Chatbot User Interface for Customer Relationship Management using NLP models

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2021 International Conference on Artificial Intelligence and Machine Vision (AIMV) | 978-1-6654-4211-4/21/$31.00 ©2021 IEEE | DOI: 10.1109/AIMV53313.2021.9670914

***Abstract*—NLP is the most researched field. Speech-to-text conversions, fake-news detection, and text summarization are the hot topics of NLP. ChatBot User Interface(UI) using NLP, allows machines to understand customers better. The aim was to use different NLP and machine learning techniques and to add ChatBot UI to guide customers or clients through the CRM software and help them whenever they get stuck. Different approaches, libraries, and algorithms like 'RASA', python's 'Chatterbot', 'Cosine similarity', and Google's embedder were used to train the model and then later compared to see which gave the best results. After that, during the deployment other 2 approaches were tried, one was fetching questions from the database and then training the model, the other was to maintain a local text document and train the model from that. The advantages and disadvantages of each approach, plus challenges and better methods for deployment is also discussed.**

Keywords—NLP, RASA, Chatterbot, Cosine Similarity, Embedder google, CRM

I. INTRODUCTION

In today's market, understanding customers is really important, NLP and machine learning are making significant progress in this challenging field and it is the most researched field as well. NLP can definitely make significant contributions to AI. AI is yet to reach the state of complete automation and human-like thinking ability. So, we use this AI and machine learning algorithms in software to make our life simple. The simplicity of using the software trumps the software which is more complex to use and has multiple functionality. CRM (Customer Relationship Management) software is always in high demand. Every big company relies on this software and saving time is essential to increase productivity as well as the decreasing amount of human errors. Deploying ChatBot UI to this type of software can be challenging as well. We already know about Chat Bots in different food delivery apps, different taxi apps as well. ChatBots can be seen on some service-based companies websites as well. Assisting people in the right way is important, rather than spending money on having several customer care people, companies are now taking the ChatBot approach to save a significant amount of money. Even a customer care person might make a mistake while guiding a person and there could be repercussion as well, but the trained models based bots will always give you the proper solution. In this study, the main idea was to see which of Chatbot techniques, Rule-based, Retrieval based, or Generative model-based gives better accuracy. The diagram for the same is shown in fig 1. In an ideal world, this machine learning model would give 100% accuracy, but we still have not reached that state and we need a large amount of data to train on to achieve high accuracy. After training NLP models using LSTM, bag of words, TF-IDF algorithms, they usually capture the trend in one's sentences, and then the model can give correct predictions. Fake news detection, speech-to-text conversions, and summarization are current research fields in NLP. In this paper I took advantage of different frameworks and algorithms to use it in a more practical manner. I used RASA, Chatterbot module of python, cosine similarity between the text and training the model on embeddings from google's embedder. NLTK is the most used library for text processing in NLP. In [18], Kavitha B.R and Dr. Chethna discussed an interesting use case for chatbot in healthcare using Artificial Intelligence. They, took a standard NLP approach with n-grams, TF-IDF and Cosine Similarity. In [14], Jeevan, Aditya, Guarav wrote an interesting concept considering current COID-19 situation to keep people informed with the help of Chatbot, "DoctorBot" as mentioned in their work. Their work and introduction with the CRM software, motivated me to make a similar bot to help people using CRM as well.

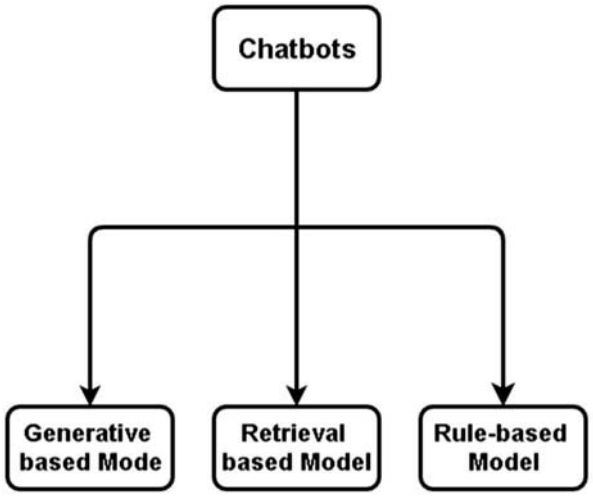

Fig 1.Types of Chatbots

II. METHODS

A. RASA Framework

RASA is a really good open source framework choice to build a mission-critical AI assistant. It is developed base on the latest conversational AI research in NLU and dialogue management. It is used to develop a really powerful industrial chatbots. Rasa chatbots can be scaled according to our needs. This framework was used to create a chatbot which was really powerful and was able to understand most conversation flows. We can also train the bot on your specific set of questions. The more smooth the training set Dialog flow is, the better results

RASA will give. Trained the model with datasets such as assisting them on how to use the software, showing specific person's tasks for a day, creating new task, creating leads and many more. This bot was giving exceptional results and was able to understand almost all tasks. After basic conversational features, The capability of further enabling the user to create a task simply by asking the bot and giving required information was also added. Which was made possible by adding actions with the intent of the training dataset.

