A Speech Recognized Dynamic Word Cloud Visualization for Text Summarization

Kayal Padmanandam[1]*,Sai Priya V D S Bheri[1], LaxmiHarshika Vegesna[1], Kalakuntla Sruthi[1]

BVRIT Hyderabad College of Engineering for Women, Hyderabad India

kayalpaddu@gmail.com

Abstract—

A word cloud is a vivid graphic depiction of the words delimited in a section of text engendered by web-oriented tools and it is a straightforward and visually appealing visualization method for text. It has a versatile utility to provide an overview by fractionating text down to those words with higher frequency. Usually, a word cloud can be built by pure text summarization where monotonous data is turned into a stunning visualization format to highlight important textual content and immediately convey crucial information. It is easy to understand visual data rather than any form of data as they are informal to comprehend and memorize. Word clouds can be exercised to analyze data from social network websites and stream service platforms for identifying the trending updates. This approach is an effective technique used to solve text analysis tasks and evaluate it as a qualitative behavior. The input data may consist of articles and pronouns like 'a', 'the', 'and', 'he', etc which have to be ignored and the frequency of significant words should be considered to produce a word cloud. Depending on the frequency of the word, the size of the word will vary while producing a word cloud. In addition to the pre-existing static text word cloud, our method proposes an improvement for the dynamic data input from the user, with speech recognition enabled with guaranteed semantic coherence and spatial stability of the words analyzed. Our work is personified in an interactive visual study system that aids users to perform text analysis and derive insights from a huge collection of documents and voice commands.

Keywords—Word cloud, Dynamic word cloud, Text Summarization,Speech recognition, Text visualization, Semantic analysis.

I.   INTRODUCTION

Displaying information containing text data is a challenge but word clouds make it an amusing task. A Word Cloud also called a tag cloud [1] is a data visualization technique that emphasizes the important textual data based on the number of occurrences. Word cloud creates a meaningful visualization of the text to understand the high prominence of the words by displaying the frequency of text by scaling the size of the words to acme the rate of occurrence. Unstructured or unorganized data can be summarized by using a word cloud. It is a powerful tool for communication and text summarization as it can be used by the researcher for qualitative data analysis prediction. Other than research, it is widely used in business, journalism, social media analyst, for market trends predictions [2]. After the advent of internet technology, the applications of websites and blogs are innumerable. Word cloud plays a major role in enticing users based on the trending post and news displayed on the webpage.

The more recurrently a word appears on the webpage, the larger it is going to be displayed. The font magnitude is assigned to each word based on the rate of frequency it appears in the text [3]. It helps for content summarization of websites, documents, or any other text in a precise and striking way. It helps for the significance analysis of the document or webpage using various information exchange and estimation algorithms [4]. Word cloud has become a prevalent data visualization tool for text as it is naive, visually aesthetic, fun to use, and communicate results very expediently to users.

II.   LITERATURE REVIEW

Business Intelligence (BI) is a focused area for many researchers around the globe. Multiple analytical techniques are being applied in various domains such as retail, marketing, finance, and telecommunication for the data collection, wrangling, and storage to systems for business insight and solutions. C. S. Ishikiriyama, et.al in [5] described the word cloud's major role in business documents for integrating and querying in text mining. It can be used for document clustering and various document identification segments. Jung Hoon Baeg in [6] identified the vital topics of selected journals in the field of Information Science and Library Science by analyzing the frequency of words used in the journal. Bongshin Lee et al in [7] introduced SparkClouds, which integrates sparklines and tag cloud for trend analysis between multiple tag clouds. Trend analysis also incorporates the analysis of social media tags, tweets, etc. Chithra Harikumar in [8] discussed the importance of Search Engine Optimization that improves a website's rankings in SERP (Search Engine Results Page) with the usage of content relevance and the search terms.

A.   Word Cloud Applications

In business word cloud plays a major role in finding the customer's pain points from the feedback and it can be better recommended for business value. It can be further used to find the most popular corporate blog posts, conducting a quick survey for decision making, and harnessed ways to promote the business with advertisements. Other than business, people involved in creative writings and official writing can be benefitted using a word cloud to analyze the effectiveness of their written communication. For instance, playwriters,

authors, novelists can identify overused words and further improve their writing conducts[9], [10]. Word clouds are also used in sciences to educate and process information. The prime function of a word cloud is to give context about the imperative or predominant ideas, which is crucial for disseminating information, particularly in research sceneries [11].

