IMPLEMENTING CHATBOT IN CUSTOMER SERVICE USING MACHINE LEARNING

Hi! I am 3OT

Making Shopping Simpler

Abhigyan Sen
School of Science and Technology, The Neotia University, Kolkata, India

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Abstract

Machines are working similar to humans because of advanced technological concepts. Nowadays it is the era of intelligent machine. With the advancement of artificial intelligent, machine learning and deep learning, machines have started to impersonate as human. Conversational software agents activated by natural language processing is known as chatbot, are an excellent example of such machine. Chatbots serve as a medium for the communication between human and machine.

While shopping, often people find it difficult to select a specific product after shortlisting because of other shortlisted products having similar specifications. Near about all products have lengthy brochures which tend to confuse the customer and they find it difficult to select their final product which sometimes also misleads the customer which results in purchasing not the best-suited product according to the consumer needs. In some cases, even the salesperson misleads the customers insisting them to buy a product that will benefit their inventory and financial needs.

In this paper, I have proposed the idea of using Chatbots to make shopping easier by providing the customer the minimalistic information about a product which also satisfies the needs of the customer without confusing them.

Chatbot 3OT is built using python as the backend language and natural language processing toolkit (nltk). It is capable in providing its users the minimal information they need from the corpus feed into it which is customizable according to the client needs.

Key Words: *Artificial Intelligence, Minimalistic Information, Chatbots. Machine Learning, Python, Natural Language Processing Tool.*

1. INTRODUCTION

Customer satisfaction with a company's services is often seen as the key to success and long-term competitiveness for a company. Customer communication has to be prompt whether for sales, marketing, or support. And if the business is not delivering smooth engagement, customers would definitely never stick with it. This is where AI-powered chatbots can make their presence felt as they can automate customer communication and augment the support in a big way. In fact, 35% of consumers want more companies to use chatbots to improve their communication strategy and deliver a better experience.

A bot is a software application that accomplishes computerized, robotic tasks and hence is used for work automation. A chatbot is a software that can converse with the users in natural language. For that purpose, it makes the use of artificial intelligence. Chatbots are simulations which can understand human language, process it and interact back with humans while performing tasks. The main aim of chatbot is to converse with humans and with the help of that it makes many redundant tasks easy for humans. Nowadays, chatbots are used in number of sectors. Some of the popular sectors are used, educational, e-commerce, gaming and are also becoming competitors for various cab booking systems.

Basically, Chatbots have two types:

VOICE BASED CHATBOTS: They are basically digital assistants that hear, perceive and respond to voice inputs. For example, Siri, Google and Alexa are voice assistants which reads voice input, analyse the task to be done and responds with relevant answers. These conversational interfaces understand natural language as they use NLP and NLU, and are trained to respond in natural language as well.

TEXT BASED CHATBOTS: These can interact and communicate only through text or messaging. This type of bot can be useful when programmed to accurately understand the customer's need and provide immediate outcomes or gather valuable feedback and ensure customers are engaged quickly.

Some more categories of Chatbots are:

RULE BASED CHATBOTS: The bot answers questions based on some rules upon which it is trained. The rules defined can be very simple to very complex.

SELF LEARNING CHATBOTS: The bot learns how to communicate using the result of a machine learning model to learn and assess current situation.

Chatbots which can reply through voice are becoming more popular due to the technologies like AI, ML etc. Chatbot provides an artificial service through which it can handle very difficult user queries of humans. Natural Language Processing (NLP) technology can understand all kinds of user requests along with their sentiments, and this widens the use chatbot.

Chatbots are not time bounded and hence can serve the user anytime. Chatbots provides efficient customer service and thus benefits to businesses and companies. Businesses also don't have to pay much if they use chatbots instead of employees to sell their products. Thus, chatbots thereby improves efficiency.

2. PROBLEM STATEMENT

During pandemic all shops and businesses are shut down and people are not allowed to step out of their houses except for basic needs. This pandemic lifestyle has deprived people from going out and shop due to which small shops and businesses are suffering a major loss.

