



Visual Text Analysis: Sentiment & Summarization With Transformers

¹Chethan M E , ²Akash S, ³ChandraShekar M, ⁴Mahesh Pai, ⁵Dr.Reshma J

^{1,2,3,4} Students, Department of Information Science & Engineering, Dayananda Sagar College of Engineering, Bangalore, Karnataka, India

⁵ Associate Professor, Department of Information Science & Engineering, Dayananda Sagar College of Engineering, Bangalore, Karnataka, India

Abstract: In a world with an ever-growing amount of data available on both offline and online sources, the task of extracting the key information from the documents and summarizing the content creates the need for Visual text summarization. In this paper, we will look into the types of text summarization and sentiment analysis how it has been helpful in various fields like social media marketing, legal contract analysis, video scripting, etc. Further, this paper conducts a methodical study on abstractive text summarization and highlights the approach which mimics the human cognitive method of summarizing text. The paper aims to analyze the numerous techniques, difficulties, opportunities, and current state of art of abstractive summarization. A detailed survey of research papers/articles was conducted based on the technologies used to make this task quicker and more accurate in recent years.

Index Terms: Document image analysis, Optical character recognition, NLP, Transformer.

I. INTRODUCTION

The challenges in OCR is a technology that changes printed or written words into text computers can read. It helps people make documents like scanned papers and pictures into text you can search, change, and use easily. OCR looks at how the letters in a picture look and turns them into words you can read. People use OCR in different places like keeping documents and helping people who cannot see well. Text Summarization makes long writings short but keeps the important parts. You can do it by taking sentences from the original or by making a new version that is shorter. Summarizing lets you understand the main ideas fast and helps people find information quickly. It also makes con-tent better by being short and to the point.

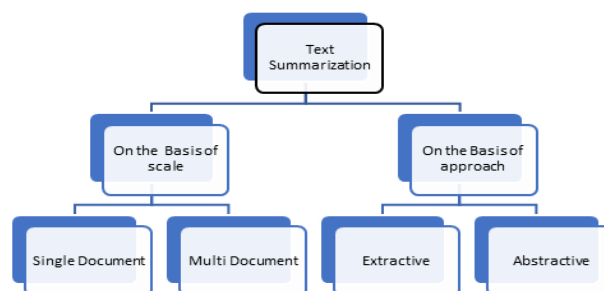


Fig.1 Types of Text Summarization

Text Sentiment Analysis tells us if a piece of writing, like a review, sounds positive, negative, or just neutral. This checking of feelings is used a lot in business studies, listening to customers, watching over social media, and protecting a brand's good name. It helps companies know what people think about what they offer or about big topics, and choose what to do next.

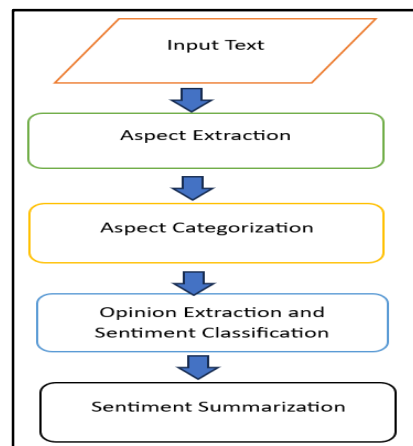


Fig.2 Steps in Text Summarization

The OCR method uses many steps to read text from images. It starts with making the image clearer and less noisy. Then it finds where the text is. After that, it uses OCR tools or learning machines to turn the text into something a computer can read. After OCR works, post-processing fixes mistakes in the text. Validation checks if the text is right by looking at the first document. This way of doing it makes sure we can turn printed or written text from pictures into text that computers can read. OCR ways are getting better all the time. Researchers are always trying to solve new problems. They want to make taking text from pictures better and faster. Adding understanding of context to OCR makes it better. It can understand and copy hard text better. This makes it useful for many different things.

