Developing an appointment Chatbot for students

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***Abstract*— Chatbot technology, which has hit the market, is software enabling brands to communicate with their customers. This technology has shown unprecedented growth, triggering an array of ideas for creative minds. The paper describes the leading theory, methodology, and implementation of the project. The report documents the project's requirements and focuses precisely on how to strategize the idea of a chatbot into a working project. The scope of the paper is to understand the underlying logic behind the implementation of a chatbot for college/university students at UMKC. Since the start of covid-19 in March 2020, large-scale lockdowns have led to colleges, universities, and public places closing. The newly established stringent norms of social distancing are making it difficult to engage in physical activities. Since February 2021, the reopening has started due to the advent of the vaccination. The need for social distancing is still in existence. To meet these demands, the University needs to have a proper arrangement so that the number of students at a given place does not exceed a particular number. The chatbot, an online media tool, helps the students check the slots' availability and book them for recreational activities. The activities cater to broadly classified categories. The application will cater to the UMKC students who want to register the slots depending on the suggested recreational activities instead of logging into the application and registering manually.**

Keywords—Artificial Intelligence, Machine Learning, Natural Language Processing

I. INTRODUCTION

Chatbot is one of the fast and effective methods of communication on many websites. Where the chatbot will converse with consumers and respond to all incoming inquiries. For instance, a user can look up available flights on a particular date and book them simply by chatting with the chatbot. One of the most valuable aspects of the chatbot is that it allows website owners to save money by eliminating the need for a huge number of staff and providing the required support at any time of day. The chatbot will understand the user's texts and react with the required response based on meaning analysis and Natural Language Processing (NLP).

In this research, we are developing a Chatbot application for the University of Missouri Kansas City to verify the possibility of booking an appointment with an academic supervisor and the availability of the entertainment activity slots at the university. From the outset, the team focused on designing the chatbot application to construct a dataset and questions expected from the students/faculty members, evaluating incoming texts and the expected answer. The chatbot will begin by greeting the user and asking for the service that can assist with. This application aims to help students and faculty to book their appropriate appointments.

II. RELATED WORK

Chatbots can be problem-solution bots or domain-precise bots mostly they are knowledge based. These can act as Virtual aides for Problem solving. The problem-solution chatbots are less complex and require a smaller skillset. These chat bots can be helpful for solving a specific question. Apart from that, Artificial Intelligence (AI) and Machine Learning (ML) can simulate human discussion and extends user experience.

Most of the Chatbots are designed with Pattern matcher, Suitable algorithms. Artificial Neural Networks is a computing system that consists of several simple but highly interconnected elements or nodes, called ‘neurons’, which are organized in layers. This further process information using dynamic state responses to external inputs.

[Herriman et al] designed and launched a chatbot to help patients with questions about Covid-19. The requirement for unique response mapping, complicated contextualization, and dynamic, human-guided validation of content through machine learning and natural language processing. They are approachable any time to prevent wait times on hold before reaching a human and letting patients to obtain solutions 24/7 where a single chat bot can handle more than thousand calls, each question answered than any human. Associating with Google generated the opportunity to leverage natural language processing and machine learning in hunt of mapping various inquiries to common fundamental intents.

[Jizhou Huang] A forum generally consists of several conversation sections. Every discussion forum consists of a specific conversation section and it includes many threads. With the help of threads People can initiate new discussions

by posting questions they would expect answers similarly vice versa. In this, threads are listed in chronological order. Within a thread, thread title, starter, replies are seen. They proposed a novel methodology for obtaining high-quality <title, reply> pairs from online discussion forums to supplement chatbot knowledge base. Which creates high-quality <title, reply> pairs extracted using a cascaded framework.

III. PROPOSED WORK

The primary purpose of the chatbot is to respond to student queries without a workforce. Students can use the chatbot in any web browser. The chatbot receives the question, which is input by the student, analyses it, and responds to the user with an answer. The questions are defined in the intent on which the chatbot will be trained to identify the queries. The analysis is done using Machine learning algorithm.