The people who get bored and opt for a little shopping do not always get a good shopping experience. There can be many reasons behind this, some major reasons can be:

- Lack of sales executive in some shops as they cannot afford them
- Even if some businesses have a sales executive present, it is not that at all times the person will perceive and warmly treat the customer, some executives might not have the information of each and every product also keeping in mind the accuracy of the information.
- Some executives also indulge in malpractices by manipulating the customer and insisting them to buy a product which will be beneficial more to the business rather than the customer needs.

  Like selling a product which is present in their inventory for a long period of time as nobody purchased it or manipulating to buy an overpriced product so that the business gains more profit.

Near about all products have lengthy brochures which tend to confuse the customer and they find it difficult to select their final product which sometimes also misleads the customer which results in purchasing not the best-suited product according to the consumer needs.

2.1 BUISNESS ASSESMENT

The covid-19 pandemic and the lockdown has negatively affected nearly every business. Shops and organizations have been forced to shut down which has resulted in significant and rapid decrease in sales.

Appointing a sales executive can adversely affect a business by creating major impact on customer satisfaction and hospitality but only large businesses are stable enough to appoint a business executive, small businesses cannot afford to hire an executive. A Chatbot can fill this gap along with saving the business from multiple malpractices done by its employees hence improving the customer satisfaction along with saving the wages of hired employees.

This paper aims to provide businesses with useful insights from the available data and ways to generate more revenue.

Chatbots are quite advanced so not only they can solve the problems mentioned in the Problem Statement by a huge extent in addition for having some more advantages for the customer too like:

- 24/7 Availability - Customers do not wait for the next available operator when chatbots are part of the communication strategy on a round-the-clock basis.
- Instant Response - Chatbots can handle the queries of thousands of customers instantly as well as simultaneously and improve the average response time
- Consistency in Answers - The use of chatbots can help businesses maintain a great level of consistency in answers and improve customer experience with the brand.
- Personalization - Bots can ensure a touch of personalization by engaging customers with one-on-one conversations, and by being good at interactive communication.

3. TARGET SPECIFICATIONS

This service provides the client or the business owner with a Chatbot which acts as a virtual sales executive of the business who works without monthly wage hence increasing profit of the business along with boosting their sales up by solving the problems hence, preventing an economic crisis. Also, the information provided to the customer is very minimalistic instead of long brochures which saves time as well as does not put the customer in a state of dilemma.

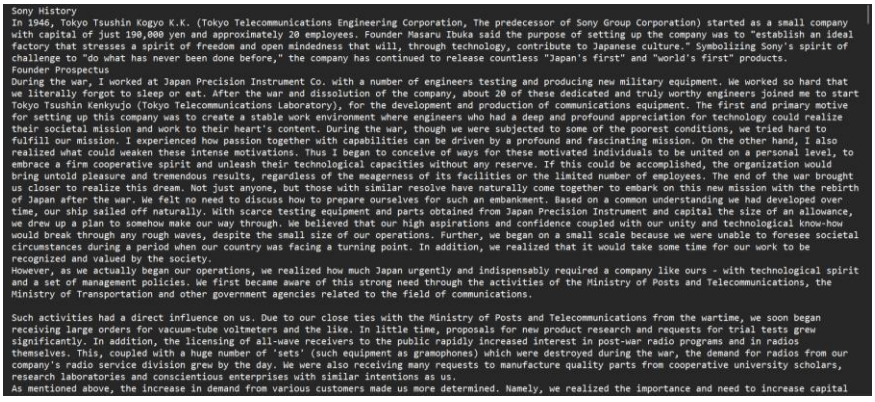
4. EXTERNAL SEARCH

The data used for testing the Chatbot is from Sony Electronics[1]. The brochures of various featured appliances of the company like televisions and home cinema[2], audio[3], cameras[4] and video cameras[5] are combined and put into a text file or corpus which is fed into the model. The corpus can be modified according to the client.