II. LITERATURE REVIEW

In this paper, we look at different ways to make short versions of texts and the steps to do it. We pay attention to making new summaries from text. Many studies have happened and there were advances to know the value of sentences and how words connect in texts. Also, we see how they use machines to make short texts in areas like money, online talking, and deals.

[1]Waqar Bin Kalim & Robert E. Mercer(2022). A survey on **Method Entity Extraction from Biomedical Texts**. Method Entity Extraction from unstructured biomedical text has been an important, yet challenging and somewhat under-examined, Natural Language Processing (NLP) task. Especially in the field of biomedicine, the automatic extraction of methodology names and terminologies is imperative. [1] Waqar Bin Kalim gave a good discussion of method entities and provided the following definition: “named entities that represent specific methods' ". More specifically, “method entities in the academic literature are nouns or noun phrases representing the specific ways, means, and channels used to solve tasks or problems proposed by the authors, including sub-categories such as discipline specific methods, software, models, algorithms, and metrics”.explored various methodologies to automatically extract method entities from biomedical text. investigated a rule based method using information provided by a dependency parse to IOB tag the method entities in the corpus. This silver standard corpus is the main contribution of our work and has been made publicly available. To evaluate the quality of this corpus, we trained two machine learning methods using this silver standard corpus to automatically extract method entities from biomedical text.

[2] **Kummari Shiva Kumar , M Priyanka ,M Rishitha,D Divya Teja and Nallamothe Madhuri(2021).Text Summarization with Sentimental Analysis.**The goal of automatic text summarization is presenting the source text into a shorter version with semantics. The most important advantage of using summary is, it saves the time for the users. Text Summarization has two methods namely extractive and abstractive summarization. An extractive summarization method focuses on the sentence present in the original document itself and concatenating them into shorter form. An Abstractive summarization tries to give summarized output based on the trained data set.

[3] **Ankita Dhar, Himadri Mukherjee, Rajesh Bose, Sandip Roy, Kaushik Roy (2022). A Study on Sentiment Analysis using Text Summarization.** have used a summarization approach to learn a supervised learning algorithm (rule- based classifier) to categorize the Bangla blog texts into their respective sentiment polarities. Bangla blog texts were summarized depending on scoring (using PageRank algorithm) the weighted terms in order to extract the features and feed the rule-base algorithm for categorizing sentiment polarities. Various works have been carried out in English followed by other non-Indic languages. The aim of this paper is to analyze six different polarities (happy, sad, disgust, surprise, fear, angry) of the sentiment for Bangla texts using a text summarization approach. Used a summarization approach to learn supervised learning algorithm (rule- based classifier) to categorize the Bangla blog texts into their respective sentiment polarities. Which proposed a feature extraction scheme based on text summarization to categorize the Bangla blog texts into their respective sentiment polarities and obtained a maximum accuracy of 98.33%.

[4] **Rupal Bhargava,Yashvardhan Sharma and Gargi Sharma ATSSI: Abstractive Text Summarization using Sentiment Infusion.**method is proposed for compressing and merging information based on word graphs, and then summaries are generated from the resulting sentences. The method assumes no domain knowledge and leverages redundancy in the text. The results show that the summaries generated are agreeable to human compendium and are concise and well formed.They first map all the sentences to corresponding Wikipedia topic and thus a bipartite graph is obtained where one of vertices represent the wikipedia topics and the other set represent the sentences in the document.²³ then uses an iterative ranking algorithm to find the best candidate sentences in the document.

