



## An Empirical Study On Text Summarization Techniques By Integrating NLP With Machine And Deep Learning Techniques

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Article History	Abstract
Received: Revised: Accepted	From the past few decades, data storage in multiple sources is getting more attention. Due to either time constraints in the current scenario or busy life in the co-operate world irrespective of the age factor, people did attract towards reading the in short news to get acquainted with the national and international news especially in their regional languages. So, the proposed paper has conducted an empirical study on the regional language "Telugu," summarization that generates a brief note of huge texts stored in multiple databases. In the early days, text summarization does perform with traditional NLP approaches, with the advancement of Artificial Intelligence; it has spread its wings to the world of NLP also, to summarize the text smartly. Smart Text Summarization technique can reduce the time and work a lot for any human to understand the exact purpose of that document. However, the real complexity arises while developing such an abstract summary by choosing the required words or phrases that fit the whole document. Some kinds of texts also were used to find its sensitivity which is frequently used in social media texts, reviews, and e-commerce sites to know the exact view of the customer or the person.
CC License CC-BY-NC-SA 4.0	<b>Keywords:</b> In-shorts, Text Summarization, Abstractive, Extractive, NLP

### INTRODUCTION

Over the past years, we can witness a tremendous growth of text data across various sources and purposes. It is tedious for humans to go through the entire documents to find out the required information and note it down. It is better to develop a tool or a system that can analyze the whole document and retrieve a condensed form in relevant keywords with meaning precisely. It can also be termed as a summary or synopsis. Usually, a summary is a short briefing of the text or information contained in the document by representing its aspect and purpose. This condensed format helps in understanding the concepts from the document by using similar or exact phrases from the whole document providing relevant meaning.

As discussed, few enhanced learning techniques were already introduced to find the exact keywords that can fit the context. With the help of such tools, we can easily retrieve the keywords, most of which are derived by awarding them with a score. This score or ranking is usually given to a frequently repeated word or phrase either by over viewing it from the whole document or a particular sentence. The approach that awards score by sentence level is said to be a local keyword, and the phrase that was repeated for the entire document is said to be a global keyword. This technique also helps us find out the technical terms of the document, thereby hinting us about the purpose of the document. We also have other tools that condense the retrieved abstracted text into a single sentence. Some other tools can efficiently convert the textual words into some score using mathematical functions.

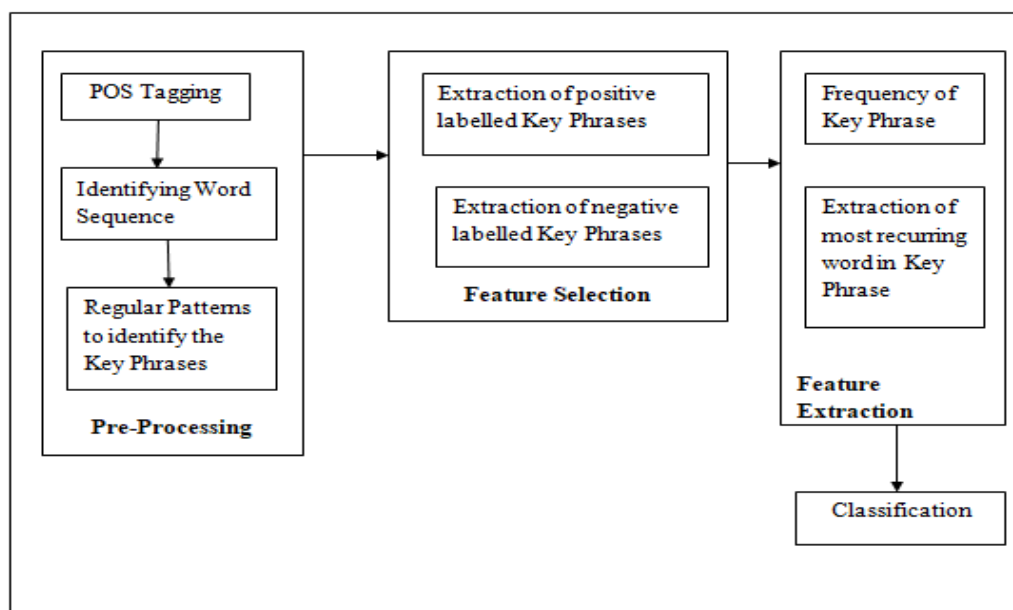
Recently, text abstracting techniques have been aiming their lime light because of their role in various platforms that can be resourceful for an organization in developing their products or services through the reviews of its customers. This process was also developed irrespective of the language and, surprisingly, achieving more significant results. There are quite a few techniques that deal with the summarization of textual data. These techniques can also be termed automatic text abstraction methodologies.

