

Implementation of chatbot for stock information searching

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Abstract

A chatbot, which is based on Rasa NLU, is built for stock information searching. It can provide real-time stock price, volume, and cashflow information. Users need to input desired company name, information, and date to complete the search. The chatbot will remind users sending required information and give out a warning when the message from a user is incorrect or invalid. Finite state machine is implemented to Rasa NLU and regular expression is used to extract entities and intents from users' message. Incremental slot filling is also implemented to extend the information list extracted from user.

Keywords: Chatbot, Rasa NLU, Stock information searching

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1 Introduction

Chatbot is a rapidly developing practical robot which involves Natural Language Processing, sentence parsing, and assignment achieving. While providing a conversational user interface, which allows users to interact with system through a message platform like WeChat and WhatsApp, the chatbot can receive input from the user, perform tasks (order hotels, fetch information), and respond to the user with text or media. A commonly used successful chatbot need to have several characters. First, to show respect to human users, the robot should greet and welcome them. Second, to avoid users getting bored, multiple responses need be prepared and chosen randomly. Third, to keep conversation moving and steer it to the goal, the chatbot must lead questions to instruct the user on what to do next and provide some responses to typical user feedback and comments. Then, as a way to remind the user of the types of commands or keyword the bot will accept, having a default “help” response can be a real lifesaver, and it’s necessary to create a default response that returns something when the users’ input fails to match any of your other responses

The goal of this paper is to present the results of stock-information-searching chatbot. A specific conversation structure is designed to promote the conversation. Several leading questions and responses are implemented to guide users to input valid messages. Incremental slot filling and finite state machine is applied to build the structure of the project. Entities and intents identification introduces challenges related to gather necessary information. This challenge has been addressed by employing regular expression and machine learning, which is packed in Rasa NLU.

The remainder of this paper is organized as follows. In Section 2 we provide overviews of the IEX Cloud and Rasa NLU. In Section 3 we describe the technique used in the chatbot and the function in each part. In Section 4 we present the results of the tests outlined in the previous section. Section 5 wraps up the paper and presents potential future work based on the results of this study.

2 Background

2.1 IEX Cloud

IEX Cloud is a platform that makes financial data and services accessible to everyone. By authenticating API requests with users account’s API tokens, we can apply any IEX Cloud API. If API token is not included when making an API request, or is incorrect or disabled, IEX Cloud returns an error. One can easily access latest financial data and stocks’ historical information with IEX API.

2.2 Rasa NLU

Rasa is an open source machine learning framework for building contextual AI assistants and chatbots and Rasa NLU is an open-source natural language processing tool for intent classification and entity extraction in chatbots. Equipped with Rasa NLU and self-designed training data, we can easily extract intents and entities from a sentence, although due to the limitation of training data quantity, sometimes the accuracy is not perfect.

Rasa NLU has two main pipelines: “spacy sklearn” and “tensorflow embedding”. “Spacy sklearn” is suitable for training the model with small data base (less than 1000 examples), while “tensorflow embedding” is designed for large data set. Except for that, a set of pre-trained word vector from third party is applied for “spacy sklearn”, which is unnecessary to “tensorflow embedding”.

The classification employed in this project is SVM, because of the limitation of training examples. Texts are tokenized to words by spacy and converted to feature vectors, then they are labelled and trained. Besides Rasa NLU, regular expression is also adopted to identify simple characters.

3 Technical Approach and Methodology

The conversation between the robot and the user is governed by finite state machine, whenever a specific condition is fitted, the robot will transfer to a related new state.

3.1 Activation State

Considering the conversation in daily life, showing friendliness is necessary during chatting, so the chatbot for stock information searching is designed to be activated by users express greeting. By inputting sentence like 'Hello' and 'Hi', or 'Can you help me', users will activate the chatbot, who will respond with something like 'What can I do for you?'. The intent of greeting or asking for help is identified by Rasa NLU. Self-designed database, which includes samples of texts with intent mentioned above, is trained by Rasa NLU and applied for future extraction.

Sometimes, when a user is new to the chatbot, he may has confusion about the function of the robot. In this condition, the user can ask its function directly. Since a question is usually composed of a 'what' word, the chatbot will check the existence of this word. If a positive feedback is returned, the robot will respond with a simple explanation. If neither condition is fitted, it will tell the user that his request is beyond its capacity.

3.2 Choose Stock State

Two actions need to be done in this state. First, the name of the company is identified by regular expression with the assumption that the stock name is written by capital letters, so a sequence of capital letter string is the symbol of a stock. Second, since a user may just input the name of the stock or both the name and the information he need, we need to check what exactly he sends. The identification of the information is solved by dependency analysis in Spacy. By saving all ancestors of the stock in a list and filtering out the one which is a noun, we can make sure whether he inputs an entity and what it is. If he does send an entity and it is among the chatbot's searching goal: price, volume, and cashflow, then it will be saved as a specific variable called 'entity', which will be used for final search.

