

INFO8010: Project proposal

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I. PROJECT DESCRIPTION

Deep Learning is a field of machine learning that is based on artificial neural networks algorithms that can learn and filter inputs through different hidden layers, in order to be able to predict and classify informations like a human can learn from experience.

To discover more about this kind of artificial intelligence, we chose the Chatbot idea as a project where we can use and develop our knowledge about Deep Learning.

As a definition of Chatbot, it's an algorithm designed to simulate human conversation via text, so we will built a conversational agent that can interact with users, and answer their required question with the best response. there are two types of Chatbot's dialogue, goal-oriented (wich is more former that help to solve problems by natural language) and general conversation (destined to talk with users on a wide range of topics).

In order to create an efficient Chatbot we will need a massive amount of training data. There exists different examples of open source data that can be useful to learn and train our agent. In this project we will use *Cornell Movie-Dialogs Corpus* as a dataset wich contains a collection of conversations extracted from row movie scripts (more than 220,500 conversational exchanges between 10,292 pairs of movies characters), and we will focus on natural language processing by using the library NLTK (*Natural Language Toolkit*) wich contains a lot of tools for preparing text for deep learning algorithms.

As an algorithm, we will train our data with the model Seq2Seq (*Sequence to Sequence model*) where we prepare 2 RNNs, the input sequence side (encoder) and the output sequence side (decoder) and we connect them with intermediates nodes.

II. RELATED PROJECT REVIEW

In the paper "A New Chatbot for Customer Service on Social Media"[1], the five authors *Anbang Xu, Zhe Liu, Yufan Guo, Vibha Sinha* and *Rama Akkiraju* explain how they attended to adress the challenges raised by the new trend of users to use social media to request and receive customer services. Indeed, by developping a new conversational system based on state-of-the-art deep learning techniques, their hope was to increase customer satisfaction and reduce the time and ressources involved by companies.

The first step of their work was the collection of data. For this purpose, 62 brands were selected, based on cer-

tain criteria, and about one million of conversion data linked to these companies were collected. Among them, 30K were used for evaluation, and the rest for the whole system development.

To create this system, several steps were performed.

- First, they cleaned the data by removing non-english requests, requests with images and @mentions.
- Second, they tokenized the data and built a vocabulary of the most frequent 100K words in the conversations.
- Third, they generated words-embedding features by using the word2vec neural network language model trained on the collected corpus. Each word in the vocabulary being then represented as a 640-dimension vector.
- Four, they trained the different networks. Indeed, the core of the system consists of two LSTM neural networks: one as an encoder that maps a variable-length input sequence to a fixed-length vector, and the other as a decoder that maps the vector to a variable-length output sequence. Note that the input and output of LSTMs are vector representations of word sequences, with one word encoded or decoded at a time. Both LSTMs are trained jointly with 5 layers x 640 memory cells using stochastic gradient descent and gradient clipping.

Concerning the evaluation, the authors first performed a content analysis and discovered the presence of two types of request. The emotional requests, where users intend to express their emotions or opinions toward a brand without seeking specific solutions, and informational requests, which are sent by users to get information that may help them to solve their problems.

Then for each of these types of request, the system was first evaluate by humans according to three measures: appropriateness, empathy and helpfulness, and compared with actual human agent as well as standard information retrieval baseline (IR). The results showed that the Deep Learning system has a similar ability as actual agents to show empathy toward users in emotional situations. In addition to that, this one also outperform IR in all three aspects of rating, especially when it comes to emotional requests. It has also been noticed that the performance of both DL system and IR dropped significantly when requests became informational, and that human agent performed better than others and equally well on different requests.

Finally, the researchers also used BLEU metric applied to 30K user requests to evaluate the DL system compared to IR. Again, the first one performed significantly better.

- [1] Anbang Xu, Zhe Liu, Yufan Guo, Vibha Sinha, and Rama Akkiraju. A new chatbot for customer service on social media expression analysis., 2018.