Automatic Response Generation to Conversational Stimuli

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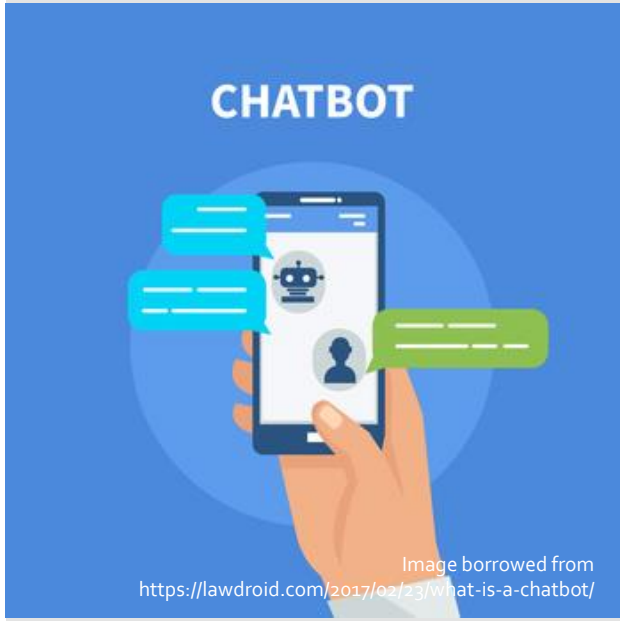


Image borrowed from https://lawdroid.com/2017/02/23/what-is-a-chatbot/

Models

- Can’t use Recurrent Neural Networks (RNN) due to the problem of vanishing gradient
- We use RNN with
  - Long Short Term Memory (LSTM)
  - Gated Recurrent Units (GRU)
- Phrase-based Statistical Machine Translation
- Information Retrieval (Nearest Neighbours)
- Keras with Tensorflow

Translation Models to Generative Models

- Most models used to translate words from one language to another.
- We adapt them to generate response based on a query.
  - Use RNN with encoder-decoder
  - Challenges:
    - Word vectors not of same lengths
    - Less previous work
    - Safe bets (Common words might appear in responses more)

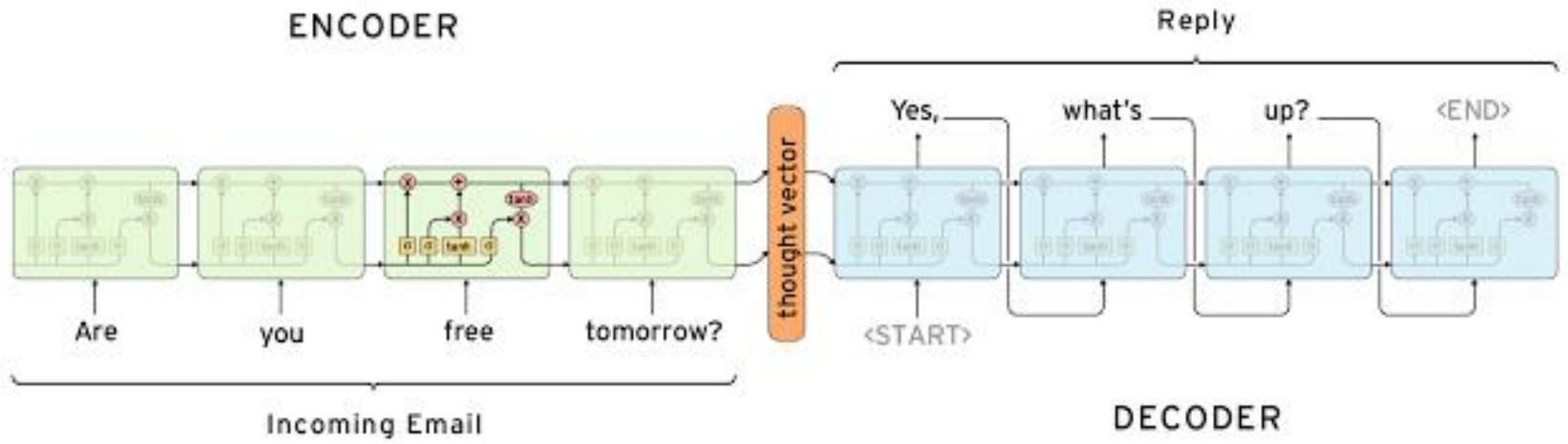
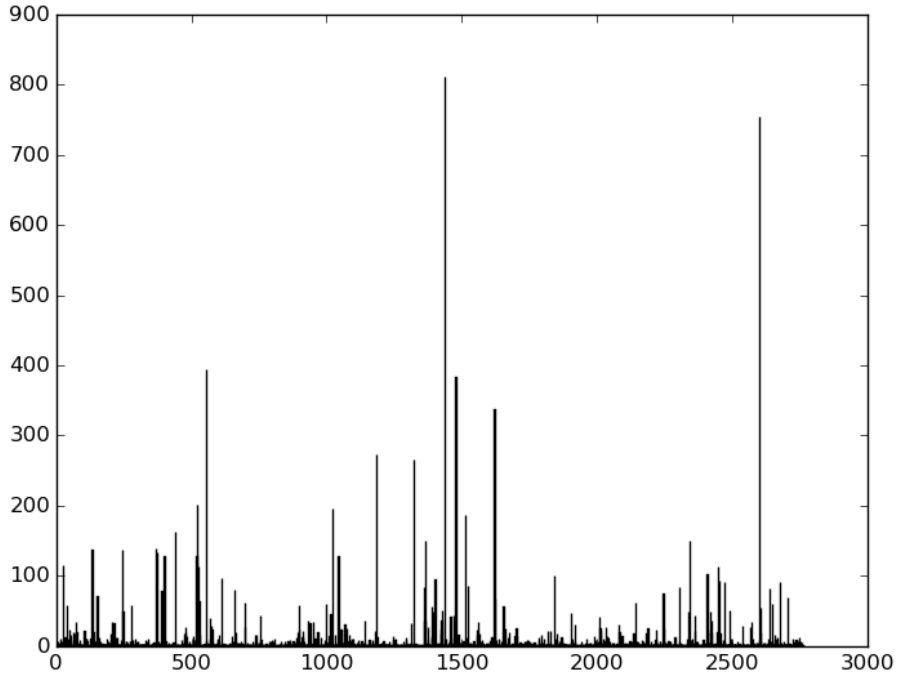


