A REVIEW ON ARTIFICIAL CONVERSATIONS FOR CHATBOTS: ARCHITECTURE AND ALGORITHMS

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ABSTRACT
Chat bots, or conversational interfaces as they are also known, are a new way of interacting with computer systems for individuals. Traditionally, a question can be answered by a software program using a search engine or by completing a form. The existing approaches to the generation of artificial conversations enhance linguistic models. The existing approaches are carried out in situations that require contextual continuity over a number of statements. Among the algorithms like natural language understanding, ASR process model, restricted Boltzmann machine we have chosen natural language understanding, because it comes under natural language processing which involves speech recognition, parsing, stemming, lemmatization and optical character recognition and thus increases accuracy where ASR process model focuses more only on speech recognition. Here, we provide a set of inputs and responses which is processed by the bot to give the customer an accurate response.

1. INTRODUCTION
Chatbot is an artificial intelligence - driven software in a device application, website or other networks that attempts to measure consumers ' needs and then help them carry out a specific task, such as a commercial transaction, hotel reservation, submission form. The need for chat systems has become important with the ubiquitous use of personal systems that want to communicate and the desire of their manufacturers to communicate with humans in a natural language. A user interacts differently with a chatbot enabled by a voice. They talk to such a bot in natural language through their voice. The voice chatbot then responds with pre - recorded messages, text - to - speech answers or a bot mixture. The more an end user interacts with the bot, the better voice recognition predicts what the right response is when communicating with an end user.
Section 2 explains the drawbacks of existing systems and gives the need for chat bots. In Section 3, we explain about the conversation engineering, implementation of chatter bots and about general conversation. In Section 4, explains the conversation metrics for performance evaluation of chatter bots. In Section 5, the architecture is explained. Section 6; cover how an artificial conversation is generated. Section 7 presents the working of various algorithms. Finally, in section 8 the conclusion is given.

2. NEED FOR ARTIFICIAL CONVERSATION
Chatbots can be used freely, and we can chat with them by sending them a message as if they were a human user. Chatbots a great opportunity in messaging apps, is to find people's pain and solve their problems in areas where there are no services needed. The challenge here, however, is that we need humorous information on consumer behaviour and preferences. Actually, at the heart of it, conversations are only a more natural way of interacting than UI. Sometimes the chatbot cannot respond with proper answer as it may have trouble understanding the question or it may not know the proper response. The chatter bot can

work efficiently and can give the answers that are expected by the user but it does not really know whether the customer is satisfied with the response or whether the customer is confused with the response.

Using [1], We note that the chatter bots are meant to be and are more suitable for exchanges of question - response types, where a series of question – response pairs exists. You cannot have a lengthy conversation but the conversation can be understood and you can monitor the direction of the conversation whether it is going in the right way.

The upcoming chat bots should be able to identify and act on these opportunities in a conversation by learning from similar information or by seamlessly passing the information on to a human representative. Context awareness is missing in the current chatter bots. In a series of interrogations or utterances in pairs, the context switches from one pair to the next. However, the context remains the same in most conversations during the exchange of utterances.

3. CONVERSATION ENGINEERING

Using [2], the existing literature in the engineering of conversations consists of stochastic, syntactic and semantic techniques. Stochastic methods make use of statistical frameworks such as the Bayesian theory, Hidden Markov models and n-gram modeling to create separate sentences. Syntactic methods use natural language processing and computer linguistics techniques to analyze and create grammatical conversation constructs. Semantic techniques use meaning models from a knowledge structure to analyze and construct the sentences.

Using [3], Modern chatter bot implementations can efficiently use computer linguistic techniques, including semantic parsing and sentiment analysis. Present-day chatter bots function very efficiently in providing responses to the question and similar utterance-exchange pair settings, where the factors of conversation are separate from one exchange to the next. Most of the chatter bots focus on either modeling of content or conversation semantics or on sub-aspects of these without making an explicit distinction.

Using [4] [5], the general definition of conversation is not something that is agreed on, but many of the characteristics are mentioned in the literature. Talks are based on a range of reactions to previous statements. Conversations are unforeseeable but not unspecified. They have semi- structural features based on social conventions established. All the conversation users try to proceed the common aim that the conversations have.

4. CONVERSATON METRICS

Pragmatics is a linguistic sub-field that investigates how context contributes to meaning. It explains how the transmission of meaning depends on the speaker's linguistic knowledge and the listener's context, knowledge of the status of those involved and the speaker's intention. It gives the different aspects of meaning that are not found in the simple sense and structures of language or words. Its roots lie in Paul Grice's work on conversational implications and the principles of cooperation. The principles of cooperation are classified into the maxims called the Gricean maxims. Each explains specific rational principles accepted by people who obey the principles of cooperation that make effective communication possible, using [6] [7] [8].

