The implementation of a storytelling Chatbot

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Abstract

Chatbots are computer programs that simulate intelligent human conversation. The design and production of interactive digital storytelling chatbots presents new possibilities, enabling the development and creation of characters with feelings and personalities. This paper will describe current efforts in the development of an interactive storytelling chatbot.

Chatbots are computer programs that simulate intelligent human conversation. There are typically three parts to any chatbot. The typed input from the user in natural language, the typed or spoken output from the chatbot and the process of passing the input through the program so that an understandable output is produced. This whole process is repeated until the end of the conversation is reached.

The very first chatbot, '**Eliza**', was written by Joseph Weizenbaum in 1966. **Eliza** simulated a 'Rogerian' psychotherapist. This program was very simple and was made as a pattern matching algorithm and templated sentence reconstruction. It had no in depth knowledge or language processing ability.

Using similar techniques, '**Parry**' was programmed by Kenneth M. Colby in 1971. **Parry** was intended to be a study of the nature of paranoia and was able to express fears, anxiety and beliefs. It was the best chatbot conversationalist at that time. **Parry** had about 6000 patterns through which to recognize elements of input and some open-pattern stock answers. **Parry** and **Eliza** talked with each other on several occasions, though the output would be more or less predictable due to the way they were programmed. (Colby, 1971).

'**Tale-Spin**' was an interactive storytelling chatbot programmed by James Meehan (Meehan, 1976). It had three storytelling modes.

Two modes were interactive whilst a third mode provided 'fixed' stories.

'**Racter**', was also a storytelling chatbot. It was programmed by William Chamberlain and Thomas Etter, in 1983. **Racter** wrote a book, 'The Policeman's beard is half constructed', (Chamberlain, 1984) but the publically released version of the **Racter** program, in reality could do little more than output clever lines of prose.

Combining real-time learning with evolutionary algorithms which optimize chatbot ability to communicate based on each conversation held means that the potential for storytelling is now possible.

An aim of this study's implementation is to be a storytelling chatbot. Simulating real and imagined personalities from the history of the ship '*HMS Ark Royal'*. There were five such ships bearing the title of *Ark Royal*, ranging in date from the 1500's to 2010. The real and imagined characters featured within the story therefore could cover this span of time. The ability to interact – to ask a question or make a comment and to receive an answer – is at the core of human communication. (Bogdanovych et al., 2005). Storytelling goes back to the earliest times of human history. Many stories have been lost over time, some passed down from generation to generation. Many cultures use storytelling as a means of education. New forms of narrative are now possible through modern technology. Interactive storytelling can develop powerful characters, structures and storylines that can have a valid place within education today. Classic storytelling techniques can be combined with our 21st Century techniques to reawaken a lost oral tradition. (Miller, 2008) Interactive digital storytelling is a valid educational tool to teach

multimedia literacy and narrative skills and to excite people about learning. It is also very much a tool for telling immersive and participatory stories. Stories that can be used for entertainment as well as education. Stories that can evolve as the persons imagination unfolds, by facilitating rather than directing the learning process (Fenton-Kerr, 2002)

Pattern matching and template based sentence building similar to **Eliza** is used as are query matching in a set of sentences indexed by keywords as in **Parry**. The short term memory of the chatbot keeps track of the conversation and ensures that the same answer isn't given twice in a row even if the user repeats his sentence. The chatbot keeps track of the latest sentence until a new sentence is added by the user. It also keeps the latest pattern in memory so that it can be later replied to and referred to. The chatbot can converse on the current topic and also on previously mentioned topics. The system logs users and refers back to the previous conversation point. So it has long term memory capabilities.

An additional feature of the program is to retrieve a set of sentences from the users input and save them as potential answers in the database. These are then used to produce new variables combined with the ones already existing in the database.

The pattern matching technique finds one of several patterns that match the user input in its database. Within the pattern, certain words were replaced by wild cards that were then matched to a group of words in a matching sentence. For each defined pattern a corresponding template generated the answer to the user input.

The input being firstly transformed by changing ‘I, My, Mine’ to ‘You, Yours, Your’ and vice versa. As an example from the Eliza program shows, ‘I want *’ where the ‘*’ can be any value. The templated response would say ‘what would it mean to you if you got *’ where the wildcard is changed to include the word(s) input by the user. The initial chatbot program also had a list of random sentences that were given when there was no direct response indicated in the database.

The program also used automatic indexing of the data to remove unnecessary suffixes like ‘ing’ and common words like ‘a’, ‘is’ and ‘for’. This ensured that words of the same family type are treated as a single keyword within the database. So words like ‘go’, ‘going’, ‘gone’ were indexed as a single keyword. It also, utilized a list of stop words which preserve the semantics of the sentence in a correct way and ignore others that are not important. Sometimes words within the previous text may be important to later text entered, as in a story, so indexing also took this into account in the context of the conversation. The system selected all of the sentences that contain one of the terms in the input and also ranks them in order of the number of times the query has appeared. It then returned a sentence that matched the query. This increased the efficiency of the chatbot. The downside was that it couldn’t generate sentences that didn’t yet exist in the database. So it is reliant upon the users input and also on the preparation of the initial database.

By using simple wildcards, it was too easy to get false positives (matches not wanted) and hard to write more discriminating patterns. Though the combination of techniques so far used allowed the user to have a reasonable conversation with the chatbot.

The next program development looked at sentence structure and defined some general rules about how they could be dealt with by the program. The string matching evolved from matching patterns of words to matching patterns of meaning (Wilcox, 2011). It therefore looked at patterns of meaning and provided responses more appropriately. As an aside, it was also important to have clear scripting semantics and syntax to help with the background editing and authoring. Debugging and writing became easier with the clearer rules. Parsing was used instead of wildcards to allow better responses to queries. It helped prevent errors in replies and made the responses appear more intuitive and correct.

The chatbot is reflective and recalls conversations only with each individual user, so the program doesn't divulge a previous conversation to anyone else.

An aim of the storytelling chatbot program was that it should be capable of sustained discourse over a period of time that could be interrupted and returned to over an extended period of time. The story could therefore continue where it last ended for an individual, as in a printed book. This was achieved using the database and chatbot memory. Using a scripted dialogue system the program

maintained the conversation and managed to keep the user interested as well as remembering the last conversations with each person. The program uses a complex pattern and topic matching system. This looks at the incoming sentences and decides which topic has the closest keyword match, then scans the rules of the topic to decide what to do. If none match, it looks at lesser matched topics. If nothing matches from the topics, it may decide to quibble with the input, or issue a gambit sentence from the closest related topic. It has a WordNet 2.1 dictionary as well as a library of phrases scanned in from historical novels and from reading text documents to learn information on a subject, a library of linguistic variables (both in pattern matching and answer generating), random generated dialog elements using for example a Markov Chain which allows prose to be written, Random Sentence Generator-methods as mentioned above and a storytelling system (to generate stories). A separate file contains misspelled words (input by the users) which are interpreted and responded to. A log of all exchanges and topics discussed is kept and can be used to populate the database. The chatbot program is adaptable and can be easily modified for a variety of storytelling scenarios.

The usage of the storytelling chatbot will be demonstrated as part of the presentation of this initial work.

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