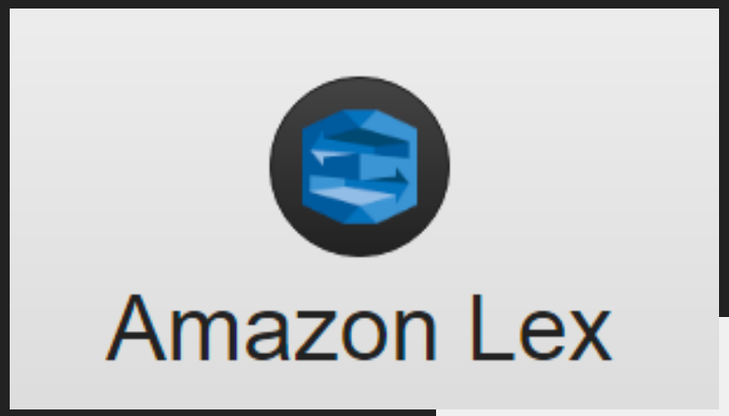
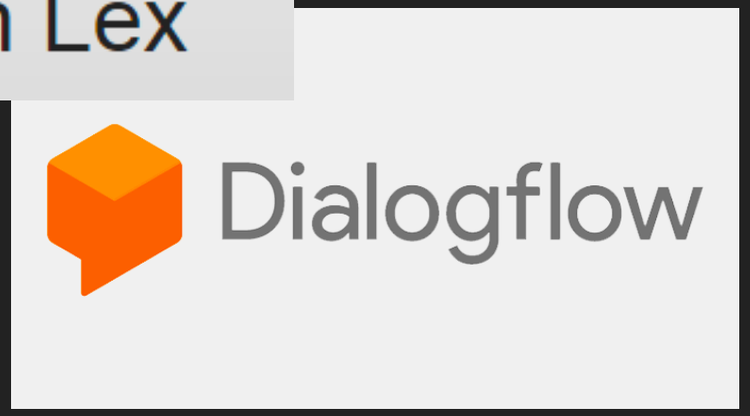
WORKSHOP CHALLENGES

1. Return the answer
2. Exclude unimportant words (“stop words”)
3. Handle synonyms (e.g. “lobby” = “front desk”)
4. Handle typos
5. Return “unknown”
6. Handle a entity/parameter (“set my check out time to 3pm”)

CHALLENGES LEFT TO THE READER

- Other languages and encodings
- Conjugation
- Domination of frequent words or intents
- Multiple intents in one query
- Conversation state/context
- Conversation design





EXTRAS

BESPOKE

humans

DESIGN CONVERSATIONS

Humans are good at sensical conversation flows.

PERFORM TASKS NOT YET AUTOMATED

When considering a new feature, have humans chat with users first.