Grice analyses the cooperation using four maxims: 1) Quality 2) Quantity 3) Relation 4) Manner. The Quality Maxim will not be satisfied if the response is not actually true. The quantity maxim will not be satisfied if the response is very unnecessary and expansive. The relation maxim deals with the relevant responses and the manner maxim will be satisfied if the response is clear and straightforward.

To understand a particular problem, the chatter bot might have to ask a number of queries to the customer. The particular questions depend entirely on the circumstances in the area. But the number of such questions is fixed for a well-defined context. In customer service domain, the purpose of the chatter bot is to provide solutions for questions asked by customers ultimately. The success ratio for solving customer problems achieved by the chat bot is therefore an appropriate measure.

$$\frac{\text{Number of successful conversations}}{\text{Total number of conversations}}$$

Thus, we determined the performance evaluation metric for a chatter bot, using [6] [7] [8].

5. ARCHITECTURE

In [2], the chatbot's architecture model is based on the core purpose of development. It can either generate a response from scratch according to machine learning models or use a heuristic to select a suitable response from a predefined response library.

The user interacts with the chat bot through the interface that we have created. The interface is connected with two engines, the conversation engine and knowledge engine. These two engines perform the entire task in the background. When the user gives the input through the interface, the input is processed by the conversation and the knowledge engine. In our system we have developed models to create chat-based artificial conversations by using the content semantics and the pragmatic semantics.

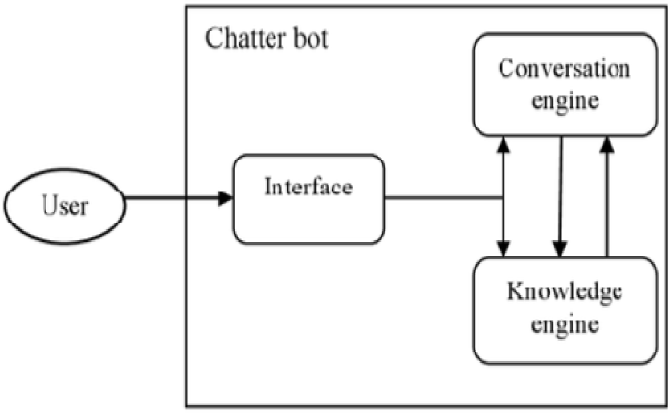

Figure 1: Overview of architecture

We automatically generate artificial conversations by interacting with functional semantics, brought about by an interlocution engine and the context semantics, brought about by a knowledge engine. This engine essentially models the what to say aspect of interlocutions and the interlocution engine models what to say about the conversation aspect.

5.1 Knowledge engine

Knowledge engine models the discussions content semantics. The design depends on the domain. The two main content features of the conversation are the domain information about the topic to be discussed and the specific act of speech to which the interlocution is based. The former gives the details of facts and the latter gives situational context for the conversations.

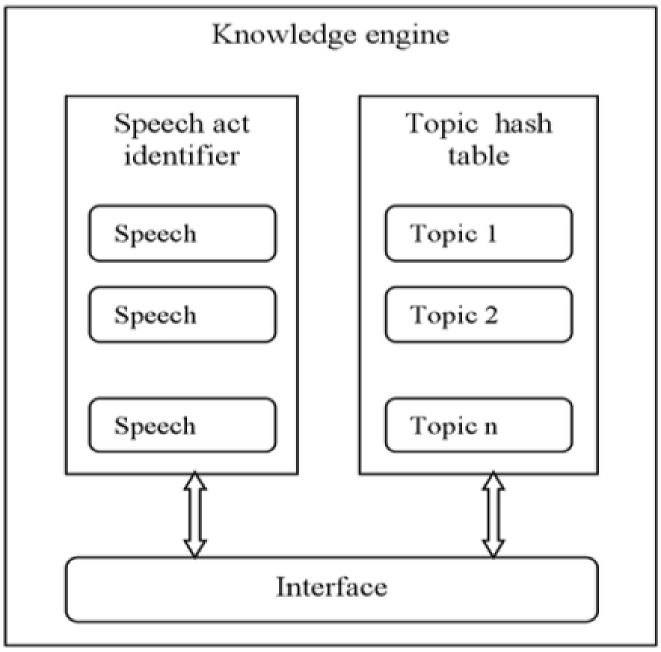

Figure 2: Knowledge engine

5.2 Interlocution engine

This engine models the discussions pragmatic semis. In addition to content, pragmatism is the other element in a good conversation. The interlocution engine (Fig. 3) contains two parts, Finite State Automata, which stores many types of conversation, and the interlocution Planner, which selects one of the types of conversation and tracks the state of the interlocution