Following are some relevant papers used for comparing and developing the model for building the Chatbot:

- A survey on Different Algorithms used in Chatbot[6]
  Siddhi Pardeshi, Suyasha Ovha, Pranali Shinde, Manasi Bansode and Anandkumar Birajdar
  (Pimpri Chinchwad College of Engineering, Pune Maharashtra, India)
- A Survey on Chatbot Implementation in Customer Service Industry[7]
  Mohammad Nuruzzaman and Omar Khadeer Hussain
  (School of Business, University of New South Wales, Canberra ACT, Australia)

SMALL PEEP AT THE CORPUS


Sony History
In 1946, Tokyo Tsushin Kogyo K.K. (Tokyo Telecommunications Engineering Corporation, The predecessor of Sony Group Corporation) started as a small company with capital of just 190,000 yen and approximately 20 employees. Founder Masaru Ibuka said the purpose of setting up the company was to "establish an ideal factory that stresses a spirit of freedom and open mindedness that will, through technology, contribute to Japanese culture." Symbolizing Sony's spirit of challenge to "do what has never been done before," the company has continued to release countless "Japan's first" and "world's first" products.
Founder Prospectus
During the war, I worked at Japan Precision Instrument Co. with a number of engineers testing and producing new military equipment. We worked so hard that we literally forgot to sleep or eat. After the war and dissolution of the company, about 20 of these dedicated and truly worthy engineers joined me to start Tokyo Tsushin Kenkyujo (Tokyo Telecommunications Laboratory), for the development and production of communications equipment. The first and primary motive for setting up this company was to create a stable work environment where engineers who had a deep and profound appreciation for technology could realize their societal mission and work to their heart's content. During the war, though we were subjected to some of the poorest conditions, we tried hard to fulfill our mission. I experienced how passion together with capabilities can be driven by a profound and fascinating mission. On the other hand, I also realized what could weaken these intense motivations. Thus I began to conceive of ways for these motivated individuals to be united on a personal level, to embrace a firm cooperative spirit and unleash their technological capacities without any reserve. If this could be accomplished, the organization would bring untold pleasure and tremendous results, regardless of the meagerness of its facilities or the limited number of employees. The end of the war brought us closer to realize this dream. Not just anyone, but those with similar resolve have naturally come together to embark on this new mission with the rebirth of Japan after the war. We felt no need to discuss how to prepare ourselves for such an embankment. Based on a common understanding we had developed over time, our ship sailed off naturally. With scarce testing equipment and parts obtained from Japan Precision Instrument and capital the size of an allowance, we drew up a plan to somehow make our way through. We believed that our high aspirations and confidence coupled with our unity and technological know-how would break through any rough waves, despite the small size of our operations. Further, we began on a small scale because we were unable to foresee societal circumstances during a period when our country was facing a turning point. In addition, we realized that it would take some time for our work to be recognized and valued by the society.
However, as we actually began our operations, we realized how much Japan urgently and indispensably required a company like ours - with technological spirit and a set of management policies. We first became aware of this strong need through the activities of the Ministry of Posts and Telecommunications, the Ministry of Transportation and other government agencies related to the field of communications.

Such activities had a direct influence on us. Due to our close ties with the Ministry of Posts and Telecommunications from the wartime, we soon began receiving large orders for vacuum-tube voltmeters and the like. In little time, proposals for new product research and requests for trial tests grew significantly. In addition, the licensing of all-wave receivers to the public rapidly increased interest in post-war radio programs and in radios themselves. This, coupled with a huge number of 'sets' (such equipment as gramophones) which were destroyed during the war, the demand for radios from our company's radio service division grew by the day. We were also receiving many requests to manufacture quality parts from cooperative university scholars, research laboratories and conscientious enterprises with similar intentions as us.
As mentioned above, the increase in demand from various customers made us more determined. Namely, we realized the importance and need to increase capital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Turn any sound into a truly immersive experience
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Sound from the screen, pictures and sound in harmony
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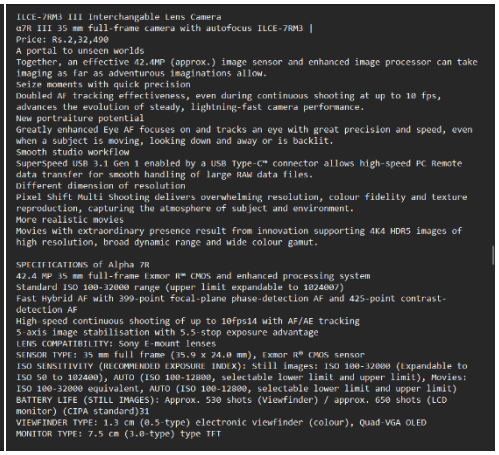
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Pixel Shift Multi Shooting delivers overwhelming resolution, colour fidelity and texture reproduction, capturing the atmosphere of subject and environment.
More realistic movies
Movies with extraordinary presence result from innovation supporting 4K4 HDR5 images of high resolution, broad dynamic range and wide colour gamut.

