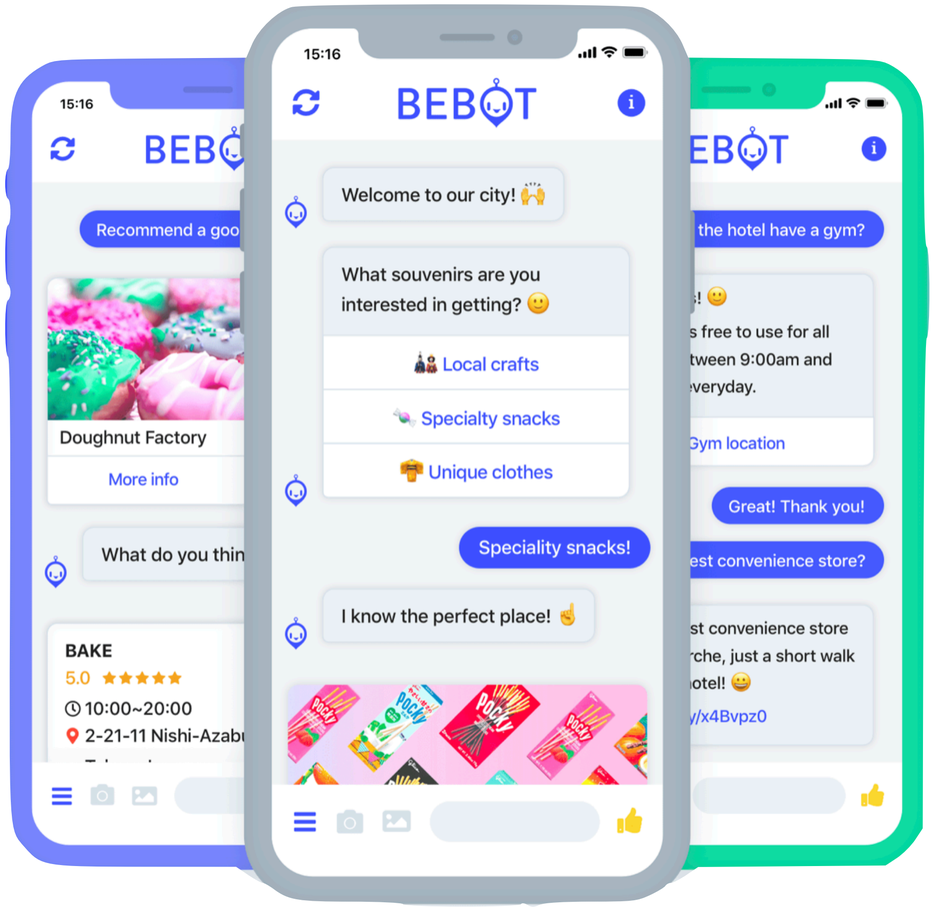
Building a Scalable AI Chatbot

From Rules to Deep Learning



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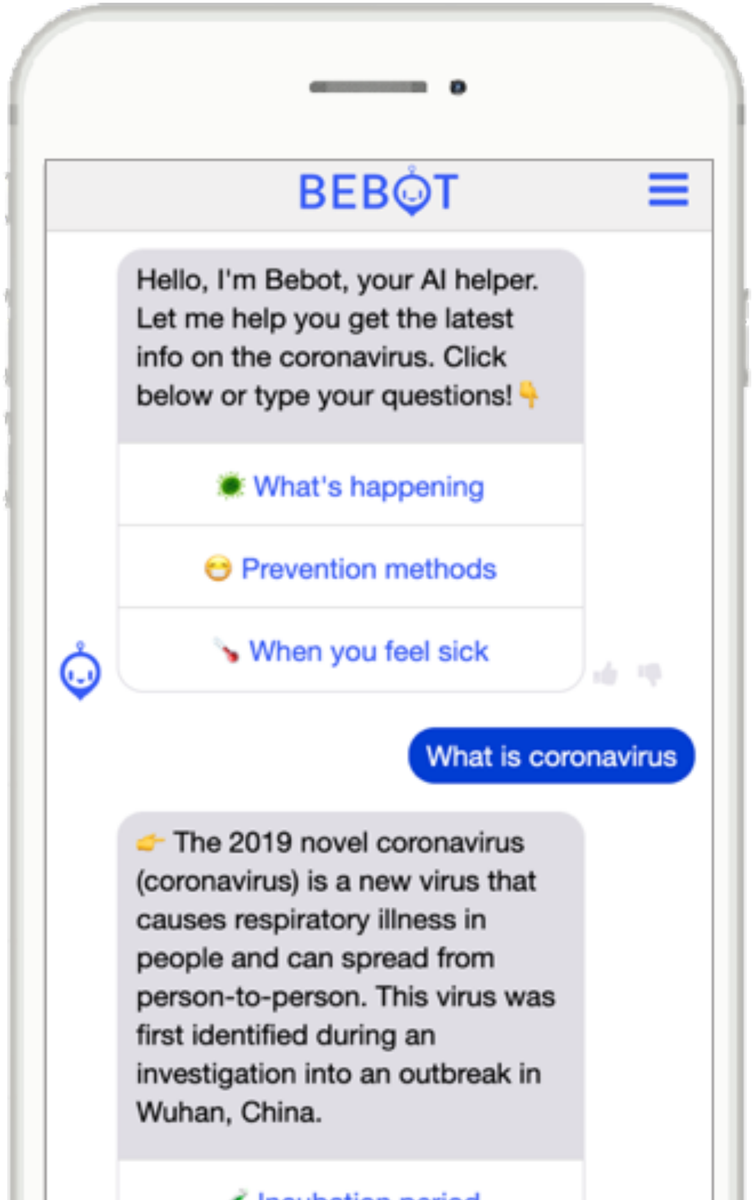
About Bespoke



