Proposal for a CHATBOT to Conduct Human-Like Conversation with Students of Eastern Illinois University

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Abstract

Eastern Illinois University has an effective social media presence such as Facebook, Twitter, etc. along with university's own website. People prefer to contact university officials using chat platforms instead of phone or email. It is difficult to manage many pages and sites 24 hours a day without a large labor force. We analyzed how EIU can provide services to students without labor through such chat platforms. We believe automation of chat conversations is a good solution to meet this requirement.

We have created a chatbot that can chat with students 24 hours a day. Chatbots are applications that can send and receive messages, and, in many cases, act as a human counterpart to provide services to the users. The chatbot is based on natural language processing methodology. We can attach this chatbot to social networking websites and university websites. Chatbots can answer student questions intelligently because of machine-learning model and data training. We used the DialogFlow framework to develop this chatbot. We created multiple intents and context elements to respond to student questions. If we use an appropriate number of examples while training the chatbot, then we can expect good performance. We can attach the same chatbot with multiple instances.

Introduction

A chatbot is an automated program that provides highly engaging, conversational experiences (Abdul-Kader & Woods, 2015). A chatbot responds to both voice and text messages. These chatbots can be implemented on websites and mobile applications as well as social media platforms such as Facebook Messenger, Slack, Twitter, etc. (McTear, 2018). Many organizations that cannot operate user support services 24 hours a day will find chatbots to be very useful in dealing with customer queries.

Chatbots have increased in their complexities as well as their usefulness over the last few years to help users. Many chatbots' work is based on a predetermined script. This kind of chatbot works fine in most cases, but sometimes it would be very difficult to handle all the user questions if the questions are not in the script. Incorporating natural language processing (NLP) in the chatbot makes it more capable of handling user questions in an intelligent manner (Liddy, 2001). Figure 1 shows different type of chatbot creation technologies. In the

first generation, a chatbot is defined using predefined rules. If a customer says something, then chatbot should respond with a specific answer. Supervised machine learning is used in the second generation with the help of labeled data. In this model, the system (chatbot) can understand the user input intent and respond with labeled answers, but we need more labeled data for training of the system. In the third generation, the system can be trained using unlabeled data with the help of adaptive unsupervised machine learning. However, adding first- and second-generation technologies will also help improve the system to respond to user questions in a variety of contexts.

As we discussed above, machine learning is classified into two types: supervised machine learning and unsupervised machine learning. Supervised machine learning expects input from variable X from the user, and it will map to the appropriate output variable Y. In unsupervised machine learning, the system expects input from the user and will not map to any particular output variable, but it can be capable of answering by observing the data.

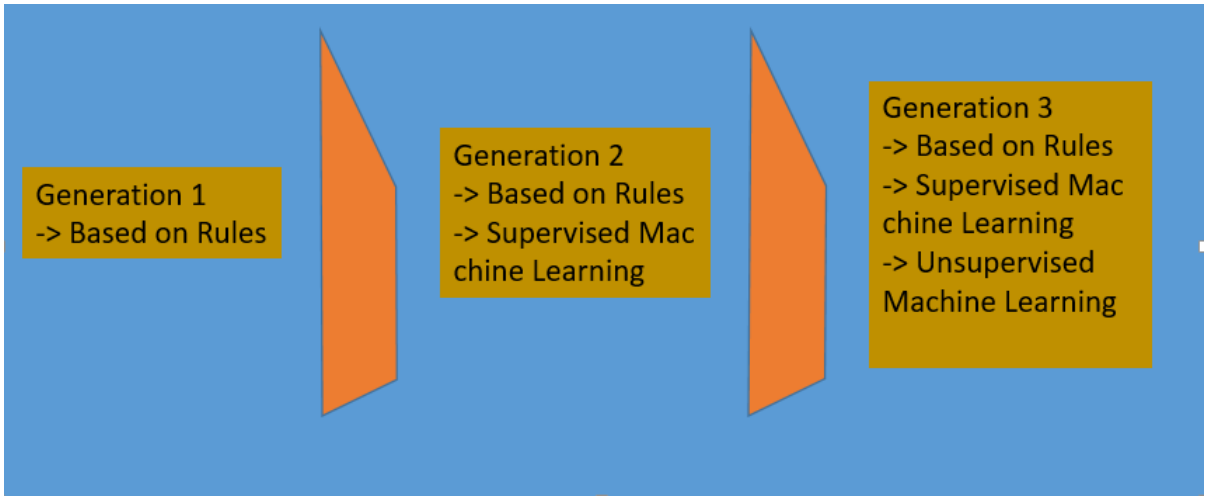

Figure 1. Types of chatbot technology.