III. OBJECTIVES OF THE PROPOSED SYSTEM

The proposed system aims to build an outright word cloud which is an appealing analytical application filled with fun and easy GUI to enable the user to use the application without any impediments. The proposed system can accept input in structured(text) and unstructured(speech) format. The unstructured data is recognized with a speech recognition algorithm and generated with dynamic text in the platform, later for which word cloud is constructed. Currently, there are many word cloud generators for the text analytical process, but the researches on unstructured text analysis is still a challenge. This work started with a motivation to riposte the challenges of unstructured data text summarization in the form of speech which can be extended for dynamic summarization of live-stream data in the future.

A. Methodology of the Proposed System

The proposed system is built using Python. It has two modules. Module 1 allows the user to upload any format structured text data into the system for which the word cloud is constructed using the word cloud generator library. Module 2 is divided into two submodules. Submodule 1 allows the user to type text in the dynamic mode for which the word cloud is built. Submodule 2, allows the user the option to speak as the system can recognize the user's speech using Google Speech API. The pyAudio which is a cross-platform audio I/O library to play and record audio is used for recording the user's speech. Later the recorded speech is converted to text using the speech recognition google speech API[12] which uses powerful neural network models for speech-to-text conversion and integrates with google cloud for storage purposes. Once the speech is recognized and converted to text, the word cloud generator library generates the word cloud and it can be saved as an image using the PIL library that enables image file manipulation and saving. All the modules are built on a GUI-based application using the Tkinter programming toolkit that provides various controls and components for GUI building. File upload widget is enabled for file selection and file dialog modules which provides classes and factory function for file selections and for ease GUI application.

B. System Description

Initially, the proposed system was designed to build a word cloud from an existing file. Later, it was leveled up to enable dynamic data input by the user. This dynamic input approach was augmented to enable vocal input as well. A user-centric GUI has been developed so that the user can easily understand and perform desired actions to construct a word cloud with

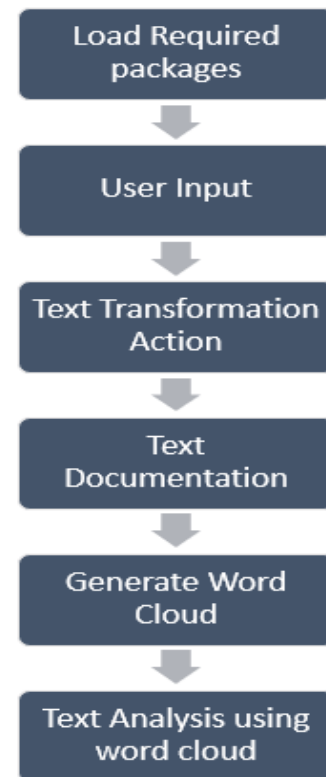various options of input as described in module 1 and module 2.

Figure 1. Process involved in the proposed word cloud

IV. MODULE DESCRIPTION

Module 1 In this module, file upload library was used to upload a pre-existing file by browsing from the desktop. Any file can be accessed from the file dialogue box, this is possible by Tkinter. filedialogue module delivers functions and classes for creating the file browser window. After selecting the file, this file will be encoded in "utf-8" format. Once after selection, we check if the text in the file contains stop words, punctuations. All the stop words are ignored for analysis and the frequency of remaining words is calculated. Based on the frequency, a word cloud is formed with the help of a word cloud library that returns an array that is converted into an image for display to the users.

Module 2 -This module works on the availability of various dynamic input options for the user. We have provided a better user input technique dynamically. This dynamic way of input can be given in a vocal format or text format in the widget as explained below.

