AI TECH AGENCY

Your chat agents are multi-tasking massively and they need help!

Problem Statement

Global Customer Service agents face a lot of challenges as they look to service their customers

Chat agents may face their unique set of problems

They may have to cover global set of customers who speak multiple languages

They have to type in fast responses as they manage multiple parallel conversations

They may have to look up product questions so they can quickly answer their customers' questions

01

ABOUT US

We offer ML/AI solutions to make your Operations teams more efficient & service your customers better

02

OUR SERVICES

We offer AI translators, Sentence Completers, Chatbots!

03

OUR CLIENTS

Banco Uno is our premier client

04

OUR TEAM

Data Collectors, Data Explorers, Data Modellers

Agenda

Background — Operational Challenges

Data — Collection, Cleaning & Pre-Processing; Exploratory Data Analysis

Modeling — Translator/Completer/ Chatbot

Conclusions — App, Future Opportunities

What do we offer to help your Chat agents?

Our translators can translate across multiple languages.

We will focus on English to Spanish

Translation Services

Your chat agents can type in the first few words and our sentence completers will complete their sentences saving valuable handle-time

Sentence Completers

Your agents service multiple products - we provide quick answers at their fingertips

Chatbots to answer key questions

All things Data

01

Data Collection
Data Cleansing & Preprocessing
Exploratory Data Analysis

Translator & Sentence Completers & Chatbot Data

Translator: Obtained ~128k rows of English sentences (input) and their corresponding Spanish sentences (target)

Source: http://www.manythings.org/anki/

Completer: Used the same dataset as above with the last 2 words being the target and earlier words being the input feature

Chatbot: Obtained Capital One's FAQ questions and generated ~37k lines of chat corpus from selecting random words

Defined intent for each question and its corresponding answers

Ideal data would have been actual chat conversations from real-life chat agents

Sample data of Translator and Completer

	eng	spa	eng_len	spa_len
15828	a dog has four legs	un perro tiene cuatro patas	19	27
15829	a lion is an animal	un león es un animal	19	20
15830	a noise woke her up	un ruido la despertó	19	20
15831	a nurse wears white	una enfermera se viste de blanco	19	32
15832	a truck hit the dog	un camión atropelló al perro	19	28

Translator dataset
'eng': Input sentence
'spa': Target

Completer dataset
'eng_pre': Input sentence
'eng_post': Target

	eng	eng_len	word_count	eng_pre	eng_post
12267	a dog has four legs	19	5	a dog has	four legs
12268	a lion is an animal	19	5	a lion is	an animal
12269	a noise woke her up	19	5	a noise woke	her up
12270	a nurse wears white	19	4	a nurse	white
12271	a truck hit the dog	19	5	a truck hit	the dog

Sample data for Chatbot

	q_perm	intent
34564	earn miss don't pay rewards bill get billl	rewards2
65555	miss bill rewards pay don't billl get earn	rewards2
28681	increase common credit line most declined reasons	reasonsdecline
50074	don't miss bill pay rewards billl earn get	rewards2
1878	negative stay credit on delinquent report bureau	CBRNegative

'q_perm': Input sentence
'intent': Target

'answer': response to 'intent' key

intent	answer
Cardapply	You'll need to provide personal information, i...
Authuser	Yes. You can add authorized users online after...
CardAppStatus	If you apply by phone or online, you will ofte...
NewCCReceive	If you're approved, you'll receive your Banco ...
ApplyPayments	We generally apply payments up to your minimum...

Data Cleansing & Pre-processing

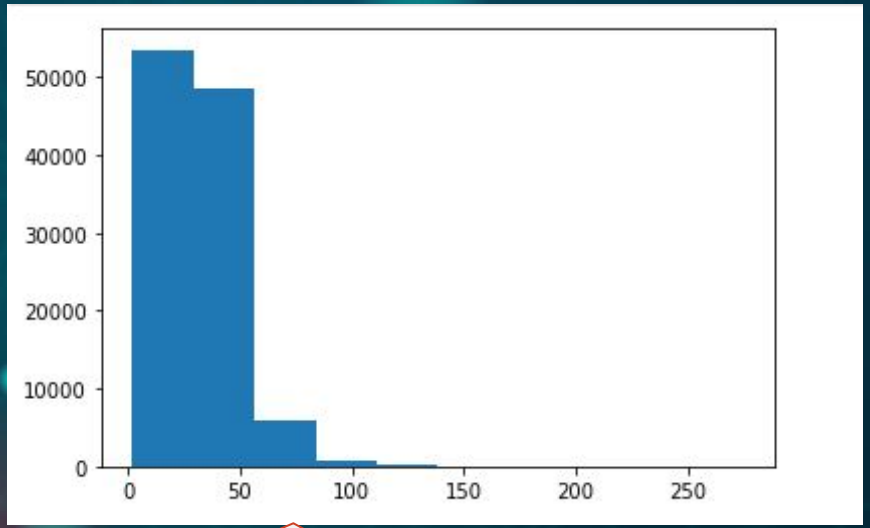
	Translator	Completer	Chatbot
Data Cleansing	- Standard text cleaning: lower characters, removing punctuations, extra spaces, numbers		Create multiple chats using different permutations of FAQs
Data Cleansing	- Removed duplicate English & Sentence Spanish sentences to maximize words to be used		