Image borrowed from https://research.googleblog.com/2015/11/computer-respond-to-this-email.html

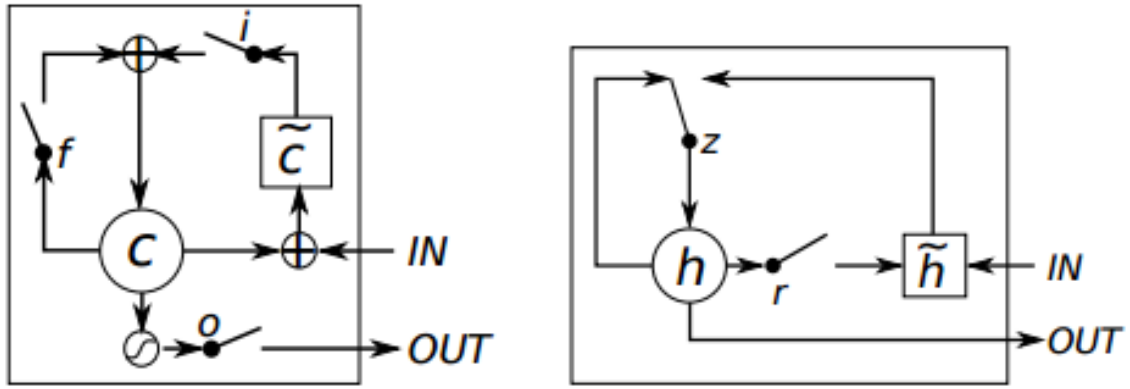
Dataset & Evaluation

- Datasets:
  - Cornell Movie Dialog Corpus
  - Enron Mail Corpus
- Feature Extraction
  - Padding
  - 1-hot representation
- Evaluation
  - Perplexity



Analysis & Progress

- Comparison of RNN-LSTM with RNN-GRU
  - Effect of no. of epochs
  - Effect of no. of latent dimensions
  - Character-by-character model vs. word-by-word model



(a) Long Short-Term Memory (b) Gated Recurrent Unit

Figure 1: Illustration of (a) LSTM and (b) gated recurrent units. (a) i, f and o are the input, forget and output gates, respectively. c and $\tilde{c}$ denote the memory cell and the new memory cell content. (b) r and z are the reset and update gates, and h and $\tilde{h}$ are the activation and the candidate activation.

Image borrowed from https://deeplearning4j.org/lstm.html

Results & Inferences

- High perplexity value: 144.707
  - No. of epochs = 100
  - No. of latent dimensions = 2
- Example:
  - Input: well i thought we'd start with pronunciation if that's okay with you.
  - Output: i i i i i i i i i i i i i i i i i i i i
- Increase hidden layers, no. of epochs, more training data

Related Work

- Google Smart Reply https://research.google.com/pubs/pub45189.html
- Neural Conversational Model https://arxiv.org/pdf/1506.05869.pdf
- Data Driven Response Generation in Social Media http://aclweb.org/anthology/D11-1054