As discussed in [2], pipeline for RASA is composed of several components, some using NLP SpaCy ,scikit-learn and sklearn-crfsuite. The pipeline is equal to following the full list of components and is refereeing to the documentation at https://nlu.rasa.ai.

```
pipeline:
- name: "nlp_spacy"
- name: "tokenizer_spacy"
- name: "intent_entity_featurizer_regex"
- name: "intent_featurizer_spacy"
- name: "ner_crf"
- name: "ner_synonyms"
- name: "intent_classifier_sklearn"
```

Fig 2. The list of components which are in "spacy_sklearn" pipeline

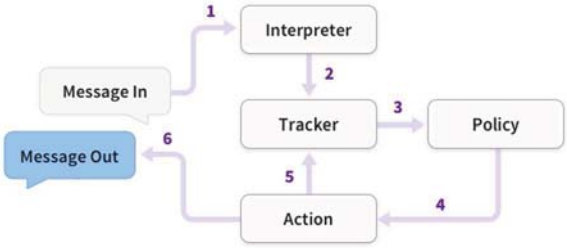

Fig 3. RASA NLU Architecture

With these components, RASA NLU analyses the message. 3 basic principles are,

1. Tokenization process
2. GloVe vectors
3. Conditional random field(CRF) to train sentence tokens and POS tags

B. *Chatterbot module*

Chatterbot is a special python module. The same way as RASA it is used to create a highly effective chatbot. It learns from the dialogue provided for training and upon giving it the same question, it randomly chooses the answer from the same. We create a training dataset and then we train the model for this different datasets. We can add multiple functionalities. For assisting, The author added some questions like, how to make a new task?, what are my tasks today?, How to create a lead?, How to see lead status etc.

Chatterbot has some inbuilt conversational dialog flow and training engine as well. The bots created using this library will also get trained automatically with the response it gets from the user as well.

C. *Cosine Similarity model*

In this model I used NLP techniques, first tokenizing the corpus, removing stop words, correcting any spelling mistakes, lemmatizing the corpus, vectoring the input and then applying Cosine Similarity between input and training set to find the best suitable output for the question. I tried experimenting both with cosine similarity and Euclidean distance as well. The reason cosine similarity works better with the textual data is that when we convert text to a vector in feature space, the distance between those vectors are not that meaningful. We also have to understand the context they are used for. Thus, Cosine similarity usually outperforms Euclidean distance for text classification problem, which is also evident in [22].

Cosine Similarity is a metric used to measure how similar are the two documents. It measures the cosine angle between the two vectors projected in a multi-dimensional space.

$$similarity(A,B) = \frac{A \cdot B}{\|A\| \times \|B\|} = \frac{\sum_{i=1}^{n} A_i \times B_i}{\sqrt{\sum_{i=1}^{n} A_i^2} \times \sqrt{\sum_{i=1}^{n} B_i^2}}$$

where, A.B is the dot product of the two vectors.

As from seen from the formula, Cosine similarity computes the distance between two vectors from dot product. In fig 4, example is shown that how Euclidean distance is taken into account on the basis of 3 documents. In this example, 2 examples of Dhoni's Wikipedia page, one small para and another big one is taken into account and another one is Sachin's Wikipedia page. As we can see in the fig 4, the distance between Dhoni's similar type document is much lesser than the distance between them and Sachin's.

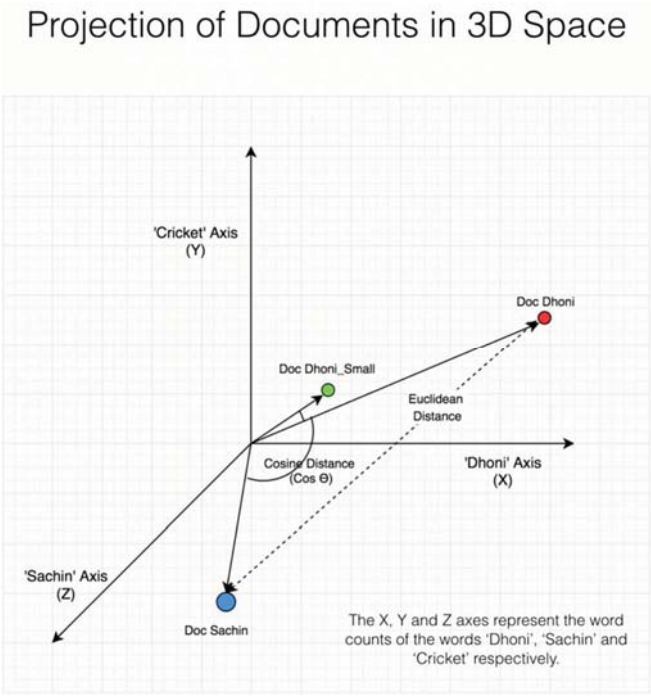

Fig 4. Cosine distance between different word vectors

Thus, we can identify questions nearest to our training set even though user's language for asking question is different. To improve the model even further we can train the vocabulary on Google's word embedding, which will give words similar in meaning almost identical vector. Thus when computing Cosine distances, even though the word is different from what was originally used in our question set, the difference between those words will be minimum. Thus we can give more accurate replies in our Chatbot UI.