Data Cleansing & Pre-processing

	Translator	Completer	Chatbot
Data Pre-processing	- Removed sentences that had fewer (<19) and too many characters (>50) - Completer: Removed sentences that had too few words		Lemmatize, Tokenize, Append, Vectorize
Data Pre-Processing		Parse: last 2 words to be target column; remaining initial words to be input features	

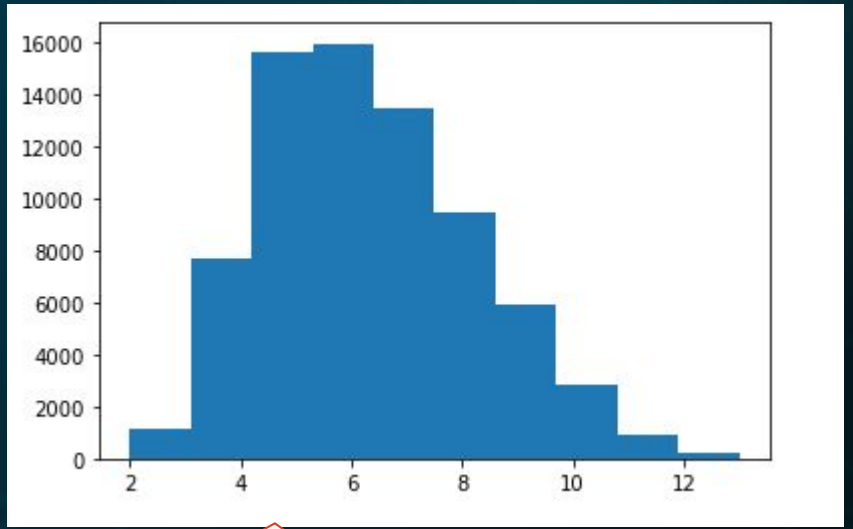
There are sentences with fewer characters and words we can clip

of Characters for English Sentences



Clip sents w/ <18 chars, > 50 chars

# of words in English sentences



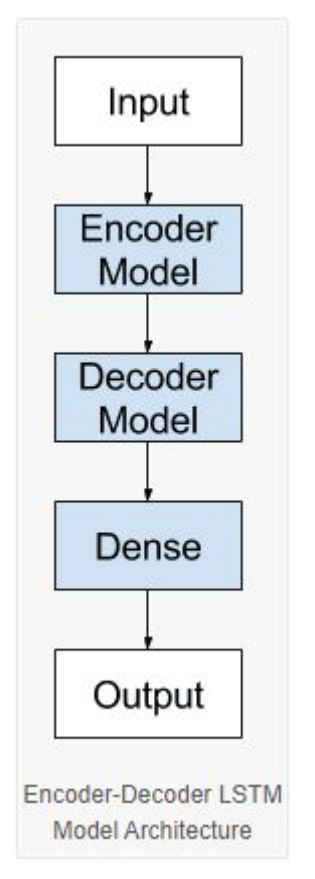
Clip sents w/ <4 words

Modelling

02

- Using LSTM for Translater
- Using LSTM for Completer
- Classification for Chatbot

