

HAI COMP3074 – Chat Bot

1. Introduction

In this coursework I have built a general-purpose chat bot which is based on LeBron James, and data from the NBA. The chat bot is built to serve multiple functions: stores and manages usernames, prompts day to day commands i.e., asking for the time, instantiates small talk conversations, and finally using an NBA database users can ask about NBA facts. The motivation behind this product, was mainly due to two main interests. I wanted a chat bot which is more like a companion which simulates a human-like conversation and interacts to have a natural flowing conversation. Lastly, the chatbot's name and NBA quiz functionality is due to my love for basketball.

2. Background

Chat bots are an *Artificial intelligence program which utilises Natural Language Processing (NLP) and sentiment analysis to communicate in human language [2]*. As part of this coursework two of the key components are NLP and ensuring an interactive communication between human and machine. I based my initial approach on the Three Pillars of an NLP Based chat bot [3]. The building blocks are, 1. Generating a dialogue system, 2. Natural Language Understanding (NLU), and 3. Natural Language Generation (NLG). The dialogue system is designed to be kept text-based, a simple approach which can be interacted through an OS terminal. Next building blocks involves NLU, where the system will need process human language and understand the query. Finally, NLG where the system will generate a response based on the user's query. With these steps, a chat bot should be ready however it is more complex than what has just been mentioned. The technical details will be explained in Section 3. Proposed system. Furthermore, my architecture inspiration is based on the paper *Chatbots: History, technology, and applications* where Figure 1. [2] helped me establish a clear architecture understanding of a general chat bot which inspires my design in Figure2.

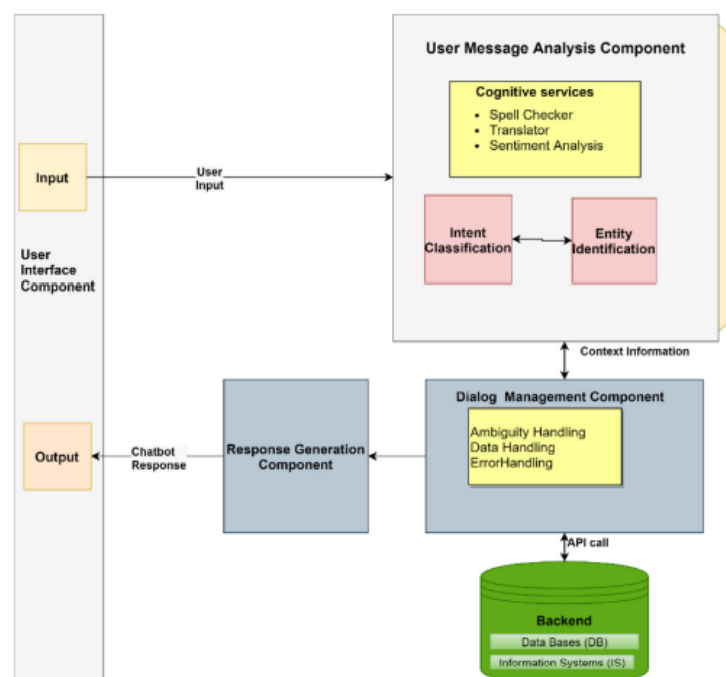


Fig. 1. General Chat Bot Architecture

In addition, NBA has already launched a Facebook Messenger chatbot which is the same topic I decided to specialise on. However, what it lacked was past NBA knowledge and their bot seemed a bit lifeless as the message came straight from the NBA page. Hence, my project tackles these problems by utilising NBA general knowledge database and familiar personnel (Lebron James).

3. Proposed System

In this section I will discuss the functionalities, motivation, and implementation of features I have implemented onto my chatbot. These functionalities include utilisation of NLP techniques, which handles intent matching, identity management, small talk, information retrieval and question answering. Figure 2. Shows an overview of the architectures of the system.

