

A Chatbot for Exploratory Data Analysis (EDA)

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Abstract—A chatbot is an intelligently software- based application based upon AI to start an online communication either with text or text-to-speech so that these can provide an environment of direct contact with a live agent at your own place. A chatbot is introduced which makes use of voice assistance to perform some basic exploratory data analysis (EDA) on datasets. In this paper, we have given the proposed methodology which can be used to implement a very basic model of this chatbot. The last part covers some future works needed to make this suitable for industrial use. This paper demonstrates proper use of chatbots in today's world along with the brief description of their features in day-to-day lifestyle. This paper along with the analysis gives us an idea that how world is changing and how we are adopting new modern gadgets to make life easier and automate with the special power of Artificial Intelligence.

Index Terms—Chatbot, Natural Language Processing, EDA, Voice Assistance.

I. INTRODUCTION

In today's world [1] where everything is automated, if someone want a direct communication with a live human agent, a chatbot is there which gives an online medium to replicate using simple text or text-to-speech source. Chatbots are mainly build to accurately show responses in a same way as human would behave as a communicating medium, although some of them are still in testing phase and no one among them can pass the traditional test called Turing Test. The first inventor of chatbot (Verbot) [21], Michael Mauldin come with the term called "Chatterbot" to elaborate these communicating sources in 1994.

In terms of communicating systems, chatbots are used for variety of reasons, including user support, routing requests of users and knowledge gathering. Although some of them may use classification of words, verbal communication process along with advanced features of ML and AI [29], [30], [31], [32], others simply go for simple word catching techniques and come up with the result using basic words from a dataset or library. The maximum among these chatbots gather measure records from window popups or online assistants. Commerce, health, e-commerce through chat, news, entertainment etc. are mainly the categories through which they can be distinguished. Section I of this document describes the literature review of several

papers describing chatbots and various exploratory data analysis methods. Section II describes the proposed methodology to create the chatbot. Section III contains the results and a discussion on recording the results. Section IV gives the results obtained. Finally, Section V and VI give the analysis and conclusions derived.

We are living in the 21st century which is the age of automation and, in various sectors such as agriculture, banking, the rise of AI is already well known in the form of various chatbots. These AI- powered bots can sense human behavior and their conversations so that they start interacting with customers according to their individual needs. They can easily interact with consumers, advise them in the right direction and answer queries. As a result, they can help overcome the workload of advisors and decrease the manpower by solving their client needs just by interacting with them at any place.

Implementing chatbot-like technologies brings a broad range of benefits as advisors now neglect basic tasks and start focusing on more complex queries [26]. This reduces both costs and time. Although, consumers can find solutions faster now, boosting satisfaction. Finally, many advisory teams can use these bots to produce leads. Overall, the user experience is smoother now and life becomes easier in various organizations if they start the use of these chatbots.

Chatbots are not new to the world. These are natural processing units which can sense user's language, analyze it, and revert consumers using automated techniques of Artificial Intelligence. In daily life, a chatbot can be used as a virtual support assistant which can communicate with clients as a human being and solve every query. The inventor of chatbot was Joseph and he named them as Eliza in 1966. All this started when Alan Turing created writing

called "Computer Machinery associated Intelligence" using a mind-changing idea known as "Can a machine ever use a living being?". This thinking changes the mindset of everyone and brings new era for chatbots [27].

These advancements have taken us to an era where communicating medium via bots have become more natural and as easy as other humans. In digital world, everyone has their own chatbots with special functionalities to impress their users and give them soothing experience by solving their problems. As per the records of Gartner, these bots on an average will be providing 85% of user experienced interactive services by 2020. Although, 80% among the business models are thinking to have this type of automated bots by the year 2020. We on the practical basis can make so many chatbots at a time, but there is no guarantee that all will be fully functioning because each chatbot have different datasets working behind it, so main task is not to develop a chatbot, is to firmly analyze the dataset entries and then prepare it according to analyzing data records [28].

Many consumers of today are always on the lookout for the best user experiences, so sometimes it seems an impossible task to fulfill all the evolving demands. Then there is one solution to satisfy the modern consumer, and that is a chatbot. With the help of this chatbot, one can easily offer high-quality support and conflict problems any time of the day, and for large variety of consumers also.

Chatbots are essential to understand changes in digital consumers by providing digital services and by solving many routine queries that are frequently asked by the customers. Bots are useful in certain ways when client service requests are specified in the main area and highly predictable, managing a large population of similar

requests, automated responses in business. We can assign automated bots for the business and industrial purposes so that every problem can have fast solution and if some have complex queries then they can refer a live agent which can analyze the problem and provide best user experience solution for that problem at any time and in any place [2,29] [2].