We are using a supervised machine learning methodology-based platform in developing a chatbot to have conversation with users. Natural language process is very powerful in understanding user input (Abdul-Kader & Woods, 2015) because it helps to understand the intent of the user input. The intent understanding is helpful in having a rich conversational experience with users. Building an NLP engine requires a good amount of machine learning skills and more data (Liddy, 2001).

Specific Problem

This paper deals with the problem of responding to student queries (and/or prospective students) at Eastern Illinois University, which offers admissions to both domestic and international students. The domestic and international admission team provides answers to the student questions through messenger or email between 8 a.m. and 4 p.m., Monday through Friday. In the case of domestic student admissions, university officials mostly receive questions during this time, but sometimes questions related to international admission

are usually after 4 p.m., due to time zone differences. This time difference causes delays in answering student questions.

Furthermore, many students (or prospective students) at the university have questions in diverse areas (such as finance, housing, scholarships, program-specific questions, etc.) that can only be resolved by university officials. Each department in the university, such as admissions or the graduate office, has a specific knowledge-based team. A student expects immediate solutions for queries from university officials, but sometimes due to the large number of questions, it becomes difficult to respond promptly.

Many students would like to contact university officials on weekends, but university offices are not open then. Hence, the response is automatically delayed. Every student expects fast and accurate response from the university, but maintaining office hours 24/7 is not practical for this EIU. This affects students from outside of the US the most, as they face delayed response due to differing time zones.

Additionally, it is well known that humans can make mistakes due to lack of skills and knowledge. So it could be difficult to have a strong knowledgeable and skilled employee to resolve student questions on university's behalf without making any errors.

Research

The university requires a system that can provide quick and accurate responses to students' specific questions from university officials. Managing social media platforms on a continuous basis is very difficult for the university. We believe developing an application that can handle student questions automatically by understanding the intent of the question is the best way to resolve the problem. We can develop a chatbot application using traditional programming languages using certain set of rules. However, it is not practical to predict all possible questions and create that many rules in a chatbot application development. We need to understand the student intent in the question for the chatbot to provide an accurate answer. Natural language processing is the best way to understand the question's intent.

We can observe from Figure 2 that NLP helps the machine to understand the human language and perform a set of actions such as text summarization, sentiment analysis, and speech recognition. NLP algorithms typically are based on machine-learning algorithms. Natural language processing is involved in natural language understanding (Liddy, 2001). We can clearly see in Figure 2 that a machine can interact with more human languages by using NLP.

