

Introduction



A business line for business owners to connect with their customers

18%

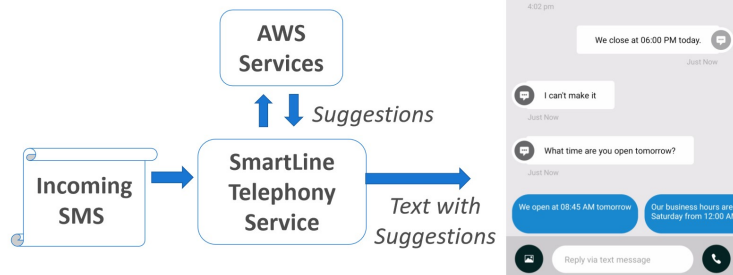
"What's your address?"

of incoming messages are **questions**

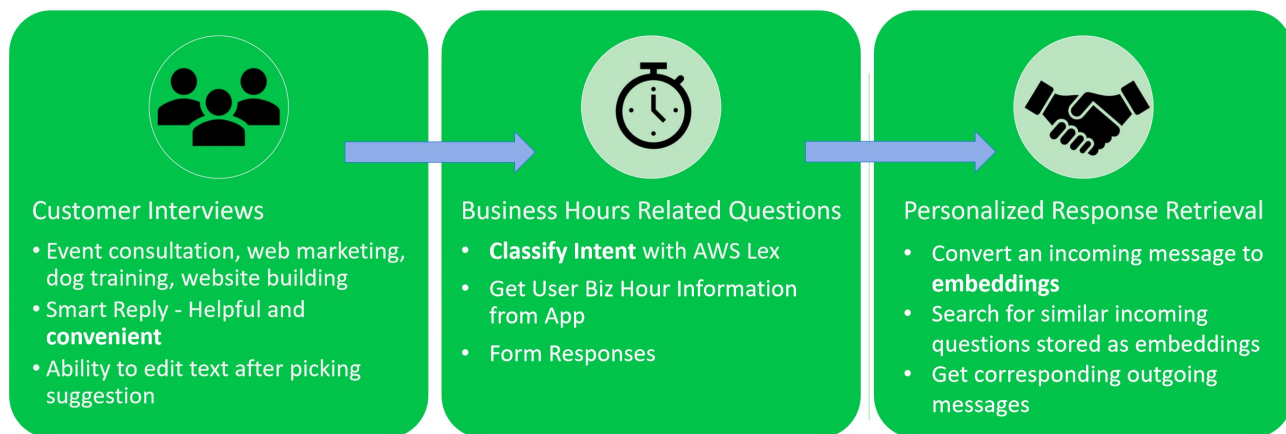
Many questions are **repeated**

SmartReply

We built a **response suggestion feature** to help Smartline users reply to their customers



Process



Future Work

1. Integrate a **feedback mechanism** to evaluate performance of models and iteratively improve them
2. For response for business hours questions, improve Lex's accuracy by periodically **updating training data**
3. For personalized response retrieval, evaluate relevance of an outgoing SMS to an incoming neighbor
4. Use other approaches such as **Sequence2Sequence** to suggest responses for other more generic incoming messages

References

1. Cer, Daniel, et al. "Universal sentence encoder." *arXiv preprint arXiv:1803.11175* (2018).
2. Bernhardsson, Erik. "ANNOY: Approximate nearest neighbors in C++/Python optimized for memory usage and loading/saving to disk, 2013." URL <https://github.com/spotify/annoy> (2013).
3. Manning, Christopher, et al. "The Stanford CoreNLP natural language processing toolkit." *Proceedings of 52nd annual meeting of the association for computational linguistics: system demonstrations*. 2014.

Machine Learning Models

Business Hours Related Questions

Using AWS Lex

- ✓ **Prebuilt system** to process text, filter noise, classify intents, and extract entities
- ✓ An **AWS Service** – Operational synergies in the medium-long term
- ✓ **Blackbox** – Only way to improve results is to finetune the dataset
- ✓ **Confidence** of Intent prediction not outputted

Datasets

Sets of examples for each of 20 intents generated from production SmartLine data

Augmenting Responses with Stanford Language Parser

Detect **yes-no questions**, based on sentence structures

Give out "Yes", "No" as additional response options

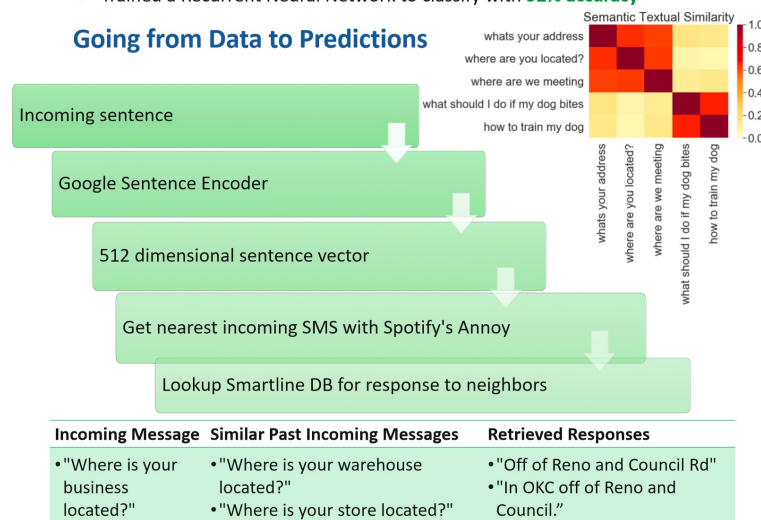
Incoming Message	Suggested Responses
Are you open Saturday?	<ul style="list-style-type: none"> • "Yes, we are open on Saturday" • "Our hours on Saturday are 09:00 AM – 01:00 PM" • "We open at 09:00 AM on Saturday" • "Sorry, we are closed Saturday"

Personalized Response Retrieval

Mining the Incoming-Outgoing Pair Dataset

- ✓ Select consequent pairs of incoming question and outgoing answers
- ✓ Labeled 4000 messages into **questions and statements**
- ✓ Trained a Recurrent Neural Network to classify with **92% accuracy**

Going from Data to Predictions



Incoming Message	Similar Past Incoming Messages	Retrieved Responses
• "Where is your business located?"	<ul style="list-style-type: none"> • "Where is your warehouse located?" • "Where is your store located?" 	<ul style="list-style-type: none"> • "Off of Reno and Council Rd" • "In OKC off of Reno and Council."