IV. IMPLEMENTATION AND EVALUATION

This section of the paper emphasizes the working of the system on the overall basis chatbot model. It focuses on the software part of the chatbot, the intent, and the dataset developed to train the chatbot. The algorithm of the process is followed by the design of the system and the motive and goals addressed by the chatbot.

To design the chatbot, the first thing needed is the data, which is processed appropriately to obtain a format understood by the machine. Since computers cannot understand the text language as understood by a human, the text is converted into a machine-readable format. The words need to be represented using a word embedding techniques.

Working Algorithm

Step 1) Select a data set, for which we need to develop a chatbot.

Step 2) Prepare the set of entities with the patterns and the responses.

Step 3) Install the required packages in python

Step 4) Train the chatbot on the dataset to understand the intent of the user

Step 5) Develop the GUI and integrating it with the bot

Step 6) Execute the codes for the results

Step 7) Exit

1) Pre-processing using NLP

The analysis and pre-processing of the text is performed using NLP (Natural Language Processing) to clean the text and process it for further research by the model.

NLP is a natural language toolkit that understands the text's components provided as input by the user at any given point in time. The NLP engine converts the text language into a piece of streamlined information that the system can process. The chatbot proposed in the model is domain-specific and should support multiple features.

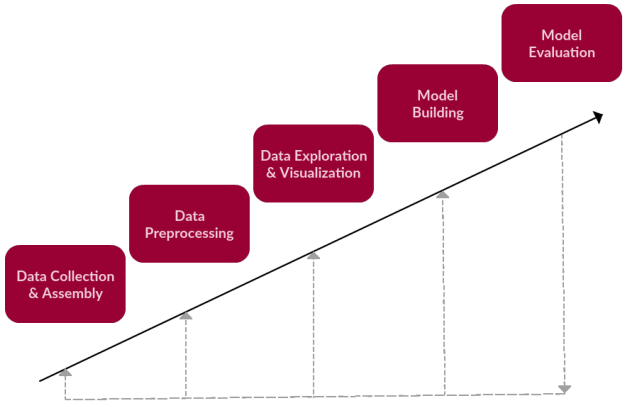


Figure 1. Pre-processing of text using NLP model

The coding for the backend of the chatbot application is performed in python. It includes many library functions like NLTK, TFIDF – count vectorizer and Multiclassification model. The GUI is developed in python using Flask.

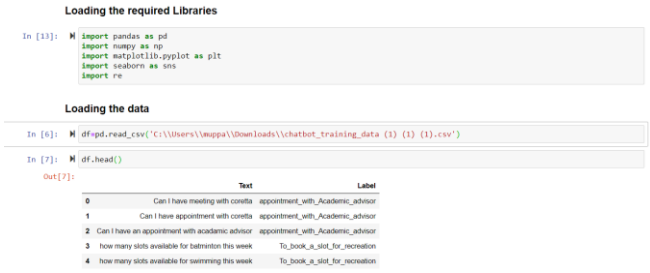


Figure 2: Loading the libraries

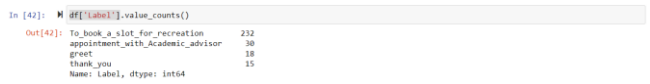


Figure 3: label count

2) Splitting the data into train and test

The train-test split evaluation is executed to estimate the performance of the model created using machine learning algorithms. The algorithms are used to make prediction on test data. The results obtained thus displayed the performance of the machine algorithm for the prediction accuracy.

The train dataset is used to fit the machine learning model. The test dataset is used to evaluate the performance of the machine learning algorithm

Figure 4: Splitting the train and test data

3) Extracting the features on the train and test data

The purpose of feature extraction is to reduce the number of features in the dataset by creating new features from the existing dataset. The new set of features can be used to summarize the original set of features in the dataset. For the chatbot development, the paper shows the use of Count vectorizer.

Figure 5: Feature extraction

The count vectorizer is a tool provided by scikit-learns library in python. The text is transformed into a vector on the basis of the frequency of the words in out data, the intent used to train the classifier. The count vectorizer creates a matrix in which each unique word is represented by columns of matrix. The words are not stored as strings but are given a particular index value.