SPECIFICATIONS of Alpha 7R
42.4 MP 35 mm full-frame Exmor R™ CMOS and enhanced processing system
Standard ISO 100-32000 range (upper limit expandable to 102400)
Fast Hybrid AF with 399-point focal-plane phase-detection AF and 425-point contrast-detection AF
High speed continuous shooting of up to 10fps14 with AF/AE tracking
5-axis image stabilisation with 5.5-stop exposure advantage
LENS COMPATIBILITY: Sony E-mount lenses
SENSOR TYPE: 35 mm full frame (35.9 x 24.0 mm), Exmor R® CMOS sensor
ISO SENSITIVITY (RECOMMENDED EXPOSURE INDEX): Still images: ISO 100-32000 (Expandable to ISO 50 to 102400), AUTO (ISO 100-12800, selectable lower limit and upper limit), Movies: ISO 100-32000 equivalent, AUTO (ISO 100-12800, selectable lower limit and upper limit)
BATTERY LIFE (STILL IMAGES): Approx. 530 shots (Viewfinder) / approx. 650 shots (LCD monitor) (CIPA standard)31
VIEWFINDER TYPE: 1.3 cm (0.5-type) electronic viewfinder (colour), Quad-VGA OLED
MONITOR TYPE: 7.5 cm (3.0-type) type TFT

5. BENCHMARKING

The Chatbot (3DT) in this paper is made using Machine Learning and Natural Language Processing Toolkit (nltk) because it makes the bot capable of answering queries in natural language. Also, the corpus is highly customizable according to the client needs hence, making 3DT a good fit for every product-based business.

5.5 COMPARING OTHER CHATBOTS ALONG WITH 3DT

Chatbot	Technical Specification		Drawback
	Input / Output	Technique	
Eliza	Basic Pattern matching with templates to generate a response	Template based	No logical reasoning capabilities, inappropriate responses
Alice	Pattern matching to represent input and output	Recursive Technique	Grammatical analysis to structure sentences
Elizabeth	Command line script as Input rules, and output transformation rules to generate responses.	Iterative	Does not split input and combine the result
Mitsuku	AIML Category to route input from the user	NLP with heuristic patterns, supervised ML	Failed to provide dialogue components
Cleverbot	Matches keywords for input and response based on previous chat	Rule-based	Unpredictable responses without context
Chatfuel	Map input sentences to output	Rule-based	Inflexible conversation flows
Watson	Identify feature values to generate responses based on the score	Rule-based NLP, UIMA	Does not process structure data. No relational databases
LUIS	Identify valuable info. from user conversation	NLU with the prebuilt domain, Active learning	Required Azure subscription
Amazon Lex	Matches keywords for input and response	NLU, AWS Lambda	Not multilingual, mapping utterances & entities are very difficult
3DT	Matches keywords from Corpus to generate Output	NLP, ML	Voice input not supported. Might not give desired output every time and lacks the capability of self-learning

6. APPLICABLE PATENTS

Natural Language Processing System and Method US9152623B2 Issue 2012-11-02
Current Assignee: Samurai Labs Sp Z. [10]

7. APPLICABLE REGULATIONS

The patents mentioned above might claim the technology used if the algorithms are not developed and optimised individually and for requirements. Using a pre-existing model is off the table if it incurs a patent claim.

1. Must provide access to the 3rd party websites to audit and monitor the authenticity and behaviour of the service.
2. Enabling open-source, academic and research community to audit the Algorithms and research on the efficacy of the product.
3. Laws controlling data collection: Some websites might have a policy against collecting customer data in form of reviews and ratings.
4. Must be responsible with the scraped data: It is quintessential to protect the privacy and intention with which the data was extracted.