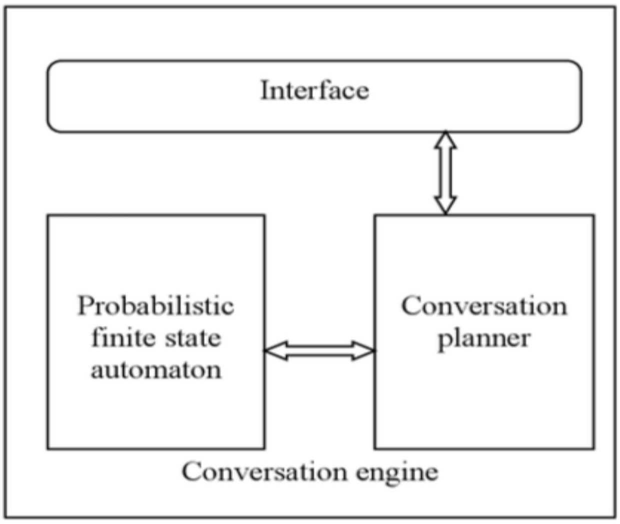

Figure 3: Interlocution engine

5.3 Chat interface

Using [9], the interface for chat is the module that interacts with the user directly. Its high-level function is to receive text from the customer, pre-process this text and delivers it to the knowledge engine and the interlocution engine, receives input from the engines and then forward it back to the user. The Utterance Bucket is an intermediate end which receives the user's chat text and moves it to a buffer. The stemmer decreases the text to its root stem. The Speech Detector phase determines the keywords and finds the keyword related language act. The sentiment detector detects the sentiment. Topic Detector detects which keywords exists by referring to a hash of keywords and puts them in a collection. The interface collects data from all the above detectors into a single set of parameters and provides it to the interlocution engine and the knowledge engine.

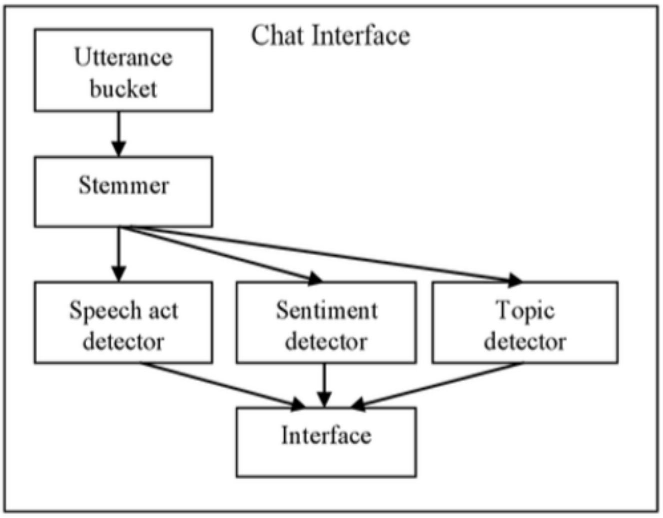

Figure 4: The chat interface

6. ARTIFICIAL CONVERSATIONS

We will now learn the sample parameters mentioned and how an artificial conversation is developed in our model. We used a body of chat transcripts between a customer and a service agent. The body consisted of nearly 2000 separate conversations where all the statements were highlighted by the customer or the service agent who provided it. An utterance is all that the customer or the admin said in a single turn. It comprises of a single or more than one phrases.

6.1 Preprocessing

Using [10], 1. Corpus conversations can be categorized into four types: procedure, information, resolution of problems and disputes. Although these types did not include everything, most conversations in the body belonged to any one of them .There are few ambiguous conversations that can be described in more than one of these types of conversation. Few conversations cannot be described and have been ignored. These four types were focused and chosen because separate automatons can be created for them manually.

2. Several topics have been selected through the analysis of the corpus: login, access control, constraints, configuration, process involved and portfolios.

3. By comparing to the natural human conversations in these content, specific domain knowledge for the contents has been generated, i.e. access controls for logins, number of days after which we can update margins, the particular dollar amount for the charged commissions etc.

4. The target achievement is merged with all the contents and conversation models were built in the hash table using the previous information obtained.