Architecture of Sequence2Sequence LSTM model



Model Summary of Translator model

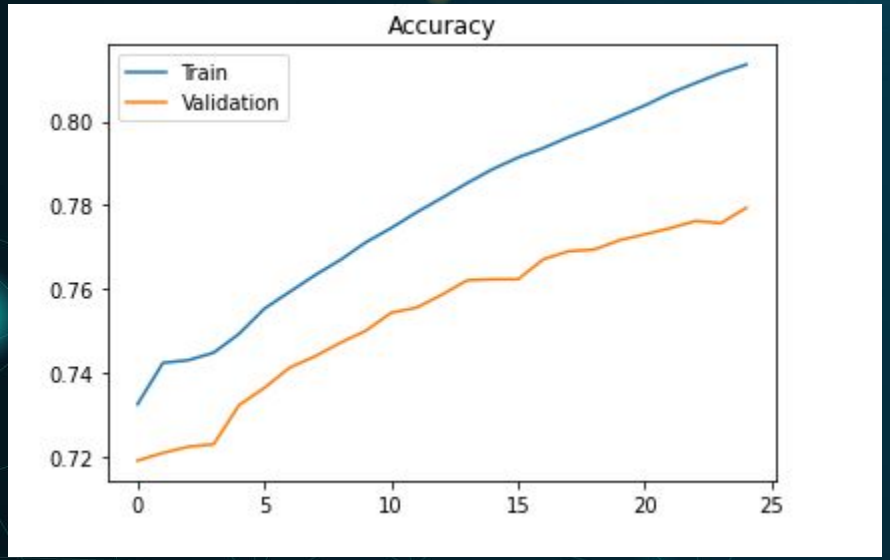
```
Model: "model"
__________________________________________________________________________________________________
Layer (type)                    Output Shape         Param #     Connected to
==================================================================================================
input_1 (InputLayer)            [(None, None, 5134)] 0
__________________________________________________________________________________________________
input_2 (InputLayer)            [(None, None, 8263)] 0
__________________________________________________________________________________________________
lstm (LSTM)                     [(None, 256), (None, 5520384     input_1[0][0]
__________________________________________________________________________________________________
lstm_1 (LSTM)                   [(None, None, 256),  8724480     input_2[0][0]
                                                                 lstm[0][1]
                                                                 lstm[0][2]
__________________________________________________________________________________________________
dense (Dense)                   (None, None, 8263)   2123591     lstm_1[0][0]
==================================================================================================
Total params: 16,368,455
Trainable params: 16,368,455
Non-trainable params: 0
__________________________________________________________________________________________________
```

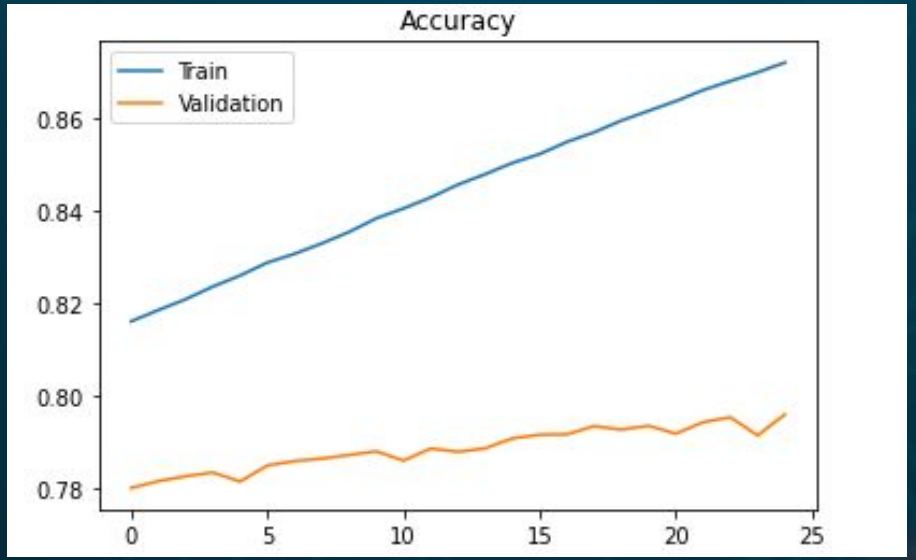
Encoder: Uses the English sentences as inputs (array dimensions defined by number of lines, max number of words in a line, total unique words)