7.1 APPLICABLE CONSTRAINTS

1. The Chatbot needs a corpus to be fed into it manually, only after which it can generate the output by processing the corpus.
2. As the Bot doesn't do a web search for questions asked so, for materials not provided in the corpus it cannot generate output.
3. The bot though being trained to greet customers cannot recognise conversations in other languages.

8. BUISNESS OPPORTUNITY

1. Many entrepreneurs complain that sometimes customers are not satisfied with their marketing experience, this can make a negative impact on the business.
2. To overcome this problem, entrepreneurs hire professional salesmen and sales executives who will look after the customers resulting in improved customer satisfaction.
3. Though hiring professionals might boost up sales resulting in generating more revenue, but more employees will lead to increased expenses.
4. Here's where few business owners instead of hiring professionals will invest in building and developing an intelligent chatbot which will be at customer service round the clock without hefty monthly wages and can also be accessed remotely over the air.
5. Also, the pandemic has created a hype for online marketing and the number of people shopping online has increased massively. So, chatbots also give the business owners to step into the world of e-commerce.

9. CONCEPT GENERATION

This service requires the natural language processing tool of machine learning to be optimized scratch in order to suit our needs. Tweaking these for our use is less daunting than coding it up from scratch. A well-trained model can either be repurposed or built, but building a model with the resources and data we have is dilatory but possible. The customer might want to spend the least amount of time giving input data.

9.1 OVERVIEW OF VARIOUS ALGORITHMS USED IN BUILDING CHATBOTS

9.1.1 PATTERN MATCHING

Pattern matching was one of the most used algorithms in chatbots Pattern Matching Algorithm contains questions and answers stored into a database. Questions are named as patterns whereas answers are named as templates. The answer for the particular question consists of Artificial Intelligent Mark-up Language (AIML) tags. Patterns and templates are stored in the form of a tree. Questions are on the branches and answers are at the nodes so whenever the question is asked by the user first that question is searched for an answer word by word, then it fetches the particular answer from the node. This type of structure is used in the ALICE chatbots. The advantage of this algorithm is that user can easily get answer to the question as it's already store. And thus it is widely used because of its incomplexity. This algorithm stores only particular types of questions and thus if any question other than the stored is asked by the user it would not be able to give an answer. And thus, it lacks self-learning capability.

```
<aiml version="1.0.1" encoding="UTF-8">
  <category>
    <pattern>HELLO</pattern>
    <template>
        Well, hello!
    </template>
  </category>
  <category>
    <pattern>WHAT ARE YOU</pattern>
    <template>
        I'm a bot, silly!
    </template>
  </category>
</aiml>
```

Figure 2: AIML Structure[9]

9.1.2 NAIVE BAYES ALGORITHM

Naive Bayes is another efficient algorithm used for chatbot. In this algorithm the first step is tokenization and then stemming. In tokenization, the whole sentence is divided into words called tokens. Then each token is stemmed. For example, 'have a great day' is tokenized and stemmed as 'have', 'a', 'great', 'day'. Next step is to give training data. This data is stored in the form of list or dictionaries where dictionary has class and sentence as attributes. For example, for the above sentence class will be 'greeting'. Then the data is organized by making the list of words of each class. When input sentence is given, it checks for each word

and compares with all the tokens then it predicts which class has possibility of having the input sentence. There can be 2 or more predicted classes for each sentence given as input so score is also calculated for each class. Then from those 2 or more classes 1 with highest score is selected. In this way this algorithm works.

The advantage of this algorithm is that if there are predefined classes it becomes easy to predict. But in case if the data given as input does not belong to any predefined class it becomes impossible to predict the output sentence. Hence because of this disadvantage it has limited usage.

9.1.3 SEQUENCE IN SEQUENCE MODEL

In Sequence to Sequence Model (seq2seq) model the model takes input as sequence of words or sentences and then generates an output which is sequence of words. This is done with the help of recurrent neural network (RNN). Hence input to this model is token of words and the output of this model is the translated token of words. The seq2seq model takes the current word or input along with the neighbouring words while translating it into output.

The seq2seq model has an encoder and a decoder. This task is sequence based. The encoder and decoder uses RNNs, LSTMs to process. The hidden state vector in this model can be of any size but in most of the cases it is taken as a power of 2 and a large number like 256, 512, 1024 which may represent the complexity of the complete sequence as well as the domain.