DEFINE EXPERIMENTS

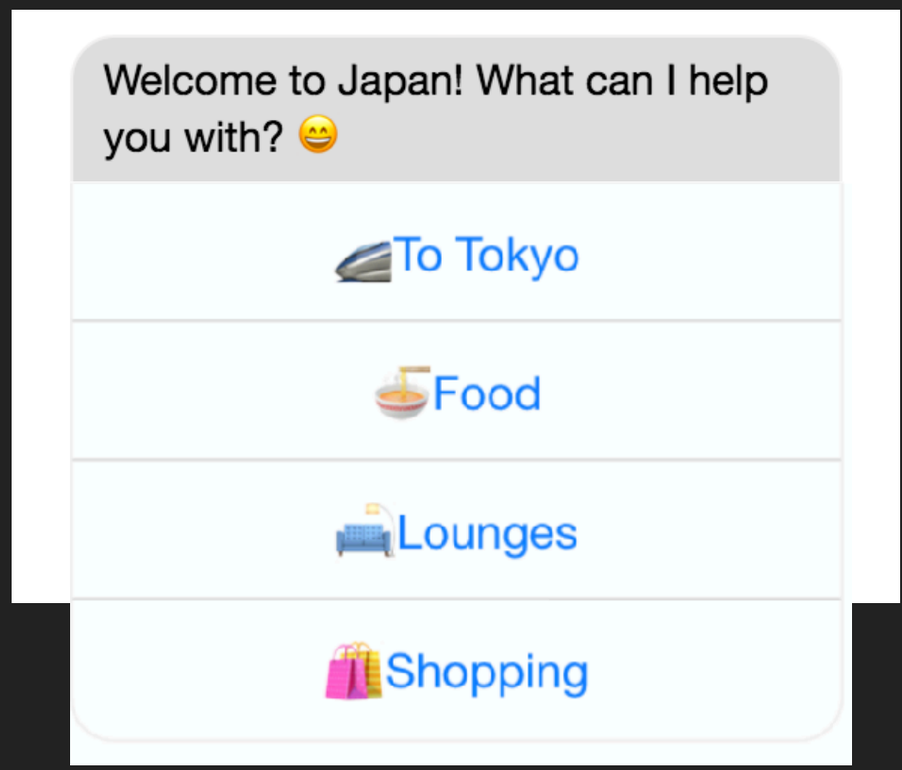
Make hypotheses about human behavior and test them.

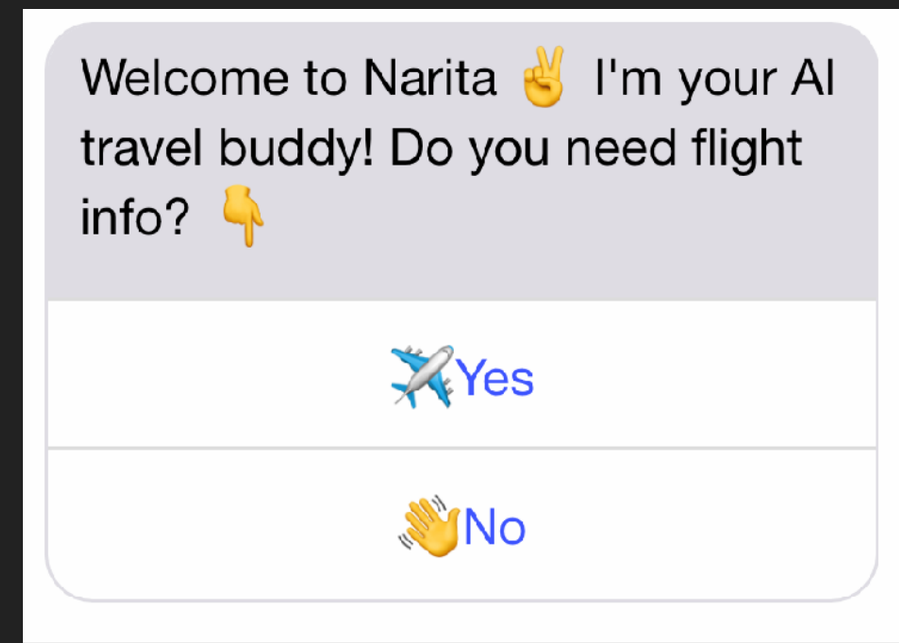
EVALUATE AUTOMATED REPLIES

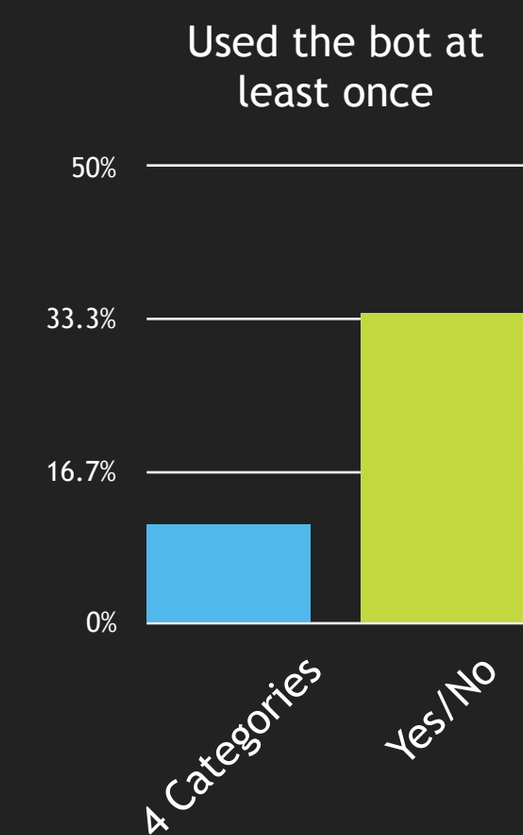
Operators give you immediate feedback on algorithm performance.