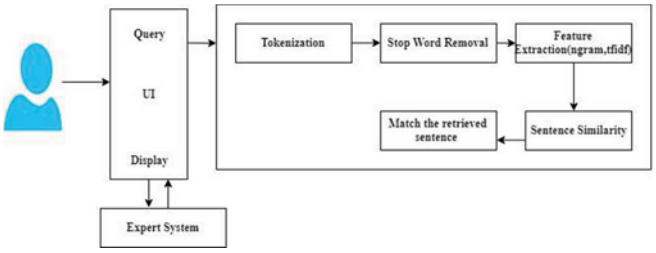

Fig 5. System Architecture for Cosine Similarity

III. Results

After experimenting with all the methods to create a Chatbot, all the bots showed different pros and cons. As one can select the bot required according to their needs. The bots did show high accuracy while asked certain CRM related questions. As for the case, when we want to answer customer queries we want to make sure that we are providing the right and accurate solution.

Methods	**Accuracy**	
	Identifying the question	***Giving proper answer***
RASA	99%	99%
Chatterbot	95%	92%
Cosine Similarity	96%	96%

Table 1. Results and accuracy of different models

I personally selected RASA and Cosine similarity chatbots to work further on with the UI. To create a UI, used flask framework to connect the Chatbot in python to the HTML and JavaScript code. Flask is a backend web framework for python. A simple code of HTML and JavaScript for testing purposes was written.

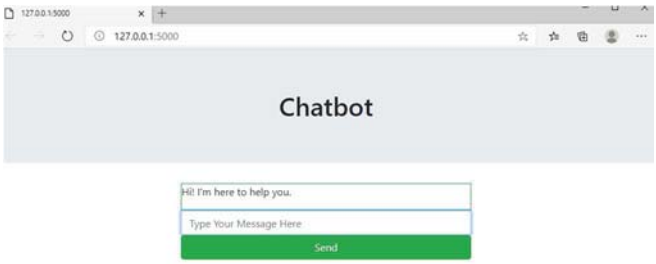

Fig 6. Chatbot UI

As shown in the Fig 6, on running the flask script, it will host the server on the local server and will show the window on the browser. We can now type the questions we want and the bot will guide us and will suggest the necessary steps as shown in Fig 7.

RASA and Cosine Similarity both method was able to understand what user meant by the questions. Chatterbot depends on the set of dialogues, so sometimes the reply the bot gave was not suitable for what user was asking.

We can deploy this bot on any software and further modify it according to our needs. Deploying Chatbots is always hard. Different companies like google's Dialogflow, Facebook, slack etc allows you to deploy custom made chatbots but in turn you can only use that bot in their environment and using it further for your enterprise would cost you a fortune. Creating chatbots from scratch is totally free and gives you the creative freedom. I tried deploying chatbots on all the platforms, of which Heroku was a really interesting and free platform.

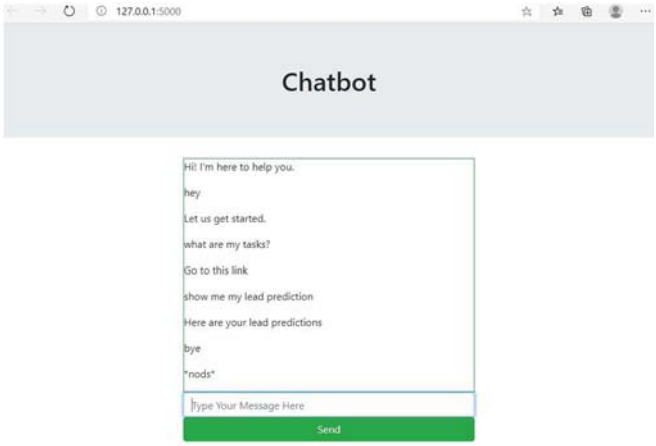

Fig 7. Chatbot answering the questions

So for those who want to deploy the bot online rather than on your local system or in software, this is a great option to try out with.

IV. Conclusion

After making Chatbots in different frameworks, I was able to understand the workings of NLU deeply and was able to modify the Chatbot greatly to use it in CRMs to help guide customers to use the software. Deploying the Chabot as effectively is also important. With the help of python's Flask web framework, The author was able to combine all the HTML, JavaScript and python parts and was able to deploy it. The bot gave answers to the question and was able to guide the users using CRM. Web-interface initially for users to ask their query was developed as a result of it. The application can certainly be improved by ensuring more security protocol layers with them. As integrating it with the CRM software, is our final aim.

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