An abstractive summarization aims to generate a conceptual briefing of the information present in the whole document by analyzing it. This concept uses language interpreting algorithms to examine and understand the text and find new contexts and expressions for expressing it straightforwardly. This approach follows some statistical methods that are implemented over linguistics to find out the most repeated phrases and thus understand the document's actual aspect.

An extractive abstraction process is usually formulated to derive the important concepts from the phrases or words and apply few mathematical and statistical methodologies to find out the repetition of the keywords at the standard levels. This method also locates the positional occurrence of a particular phrase in the document. It retrieves a short and crisp note that is easier to understand and work out by avoiding the deep understanding of the actual contextual meaning. As previously explained in short, we have a technique that awards the score to particular words or phrases in the document based on its usage at different levels, which can be termed as local levels and global levels. Depending on their levels, the scores or weights we award to those words can be named local weights and global weights, respectively. This approach mainly focuses on the polarity of the words by calculating their score using statistical methods. Local weights are derived based on the repetition of a particular word or phrase when compared at a sentence level, and global weights are awarded based on the usage of the selected word in the context of the entire document. These global weighted words represent the context and purpose of the document as well.

Usually, the textual data is read by the system by initiating from pre-processing stages. These stages are designed in the context of removing unnecessary information or information duplication, thus by only focusing on relevant keywords, which can also be termed easily as the data cleaning stage. At this stage, the developers have the authority to choose a set of words that needs to be specially focused on or leaving the decision to the developed machine by letting it perform the statistical operations and choosing the relevant keywords or phrases by itself. Alternatively, a programmer can choose both options.

Such kind of fragmenting the sentences into a group of words or phrases is called corpus. It is better to apply the chosen enhanced learning methodology over the corpus. These corporuses can usually be represented in a matrix format after converting them to their respective mathematical values as vectors. As discussed earlier, these vectors also bear weight or score depending on their frequency of repetition at their respective levels. This process can also help in deriving the polarity of the sentiment of the text from the document. It can classify them into various categories as designed like positive, negative, or neutral accordingly. This helps majorly in the e-commerce organizations or service providers developing their respective services or goods by verifying the collected reviews from the customers or clients. Few conspiracies arrive while dealing with the text abstraction processes, which may be related to various aspects like retrieval of the exact keyword related to the aspect of the document, factors impacting the text summarization, finding out the true sensitivity of the word, maintain the developed system's redundancy and gaining increased performance standards by enhancing the ability of the system. The overall architecture of the text summarization process considered a supervised machine learning algorithm, can be illustrated as shown in figure 1.



**Figure 1:** Text Summarization Process

Text mining with the help of Artificial Intelligence converts the unstructured data into structured data for making the decisions effectively. Business applications widely use text classification to get insights of their customers by analyzing their buying patterns and reviews of the products. Text mining in collaboration with machine learning can create classification or feature extraction models based on the training data. This research article uses NLTK library to work with the reviews.