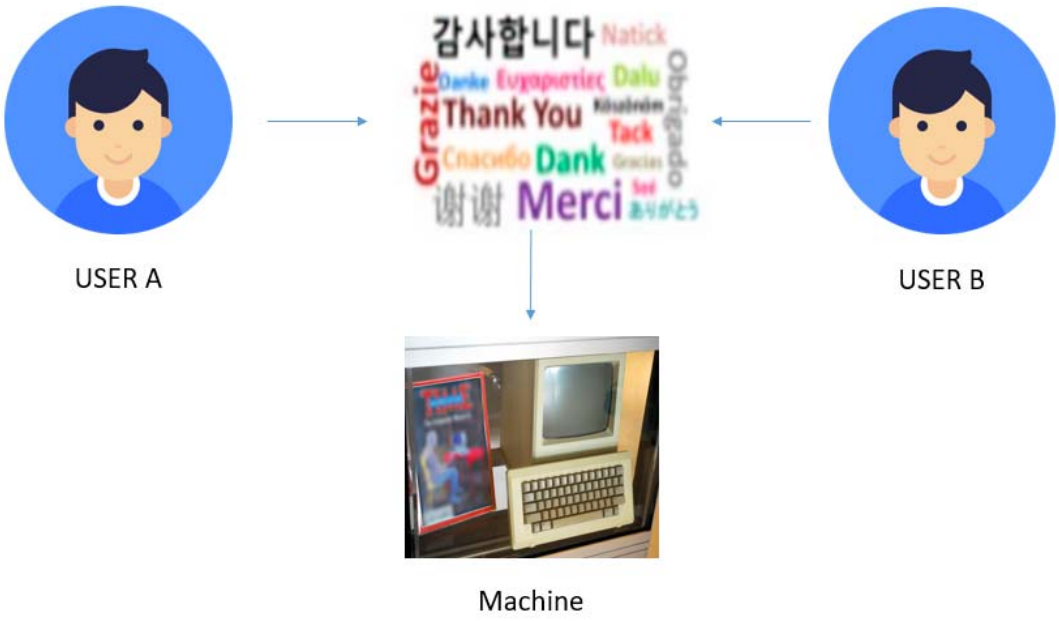

Figure 2. Natural language understanding.

Natural Language Understanding

The idea of exploring how the machine can understand human instruction started in 1971, when Terry Winograd developed the SHRDLU robot that was able to convert human commands into machine commands such as “move the red pyramid next to the blue pyramid.” To act in this way, the system needs to build up semantic knowledge (Winograd, 1971).

Example

Person: Pick up a blue block.
System: OK.
Person: Hit the pyramid.
Computer: I am not understanding which pyramid you are talking.

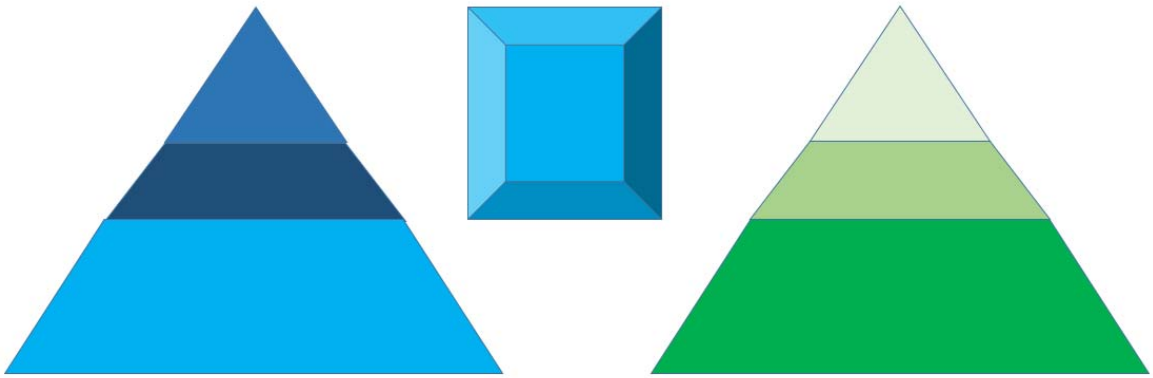

Figure 3. Blocks of various shapes and sizes.

Linguistic Analysis

Three major parts in the linguistic analysis are syntax, semantics, and pragmatics. “Syntax” deals with the grammar of the sentence. In a simple way, successful syntax means a lack of grammatical mistakes. “Semantics” explains the meaning of the words and sentence; correct grammar is not only the criterion for a meaningful sentence. “Pragmatic” is the main goal or purpose of the sentence that points to the main theme or larger context of the conversation (Liddy, 2001).

