

COVID19: INTELLIGENT CHATBOT AND FINANCIAL AID APPLICATION

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ABSTRACT

Covid19 has devastated all continents causing disasters not only on the health sector but also at social, economic, and at political levels. The world is still trying to eradicate the virus. One of the measures taken is to inform citizens about the virus in order to avoid contamination as much as possible. Several people lost their jobs, and found themselves without any income. The whole world is confined, and the poor can no longer endure this critical situation. Financial assistance is therefore necessary in order to reduce the impact. This paper aims to propose an intelligent financial support application that computes the eligibility for a citizen to get a support during the pandemic; and to explain steps for chatbot using DialogFlow. The training realized using a machine learning algorithm was chosen after making a comparison between some other algorithms. Gradient Boosting Classifier algorithm was the accurate and most efficient for the application. It is possible to train the system again using other data set to make any adaptive results or computations.

KEYWORDS

K-Neighbors Classifier, Gaussian Naïve Bayes Classifier, Decision Tree Classifier, Logistic Regression Classifier, Chatbot, DialogFlow

1. INTRODUCTION

Unfortunately, the difficult sanitarium circumstances of Covid19 have taken world by storm. Some applications such as chatbots have been a real help to inform citizens on the virus and its impact on human health as how to prevent the virus. Besides, it can inform on the diagnosis in case of contamination to make a quick visit to the nearest medical service. In addition, they were used to broadcast the real time contaminations, deaths, and covers numbers' fluctuations. It helps them to stay up to date to ease the fear and guide them to the right habits or actions. Most of them have a relatively simple backend that looks up information by walking through a "decision tree" based on the users' input. Furthermore, the developed chatbot in this paper ought to facilitate the visualization and the displaying of any kind of documents related to Covid19. This can undoubtedly answer the frequently asked questions about the virus. Chatbots are widely used on the Internet by several services to simulate a conversation by voice or text exchange. The decision-making system to ensure some aid to COVID-19 crisis should be able to process the financial supports' requests. The decision is based on people in need information. It may be an acceptance or a refusal.

This paper is organized as follows: After the introduction in section 1, the section 2 cites several works that carried the financial supports measurements taken by several countries during the Covid19 pandemic and an overview of several studies conducted on developing chatbots. After that, section 3 defines the financial aid application and the different algorithms used to generate the most accurate decision making system. Section 4 explains the steps to develop the chatbot using google API Dialogflow. The summary and possible future works are discussed in section 5.

2. RELATED WORKS

2.1 Financial Support During Covid19: Overview

In (Kim,et al.,2021) authors presented the aid set up by USA under the name of CARES act (Coronavirus Aid, Relief, and Economic Security) to help people who have lost their jobs they minimized the number of consultations in clinics, and reduced the number of confrontations between sick patients and the medical staff. They want to expand the field of telemedicine, as a substitute for face to face consultations. Moreover, in (Poliak,and al.,2018) there are some programs related to the COVID pandemic. The main ones are: Public Health and Social Services Emergency Fund: \$ 30 billion in grants dispersed to hospitals and physician practices, PPP and EIDL where small businesses can apply for loans. Authors in (Dennis, et al.,2020) examined the chaotic situation of American families and calculated whether they can continue to meet their typical monthly expenses with the cash assistance under the CARES act.

Many countries dealt with the crisis differently. In (Satiani, et al.,2020) authors showed the critical state of African countries in this pandemic. The large number of young Africans can be an advantage in order to minimize the harmful impact of the disease. Learning from previous pandemics and strengthening new partnerships were examples of measures taking by Africa. Authors in (Mehfooz, and al.,2021) presented the emergence of Covid19 and the EU's emergency response to this virus. The EU is committed to sourcing all necessary medical materials and promoting research into a potential vaccine or treatment. Authors in (Battineni, et al.,2021) gave an overview of the economic situation experienced by the world since the appearance of the virus in China in 2019. The government is obliged to offer financial assistance as an emergency for business and unemployed people.

2.2 Former Works on Chatbots During the Pandemic

Many works related to the development of chat bots during the pandemic was found in the literature. Some authors presented how they were developed, or made comparison studies between others existing in order to enhance their performance. There are others who sensed users' interests and opinions. They all have the objectives to support citizens, to guide them in preventing the contamination, to advise them in the nearest center for the Polymerase Chain Reaction known as PCR test, to fight hesitation to vaccines, and to inform them about the symptoms and treatments against the virus.