## LITERATURE SURVEY

- [1] The author explains the complexities one faces to read all the documents and generate a small summary for it as it is exhaustive and stagnant. They state that many algorithms have been developed to reduce time and energy by designing an automated summary text generator for both lone and multiple documents as inputs. This research was designed in the context of generating such arbitrary text for an Indian language, Telugu. The opted algorithm for this research work is based on the ranking of frequently observed texts. This algorithm identifies the repetitive words in a document, groups them, and notes down the number of times it has appeared. Further, the authors said that this project could be extended based on query abstraction techniques as a concern.
- [2] Text abstraction has been a decent applicable use of the current issue to extract the summary of a document rather than read it as a whole. The author stated that even though many types of research are based on this issue, the differences in deriving the solution will depend on various aspects like the text formats, domains, and contexts. Advanced applications in neural grids can be applicable for this problem, which can help predict the continuation of the specified text by keeping track of the initial stages and gaining information through it. This work is designed in the context of predicting the sequence based on the meaning of the information by recording them in a matrix of similarity. This matrix maintains the records of both the frequently occurring words and stops words as well.
- [3] According to the developer of this research project, the advantage of having a short briefing of an enormous document is better than following up with the whole document to know its context. This briefing helps in minimizing the efforts at work and on time. Usually, this brief passage will contain the keywords, actual context, and information needed from the whole document. Again, generating those keywords relevant to the concept with a higher ranking is complex and may lead to various errors if these are extracted manually. Thus, the researchers have developed a methodology that can automatically retrieve those keywords by experimenting on a newspaper in the Telugu dataset. To make the model more precise, the developers have compared the evaluated outcomes with similar contexts from other articles.
- [4] In this research, the authors have focused on deriving the importance of the frequently repeating words for calculating their rank of repetition by categorizing their locality in two ways. The developers have explained that the baggage of words is depended on their repetition in either sentences or the whole

document. The weights' tolerance focuses on the text's material; one phrase may have different qualities in a different article, known as LW based method. In the instance of GW, ratings of the terms are generated from an alternative dataset, implying that the scores of all phrases stay unchanged across articles. For LW based module, they have used a method of scoring similar to standard statistical analysis, and for BW module, they have opted for VSM method, which can extract the keywords from various other documents and remain constant.

- [5] The authors of this paper have explained the complexities of developing and categorizing the text phrases of nouns in the language Arabic. As a solution for this problem, the developers have proposed an innovative approach that can be represented in a graphical manner. Here, as said, each graph represents an individual document, where the sentence in the text of the document acts as vertices. An enhanced scoring algorithm was developed by specifying an initial rank at each node that denotes the quantity of nouns in that particular sentence. The edges connecting each node contain a functional similarity among the sentences, to achieve the optimal abstraction with more information. The observed abstraction depends on considering various aspects by eliminating the unnecessary information and making the system redundant.
- [6] Although most text categorization studies have focused on directed learning approaches, some samples have been created for overview challenges. The majority of the extant description files lack human-generated target descriptions, which are essential for both review development and evaluation. As a result, a novel dataset for textual and integrative abstraction tasks was offered in this research. The developed design was framed in a context to compare the system's outcomes to manual results for rightness. For the suggested dataset, a thorough linguistic distance metric was created, and the influence of these aspects on the information quality of the generated report was explored. The linguistics observed was subjected to a tool that converts the textual data to vectors, and neural grids were also applied for the later propagation.
- [7] The developers of this research project have explained the usefulness and importance of text abstraction of various documents and their importance in respective fields. Thus, they have proposed a new method that performs iteratively, aiming to extract the brief texts of online news media articles of a regional language. The method has considered the significant criterion for summarization by breaking down the sentences into smaller words or phrases and awarding with some score based on their usage, importance, or repetition over the whole sentence. Thus, depending upon the scoring of each important extracted word or phrase, a condensed short briefing will be generated that will be both informative and meaningful. The authors state that their developed model has shown better outcomes than the standard methodologies by experimenting with them under various quality evaluation techniques.
- [8] The researchers of this work have stated have developed this model to derive short and crisp information that fits in a single line by covering the whole aspect and purpose of the entire document. They have also stated that they have designed and used their own dataset for this research. They have approached this problem with enhanced learning methods that maps the highly used words or phrases. Initially, the model reads the inputted data sequentially and stores them in a hidden state, and transfers the data to the next levels. Later, this information from the hidden state is taken and is subjected to find the probability of a particular word over the whole sentences' probability using a mathematical function which in return retrieves the highest happening word.
- [9] The authors have demonstrated the increasing growth of usage or importance of text abstraction at various aspects in respective areas. This paper has proposed a multi layered enhanced learning methodology that could preserve the process that happened at the previous stage in the memory and use it as a reference for the later stages. This method as stated was completed applicable for identifying the particularities in a specific domain in a regional language. The developed framework was intended to derive the contexts of the textual information based on its meaning and gives the keywords a specific rate. The designed model extracts the dependencies of particular words or phrases locally and globally of the document and notes down the meaning and purpose of those words.
- [10] The researcher here have explained the difference between the various types of text abstraction techniques which were automatic, where important sentences were derived from the inputted documents to escape from overloading of information issue and extractive that only focuses on specific words in the document. The developers have opted for the NLP technique that generally uses three stages of information processing that undergo cleaning or removal of unnecessary words from the document, segregating specific words with respective of their sentiments and fragment sentences. This research is also motivated to identify the sensitiveness or polarities of the given context using a specially developed