AI engagement platform for **tourism** and **emergency** services.

Narita Airport
Connecting Japan to the World

JNTO
Japan. Endless Discovery.

The New Otani
NEW OTANI HOTELS

Tampa International Airport

~ 30,000 users per day

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Types of Conversational AI

Most people probably think of generative systems when they hear "chatbot."

However, in practice these have many problems and are still of limited applicability.

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Retrieval-Based Chatbot

User query:

“ohi how get 2 hotel kthx ¯_(ツ)_/¯”

Classified intent:

“where_is_my_hotel”

Response:

“Your hotel is located across from Shibuya Station.

Check out these directions: https://goo.gl/aoeu"

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Why even build your own chatbot?

There are many commercial conversational AI systems.

Why waste time and resources building your own?

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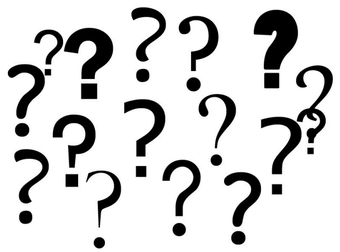
Why even build your own chatbot?

Existing systems have fixed constraints.



✗ Limits and quotas

✗ Language support

✗ Still need to manage the system

First in-house prototype achieved comparable results on our data.

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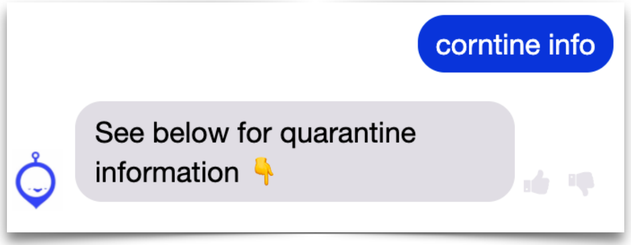
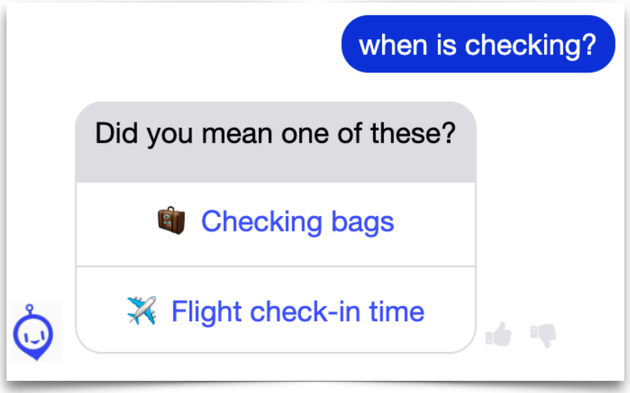
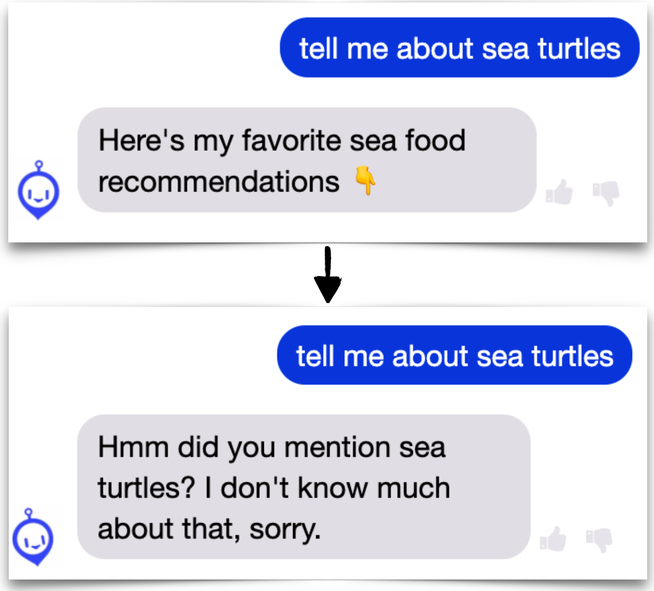
Why even build your own chatbot?