4) Selecting the algorithm

In machine learning context classification is used as a supervised learning algorithm. In supervised learning the data provided to the network is labelled consisting of the important features of the dataset. The model learns from the data using he labels to understand the important part of the data which are separated into distinct categories. The task can be achieved using different classification algorithms like Decision trees, Naïve Bayes, Gradient Boosting, SVM (support vector machine)

5) Naïve Bayes and Multinomial NB

The intent classification for the chatbot is trained on the model built using Naïve Bayes and Multinomial Naïve Bayes classification.

Intent Classifier: It takes input from the user, interprets its meaning, and then relates it to that intent which is supported by the chatbot.

Entity Extractor: It extracts the critical information from the query of a user

6) Fitting the train data set with model

The dataset consisting of the intent of the user and corresponding answers is made, each question and the response given to the user is labelled. The label relates the question to the answer. There are multiple questions in the dataset that have the same response.

The classifier is trained using the fit() method by passing in the training vectors and labels. The input is collected from the user using the chatbot at the backend and converted into a vector with the help of the vectorizer. The model understands the intent and get predictions of the label from the classifier.

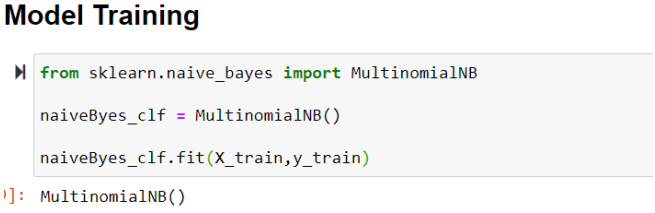


Figure 5: Model training

7) Chatbot Framework

UI creation for chat icon

The theme CSS file is created for the UI which defines the overall look and feel of the UI. The UI is developed using html and JavaScript files to render the bot icon in the web browser.

The chatbot application framework is created by exposing this UI code as a flask API in python to interact with the backend of the bot where, the ML model is included. The ML model for the functioning of the bot is configured in config.js file of UI project named simple_bot_api.

The chatbot includes the functionality of logging the chat conversations of the user and includes the code to push the necessary information into SQL database. The ML model is configured in chatbot_api project by deserializing the pickled ML model using pickle library in python.

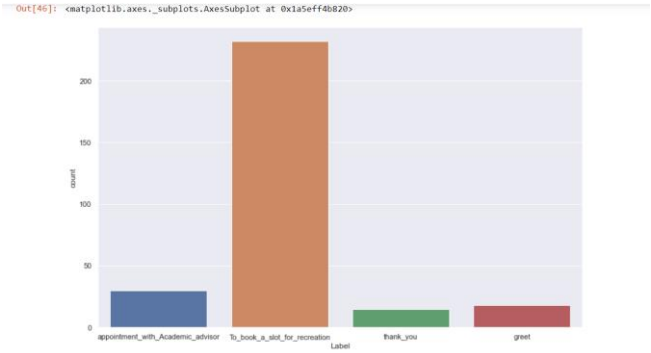
Workflow of the Chatbot

Figure 6: Workflow of the chatbot model

V. Evaluation and Results:

1) Dataset Statistics

Exploratory data analysis approach is used to analyse the datasets and the class distributions. The results analyse below summarize the class distribution in the dataset.



2) Evaluation matrix using accuracy metric and confusion matrix

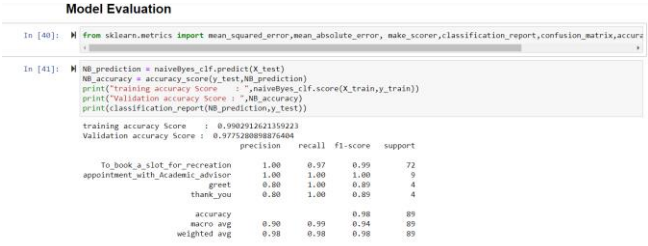


Figure 7: Confusion Matrix

The model evaluation is performed to check the accuracy of the trained model on the test dataset. The accuracy achieved is 99.03 %. The classifier is able classify the intent of the user with 99% accuracy.