7. ALGORTIHMS

A unique pattern must be available in the database for each type of question to provide an appropriate answer. It creates a hierarchical structure with a lot of pattern combinations. We use algorithms to reduce classifiers and create the structure that is more manageable. Computer scientists call it a "reductionist" approach-it reduces the problem in order to provide a simplified solution. Multinational Naive Bayes is the classic text classification and NLP algorithm. Let us assume, for example, that a set of sentences belonging to a certain class is given. With the new input phrase, each word is counted for its occurrence and its commonality is taken into account. Few sample Sentence classification: input: "hello good morning" term: "hello" (no matches) Term: "good" (class: greeting) term: classification "morning" (class: greeting): greeting (score=2). With the help of the equation, word matches for certain sample sentences for each class can be found. The classification score identifies the class with the highest term matches, but has certain limitations as well. The score indicates the intent of the sentence but does not guarantee that it is the perfect match. Highest score only provides the relativity base.

7.1 Artificial Neural Networks

In [10], neural networks are a way to calculate the output from the input using weighted connections calculated from repeated iterations during the training of data. As mentioned earlier, each phrase is divided into different words and each word is then used as an input for the neural networks. The weighted connections are then calculated thousands of times by different iterations through the training data. Every time the weights are improved to make it accurate. The trained data of the neural network is an increasingly less code- like algorithm. If there is a comparatively small sample in which the training sentences have 200 different words and 20 classes, it would be a matrix of 200 twenty.

7.2 Natural Language Understanding

Using [14], the concept of NLP which involves,

Entities: entity is essentially a concept in your chat bot. It could be your Ecommerce Chat bot payment system.

Intents: Basically, when the user says something, the action chat bot should perform. For example, if users type "I want to order a red pair of shoes" the intention can trigger the same thing, "Do you have red shoes? I want to order them" or " Show me a red pair of shoes, " all of these users ' text shows a single command trigger that gives users Red pair of shoes options.

Context: When an NLU algorithm analyzes a phrase, it has no user conversation history. It means that if you receive the answer to a question that you have just asked, you won't remember that. To differentiate the phases during the chat, the state should be stored. Flags such as "Ordering Pizza" or parameters such as "

Restaurant:' Dominos' " You can easily connect attempts with context without knowing what the previous question was.

7.3 ASR Process model

Using [11], first, we need an acoustic model that gives us P(X/W) – We will find the argmax over all words in our language w, or the word with the highest likelihood of representing this sound. Acoustic models are typically trained on sound recordings and accompanying transcripts, which can empirically be used to determine these probability. The statistical representation of each word (or phoneme) produced by the sound corpus analysis is typically represented as a Hidden Markov model. Secondly, we need a language model that can tell us how likely a word is to be heard in our language. Thirdly, a dictionary with a list of words and phonemes is needed to process our provided inputs. We can decode a word by applying the Bayesian rule.

The fourth step is post- processing; the Bayes rule gives us a list of the likely word sequences with their ranks, and we select the most likely word sequence we have heard. The other top hypotheses are saved and can be used in learning algorithms for strengthening.

7.4 Restricted Boltzmann Machine

Using [12], Deep learning and the use of RBMs have led to the development of even more efficient methods for the decoding of sounds into phonemes. RBMs are neural networks with N number of hidden layers and a single visible layer; there are no links to each layer, but typically there are links between each unit in the visible layer and each unit in the hidden layer. The weights on each edge are determined by activation and altered during back propagation. Rather than including an HMM to represent the sequence, RBM-based models represent each phoneme with an RBM, where each sound frame that composes the phoneme is a visible unit. Three tested variants of the RBMs in acoustic modeling: the unconditional RBM, a conditional RMB (CRBM), which considers the visible variable from previous time frames alone as inputs, and the interpolating CRBM (ICRBM), which considers both previous and future time frames as inputs.

8. CONCLUSIONS

We have analyzed that our chat bot on Natural language processing gives more accurate responses compared to using other algorithms like restricted Boltzmann machine and ASR process model as it involves speech recognition, stemming, lemmatization, named entity recognition, parsing, morphological segmentation and optical character recognition. Our chat bots makes customers feel more comfortable and satisfied as it responses in the same way as a human does and even more clear. Our work can be more useful to the people who concentrate on natural language processing algorithm. Our chat bot will always respond in a way that the customers don’t get hurt irrespective of how rough the customer may be. Our future work will be to enhance our chat bot to its next level with more accurate responses. There is always a default sentence which will overcome the failure situation like when it is not clear about the answer. Thus our chat bot is able to handle all the best and worst situations in the same manner. There is no limitation of words in inputs which makes the conversations more easy and interactive. Finally our chat bot always provides the user with an accurate response and is more advantageous compared to human-human conversations.

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