3.3 Choose Entity State

The execution of this state is optional, which depends on the user's input in the last state. If the user has already input a valid entity in Choose-Stock State, then this state will be skipped, otherwise, the chatbot will send out a warning or reminder to inform the user to input a valid sentence. The method to identify the entity is to search keyword in the input.

3.4 Choose Date State

The identification of date is solved by regular expression with the assumption that users will only input the month and date, connected by '.', '-' or '/', the result is saved in the variable 'date'.

3.5 Present Historical Price

The chatbot has another function, that is to present a stock's historical price trend in the last month. The bot will send out a question asking for the user's intention about the chart, if a positive response is received, then the bot will search the stock's historical data, including daily highest price, lowest price, open price, and close price. Different color is used to represent positive or negative of the change, where red indicates that close price is higher than open price, while green indicates the opposite.

After presenting the historical price, or the request is denied, the chatbot will ask whether the user has other request. The user can ask for other information of the same stock, or ask for other stocks. The bot will present as described before, remind the user for necessary information or specific date.

4 Test Results

In this section, different messages are sent to the chatbot and its feedback is presented. When the chatbot is started, it is at 'INIT' state, if the user is not familiar with its function, he can ask about it. The robot will respond with "I'm a bot to offer price, volume or cashflow of stocks". Then, if the user successfully activate the following conversation, the robot will say: "What can I do for you?" and pass to the next state. Otherwise, it will say, "I'm sorry - I'm not sure how to help you" and stay at the 'INIT' state.

In the Choose-Entity state, the user can ask for help by saying “what’s the price of AAPL”, for example, which will lead to the pass to the Choose-date state, since he provide both the date and information he needs. If he inputs “how is AAPL going”, then the robot will go to the Choose-entity state for more detailed searching goal. If no valid stock name is received, then the bot will say, ”I’m sorry - I can’t identify this stock.”.

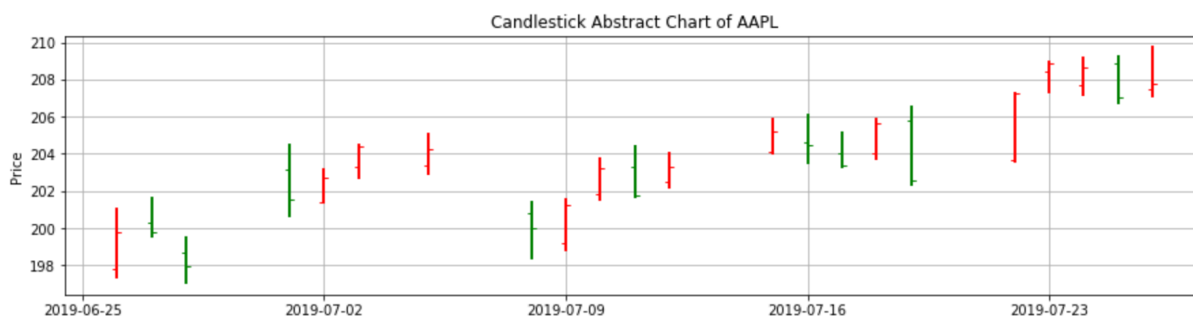
In the Choose-entity state, if valid information is provided, it will reply, ”Perfect, which date are you interested in?”, otherwise, in will return ”I’m sorry - I can only search price, volume, and cashflow.”.

In the Presentation-of-Historical-Price state, a chart will be shown if user give a positive feedback, and robot will go on to ask if there’s any other request. The following is a sample of the conversation:

```

USER : can you help me
BOT : What can I do for you?
USER : what's the price of AAPL
BOT : Well, which date are you interested in?
USER : 5-29
BOT : Ok, here's what you want:
The price of AAPL is 207.74
BOT : Do you want to take a look at its historical price?
USER : Yes
BOT : Here's the historical abstract price chart
Company: AAPL

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BOT : Do you need anything else?
USER : Yes
BOT : Ok, which stock do you want?
USER : TSLA's volume
BOT : Well, which date are you interested in?
USER : 7.2
BOT : Ok, here's what you want:
The volume of TSLA is 8851621
BOT : Do you want to take a look at its historical price?
USER : No
BOT : Ok, do you need anything else?
USER : No
BOT : Good bye, see you next time

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Figure 1: Function Presentation

5 Potential Future work

In this report, we design a stock information searching chatbot, using Rasa NLU as its structure and regular expression to assist classification. It can now answer contextual questions and respond to users input. Several different circumstances are considered, and some talking habits are included, like greeting first. By using state machine, the action of the robot is modeled. It can now ask question like “Do you need anything else”, which is very much like a human being. Later, more functions will be added to the Chatbot, more information it can search, and more circumstances it can handle.