A. Dynamic Word Cloud from user as Text Input- The dynamic input is retrieved by using the "("1.0", end-1c)" method to read from line one, character zero till the end of the text. Then the input is saved in a file with only the write "w" option. Any number of words can be typed in as input in the

text box space by the user, with copy and paste options. The validation is done for the text containing stop words and actual words. Based on the calculated frequency, a word cloud is formed with the help of a word cloud library which returns the output as an array that is converted into an image. The image is saved as a portable network graphic file with the help of the library matplotlib.savefig. The image is processed by imageTk.photoImage and output is displayed using Tkinter in the widget.

B. Dynamic Word Cloud from user as Speech Input-The vocal input retrieval starts by creating a recognizer instance and allocating the Microphone as a source to it. The Google speech API in python has been used to convert spoken data into text. This converted text data is written into the text widget so the user can see what he/she spoke. The converted text is then checked for stop words and articles. The frequency of the remaining words is analyzed and based on the word's frequency, the word cloud building is produced and displayed as explained in module 1.
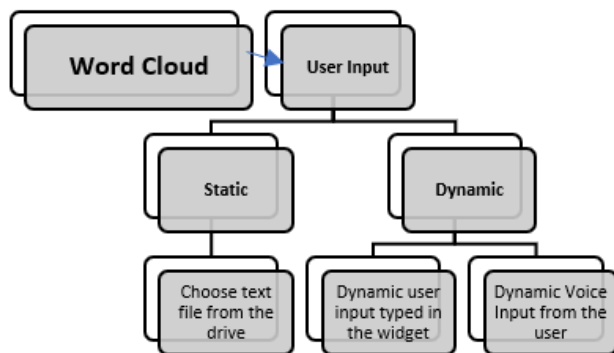
Figure 2. Detailed flowchart of the proposed word cloud

V. EXPERIMENTAL OUTPUTS

While testing against static input format, a pre-existing YouTube dataset has been considered which is from the YouTube channel of a singer. Dataset has been downloaded from the URL https://archive.ics.uci.edu/ml/machine-learning-databases/00380/. The most frequently used words were "subscribe", "like", "share", "I" etc. The file consisted of various comments on the videos of the singer. Another dataset was tested which contained information from the channel of a vlogger on YouTube. The file consisted of the description of the videos and the respective comments. Hence, the output consisted of frequent words which are "Travel", "like", "lifestyle", "fan", "please" etc. Data from a digital channel on YouTube was tested which consisted of the comments on its videos. The word cloud building consists of words such as "easy", "like", "pun", "furniture", "siblings", "best friends" etc. During the dynamic input format testing phase, the ".get("1.0",

end-1c)" method from the Tkinter library was used to retrieve the input from the text widget using "1.0" and "end-1c" format that reads the complete line. No restrictions for the length of user input have been given. During the testing phase of vocal input, PyAudio and Speech Recognition libraries were installed to recognize and convert vocal input to text. The word cloud building was formed based on this vocal input. This vocal input is restricted only to the English language. Figure 3(a,b,c) describes the various .csv format input file used for module 1 which has the rows as comment_ID, authors, date, content and class for text classification. These are the comments given by various viewers for a particular video. The column 'content' is the input text which will be analyzed for the word cloud building. Figure 4 shows the look and feel of the graphical user interface built for the proposed system. Figure 5 shows the word cloud built using module 1. The file chosen for this report is shown in Figure 3a. Figure 6 shows the word cloud built using module 2A, which shows the user typed text. Figure 7 shows the word cloud built using module 2B that displays the user spoken text in the widget.

(a)

(b)