boasting algorithm. This algorithm is based on statistically segregating the information using multiple combinations of enhanced methodologies to meet the goal of deriving higher performance of the model.

## RELATED MATERIALS

### Data Pre-processing

The process of cleaning the data plays a vital role in improving the accuracy of the system. Before working with the text mining, the system should handle the missing values.

**a. Handling Missing Value:** The dataset is obtained from the open source, kaggle. The dataset consists of both numerical and categorical attributes with 23,486 rows and 11 columns. The data set is described as below with missing values count:

```

Unnamed: 0          0
Clothing ID         0
Age                0
Title             3810
Review Text       845
Rating            0
Recommended IND    0
Positive Feedback Count 0
Division Name      14
Department Name    14
Class Name         14
dtype: int64

```

**Figure 2:** Values representing the count of missing values for each attribute.

The traditional mechanisms suggest ignoring the tuples that contain the missing values. Since the data set contains more missing values, the ignoring values procedure may lead to deficiency in the accuracy. So, the missing values of numerical data are filled with mean values and the categorical values are filled with mode values.

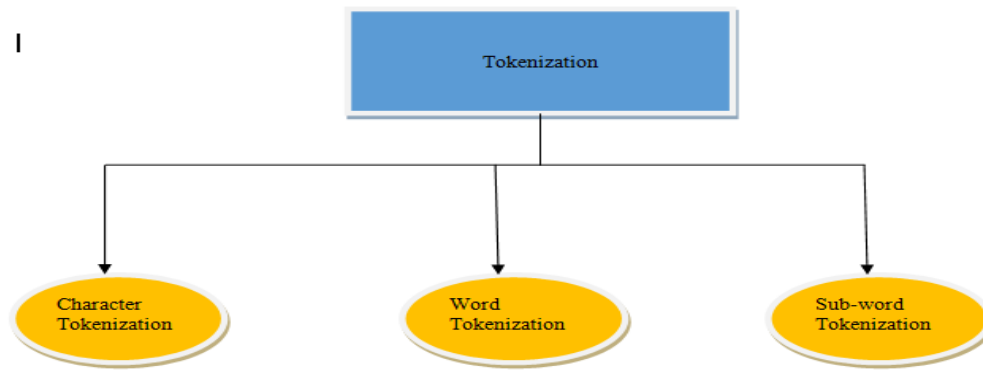
**b. Dealing with Punctuations:** In text mining vectorizer, word counts plays major role rather than the grammatical context. So, in the dataset, the categorical attributes containing punctuations are handled with the pattern recognition by writing the regular expression.

	Review Text	Non_punc
0	Absolutely wonderful - silky and sexy and comf...	Absolutely wonderful silky and sexy and comfo...
1	Love this dress its sooo pretty. i happened ...	Love this dress its sooo pretty i happened t...
2	I had such high hopes for this dress and reall...	I had such high hopes for this dress and reall...
3	I love love love this jumpsuit. its fun flirty...	I love love love this jumpsuit its fun flirty ...
4	This shirt is very flattering to all due to th...	This shirt is very flattering to all due to th...
...	...	...
23481	I was very happy to snag this dress at such a ...	I was very happy to snag this dress at such a ...
23482	It reminds me of maternity clothes. soft stret...	It reminds me of maternity clothes soft stretc...
23483	This fit well but the top was very see through...	This fit well but the top was very see through...
23484	I bought this dress for a wedding i have this ...	I bought this dress for a wedding i have this ...
23485	This dress in a lovely platinum is feminine an...	This dress in a lovely platinum is feminine an...