Custom solution provides flexibility and user-centric design.







✓ Custom **typo-correction**

✓ Ability to **disambiguate** and **inspect** reasoning

✓ Custom **handling of out-of-domain** queries

Problem-specific design gave us 15-20% increased accuracy over existing solutions.

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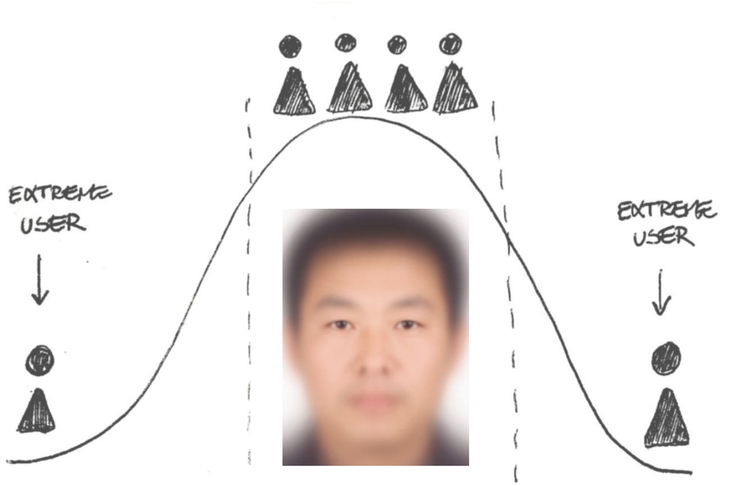
So I Just Implement the State-Of-The-Art DL Model?

No!

Academia and industry are VERY different.
Results often cherry-picked and on toy data.

Good product designers know:
Design a product for edge users and the middle will take care of itself.



But much of ML/DL is by definition mostly focused on the average cases.

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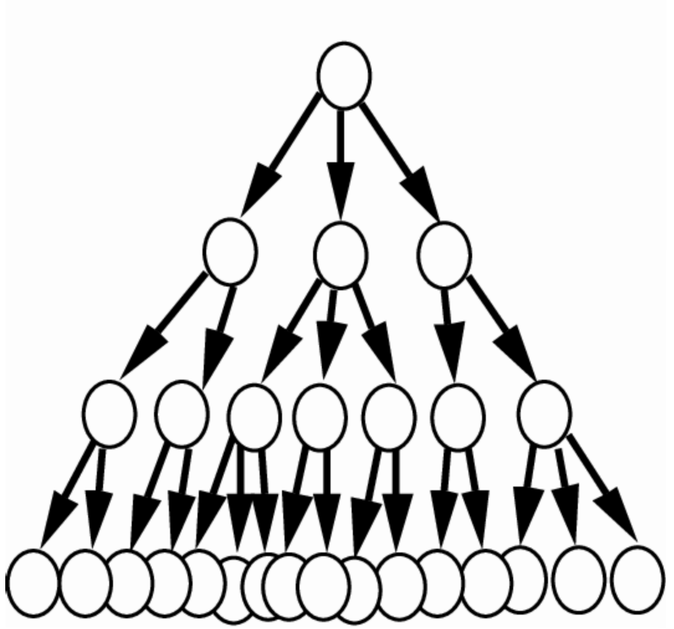
Building a Robust Pipeline

Start from simple but effective methods,
then layer on more complexity.

Don't underestimate "naive" approaches.

Deep learning is very powerful, but it should
rarely be your first approach.



Always start with user needs in mind!
Harsh truth: NO ONE actually wants a [your ML product].
What they want is the problem it can solve.