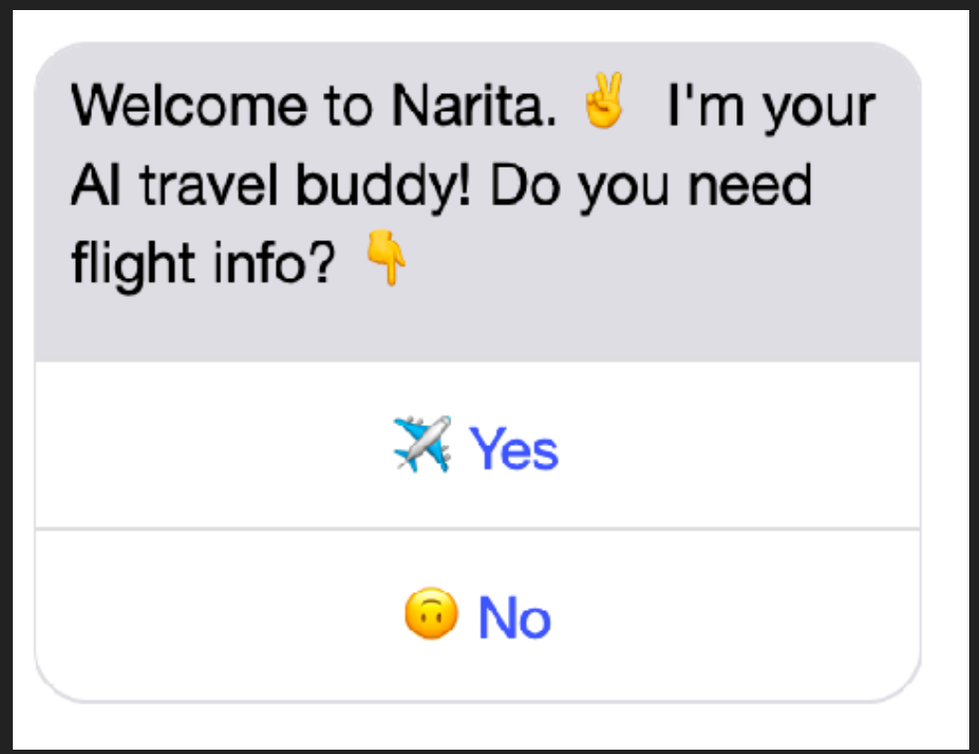
EXTRAS:

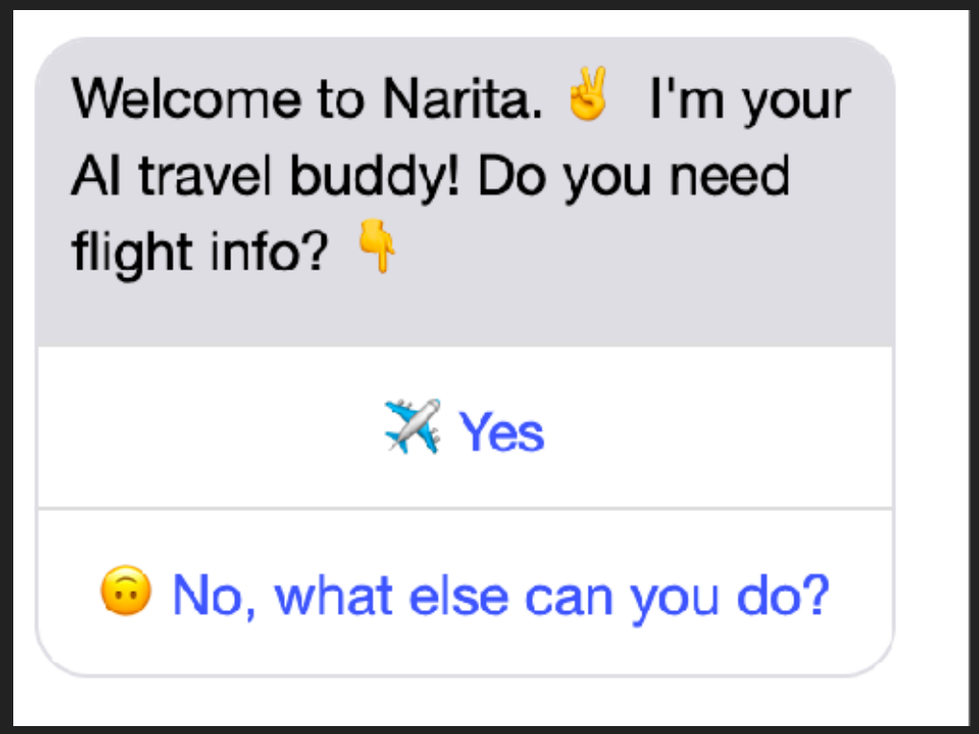
EXPERIMENTS

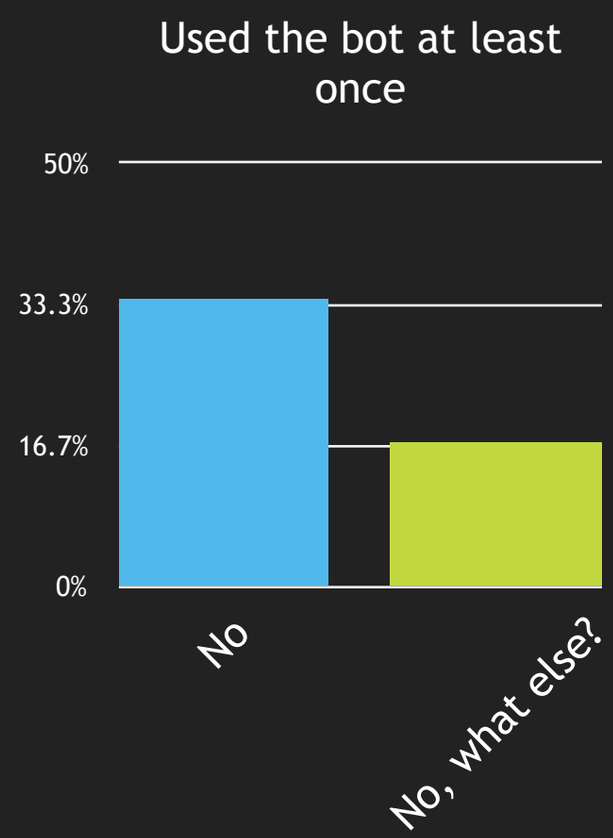

Welcome to Japan! What can I help you with? 😄
🚄To Tokyo
🍜Food
🛋️Lounges
🛍️Shopping


Welcome to Narita ✌️ I'm your AI travel buddy! Do you need flight info? 👇
✈️Yes
👋No


Used the bot at least once
50%
33.3%
16.7%
0%
4 Categories
Yes/No


Welcome to Narita. ✌️ I'm your AI travel buddy! Do you need flight info? 👇
✈️ Yes
🙃 No


Welcome to Narita. ✌️ I'm your AI travel buddy! Do you need flight info? 👇
✈️ Yes
🙃 No, what else can you do?


Used the bot at least once
50%
33.3%
16.7%
0%
No
No, what else?

