

Genre classification of books from Project Gutenberg

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Abstract—With the advent of Mixed Reality systems, the need for an automated self learning virtual assistant system is inevitable. Today natural language understanding in such systems is not at a satisfactory level and comprehension of personal speech behavior is urgent. This provides a personalised experience to the user. Various problems associated with the same and their resolution under work have been described in this paper.

I. MOTIVATION AND PROBLEM STATEMENT

Classification of text has found to be of great advantage in today's world. From classification of movie reviews into positive or negative or categorisation of news articles into different topics, such classifications are very important for systematic categorisation of text for any organisation. For example, a telecom company can categorise the incoming queries into various topics such as complains, inquiries, requests etc. Furthermore, any of these topics, such as complains can be further categorised into complains related to bills or that to services. Hence, it becomes easy for the company to organise and work on the queries effectively.

This project deals with the task of categorisation of books belonging to 19th Century English Fiction into different genres. Learning from this project is highly applicable in real-world applications. For example, in an e-commerce website, the products are categorised into different categories and costumer can look for an item based on such categorisation. So, if a customer is interested in buying a novel of genre 'mystery', he can easily do so as the books have already been categorised into different genres.

One of the major concern in implementing a task of this kind is how to correlate the content of a text, here a book, to its genre. In this project we have tried to work on this issue. On the other hand, handling the data set to get the most relevant information is a task to be worked on as well.

II. DATA SET DETAILS

For the task at hand, we have a data set of 1079 books and 9 genres. As a part of data for the project we also have a .csv file with details of the books such as book name, book id, genre and author name. Since this file consists of entries on 996 records, we have considered only 996 books as our data set. In the .csv file, the book ids with format similar to pg10067 has an html file in the following format : pg10067-content.html. Hence the task also includes mapping the data from the .csv file to the corresponding html document.

Virtual Assistants not able to recognise the human's native speech creates a hindrance in the day to day activities of the user. The system often misunderstand the speech as it is not able to recognise the dialect of the user. Also, as there is no capability in the system to continuously understand the flow of the users commands, it is often required to repeat the activation keyword for each command. For example, if a user wants to ask the system to turn off the light and turn on the fan, she needs to repeat similar commands in order to achieve this. This is cumbersome and a problem in daily life. Virtual assistants are meant to provide ease in day to day mundane jobs. But if the usage of these systems are difficult, user might not opt to use it. Today we have virtual assistant but they are not very widely used.

Today, the usage of virtual assistants are limited to setting an alarm or playing music and other mundane tasks. To have these systems do complicated tasks at home, it needs to be more connected with the user and know more about the user. This will require the system to know the daily mannerisms of the user and her day to day tasks. Only then, the system can make changes or execute a task if ordered to do so.

The system needs to perform complex tasks for the user and provide real time output. For the complex tasks the system should have access to user data and user's possessions such as electronic devices. This can be used in the field of medicine and engineering in a very efficient way. In medicine, surgeries can be performed in a very interactive way. For instance, a surgeon can see real time data of the patient such as live health reports and can monitor the patient without fiddling with physical reports. The virtual assistant can take control of the instruments and perform precise cuts on surgeon's orders. This will allow the operation to be more organised and under control of the surgeon.

III. ISSUES RELATED TO THE PROBLEM

There are multiple issues related to the problem at hand. Some of them include recognition of fillers, comprehension of sentences with speech defects and passive listening. Below is a schematic diagram illustrating the same.

In real world, people often use fillers while speaking and the system needs to identify this in order to comprehend the user effectively. Also, one of the major issues is comprehension of commands by a user with speech defects. Stammering is an example of a speech defect and a competent system must be able to handle such situations. Also, the virtual assistants

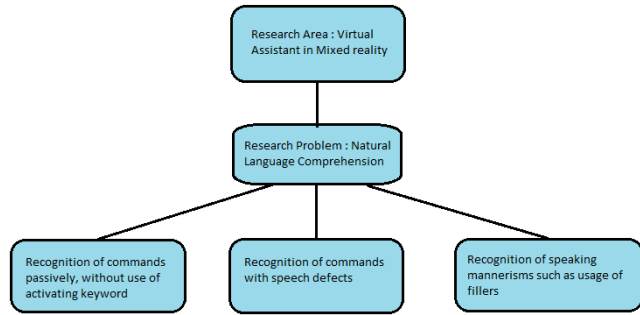


Fig. 1. Problem of Interest and Related Issues

today are active listeners, i.e. they need an activating command to start listening. To make virtual assistants comfortable to be used, they should have passive listening capabilities.

The problem of training the system to understand the personalised behaviour of the user is an arduous task. It will require a data set of large volume accumulated from people of different parts of the world. The data will be used to train the system and test it for accuracy. The more the data, the better the model will be built and the system will be more robust. Also, the system will need to be trained for better response to the user queries.

Another issue with the system can be active listening to user and connectivity to the internet without a downtime. The experience of using the system will degrade if there is a downtime. The experience of using the system will degrade if there is a downtime and if the system is not able to respond to user's queries.