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Building a Robust Pipeline (Example)

1. Exact string matching

"When is check-in?" → ✓ *when_is_checkin*

"When is checkin?" → ✗

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Building a Robust Pipeline (Example)

1. Exact string matching
2. Partial/fuzzy string matching

"When is check-in?"  ✓ *when_is_checkin*

"When is checkin?"  ✓ *when_is_checkin*

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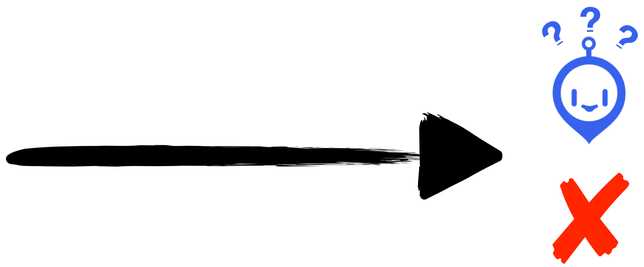
Building a Robust Pipeline (Example)

1. Exact string matching
2. Partial/fuzzy string matching
3. Simple probabilistic classifier (e.g. Naive Bayes)

"How early can I check in?"

98.1% when_is_checkin
1.4% when_is_checkout
0.2% breakfast_time
…

"Can I check out before checking in?"



34.9% when_is_checkin
32.3% when_is_checkout
28.6% meaning_of_life
…

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Building a Robust Pipeline (Example)

1. Exact string matching
2. Partial/fuzzy string matching
3. Simple probabilistic classifier (e.g. Naive Bayes)

Pre-processing, e.g:

- Correct typos
- Normalize text
- Remove punctuation

"Wat time iz chick-in 🤔 !!?!? "  *when_is_checkin*

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Building a Robust Pipeline (Example)

1. Exact string matching
2. Partial/fuzzy string matching
3. Simple probabilistic classifier (e.g. Naive Bayes)
4. FINALLY: Add some neural networks (e.g. BERT)

Pre-processing, e.g:

- Correct typos
- Normalize text
- Remove punctuation

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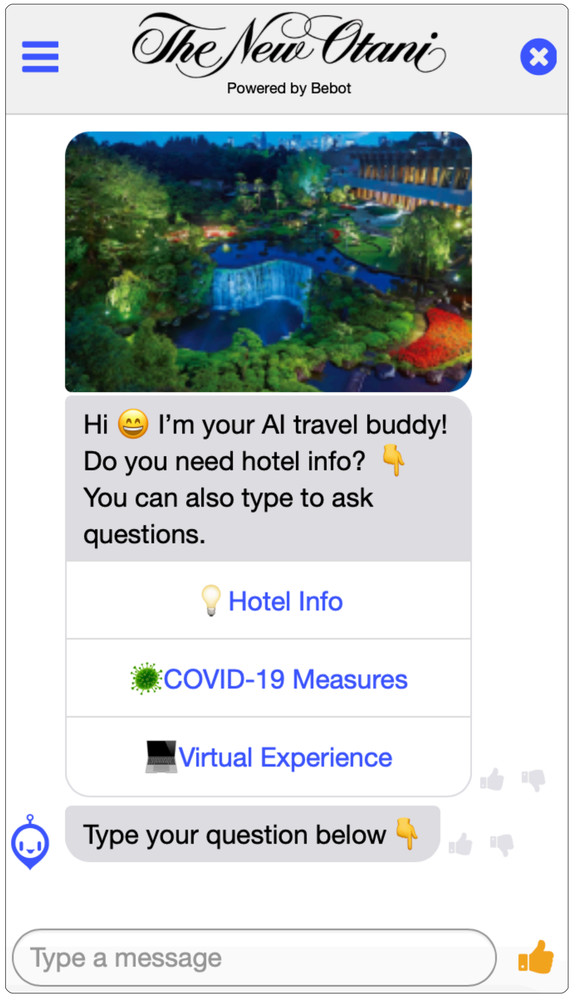
Beyond Text Classification - Conversation Design

Not every input has to come from text queries.

Buttons have several advantages:

- Users are lazy. Clicking is easier than typing.
- Users don't actually know what they can ask.
- Guaranteed "100% accuracy".