Chatbots are beneficial for every type of industrial use. There are so many ways to update communication medium between customer and company. One effective method (both in terms of cost and facts) for any business to grow and improve their user service experience is by using chatbots. Recently, these bots are adapted by various business models and have had many proven many successful records.

There are 2 types of chatbots one is transactional chatbot which is designed to provide consumer with a variety of fixed choices. A user can select an option that is up to what they want to or problem they want to solve. Once an option got selected, chatbots help them according by giving more options and choices till the whole problem get solved. This type of bot is good for businesses such as hotel, delivery services and for banks also.

On the other hand, the other one is conversational chatbot, which is beneficial and designed to respond to a conversation in natural like human-like behavior. It uses AI and NLP like features to behave like a live agent for solving complex problems. These types of designs are built by EDA (Exploratory Data Analysis).

Chatbots are solving a complex technical problem now a days and creating a machinery environment that can certainly mimic human conversations and depicts their intelligent minds. In real life, this is a version of so-called Turing test, which checks whether a computer or any other

machine has the ability to display human behavior and intelligence, while building bots that frequently come in the way to moving the Turing test, innovators can create better user and personalized experiences for a vital range of diverse business models [30]. Chatbots have diverse levels of functionalities, called stateless and stateful. These stateless bots take over every communicating source just like as they are communicating with a new one. On another side, stateful bots can check for previous history of interactions and revert new responses in that situation of problem. To add a bot in the sales model requires less coding. Many service providing companies help developing team to make communicational user-friendly UI for third-party business companies. The main aspect of this implementation is selecting the right engine of NLP. Some of the business models must decide whether should they opt a structured or unstructured type of communications because [31] use chatbots made for structured are fully script-based, which predicts programming but start restricting what users can ask in future.

II. LITERATURE REVIEW

In paper [3] the concept and development of an automated voice catching chatbot are presented. The technical demonstration is provided in the study to analyze proposed framework for handling such a web service called chatbot. Then a black box concept is utilized, this web-based service helps various varieties of users to communicate with the main server from any type of platform by regulating the interactive model through web-service. This service got easily access using created user-friendly interface that allows for smooth processing of XML, and flexibility extends the lifespan of web-service.

The web-service based bot deliver personalized user results aligned to

intended character using an artificial brain. Queries that the bot does not understand are given to another expert system which are outside for further processing. There are solely restricted data regarding the impact of chatbots at the individual, group, and social group levels. So, in paper [4] a research agenda is suggested for chatbot research in the form of future directions and difficulties. This paper [4] brings together years of discussion on chatbot research in the CONVERSATIONS workshop series. They explore future directions inside six topics of interest, following a thoughtful analysis method among workshop participants: Users and their suggestions, User expertise and their style, Frameworks, User Platforms, Chatbots used for collaboration and connecting people, Democratizing chatbots, Ethics, and User Privacy.

A. Exploratory Data Analysis

Experts use EDA to study and gather important information from datasets and analyze their end-results according to the requirements using data visualization technologies.[5,32] [5] It helps experts in depicting a way to get better results that they need, creating it so easy for them to search out some useful pattern among data, assume possibilities and check hypotheses. This technology help to gather assumptions of future predictions in graphical way so that there are less chances of error and delicacy between the data. EDA is generally used to investigate what data might reveal beyond the formal modeling or hypothesis testing task, and it helps to comprehend data set variables and their interactions.it would conjointly assist you in determining whether or not the applied mathematics techniques {square measure} considering for knowledge analysis are appropriate. EDA techniques [5], which were first

established in the 1970s by American mathematician John Tukey, are still commonly employed in the data discovery process today. EDA is an approach to investigate and analysis of data sets to showcase their main characteristics along with their properties. Some often use different visualization techniques to discover patterns, check anomalies, given assumptions, or test a hypothesis through summarizing facts and by representing on graphs.

EDA goes beyond the modeling or facts to give more insight into the data set by analyzing the structure model, and in checking influential datatypes and variables. It can also be used in selecting the most appropriate and exact data analysis approach for a given project. Some useful knowledge, such as the creation of some ranked list of exact factors to be used as major guidelines, can also be obtained by EDA.

EDA techniques are either graphical or non-graphical types of techniques. While graphical approach involves gathering the data in a visual way and in quantitative method that is non- graphical method, involves calculating and summarizing the facts and statistics on daily basis.

Exploratory data analysis refers to the approach of getting more information about the data in prior so that preparation for the modeling process should become easy. EDA is an art where everyone gets to play around with the different data so that chances of duplication become less and try to get insights before any prediction. Many people understand machine learning revolves around models and algorithms. But for these types of models where accuracy is at main risk, EDA is important at that point in time. EDA gives a lot of useful data that is very easy to miss, data that helps that analysis in the long run.