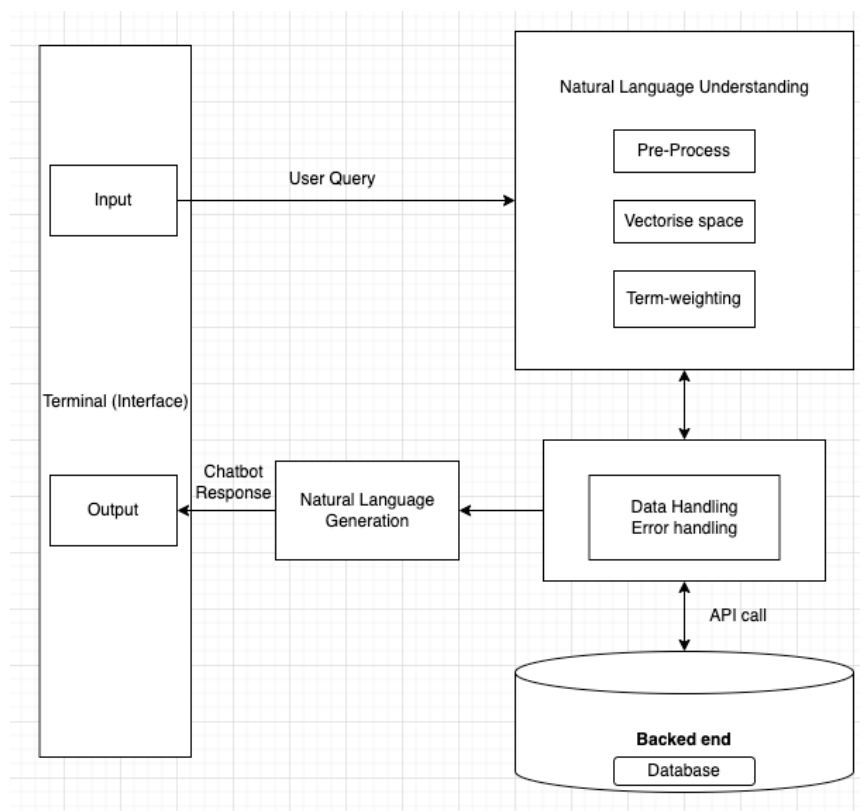


Fig. 2. NLP based General Chat Bot Architecture

3.1. Identity Management

The motivation behind the structure of the name management was to have a flowing dialogue even when it involves an administrative task. Therefore, recognising name statements and keywords in query were vital.

When the Chabot first gets booted up the user is presented with the Chabot (Lebron) who asks the user's their name. The chatbot is designed to recognise name statements, such as ("my name is x") where x is recognised as the name and stored onto the system. This statement is pre-processed by tokenising the statement into tokens, removing stop words from the tokens, and checking for Part of Speech Tag on nouns. This will extract the user's name as shown in Figure 3a.

```

LeBron: Hello I am LeBron James, your general chatbot what is your name?
my name is Sahil
[Your user name has been set to Sahil]
[note you can change your name, Just ask LeBron!]
LeBron: Hello, Sahil how are you? :)
Sahil: 

```

Fig. 3a. Recognising name in name statements

Furthermore, the chatbot has the feature to change the user's name. This feature adheres to intent matching technique (Section x). Where, occurrences of user's query will match the statement against an intent. When the intent 'change_name' is recognised the change name function is called. This runs through the same process as mentioned above, where the name statement gets pre-processed and set onto the system.

```

Sahil: Hi LeBron can you change my name
LeBron: What would you like to change your name to?
James
[Success!! Your user name has been set to James]
LeBron: Hello, James could i help you with anything else?
James: 

```

Fig. 3b. Recognising name in name statements

3.2. Small Talk

The motivation behind the small talk, is to have a natural human-computer conversation. Where the bot should be able to handle free flowing conversations and keep the user engaged.

Again, once the user has set their name as shown in Figure 4a. the chatbot commences a conversation. This is so the user is guided to respond in having a conversation as the chat bot could be about anything. This guidance principle is continuously applied, for example in Figure 4b. once the user has reached a dialogue with the bot the conversing output suggests a quiz. In this context is to do with the NBA, and LeBron James being the bot it plays as an act thus referring to itself as LeBron.

```

LeBron: Hello, Sahil how are you? :)
Sahil: i am sad
LeBron: When I am sad I love a hot brew, would you like a cup of tea
Sahil: yes can you make me tea
LeBron: Tea brewing up :D
Sahil: 

```

Fig. 4a. Flowing conversation

```

Sahil: what is your hobby
LeBron: I love basketball, ask me anything on the NBA
Sahil: who was the number 1 draft pick in 2003
LeBron: That was me, LeBron James! :)
LeBron: Could I help you with anything else?
Sahil: 

```

Fig. 4b. Flowing conversation – guiding user

The implementation of this method starts by, pre-processing as mentioned during the NLU stage. This is to retrieve words from a document and remove trivial instances, once the terms of words are ready the terms are embedded to be represented as a vector space to be weighted using the TF-IDF format. The relevance of each of the word is weighted and is passed through a cosine similarity function which is adjusted based on thresholding. Based on the thresholding, the accuracy of matching utterance will to response will be tested. In most instances, I opted for high thresholds as I tested more specifically to my data however this is better used with a high-volume document as small talk would benefit the typical user as the types of conversation are unpredictable from people to people. Therefore, it is more like NLG processing generates the wanted responses. This implementation is then repeated for different functionalities throughout the system, with different thresholding limitations.