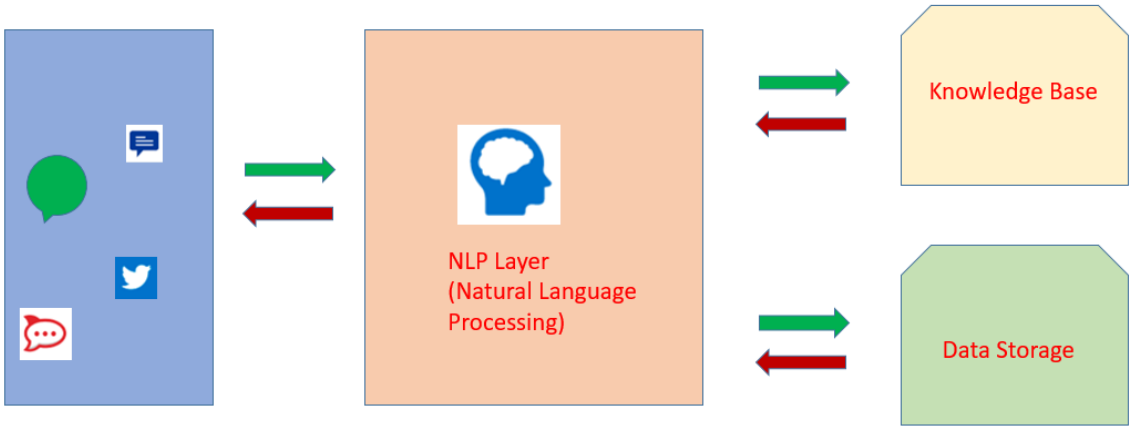

Figure 4. Working of NLP layer.

“Tokenization” is part of syntax analysis or signal processing between signal processing and syntax analysis, converting the input signal into several parts for easy computation. We can see in Figure 4 how the NLP layer acts as a medium to perform natural conversation with users. The NLP layer receives messages from users and can answer by using data from the database system (Liddy, 2001).

We have used DialogFlow framework platform to build a bot to resolve the problems that we discussed above. DialogFlow is a powerful tool to build chatbots for natural conversation

with students (Bot, n.d.). This platform is based on NLP methodology and is enhanced with the help of machine learning. All the NLP-related considerations require care by DialogFlow tool to develop a chatbot, and the developer must train the bot with certain data to perform intelligent operations. The items below are necessary for chatbot creation.

Invocation

This will allow a chatbot to start a conversation with students with the help of invocation. Developers can define their own invocation in to initiate a conversation. We can select recognizable terms as invocations to define in a chatbot (Debasatwa, 2017).

Example:

"Hi Panther, I need admission details..."
"Hi Panther, I need a university address…"
"Hi Panther, I need help…"

Intent

An intent is a defined action in DialogFlow that can be triggered by a user (Debasatwa, 2017). The NLP methodology can understand the user question predict the correct intent based on that question. There are actions needed to define the intent for handling user questions. We can create a default intent for each chatbot, which will trigger if no user question is mapped to a particular intent in the chatbot. Intent has four sections to get trigger intent and respond to the user:

- Training phrases
- Action
- Response
- Contexts

Training Phrases

In each intent, we have a training phrases option that triggers the intent and provides an accurate answer for a given question. We have no idea how a user may frame a question to know details from the chatbot. We can expect intelligent responses from the chatbot based on different kinds of questions we define in the training phrases option, including context elements that can help the chatbot identify the context of the question.

Action

This section has a name field and a parameter field to perform a specific action based on parameter values (Debasatwa, 2017). A user sometimes does not provide required values in the question to provide accurate responses. Then action and parameter values may help to extract required details from the users.
Response

We can add an agent response in response area as well as multiple responses in one intent to add variation in the answer. We can add parameter reference values in agent response (Debasatwa, 2017).

Context

Context helps to pass information from previous conversations or external sources (Debasatwa, 2017). If a chatbot behaves in an intelligent manner, then it should know the context of the conversation.

Discussion

The chatbot that we developed using DialogFlow is based on labeled data training. It can understand the intent of a question and trigger the suitable intent in the list of available intents in the agent. This framework is based on supervised machine learning. The chatbot cannot train itself using the unlabeled text data and user conversion data. This kind of chatbot has difficulty handling different kinds of questions. An unsupervised machine learning-based chatbot will perform better and carry out more intelligent conversation than a supervised machine learning-based chatbot.

Sometimes it is difficult for a chatbot to answer all the questions that are posted by the user due to lack of suitable data training. We cannot expect high performance from a chatbot initially because we must observe the bot's performance and its responses to user questions. If the chatbot fails to provide answers to any specific set of questions, then we need to re-train it to make it more intelligent. Continuous observation and training are important in developing an intelligent chatbot.

Conclusion

We have developed a chatbot to respond to current and prospective student queries for Eastern Illinois University. We are still in a testing phase. To make our chatbot smarter and perform intelligently, we must to train it using an appropriate amount of data. Initially, it is a bit challenging to depend totally on a chatbot to solve user questions, so we make sure that it should be continuously monitored.

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Biographies

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