COMMENT_ID	AUTHOR	DATE	CONTENT	CLASS
z13lgffb5w3ddx1ul22c	dharma pal	2015-05-2	Nice songï»¿	0
z123dbgb0mqjfxbtz22	Tiza Arellano	2015-05-2	I love song ï»¿	0
z12quxxp2vutflkxv04c	PrÃ¬Ã±Ã§eÅ›Å› Ã¸liÂ	2015-05-2	I love song ï»¿	0
z12icv3ysqvlwth2c23e	Eric Gonzalez	2015-05-2	860,000,000 lets make it first f	0
z133stly3kete3tly22pe	Analena LÃ³pez	2015-05-2	shakira is best for worldcupï»¿	0
z12myn4rltf4ejddv23n	jehoiada wellington	2015-05-2	The best world cup song ever!	0
z135vzqy1yrjhluew23l	Kara Cuthbertson	2015-05-2	I loveï»¿	0
z12uujnj2sifvzvav04ch	Sudheer Yadav	2015-05-2	SEE SOME MORE SONG OPEN (	1
z13lvh1qnma4d15sy23	Alex John	2015-05-2	Awesome ï»¿	0
z135hlk5grfwjhmym04	Nirab Valobasha	2015-05-2	I like shakira..ï»¿	0
z121cvvqftuvuz1ld22p	Chelsea Andrews	2015-05-2	Shakira - Waka Waka LO'	0
z12uf5gatnf1dflws04c	Kevin Sosa	2015-05-2	Why so many disliked??????!!	0
z13pihfbwlv5hv4ap04	OldSchool Music	2015-05-2	I don't think this song wil	0
z13utfk5rny3yzqtj22pl	Stephen Lister	2015-05-2	Love songï»¿	0
z13usjdoivinwzsoy04c	KarolÃ¬-na HlavatÃi	2015-05-2	wery goodï»¿	0
z12bhf4rzpjsvjmcw22g	DubCedSky	2015-05-2	Every time I hear this song, I tl	0
z132i1cj3t2cedajp04cf	akita hachiko	2015-05-2	Whose watching this in 2015. I	0
z12aw1ah2m2vh30tb2	Benjy Growls	2015-05-2	I love this song so much <3<	0
z12cydggrzyesrklw23q	monkey moments	2015-05-2	i love this song thumsb up to y	0
z12gddhblwz3cf3wc04	Dr.geetanjali sharma	2015-05-2	Waka best oneï»¿	0
z13xwz5p3xq4zxdyv04	Axy665	2015-05-2	5 years later i still love this sor	0
z135glg5fnnielbbd04c	celma ioao tomas an	2015-05-2	Likeï»¿	0

(c)

Figure 3(a,b,c). Various input file used for the word cloud building

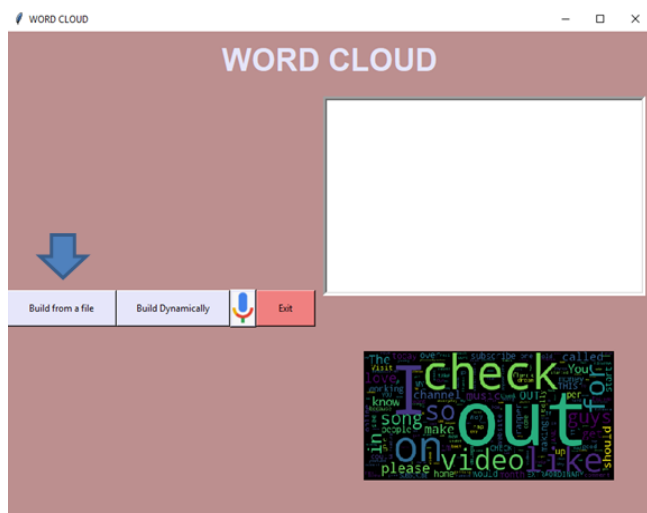Figure 6. Building Word cloud with module2 -dynamic text generation
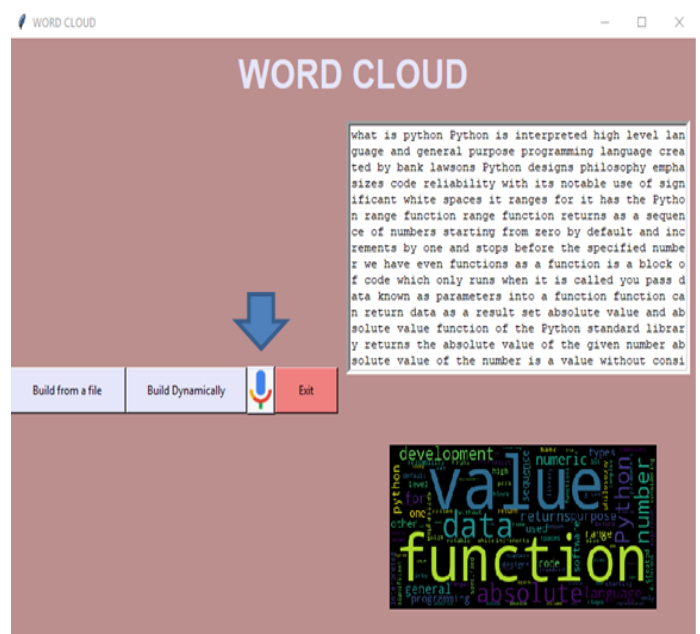