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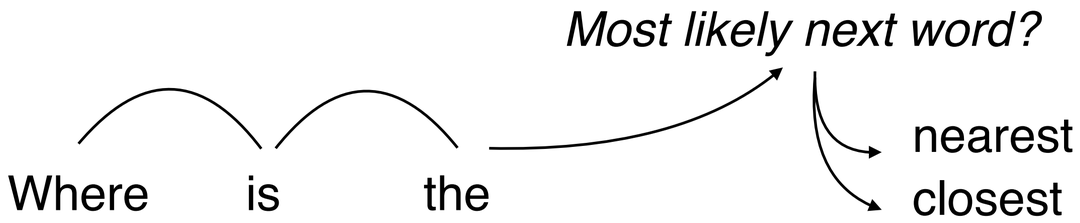
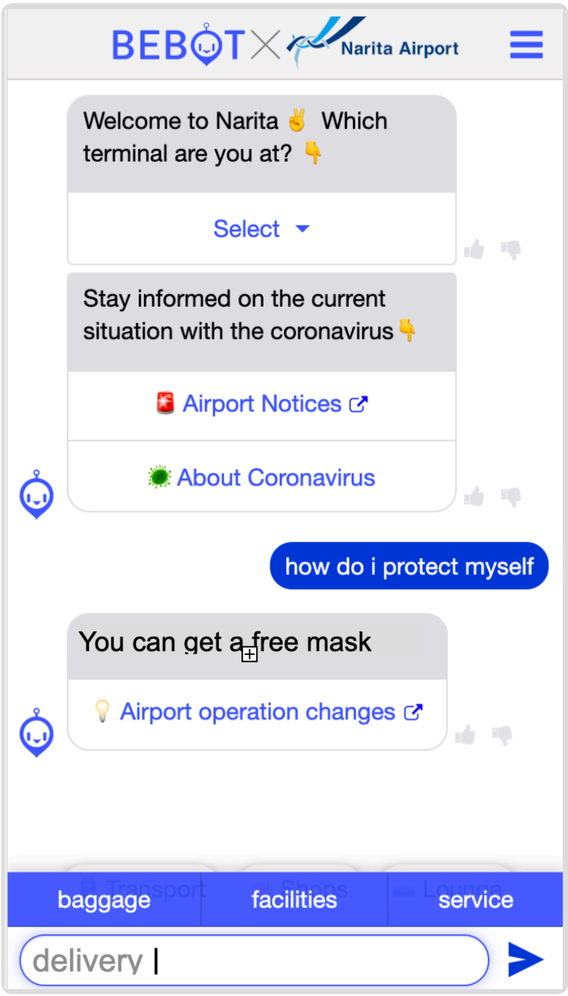
Beyond Text Classification - Conversation Design

Problem-specific **Autocompletion**



- Easier/quicker input
- Reduces typos
- Directs users towards questions we have answers to
- Can even be used to promote content



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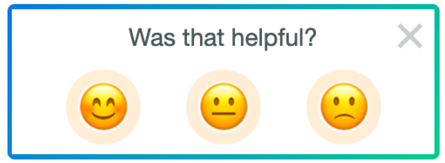
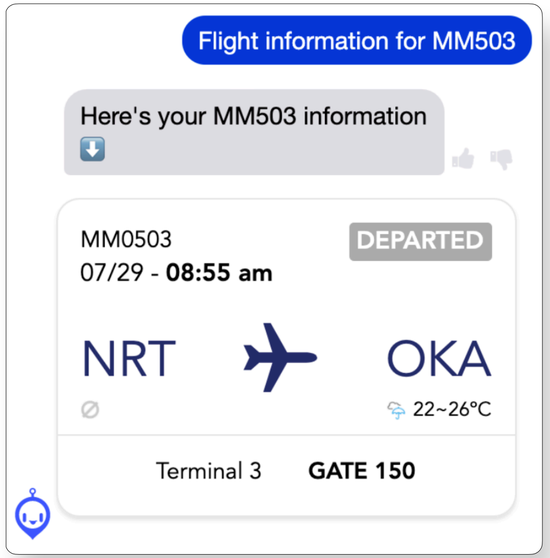
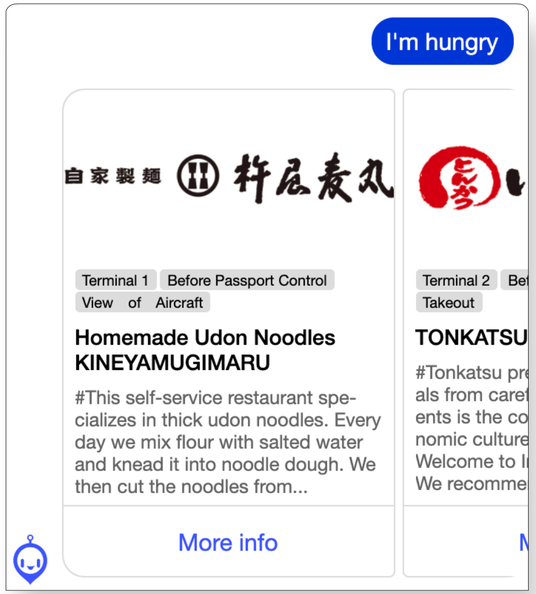
Beyond Text Classification - Conversation Design

Many more opportunities for improvement:

- Connecting to external APIs
- Named entity recognition
- Longer range context
- Smalltalk
- User feedback
- Bot personality
- …







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