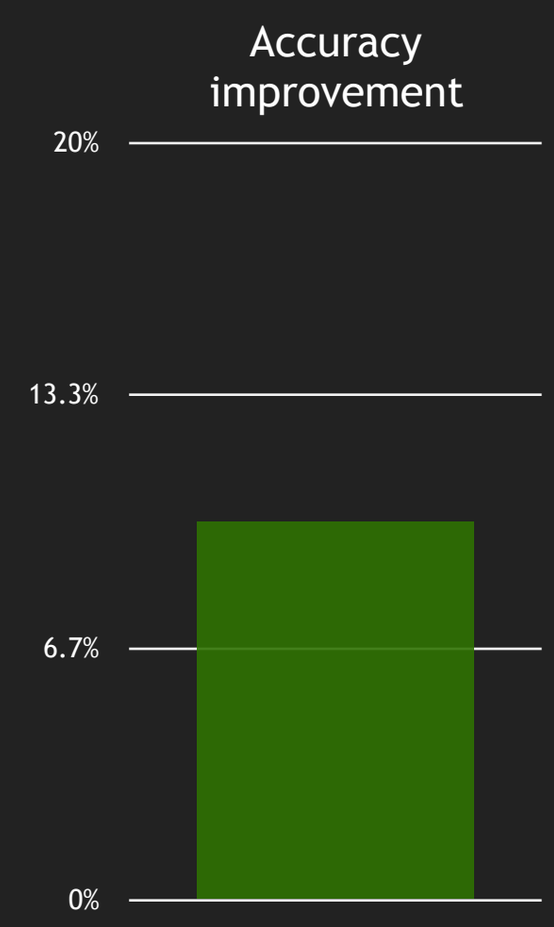
“i want to go to a pokèmon centre”

pokèmon ➡ pokemon

(convert to ASCII)

ok🦊thanks! ➡ ~~okthanks!~~

ok thanks!



```
class MyApp {

    function getAnswer(String question) {


        // normal algorithm
        result = new NaiveBayesAlgorithm().predict(question);
        return result;
    }

}
```


```
class MyApp {

    function getAnswer(String question) {

        if (NEW_ALGORITHM_ENABLED) {
            return new NewAlgorithm().predict(question);
        }

        // normal algorithm
        result = new NaiveBayesAlgorithm().predict(question);
        return result;
    }

}
```

code hooks

RUN EXPERIMENTAL ALGORITHMS

After benchmark test sets, enable in production for a short period of time.

RUN UNOPTIMIZED CODE

Ugly code? Memory-intensive code? See if it works before improving it.

COMPARE ALGORITHMS

Log the results of both the old and the new algorithms.

USE NEW TECHNOLOGIES

Code hooks can run independently of your existing stack.

THANKS!

(AND WE'RE HIRING IN TOKYO!)

Current openings:

- Chatbot R&D Team Lead
- R&D engineer (upcoming)

be-spoke.io/jobs

chris@be-spoke.io
Chris Gerpheide
@phoxicle

BESPOKE

AWS LAMBDA + API GATEWAY

Serverless App Repository:
Microservice-http-endpoint-python3

Create a deployment package with sklearn

```
import json

print('Loading function')

def respond(err, res=None):
    return {
        'statusCode': '400' if err else '200',
        'body': err.message if err else json.dumps(res),
        'headers': {
            'Content-Type': 'application/json',
        },
    }


def lambda_handler(event, context):
    '''Demonstrates a simple HTTP endpoint using API Gateway. You have full
    access to the request and response payload, including headers and
    status code.
    '''
    #print("Received event: " + json.dumps(event, indent=2))

    operation = event['httpMethod']
    if operation == 'GET':
        query = event['queryStringParameters']['query']
        # To start, you could simply train the model on every run
        # Then, run the predict method here.
        return respond(None, "Hi! Your question was: {}".format(query))
    else:
        return respond(ValueError('Unsupported method "{}"'.format(operation)))
```