

Dialogue System using Long Short-Term Memory

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Abstract

As the technology of natural language understanding and language generation improve, there is increasing human interest towards human-computer interaction, which can be used for various applications such as customer services, travel, and much more. Well known examples of conversational AI are Apple's Siri, Amazon's Alexa, Microsoft's Cortana and Google's Google Assistant.

Most work related on this field are emphasizing on single sentence or speaker turn. While sometimes a conversation has their own context according to previous conversation. Designing this kind of conversational system is challenging, most of the time conversational agent are built based on knowledge based system and rule based system. By building a conversational agent with data driven approaches, which learn from a corpus we could improve the amount of time and effort needed to create a rule based system.

Keywords : natural language understanding, dialogue system, conversational agent, LSTM

1. Introduction

Natural language application are getting popular as the technology of natural language understanding and language generation improve. Many big companies are building natural language based application or AI conversational agent, these applications are popular to customers since they give a unique experience of being served by human-like applications. Many start-ups and business are also starting to adopt and use AI for economical customer relation and customer service. Besides that, the behavior of users now have changed, people are using internet more often, they expect something fast and consistent, which are the main usage and ability of computer.

Background

Conversational AI are designed to imitate how human talk, creating an experience of being served by human, while giving consistent and fast response which might not be able to be provided by regular applications. Most conversational agent are built with knowledge based system and rule based system, but on this research, the dialogue model will be implemented with rule based model but with data-driven approach. Many other work has accomplished data-driven approach, the work of Ritter [1], for example demonstrates that a response generation system can be constructed from Twitter conversations using statistical machine translation techniques, where a status post by a Twitter user is "translated" into a plausible looking response. However, the approach that is done by Ritter et al. (2011) does not address the challenge of generating responses that are sensitive to the context of the conversation. The ability to take into account previous utterances is key to building dialog systems that can keep conversations active and engaging. A neural network architecture is used to address sparsity issues that arise when integrating contextual information into classic statistical models, allowing the system to take into account previous dialog utterances[2].

One of the advantages of RNNs is that they might be able to connect previous information to the present task, such previous conversation might inform something about current conversation. But as the gap of the context grows, RNNs became unable to connect the information. This problem is called vanishing gradient problem[12]. In this work, we are using an LSTM cell, that is designed to avoid the long-term dependency or vanishing gradient problem.

Problem Identification

A conversational system with a context based on dialogue history can be a challenge to design, given the context of a dialogue and number of possible outcome in a dialogue. To solve the problem, this research will try to build a dialogue system using rule based with data-driven approach from a corpus by utilizing an LSTM network. In this case LSTM neural network is chosen because it has the ability to remember past observations arbitrarily long, and has been shown to yield superior performance in many domains[17].