3.3. [Question Answering](#)

The question and Answering schematics are based on the NBA and a general database, this involves trivia like question that is queried and retrieves answers based on the information given. The Motivation behind this was to have a chatbot which has general knowledge on NBA data as shown in Figure 5a.

```
Sahil: What team drafted Ray Allen
LeBron: Minnesota Timberwolves
LeBron: Could I help you with anything else?
Sahil: How was the tallest player ever in the NBA
LeBron: Gheorghe Muresan (7' 7"-5/8)
LeBron: Could I help you with anything else?
```

Fig. 5a. NBA trivia

```
Sahil: What is add ons
LeBron: Add-on (Mozilla) , a piece of software that enhances and customizes Mozilla-based applications
LeBron: Could I help you with anything else?
Sahil: how much in 1 tablespoon of water
LeBron: In Australia one tablespoon (measurement unit) is 20 mL.
```

Fig. 5b. NBA trivia

The question and answering functionalities follow the same methods from Section 3.2 Small Talk. This process is locked into the normal flow of dialogue as I wanted the chat bot to have a natural flow of conversation. Rather telling the Chat bot to instantiate small talk feature or Question Answering feature, the user can instantly query it. This also allows documents to be laid out in a more fluid manner, as reaching a specific feature is done by intent matching which itself has its own sperate document.

3.4. [Intent Matching](#)

Intent matching Is one of the main components of the chat bot. The motivation is to have more than one function and have general features such as asking for the time, date, and requesting a changed name. Moreover, this application applies to shutting the system off, therefore an implementation to terminate the chat bot is also inputted.

The intents I classified were 'get_time', 'get_date', 'change_name', and 'say_bye'. These intents are stored into one document, as each component doesn't store many terms. For example, during NLU when a user phrases a query such as 'what is the time' or 'could you tell me the time' retrieves the intent. This intent is used to understand which NLG process is required, thus in this context the time function is called which generates a response as shown in Figure 6.

```
Sahil: Could you tell me the time?
LeBron: The time right now is 12:42
Sahil: Whats today's date
LeBron: Today's date is Thursday 08 December 2022
Sahil: Okay thank you, bye
LeBron: Bye Sahil, see you next time!
```

Fig. 6

4. Evaluation

Having a computer system understand natural language with 100% fluency is almost impossible, as at the end of the day it is still just a computer. My testing involved using user testing where different users had a go at the system. This came fruit with system comprehensive problems. As every individual have their own way of speaking. For example, In Figure 7a. the user followed the guidance response however the chatbot failed to carry on the conversation. This is mainly due to a lack of data provided to the chatbot as the small talk series currently only holds up to 43 responses. This could be mitigated using a larger dataset.

```
LeBron: Hello, John how are you? :)
John: hi i am okay
LeBron: only just okay? You can be better than okay!
John: yes i am doing amazing
LeBron: I did not understand :(, please say something else
John: █
```

Fig. 7a

Another notable aspect was during name management in a normal case as see in Figure 3a. the system recognises name statements, and the user's name is retrieved and stored. The system also has moments during which more than one word is stored as the name. In Figure 7b. 'callSahil' is recognised as the username as the stop word couldn't filter 'call' out and 'call' is recognised as a noun as well.

d

```
LeBron: Hello I am LeBron James, your general chatbot what is your name?
they call me Sahil
[Your user name has been set to callSahil]
[note you can change your name, Just ask LeBron!]
LeBron: Hello, callSahil how are you? :)
callSahil: █
```

Fig. 7b

5. Discussion

In terms of real-life usage, the chatbot is not fully prepared to be deployed. It still has its major flaws as mentioned in the evaluation. However, with further development it does have a place in the market. However, throughout development the breadth on NBA based functionalities is lacking. Further features such as checking game results or checking current scores could promote more people to use the chatbot towards NBA speciality. Likewise, this is also a general chatbot therefore implementations of more mundane intents, such as asking for weather or sending emails would improve user experience over all [4].

Furthermore, I would also implement a feature which allows users to change the chat bot. Currently the bot is a male athlete, therefore inclusion of a female athlete actor would help reduce a sense of gender biasness. This is especially important as gender inequality still exists in sports and promoting more female representation would promote a better change [5].

In deployment of this system to the public, the AI training data set would need to be more refined, and it comes a larger training data set. Processing and training data may cause racial bias when it comes to names. Data is trained over a large volume, and the set of data needs to be trained and classified carefully [6]. It is also a large problem there maybe racial bias when it comes to ethnic names as they aren't recognised accurately as a more western name. Therefore, datasets must be trained in an inclusive manner to tackle these ethical issues.

6. Conclusion

Overall, the chatbot does what it aimed to do initially. This includes general features of small talk, name management, question and answer utilising NBA database, and intent matching. The chatbot provides a flowing conversation and accesses data for when prompted from the database. However, in the future I would also implement a transactional dialogue which would allow users to complete tasks such as requesting NBA live data i.e., current score by utilising the chatbot.

7. Bibliography

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