The recurrent neural networks (RNNs) takes inputs from the current example they are fed and also some inputs from the representation of the previous input. Thus, the output of seq2seq model at time T is dependent on the current input as well as the previous input that is at time T-1. This serves as the reason for the better performance of seq2seq model in sequence related tasks. The sequential information which is collected is stored in a hidden state vector of the network and then it is used in the next instance of the sequence.

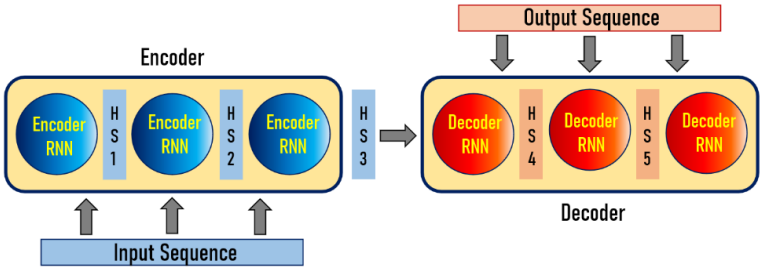
As seq2seq model mainly has two components namely Encoder and Decoder so this model is also called as the Encoder-Decoder Network.

ROLE OF ENCODER:

The main motive of the encoder is to capture the context of the input sequence in the form of a hidden state vector and then the encoder feeds it to the decoder which at the last produces the output sequence. The encoder converts the input words to corresponding hidden vectors by using deep neural network layers. The current word and the context of the word is represented by each vector. The Encoder takes the sequence of words as an input and generates a final embedding word at the end of the sequence with the help of RNNs. This final embedding sequence of words is then sent to the Decoder. The Decoder uses it to predict a sequence, and after every successful prediction, it uses the previous hidden state vector to predict the next instance of the sequence.

ROLE OF DECODER:

The input to decoder is the hidden vector which is generated and fed by Encoder. The decoder reverses the process of Encoder. It turns the hidden state vector fed by the encoder into an output sequence of words. It uses the previous output as the input context for doing this. It also uses its own hidden states and current word to predict the next word. This model's different applications can be seen in conversational models, image captioning, text summarization etc.



DRAWBACK OF SEQ2SEQ MODEL:

The output sequence of words in seq2seq model depends entirely on the context defined by the hidden state vector in the terminating output of the encoder. This brings difficulties for the seq2seq model to process long sentences which consist of long sequence of words. In such cases there is a strong possibility that the beginning context gets vanished by the end of the sequence.

9.1.4 NATURAL LANGUAGE PROCESSING

Chatbot can answer users queries in natural language which is made possible by using an artificial intelligence term natural language processing or NLP. Natural language processing gives machine the ability to ingest the given input, break it down, extract it's meaning, determining appropriate action and answering user in their natural language. Natural language processing (NLP) has two subsets Natural language understanding (NLU) and natural language generation (NLG). NLU takes unstructured data as input and convert it into structured data so machine can understand and act upon it. NLU focuses on extracting the meaning from user input query. Natural language generation (NLG) simply converts the answer generated by chatbot in structured data to human understandable natural language. Natural language processing (NLP) does the process in 5 steps. The unstructured data is first passed for lexical analysis. The structure of words is analysed and identified. The whole input text is divided into tokens. Then the tokens are passed to syntax analysis where tokens are analysed for grammar and arranged in a way in which relationship among the word is easy to understood. Then the input is passed to semantic analysis. The meaning of words or tokens is extracted in this step. Object in task domain and mapping syntactic structure are responsible for meaning extraction from input. Next step is discourse integration where the meaning of sentence is tried to extracted using the previous sentence meaning. Final step is pragmatic analysis. In this analysis, the main emphasis is on what was said is reinterpreted on what does it actually meant. After all this steps the meaning of sentence is known to machine and it finds answer to user query and passes it to Natural language generation (NLG) for generation of final output. Natural language processing (NLP) is used in many chatbot for effective communication with humans. Below figure 1 shows Basic working of chatbot using Natural language processing (NLP).