Decoder: Takes interim output of Encoder

Dense layer: takes input from Decoder and maps to final output using Softmax

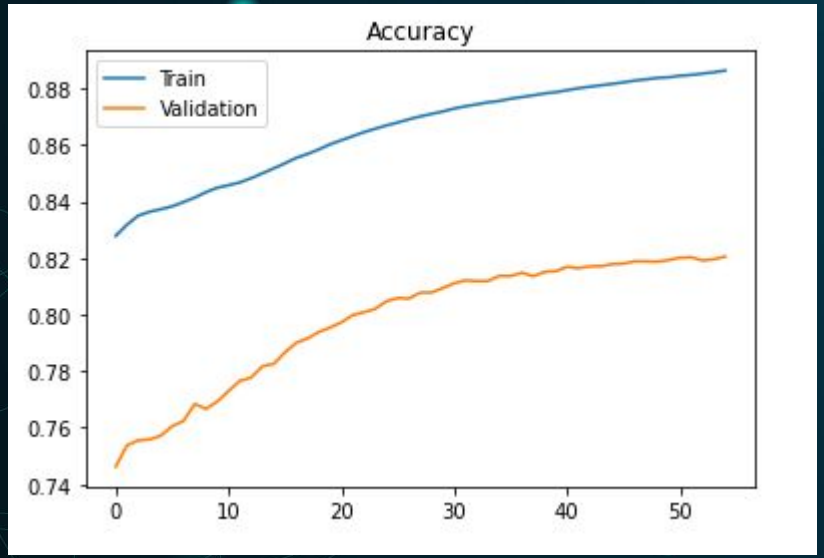
Training over epochs (1-25, 26-50) for Translator

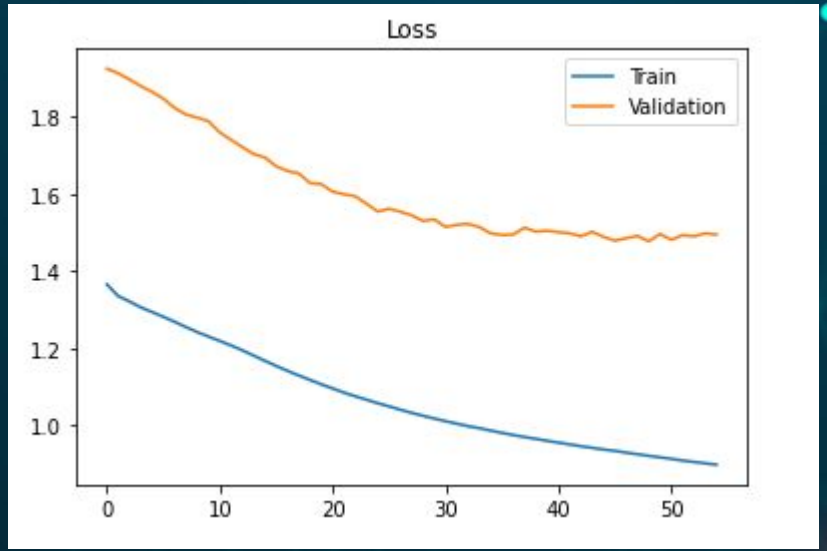




1. Model was trained over Google Cloud Platform due to high dimensionality of the arrays
2. Training took > 50 epochs and over 3 hours after which model started overfitting with no noticeable improvement for training population

Model training over epochs for Completer





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Key highlights & challenges for LSTM models

Memory needs

Model dimensionality required model to be trained only on 18k lines for translator

Memory & run-time

Memory needs required model to be run on GCP

Decoding sequence

Separate scripts had to be built to take in text, read model, encode the text, decode the text and convert into output

Stop/Start epoch runs

Had to build separate functions to store interim epoch models so that model could pick-up training later

Building Chat model

Tokenize &
Lemmatize

Pre-processing

Function to read in
text and predict

Predictor

Data Collection

Chat Corpus created from questions

Target: ‘Intent’ of chat - multiclass classification

Build model

Pipe consisting of Tfidf-Vectorizer & Logistic Regression

StreamLit

Build StreamLit app to run the model

Apps Demo

03

- Translator!
- Completer
- Chatbot

Conclusions & Future Development

04

- Translator!
- Completer
- Chatbot

Conclusion

Translator

The model does good on words it has been trained. However, it is not as good on longer and complex sentences

Completer

Sentence completion is not as good as wanted. Model may need more data to improve.

Chat

Model does good job on interpreting intent and responding to the intent.

Overall

Run-times are longer for translator and completer since it needs more computations

Future Development

More Computing power & Data

Training was limited by how much data could be fed into the model due to computing limitations

Actual Chat Transcripts

Using actual chat transcripts will expose the model to more unseen data

Improving algorithms

Bringing in concepts like embedding are expected to improve model performance for Translator and Completor

More languages

Expand to more languages

THANKS!

Thanks to Chuck, Varun, Grant, & Lea for all the lessons and classes! It has been a fun learning atmosphere!

And thanks to all the cohort members of DSI-22221 East. I got to learn something from each of you!

Appendix

Citations

1. Link to dataset of Spanish-English sentences: http://www.manythings.org/anki/spa-eng.zip

2. Francois Chollet's usage: https://blog.keras.io/a-ten-minute-introduction-to-sequence-to-sequence-learning-in-keras.html