Another issue related to this is making a self learning model to train the system to learn the user's behaviour and find patterns in her day to day tasks. The better the model learns the more personalised its behaviour will be for the user. This training will be after the usage of the system by the user and will be different for each user. The system will also need to know more about the user, her work, her routine and her experiences to make itself more usable. User training will be an essential part of this to make it more personalised. The dialect training will be a crucial task as each individual has a different way of speaking and the system should be able to recognise the same.

Privacy is another issue associated with the system. As mentioned above, the system will need to learn the user patterns and day to day activities and it raises a concern for data privacy. The data fetched from the user will range from the personal details to the house hold devices. This is because the system will need access to all the devices to control it remotely. The user data can be very sensitive and should not be publicised. The system need to encrypt the data against any kind of malware and hacks. Hence, the system needs to be made robustly, in order for it to gain popularity. The safely of

users is of prime importance today when data theft is a major concern. The connectivity to internet poses more problems and security is needed at network level as well. Making the system secure is very important and special attention needs to be made for this.

Recognition and comprehension of people with speech defects is also very important. It will be a novel move in the direction of natural language processing. People with speech defects such as stammering and lisping issues should also be able to use the system. The system should be able to be trained to recognise such defects and understand the meaning of the spoken words with fillers and breaks.

IV. NEED FOR THE PROBLEM TO BE ADDRESSED

The problem is needed to be addressed as in this ever changing world, user experience is a priority for any tech enthusiast. Today, the virtual assistants act more like robots than humans and the more the personalised experience users get, the more the system is used. In terms of sales, it is seen that a more user friendly device has an upper hand at the one with is less usable. In smart phones as well, user friendliness is vital to have better sales. The easier the features of the device are the popular it is among the masses. Usability is an important factor when it comes to popularity.

Virtual assistants today are limited to small smart devices and smart phones. They are usable enough for small daily jobs like playing music but are not ready enough to operate on complex jobs. With the advent of IoT technology, virtual assistants can be omnipresent. The devices with virtual assistants can be more intuitive and understanding to the user's needs and position. They can suggest the user with options to execute a task. For example, a system can lower the temperature of the room in a summer day without the user specifically asking for it. This will make it more functional than the virtual assistants we have today. In continuation with the example given, the system should be able to learn the preferences of the user with regards to temperature during night and day of the room. This will allow the user to have automated system with more personalised functions. In order to make the device make more automated, certain privileges must be given to it such as access over internet, data and things. It can be connected to various devices in order to form a network of devices. This will be essential for the user in order to have control over all the devices.

The problem related to data privacy will be a major concern for the consumers and the system will be trained based on the user behaviour and private information. The data fetched by the system needs to be kept safe and encrypted. The system will fetch the personal data of the user and the data from the devices used by the user privacy needs to be maintained in order to keep the data safe. With an increase in the number of data thefts, this an important issue to deal with during the development of such systems. As mentioned earlier, a virtual assistant is programmed to store all the information of the user such as contacts, works details, personal information and information about the personal belongings. With the advent

of cloud storage, all this information is stored on the internet which makes it susceptible to theft and misuse. Various cases of such hacks have been reported in recent past and it is wise to develop a system which can encounter this. Virtual assistant typically have access to all the password-protected devices so that they can be used efficiently. Thus, these systems should be built very securely in order to be usable.

V. APPROACHES USED TO ADDRESS THE ISSUES

The issues described in above sections can be dealt in a systematic way. The problem with speech training can be resolved by training the system with a huge amount of data taken from individuals from different parts of the world. The authors of [2] deal with voice commands in mixed reality systems.

An ever connected network needs to be implemented in such a system which can not afford to have a downtime. For such a system, robust connectivity methods needs to be used, which are typically used in high end servers.

The virtual reality systems need to be converted into mixed reality systems as described in [1]. Today, the applications of virtual reality are widespread. These include in the areas of gaming, training and mental health. Various games have been developed and various simulations are currently being used in game parlours etc. Also, the virtual reality technology is being used in order to treat patients of different phobias. These applications can be converted into mixed reality applications. Not only, the conversion will make it easier for developers to work on similar applications but also, it will provide a wide variety of use to these devices.

Basic approaches must be used in understanding the mixed reality system so that products and applications can be developed for such devices. [3] is useful in understanding the fundamentals of the mixed reality systems. According to the paper there is no specific definition of mixed reality system available. The authors conducted interviews with experts of this field to get a general idea of mixed reality. According to the authors, there are seven dimensions to characterise mixed reality applications, number of environments, number of users, level of immersion, level of virtuality, degree of interaction, input and output. The authors aim to provide an understanding of mixed reality for research and not give a definite definition of mixed reality. Their contributions provide conceptual framework for organising different notions of mixed reality along the mentioned seven dimensions.

Using the above approaches some of the issues related to virtual assistants in mixed reality could be tackled.

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