Figure 1: Understanding Language[8]

9.2 SELECTING APPROACH

Out of all the tools and algorithms briefed above Natural Language Processing is the best suited for any product-based business because the corpus can be customized according to the products listed by the business and hence responds according to results fetched from the corpus making the need to fetch results from web irrelevant.

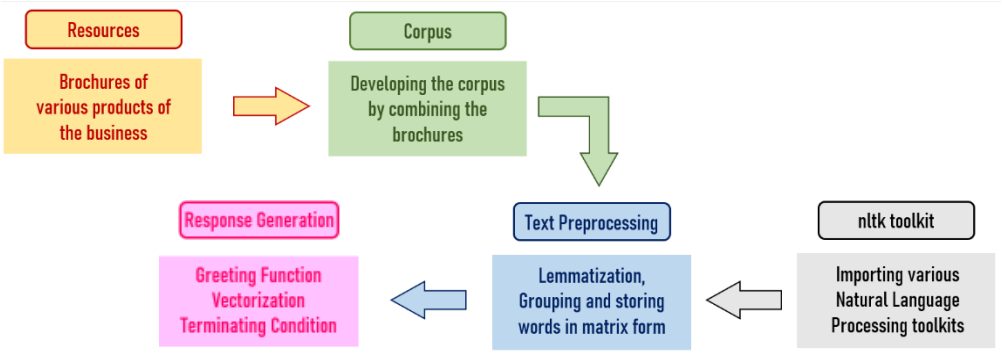
And so 30T uses python as the back-end language and nltk tools to make it up to the client needs.

IMPLEMENTATION: The 30T

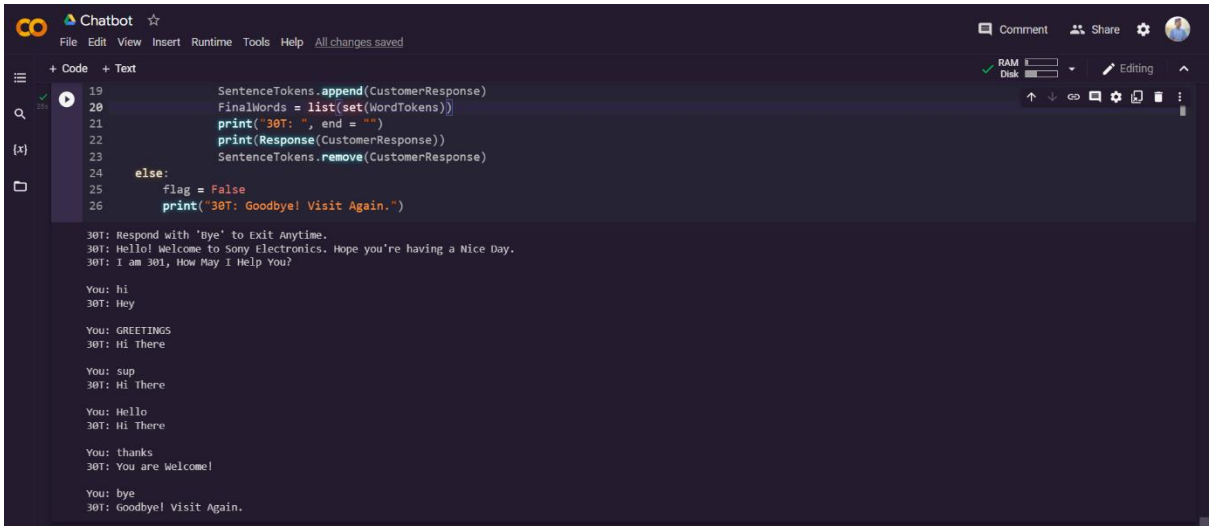
10. CONCEPT DEVELOPMENT

The concept is developed using Python as a Backend Language and using Machine Learning Algorithms along with Natural Language Processing Toolkit for building and developing 30T. The corpus has to be generated according to the needs of the client by choosing the products and services offered by the business which has to be later combined and finally fed into the corpus.