III. TYPES OF EXPLORATORY DATA ANALYSIS

A. Univariate non-graphical

When the data start analyzing, get only one type of variable used, this is the very simple and easiest form of analyzing the data. The relationship between different variable doesn't play an important role as there is a single variable present. The main prospective of this analysis is to categorize the data and check for patterns between them. This is a very simple form of data analysis among all the other techniques. This type of technique involves data is being analyzed just considering a single variable. The main use of this technique is to describe what type of data present and how to deal with it. [6]

B. Univariate graphical

The different types of methods that are not pictorial don't get user clarity about the facts. This type of method gives the full analysis of data. The three main types of analysis under this method are histogram, leaf and stem plot, and box plots. This histogram checks the value range among the total count of cases present. As a result, graphical methods are required. The new type called Stem and leaf plots, which depicts all values of data along with the different forms of distribution, which are a common style of univariate graphics. This another type called box plots are have their graphical importance in EDA.

C. Multivariate non-graphical

This multivariate data is full of varieties of variables present. These technique uses tabular formation along with statistics to gather the relation between varieties of factors in the dataset. This method generally depicts the relationships among multi- ple data variables through cross-tabulation or facts.

D. Multivariate graphical

Graphics representation provides the relation between two or more sets of data in this formation. A bar plot is the most widely used along with group representation of level-by-level structure of one variable and each bar are inside the group depicts the level of variety of variables.

Other common types of multi-variety of graphic techniques include:

Graphical plotting is widely used to show how many variables are dependent on each other by plotting a scattering graph on vertical and horizontal axis so that reliability of variables can be predicted.

The type of graphical representation which depicts relation between multi variables is called multivariate chart.

The data line that displayed over graph is known as run chart.

The several circles (bubbles) that are widely displayed in 2-dimesional graph are a type of data visualization chart called bubble chart.

The graphical representation where values are color- enciphered are called heat chart.

E. Neural Intents Library

Any task-oriented conversational system must include Intent Detection. The system must utilize its intent detector to classify the user's utterance (supplied in an exceeding form of natural language) into one amongst several predetermined classifications, or intents, so as to grasp the user's present aim. However, because it's difficult to gather enough examples for novel intents, the performance of intent detection has been hampered by data scarcity. In recent years, there has been lots of dialogue about a way to properly discern user intents in few-shot learning.

This is a replacement library released on March 10, 2021 (version 0.0.3). It does all the functions required by us and is extremely easy to use. This library is employed to create easy interfaces and chatbots.

F. Natural language processing in chat bot

NLP combines linguistics which is the main rule-based modeling of human language with intelligent and AI-based algorithms such as statistical, machine learning, deep learning- based algorithms.

Chatbots use Natural Language Processing for a variety of reasons which are as follows:

Intent recognition - Natural Language Processing analyses complete sentences by understanding the means of grammatical errors and plenty of different aspects that human language will have [1]. This NLP procedure cuts down the whole sentence to an easier formation so that different factors related to speech recognition can fulfil.

Recognition of an entity - Analyses the sentence and identifies the nouns that square measure folks, location, names, company names, etc. It's in addition known as entity identification or entity extraction or entity unitization.

Tense and verbs - The chatbots analyze grammatical tenses and verbs so that there are less chances of error in speech recognition.

Expansion & Transfer of Vocabulary - NLP allows bots to instantly go for new synonyms and uses ML to extend chatbot vocab so that conjointly transfer of vocabulary between bots goes on.

3. Proposed Methodology

In this paper, we will be introducing an application that is capable of doing some

basic exploratory data analysis (EDA) on the dataset specified by the user. We use the Neural Intents library in order to get this project working.

G. Input to the chat bot

Input to this chatbot is the query in the formation of voice note provided by the user. The client can create his own to-do list and append to it. He can also select the dataset for EDA and perform some basic functions on this dataset e.g., view head and tail of this dataset, get the null value count of all columns, and get the information about the dataset.

H. Creating JSON file for intents

This file contains the tags, patterns, and responses. The pattern contains all the doable things that a user will say. The tag indicates the cluster these messages belong to. With this information, we'll train a neural network to require a sentence of words and classify it united of the tags in our file. Then we will merely take a response from those teams and show that to the user.