3) Deserialization of the built model

The serialization of ML model is performed using pickle library from python.

```
In [28]: import pickle
         pickle.dump(vectorizer, open('vectorizer.sav', 'wb'))

In [27]: pickle.dump(naiveByes_clf, open('chat_bot_final.sav', 'wb'))
```

Figure 8: Pickle library for serialization

4) Working Chatbot

The chatbot greets the user when the user logs into the web browser with a greeting message. “Hi, I can help you to book a slot for recreational activities and to schedule a meeting with academic advisor.

The chatbot understand the intent of the user depending on the intent whether the user wants to book a slot for recreational activities or if the user wants to book an appointment with the academic advisor. Based on the intent of the user the chatbot will respond to the user with the message asking the details pertaining to time and date for booking the respective slot.

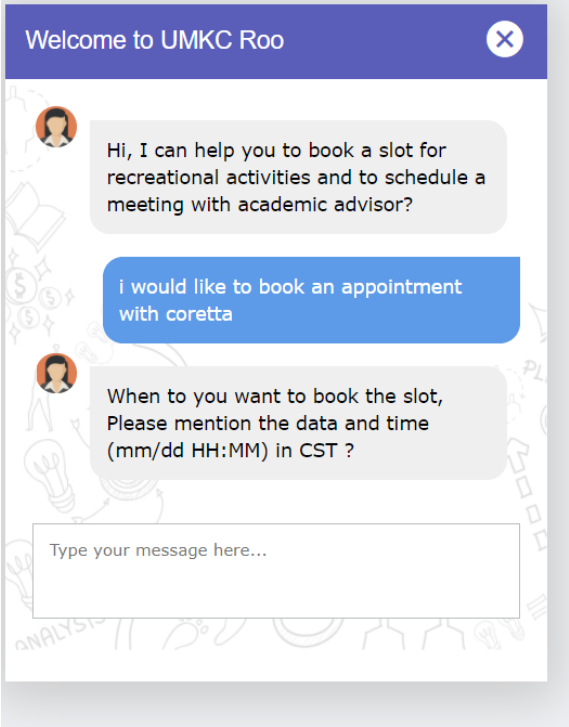


Figure 9: Working chatbot model

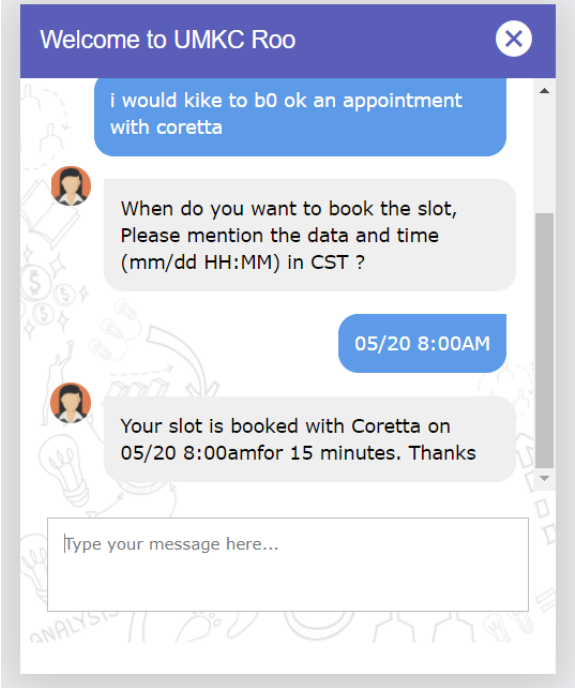


Figure 10: Chatbot responding to queries

CONCLUSION

It has multiple uses, and below, we explain the use case to show how helpful the appointment booking chatbot can be for the university. The chatbot uses AI and Natural language processing technology to understand the sentence structure, which in this use case are the questions the student will ask the chatbot. The chatbot processes that information and progressively gets better at answering the questions. The intent created by the data scientists includes various combinations of questions that the students will be asking the chatbot. It can be booking an appointment with the academic advisor or booking slots for recreational activities fed to the model at the backend. The chatbot understands the intent of the user, it delivers the answer based on the existing data.

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