[5] **Lavanya K C, C. Sivamani, Linnet Tomy, Ann Rija Paul(2019).Two-Level Text Summarization with Sentiment Analysis for Multi-Document Summarization.** In this research, propose a novel method of two level extractive document summarization with sentiment analysis from online sources is introduced Initially, Sentiment analysis is performed on these individual summaries to check whether there is any difference in reporting the same concept. It will also give assistance to know the summary generated is whether positive, negative or neutral. At last, a single summary is generated among all these individual summaries. This will provide the most important sentences from all the documents. The performance of this system can be evaluated using ROUGE metric.After generate the first level summaries, sentiment analysis applied on them to check whether there is any difference in the idea of the documents. If there is any difference in viewpoints then sentiment analysis shows negative. If all the documents convey the same idea then sentiment analysis shows positive. If some of the document said it is good and some of them are said it is bad then sentiment analysis shows neutral. Finally, main sentences from the individual level summaries are extracted and compile for second-level summary generation.

[6]**Hsin-Ting Hsieh,Diana Hristova (2022) study on Transformer-based Summarization and Sentiment Analysis of SEC 10-K Annual Reports for Company Performance Prediction.** In this ,the main aim is to answering this question by proposing a state-of-the-art NLP methodology that generates the summaries of annual reports together with their topics and sentiment and relates them to company performance in an interpretable way. Our methodology combines the two streams of research of text summarization/topic modelling and sentiment analysis using state-of-the-art NLP methods. It consists of four steps: 1) creating summaries of the reports with BERTSUMEXT 2) deriving the summaries' topics with LDA, 3) summaries' sentiment analysis with FinBERT and 4) a tree-based ML model for the prediction of future stock price growth. The above steps can be implemented as a pipeline in an IS used for the automated analysis of annual reports in addition to financial metrics. This IS would be developed together with financial experts, who could also enhance the topic interpretability.

[7] **Pansy Nandwani, Rupali Verma.** A review on **sentiment analysis and emotion detection from text.** There are three types of sentiment and emotion analysis techniques: lexicon based, machine learning based, and deep learning based. Each has its own set of benefits and drawbacks. Despite different sentiment and emotion recognition techniques, researchers face significant challenges, including dealing with context, ridicule, statements conveying several emotions, spreading Web slang, and lexical and syntactic ambiguity. Furthermore, because there are no standard rules for communicating feelings across multiple platforms, some express them with incredible effect, some stifle their feelings, and some structure their message logically. Therefore, it is a great challenge for researchers to develop a technique that can efficiently work in all domains .

[8] **Ramya R S, M Shahina Parveen, Savitha Hiremath, Isha Pugalia, S H Manjula.** A Survey on **Automatic Text Summarization and its Techniques.** In this paper have seen various Text summarization techniques based on network structures, attention modules, machine learning, and deep learning algorithms used by the researchers in recent years. We have found that the process of Automatic text summarization includes tokenization of data, word embeddings, Attention mechanism, text categorization and adversarial Training. The common challenges faced in this field are generating more accurate and human-like summary, second one is repetition of words and the coverage which is tackled using pointer generator networks. Most Researchers used graph-based methods for context vector generation which are quite effective with respect to abstractive text summarization implemented along with supervised/unsupervised/hybrid learning models.

[9] **Vladimir Lebedev, Transformer basics.** A transformer is a device that transfers electrical energy from one circuit to another by magnetic coupling without requiring relative motion between its parts. It usually comprises two or more coupled windings, and, in most cases, a core to concentrate magnetic flux. An alternating voltage applied to one winding creates a time-varying magnetic flux in the core, which induces a voltage in the other windings. Varying the relative number of turns between primary and secondary windings determines the ratio of the input and output voltages, thus transforming the voltage by stepping it up or down between circuits. The transformer principle was demonstrated in 1831 by Faraday, though practical design did not appear until the 1880s. Within less than a decade, the transformer was instrumental during the "War of current" in seeing alternating current systems triumph over their direct current counterparts, a position in which they have remained dominant. By transforming electrical power to a high voltage, low current form and back again, the transformer greatly reduces energy losses and so enables the economic transmission of power over long distances. It has thus shaped the electricity supply industry, permitting generation to be located remotely from points of demand. Amongst the simplest of electrical machines, the transformer is also one of the most efficient, with large units attaining performances in excess of 99.75%. Transformers come in a range of sizes from a thumbnail-sized coupling transformer hidden inside a stage microphone to huge giga VA-rated units used to interconnect portions of national power grids. All operate with the same basic principles and with many similarities in their parts, though a variety of transformer designs exist to perform specialized roles throughout home and industry.