Example of a json intent object:

```
{  
  "tag": "greeting",  
  "patterns": ["Hey", "hello", "What's  
up?", "How is it going?", "Hi", "Good day"],  
  "responses": ["Hello Sir!", "Hello, What can I  
do for you?"]  
}
```

I. Creating functions for EDA

Functions are written using popular libraries of python which are used for exploratory data analysis e.g., NumPy, Pandas, Matplotlib, and Seaborn. These functions are then mapped to tags that were created for identifying the intents of the user. The function for plotting the graph is

modified as the user should have the flexibility to choose columns of his choice for the plot.

The first step in EDA is to inspect missing values, find patterns according to the missing values and make a decision about how to deal with them. Another step is to make functions for data visualization by using box plot, stem, and plot methods so that our bot behaves and gathers information like the human brain to visualize perfect patterns. The next step is to make functions for changing datatypes so that no data type and unique variable should be missed and at last data should be unique as well.

We can plot different types of graphs for our dataset using various Python libraries like matplotlib, seaborn for interfaces of that graph, boxplot, scatter plot and water distribution curves. By plotting different graphs, we can check for how many unique tuples are there in our dataset, we can analyze the error rate by water distribution plotting. By plotting the graph, the chance of getting the unique values will be increased and there are less chances of error in the dataset. That's why, while implementing EDA for our dataset this is an important technique to use[33-38].

IV. RESULTS

This bot answers following queries related to EDA after reading the dataset chosen by the user:

```
df.head(),      df.tail(),      df.summary  
      ,df.info()  
,df.describe()etc.
```

In addition to the above commands, the virtual assistant is also able to do a few other tasks that include adding items to a to-do list, converting dictated notes to the text and exporting these notes to text files, etc. The virtual assistant can understand

commands with decent accuracy and produce the desired outputs.

These bots are used in various fields for different usage consists of services for users, routing requests for users, or capturing useful data. Although some among them use extensive classification methods, NLP, and automated AI or ML techniques, others simply run and check for normal keywords, tenses and vocab and generate results according to the phrases present in dataset or library.

This chatbot has NLP capabilities to understand and communicate the context of complex and multi-lingual conversations. It can also define the intentions of consumers asking the question and replying according to their needs. For a smooth experience, it converses seamlessly through different digital sources and maintains data and meaning. If required, even pass the data on to a live agent to get the best results.

During some conversations, the chatbot can feel consumer personality behaviors and understand the motion and tone to deliver a personalized experience, or where required, transfer to a live agent for more appropriate results. Without any human help, the chatbot can execute complex reasoning with the help of facts.

These types of chatbots prove to be very useful in different models of the industry. With the help of these analytics, business models can analyze how well the bot performs in terms of getting big deals and successful outcomes and also detailed insights on how people interact with their business schemes and ideas and what they are asking in different scenarios. Apart from all these use cases, these bots are flexible to use in different aspects and allow different business models to serve their users on any platform. It's quite easy to adapt and use them into existing IT infrastructure or model.

Customer engagement is the main need in the market to boost your sales and to keep this, these bots are the best tool for this. Many researchers suggest that businesses that are successfully engaged with their clients can increase client spending by approx. 20-40%. These chatbots are easy to use and user-friendly which in return increase customer engagement.

The perfect example of this would be getting reservations online on any platform. As soon as the client starts conversation with the bot and someone shows interest, the bot redirects the user to the new page related to the user's choice. This kind of quick and friendly experience gets the client happy. Further, due to the bots being programmed by nature, they sound more like a human and are friendly by nature, making the user experience more pleasant and healthy.

One of the best results of these chatbots is that they enhance any business and save time and money by solving basic problems. Only the complex ones that need human intelligence are directed to the executives on the support team. Chatbots for this very quickly resolve queries and automate data-based queries so that their staff can spend more time on complex ones, reducing manpower, operational costs significantly.

Chatbots for industrial use have been the boom. Over the past few years, customers and business models collectively jumped on board with this innovation. For clients, chatbots mean a faster source of replies for their queries, better user experience, easier sales flow, and more personal alliance with the company they purchase from. From an industry perspective, it helps in lowering manpower, costs, increasing conversion rates, boosting customer space with their trust, boosting sales growth, and generating new clients.

These type of chatbots are beneficial for medical purposes, travelling, hotel management systems, touring requirements, mini stations, metro stations, business deals, appointment centers, dental centers, schools, colleges etc.

V. CONCLUSION

The voice-controlled chat bot is capable of doing some basic EDA functions like reading the dataset of user's choice, giving insights on the null values, shape and also describes the dataset. The chat bot is capable of creating some pair plots which gives insights on small dimension datasets (Bivariate analysis). Furthermore, if the accent compatibility issues get resolved this chat bot is capable of doing some univariate analysis like probability distribution analysis, box plots etc. This application can be a great contribution for beginners to learn more about exploratory data analysis with easy code view integrations also.

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