In order to recommend immediate measures when people are exposed to Covid19, some authors designed an intelligent chatbot for the diagnostic and providing the recommendations. Besides, a virtual assistant was presented to measure the infection severity and has the purpose to connect with registered doctors when symptoms become serious (Goniewicz, et al.,2020). Some chatbots have already been implemented in time of Covid19 such as LINE'S chatbot in Japan. It is the largest social communication application that counts 83 million active users. Based on its data collected over 431,106 individuals aged over 15 years until April 16, 2020 they noticed that hand washing and cough etiquette are quite widespread preventive actions, as about 90% of all age groups were practicing them (Mogaji,and al.2020). In (Höhn, et al.,2020) they focused on understanding how people respond to Covid19 screening chatbots. The test was conducted over 371 participants. They noticed that the chatbot's agent is less trustful than human as to make a correct diagnosis, to make the information private and specially answering users for their interest.

3. THE PROPOSED FINANCIAL AID APPLICATION

The application facilitates retrieving relevant information when requesting financial help. The user selects the request creation form in the menu. It is filled out; the information entered is processed by the automatic processing system. The treatment result is displayed and the user can see if his request for the financial aid has been accepted (Granted) or refused (Denied). In the case of acceptance, the user needs to attach the necessary supporting documents. On the other hand the administrator may validate the attached documents attached to the request. In the case there are missing or non-compliant documents the user is notified. He can display the list of pending requests. He can also consult the Pending requests and processes them. The proposed web application uses noSQL at the level of our database. The Fig.1 shows the Document Data Model used.

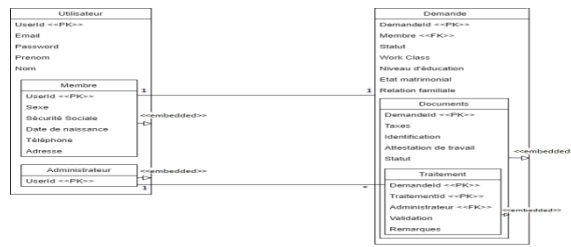


Figure 1. Document data Model

Three types of learning algorithms were applied for the training, instance-based algorithms, algorithms based on decision trees, and probabilistic algorithms, in addition to logistic regression specifically: K-neighbors classifier, Gaussian Naïve Bayes Classifier, KNN and Logistic regression Classifier algorithms. Table 1 presents a comparative table of the performances of each algorithm.

Table 1. Comparative table of algorithms used for the training

| | Algorithm | Training accuracy | Precision | Recall | F1-score |
|----------------|-------------------|-------------------|-----------|--------|----------|
| Denied | Logistic | 0.80 | 0.83 | 0.93 | 0.88 |
| Granted | Regression | | 0.64 | 0.38 | 0.48 |
| Denied | Gradient Boosting | 0.84 | 0.87 | 0.93 | 0.90 |
| Granted | Classifier | | 0.70 | 0.55 | 0.62 |
| Denied | K-neighbors | 0.82 | 0.87 | 0.90 | 0.88 |
| Granted | Classifier | | 0.62 | 0.56 | 0.59 |
| Denied | Gaussian Naïve | 0.79 | 0.89 | 0.82 | 0.86 |
| Granted | Bayes | | 0.54 | 0.69 | 0.60 |

In classification problem with unbalanced data, accuracy alone is not reliable in determining algorithm's performance for the dominant class that has high precision, the minority class has low precision. So the evaluation criteria used were f1-score, precision, and recall. F1-score represents the harmonic mean of the precision and recall value. The precision denotes the proportion of relevant data among all others offered. Whereas the recall is the proportion of relevant data proposed among all the other similar data. The type of algorithm that performs the best in this context is Gradient Boosting.

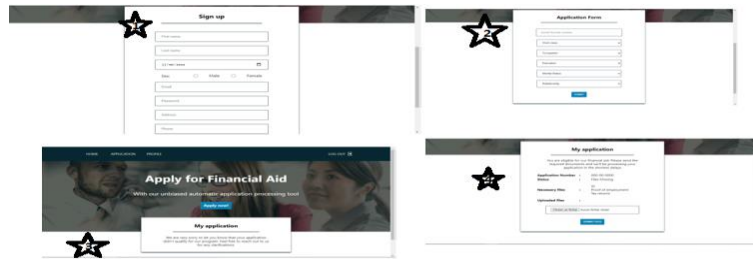


Figure 2. Some interfaces from the financial aid web application

After the training which is the process in the backend of the system. The interfaces of the application were developed to ease the use of citizens in need and to fill necessary information and documents for the financial support. There is a sign up before each request as it is shown in figure 2 first interface to the left. The form is to be filled as it is in the second interface to the top right of the figure 2. The status of the request is in interface 3. The fourth one of the figure 2 shows the answer in the case of an approved request, the member or the user is required to send supporting documents related to his request.