**Figure 3:** Reviews after removal of Punctuation Marks

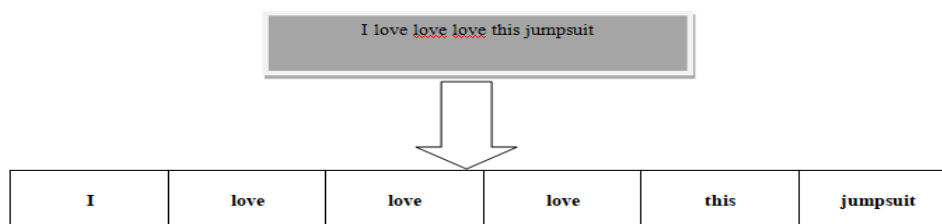
**c. Tokenization:** The process of dividing the data into small chunks is known as “Tokenization”. The process of tokenization can be done in three ways. They are:





**Figure 4:** Classification of Tokenization

Tokenization is the basic building of vocabulary, to form unique values from the corpus. In the proposed system, to boost the performance of the model, it considered top 100 frequent vales of the words that occurred. The research article considered word tokenization and sub word tokenization with the help of n-grams to construct a model. The proposed system performed word tokenization based on the regular expression. The word tokenization divides the sentence into individual words as in figure 5. The major drawbacks of word tokenization are that it cannot handle new words, which may occur during the prediction phase. This problem is referred to as “OOV Words” and it is very complex to construct the corpus with large amount of unique words. This huge amount of vocabulary spends more time in searching rather than construction of task.



**Figure 5:** Word Tokenization Process Flow

	Review Text ...	word_token
0	Absolutely wonderful - silky and sexy and comf...	[absolutely, wonderful, silky, and, sexy, and,...
1	Love this dress its sooo pretty. i happened ...	[love, this, dress, its, sooo, pretty, i, happ...
2	I had such high hopes for this dress and reall...	[i, had, such, high, hopes, for, this, dress, ...
3	I love love love this jumpsuit. its fun flirty...	[i, love, love, love, this, jumpsuit, its, fun...
4	This shirt is very flattering to all due to th...	[this, shirt, is, very, flattering, to, all, d...
...	...	...
23481	I was very happy to snag this dress at such a ...	[i, was, very, happy, to, snag, this, dress, a...
23482	It reminds me of maternity clothes. soft stret...	[it, reminds, me, of, maternity, clothes, soft...
23483	This fit well but the top was very see through...	[this, fit, well, but, the, top, was, very, se...
23484	I bought this dress for a wedding i have this ...	[i, bought, this, dress, for, a, wedding, i, h...
23485	This dress in a lovely platinum is feminine an...	[this, dress, in, a, lovely, platinum, is, fem...

**Figure 6:** Reviews after word tokenization

**d. Removal of Stop words:** Stop words are the most frequent words that generally occur in common language. Most of the machine learning and text mining techniques tries to find out the interesting patterns based on the frequency. If we consider the frequency then the stop words, then the systems generates wrong predictions. So to solve these type of problems NLTK identifies these type of words from common language and remove them. In English, till date there exists 179 stop words in NLTK library. There are various libraries to remove stop words using python. The proposed system utilized the concept of NLTK library to remove the stop words. The list of stop words are incorporated in NLTK corpus and then word tokenize method is called to do further analysis. A few examples of stop words in English:

A	Am	Both	Can	himself	been	To	Because	She	Then
While	Should	During	Until	further	over	Very	Most	Now	Y