Figure 4. Ease GUI for Word cloud

Figure 7. Building Word cloud with module 2-speech recognition system. (Text generated from speech)

VI. CONCLUSION

Word clouds are fun to use as a visual aid with the main words focused. The larger, and bold words imply their significance while the smaller words imply that they are less used. The proposed system has clearly implemented the usage of the word cloud with various input options that enable the user to use it easily and effectively. The system has implemented the word cloud building with dynamic text inputs but restricted to the English language only. As a future enhancement, the work

Figure 5. Building Word cloud from a .csv file format.

will attempt to enhance the implementation model to read live social media data for text analysis and to analyze its pattern, and find the trending data updates from social media with multilingual support.

References

[1] W. Cui, Y. Wu, S. Liu, F. Wei, M. X. Zhou, and H. Qu, Context Preserving Dynamic Word Cloud Visualization. .

[2] "Text mining and word cloud fundamentals in R : 5 simple steps you should know - Easy Guides - Wiki - STHDA." http://www.sthda.com/english/wiki/text-mining-and-word-cloud-fundamentals-in-r-5-simple-steps-you-should-know#reasons-you-should-use-word-clouds-to-present-your-text-data (accessed Nov. 28, 2020).

[3] Y. Jin, "Development of Word Cloud Generator Software Based on Python," in Procedia Engineering, 2017, vol. 174, pp. 788–792, doi: 10.1016/j.proeng.2017.01.223.

[4] W. Cui et al., "Context-Preserving, Dynamic Word Cloud Visualization." Accessed: Nov. 11, 2020. [Online]. Available: www.flickr.com/.

[5] C. S. Ishikiriyama, D. Miro, and C. F. S. Gomes, "Text mining business intelligence: A small sample of what words can say," in Procedia Computer Science, 2015, vol. 55, pp. 261–267, doi: 10.1016/j.procs.2015.07.044.

[6] J. Hoon Baeg, "The Analysis of Journals Topics and Trend: Text Mining and Word Cloud," J. Assoc. Inf. Sci. Technol., doi: 10.9776/16578.

[7] B. Lee, N. H. Riche, A. K. Karlson, and S. Carpendale, "SparkClouds: Visualizing trends in tag clouds," IEEE Trans. Vis. Comput. Graph., vol. 16, no. 6, pp. 1182–1189, 2010, doi: 10.1109/TVCG.2010.194.

[8] C. Harikumar, "KEYWORD ANALYSIS:USING TEXT ANALYSIS FOR SEARCH ENGINE OPTIMIZATION." Accessed: Nov. 11, 2020. [Online]. Available: http://www.ijpam.eu

[9] Y. E. Wang, G.-Y. Wei, and D. Brooks, "Benchmarking TPU, GPU, and CPU Platforms for Deep Learning," 2019, [Online]. Available: http://arxiv.org/abs/1907.10701.

[10] "4 Creative Ways to Use Word Clouds to Better Your Business - DiSC Profiles." https://www.discprofiles.com/blog/2016/02/word-clouds/#.X7Yyf2gzbIU (accessed Nov. 19, 2020).

[11] "Exploring the idea of word clouds in modern medicine." https://www.medigroup.com/02-03-17-exploring-the-idea-of-word-clouds-in-modern-medicine.html (accessed Nov. 19, 2020).

[12] N. Anggraini, A. Kurniawan, K. Wardhani, and N. Hakiem, "Speech Recognition Application for the Speech Impaired using the Android-based Google Cloud Speech API," TELKOMNIKA, vol. 16, no. 6, pp. 2733–2739, Dec. 2018, doi: 10.12928/TELKOMNIKA.v16i6.9638.