4. THE PROPOSED INTELLIGENT CHATBOT

The proposed chatbot is able to answer to users' questions related to Covid19. The user is able to visualize statistics of the contaminated, death and covered people from Covid19 worldwide relying on Google API. It is

the natural language understanding platform offered by Google that facilitates the design and the integration of conversational user's interface in mobile applications and web applications. It can analyze several types of input. This includes text or audio input. It can also respond to customers in different ways, DialogFlow will be linked with the Python and Flask backend. Moreover, the user may receive a report that explains the preventive measures. In addition to that, he has access to interact with the intelligent agent as a Help Desk to answer his specific questions, to send the recent news asked for, announcements, images, and videos related to Covid19. Furthermore, all discussions are saved in the MongoDB database for future text mining analysis. Besides, during the realization of the chat-bot it was taken into consideration the quick responding, the reliability to avoid bugs, and the ergonomics user interface.

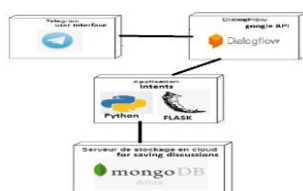


Figure 3. Deployment diagram of the chat-bot

The DialogFlow is an interface that uses Google's intelligence. Using its Cloud Natural Language API, it recognizes and understands sentences sent by users. Google look for the “intents” configured and takes the action in return programmed in the application. Intent is a messaging object that describes how to do something. It can be defined in one of two ways by providing the fulfillment for intent, or by requesting the fulfillment of intent by Google Assistant Intent is linked to one or more training phrases that were defined. It has contexts, training phrases, events, actions / parameters, and a response. Contexts represent the current state of the user's request. Their purpose is to allow the agent to transport information from intent to another. One context can be a context entry when it receives from the other intent if on the other hand it sends a message to another intent it is considered as an output context. By using combinations of the entry and the output contexts, users' conversations are controlled and saved in the dialog box. To make the connection with the data base, the creation of a cluster is necessary. The data base is configured by entering the Network address, and then it is possible to create the collections. That is made by copying the connection coordinates by clicking on connect and choosing the python language to connect the database to Python.

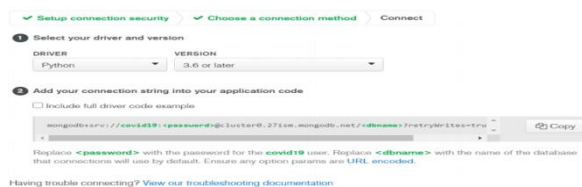


Figure 4. Establishing connexion in MangoDB

The application was deployed in Cloud Foundry. This allowed obtaining the URL link. This last was past into fulfillment web hook agent activation interface in dialog flow.

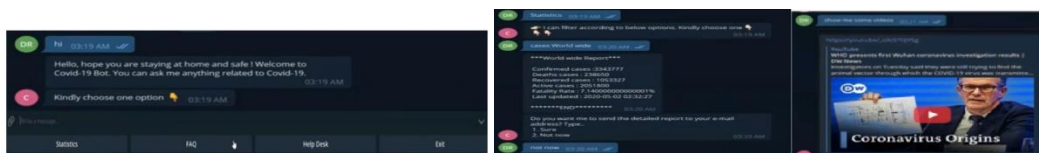


Figure 5. The interface of the chat bot integrated in telegram and answering questions and sending a video

5. DISCUSSION AND CONCLUSION

The financial aid application proposed integrates a decision making system based on data mining algorithms. The data used for the comparison of these algorithms were taken from an existent and public data set. Results might be better if the application is integrated for use and data gathered are processed as an entry to make training and reevaluating the chosen algorithm. As one of possible extension to this work is to experiment, after a certain period of the application's launching, reprocessing the comparisons for better results. However, including efficient classification algorithms in financial aid web applications is recommended for an accurate computation and right decision. A potential quality system evaluation of these applications can be considered as future work.

For the chatbot application, this paper explained in details the easy and the faithful way to create a chatbot using google API. It was developed to inform about Covid19 and it can also be used for other purposes and/or to communicate with citizens in other context. All conversations are saved in a data base for future analysis. Data text, the extraction of meaningful knowledge and finding a user pattern and/or understand the users' interests are possible to improve the chatbot. Both the proposed applications complement each other. They both serve the citizens and help them being well informed to be able to protect themselves and bring them the necessary formative or financial support. In addition, it should be noted that the applications have not been evaluated among citizens. In addition to the one described in this article, a new chat bot will be proposed and integrated into a learning management system as an extension of this work. The comparison process between both assists in determining the best methodology and type of bots. The effectiveness is measured in terms of the quality and time spent notifying students about new information and reminding them to take the next action in the learning platform.

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