	Review Text	...	After stopwords
0	Absolutely wonderful - silky and sexy and comf...	...	[absolutely, wonderful, silky, sexy, comfortable]
1	Love this dress its sooo pretty. i happened ...	...	[love, dress, sooo, pretty, happened, find, st...
2	I had such high hopes for this dress and reall...	...	[high, hopes, dress, really, wanted, work, ini...
3	I love love love this jumpsuit. its fun flirty...	...	[love, love, love, jumpsuit, fun, flirty, fabu...
4	This shirt is very flattering to all due to th...	...	[shirt, flattering, due, adjustable, front, ti...
...	...	...	...
23481	I was very happy to snag this dress at such a ...	...	[happy, snag, dress, great, price, easy, slip,...
23482	It reminds me of maternity clothes. soft stret...	...	[reminds, maternity, clothes, soft, stretchy, ...
23483	This fit well but the top was very see through...	...	[fit, well, top, see, never, would, worked, im...
23484	I bought this dress for a wedding i have this ...	...	[bought, dress, wedding, summer, cute, unfortu...
23485	This dress in a lovely platinum is feminine an...	...	[dress, lovely, platinum, feminine, fits, perf...

**Figure 7:** Reviews after Stop words Removal

**e. Lemmatizing:** Lemmatization is similar to stemming process but it depends on morphological analysis as well as it depends on the context of words. It is more efficient than stemming because it converts the word into base form with a meaningful context. The proposed system uses wordnet lemmatize, which is an open source English lexical database to construct a structured semantic relation between the words. The efficiency of this model can be increased by specifying the parts of speech as input parameter.

	Review Text	...	lemm data
0	Absolutely wonderful - silky and sexy and comf...	...	[absolut, wonder, silki, sexi, comfort]
1	Love this dress its sooo pretty. i happened ...	...	[love, dress, sooo, pretti, happen, find, stor...
2	I had such high hopes for this dress and reall...	...	[high, hope, dress, realli, want, work, initi...
3	I love love love this jumpsuit. its fun flirty...	...	[love, love, love, jumpsuit, fun, flirti, fabu...
4	This shirt is very flattering to all due to th...	...	[shirt, flatter, due, adjust, front, tie, perf...
...	...	...	...
23481	I was very happy to snag this dress at such a ...	...	[happi, snag, dress, great, price, easi, slip,...
23482	It reminds me of maternity clothes. soft stret...	...	[remind, matern, cloth, soft, stretchi, shini...
23483	This fit well but the top was very see through...	...	[fit, well, top, see, never, would, work, im, ...
23484	I bought this dress for a wedding i have this ...	...	[bought, dress, wed, summer, cute, unfortun, f...
23485	This dress in a lovely platinum is feminine an...	...	[dress, love, platinum, feminin, fit, perfectl...

**Figure 8:** Review after Lemmatization process

## VECTORIZING OF DATA USING BAG OF WORDS

It is an efficient approach to construct vector of features in a structured manner. N-grams is more analytical than bag of words because a single word cannot predict the intention of the user. So, N-grams try to extract the context of the sentence based on the sequence of words. N-grams is a language model which works on the concept of probability distribution to find the most frequent word that occur in the sequence. The proposed system implements bigram and uses likelihood ratio by calculating  $P(W1/W2)$  using Bayesian probability. In this bigram process, it computes the frequency of two words and bigrams. Few probabilities are calculated and then chi-square test performed on the unigrams to extract the features.

```
(0, 2301)      1
(0, 98126)     1
(0, 72975)     1
(0, 6100)      1
(0, 71036)     1
(0, 5207)      1
(1, 49369)     1
(1, 85799)     1
(1, 24958)     1
(1, 43192)     1
(1, 76838)     1
(1, 64905)     1
(1, 35668)     1
(1, 87514)     1
(1, 29406)     1
```