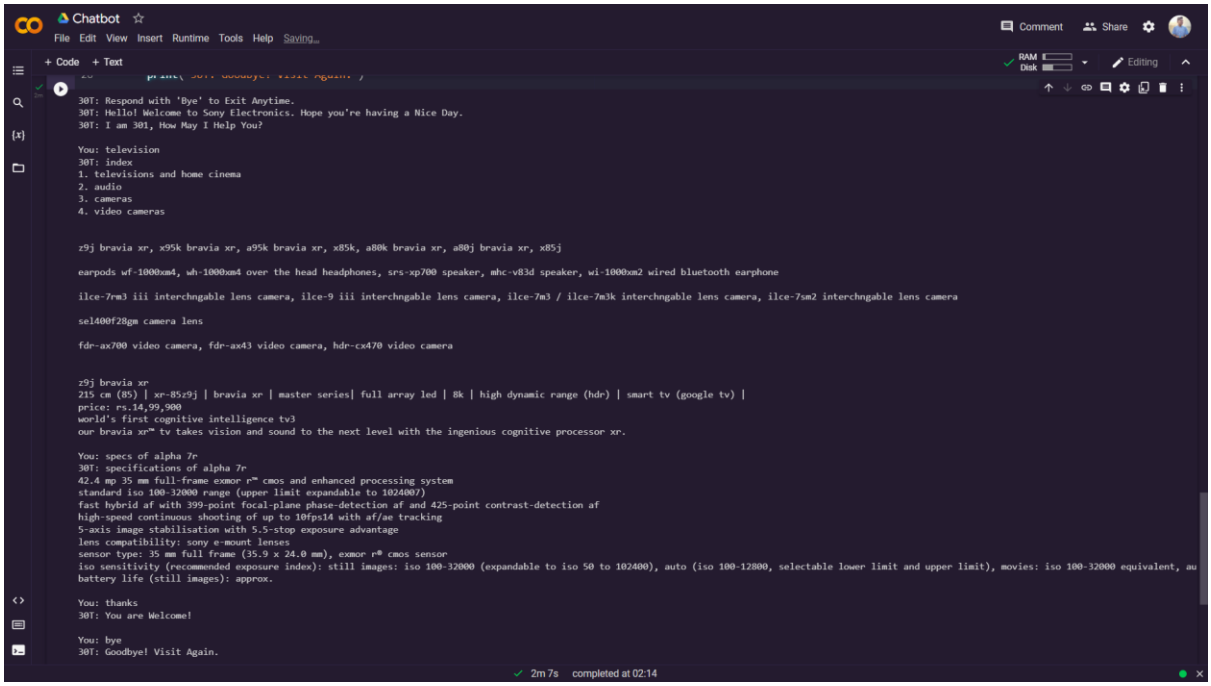
To make interaction with 30T more like a human it is capable of greeting the customers the moment they start chatting with 30T and before the end of conversation.



GREETING FUNCTION



RESPONSES



11. FINAL REPORT PROTOTYPE

The product takes the following functions to perfect and provide a good result.

BACK-END

Model Development: This must be done before releasing the service. A lot of manual unsupervised machine learning must be performed to optimize the automated tasks.

1. Performing EDA to realize the errors and checking malfunctioning of under certain inputs.
2. Optimization of the corpus must be done to minimize unwanted or irrelevant output.

FRONT-END

1. Different user interface: The user must be given many options to choose form in terms of parameters. This can only be optimized after a lot of testing and analysis all the edge cases.
2. Feedback system: A valuable feedback system must be developed to understand the customer's needs that have not been met. This will help us train the models constantly.

12. PRODUCT DETAILS

An interactive chatbot that takes inputs from the customer regarding a product and the customer will be returned the minimalistic information.

13. CONCLUSION

There are many businesses large and small, some have the capability to hire a sales executive while others don't. Its not always true that a sales executive will be beneficial for the growth of a business, some executives are very dedicated to their work who treat customers as the almighty while others just do it as a job or simply to have a source of income. Also after the pandemic people prefer to shop more from home, but sales executives rarely do product briefing remotely. Here's when '𝟯𝗗𝗜' comes into effect, a chatbot available round the clock everytime and everywhere at customer's service, providing its users the minimal information they require instead of throwing long brochures along a warm greetings to its users so that they feel as if they are conversating with a human.

14. REFERENCES

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