**Figure 9:** A snapshot of n-gram Vectorized data

## RESULTS AND DISCUSSION

**Table 1:** Merits and Demerits of Existing Works

S. No	Author name	Algorithms used	Merits	Demerits/ Future Work.
1.	K Usha	Text Rank	It can be applied to other different languages.	Summarization on question-based can be designed.
2.	D. Naga	Text ranking, ROGUE evaluation standards.	Increased performance standards.	Can use optimization for larger contexts.
3.	Reddy	POS tagging	Better retrieval of keywords.	Concentrated more on keyword generation rather than the summary extraction.
4.	Nawaz	LW- BW based modules, VSM method for BW module.	Concentrated on developing the score for both local and global phrases through the dataset.	Limited performance.
5.	Elbarougy	Enhanced PageRank methodology.	Concentrated on data overlapping and system's redundancy. Developed a new graphical way for abstraction.	The performance of the system is average.
6.	Mutlu	ROUGE-n score, GloVe, W2V	The research not only worked on deriving the abstraction but also the phrases that affect the summarization process.	Will focus on domain explicit text abstraction.
7.	Kishore	IE, ROUGE	Improved performance. Heuristic methodology was implemented.	Regular concepts were used.
8.	B. Mohan	Standard Encoder-Decoder	The text summary was shortened to a single sentence.	Transformer architecture will be opted in future.
9.	Gundapu	CNN, LSTM	Observes the dependencies of words at both local and global range.	Focused to improve on unambiguous cases in future.
10.	Naidu	Adaboost classifier, NLP	Also focused on deriving the polarity of the given text.	Future work is focused on analyzing the images from the reviews of the customers and to generate an effective response from the model.

## CONCLUSION

The best real time application for text summarization in the world of digital news is “In-shorts”, which uses the concept of text ranking to identify the important words in the large document. From the above results and discussions, the proposed model has identified four important gaps that can be addressed in future work; we need a system that highlights the incidences based on their word polarity. Few systems have not taken care of ambiguous words; this has to be treated with utmost care in the regional languages because a small alphabet modification will change the entire content meaning. In the further studies, multiple documents can also be considered, where classification technique involves genetic approaches to design its neural network layers. Most important factor, one has to consider is performance of the system, because while summarizing the documents, it takes lot of memory for storing and searching, so we need a data structure that minimizes the both.

## REFERENCES

1. K. U. Manjari, "Extractive Summarization of Telugu Documents using TextRank Algorithm," 2020 Fourth International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC), 2020, pp. 678-683, DOI: 10.1109/I-SMAC49090.2020.9243568.



2. Y MadhaveeLatha, D. N. S. (2020). Multi-Document Abstractive Text Summarization through Semantic Similarity Matrix for Telugu Language. *International Journal of Advanced Science and Technology*, 29(1), 513 - 521. Retrieved from <http://sersc.org/journals/index.php/IJAST/article/view/3105>
3. Naidu, Reddy & Bharti, Drsantosh&Babu, Korra&Mohapatra, Ramesh. (2017). Text Summarization with Automatic Keyword Extraction in Telugu e-Newspapers.
4. Nawaz, A., Bakhtyar, M., Baber, J., Ullah, I., Noor, W., &Basit, A. (2020). Extractive Text Summarization Models for Urdu Language. *Information Processing & Management*, 57(6), 102383. <https://doi.org/10.1016/j.ipm.2020.102383>
5. Elbarougy, R., Behery, G., & El Khatib, A. (2020). Extractive Arabic Text Summarization Using Modified PageRank Algorithm. *Egyptian Informatics Journal*, 21(2), 73–81. <https://doi.org/10.1016/j.eij.2019.11.001>
6. Mutlu, B., Sezer, E. A., &Akayol, M. A. (2020). Candidate sentence selection for extractive text summarization. *Information Processing & Management*, 57(6), 102359. <https://doi.org/10.1016/j.ipm.2020.102359>
7. Et.al, K. K. M. (2021). A Heuristic Approach for Telugu Text Summarization with Improved Sentence Ranking. *Turkish Journal of Computer and Mathematics Education (TURCOMAT)*, 12(3), 4238–4243. <https://doi.org/10.17762/turcomat.v12i3.1714>
8. B, Mohan & B, Aravindh& M, Akhil. (2021). Neural Abstractive Text Summarizer for Telugu Language.
9. Gundapu, S., &Mamidi, R. (2021). Multichannel LSTM-CNN for Telugu Technical Domain Identification. *ArXiv*, abs/2102.12179.
10. Naidu R., Bharti S.K., Babu K.S., Mohapatra R.K. (2018) Text Summarization with Automatic Keyword Extraction in Telugu e-Newspapers. In: Satapathy S., Bhateja V., Das S. (eds) *Smart Computing and Informatics. Smart Innovation, Systems and Technologies*, vol 77. Springer, Singapore. [https://doi.org/10.1007/978-981-10-5544-7\\_54](https://doi.org/10.1007/978-981-10-5544-7_54)