[10]. **Zengliang Zhu, Qinglong Meng, Jiarui Bi.** Transformer in Computer Vision, Transformer is widely used in Natural Language Processing (NLP), in which numerous papers have been proposed. Recently, the transformer has been borrowed for many computer vision tasks. However, there are few papers to give a comprehensive survey on the vision-based transformer. To this end, in-depth review of the vision-based transformer. In conclusion 15 articles covering transformers on image object detection, multiple object tracking, action classification, and visual segmentation. Furthermore, summarize 6 related datasets for corresponding tasks as well as their metrics. provide a comprehensive experimental comparison to validate the strength of transformer-based methods. provide a brief introduction to the transformer and its applications on computer vision tasks, which can help beginners to recognize it.

[11]. **Nisha Yadav, Rajeev Kumar, Bhupesh Gour, Asif Ullah Khan.** Extraction-Based Text Summarization and Sentiment Analysis of Online Reviews Using Hybrid Classification Method. Sentiment Analysis and Opinion Mining is the most popular field for analyzing and discovering insights from text data from various sources, such as Facebook, Twitter and Amazon, Zomato, etc. It involves a computational study of an individual's behavior in terms of buying interest and then extracting his opinions on the business entity of the company. This entity can be viewed as an event, individual, blog post or product experience. Scholars in the fields of natural language processing, data mining, machine learning and others have tested a variety of methods for automating sentiment analysis. These reviews are increasing on a daily basis, as a result of which the summarization of the reviews plays a role where the text is summarized as needed, which provides useful

information from a large number of reviews. It is very difficult for a human being to extract and interpret useful data from a very large file. In the text analysis, the value of sentences is decided on the basis of the linguistic characteristics of sentences.

Author	Visual Text Analysis: Sentiment & Summarization with Transformers		
	Year of publication	Detection method/Parameter	Detection rate
Waqar Bin Kalim & Robert E. Mercer	2022	Corpus containing candidate methodA Method Entity Extraction from Biomedical Texts.	Great Extent(Approx 90-95%)
Kummari Shiva Kumar	2021	Text Summarization has two methods namely extractive and abstractive summarization.	97.5%
Rupal Bhargava	2020	Graph based abstractive summarization	Not specified
Rupali Verma	2021	Sentiment analysis and its various levels, emotion detection, and psychological model.	91.14% wild dB and 100% for FEI dB
Lavanya K C	2019	A novel method of two level extractive document summarization with sentiment analysis	83.8% for BFDB
Hsin-Ting Hsieh	2022	a state-of-the-art NLP methodology is used to generate the summaries of annual reports	Greater than RGB or YCbCr space
Ankita Dhar	2022	Supervised learning algorithm (rule- based classifier) are used to categorize the Bangla blog texts	82.78% FRGC dB
Savitha Hiremath	2023	abstractive text summarization implemented along with various supervised/unsupervised/hybrid learning model	Not specified
Vladimir Lebedev	2022	Transfers electrical energy from one circuit to another by magnetic coupling without requiring relative motion between its part	90.5%
Zengliang Zhu	2021	Transformer in Computer Vision	Not specified
Nisha Yadav	2019	Extraction-Based Text Summarization and Sentiment Analysis of Online Reviews Using Hybrid Classification Method	90-95%

TABLE I : Sentiment & Summarization with Transformers on different illumination

III. METHODOLOGY

Text summarization with sentiment analysis is a powerful application of natural language processing (NLP) that combines two essential tasks. The first task is text summarization, which aims to distill lengthy pieces of text into concise summaries, preserving the most critical information. This can be achieved through either extractive summarization, where important sentences or phrases are selected based on their significance scores, or abstractive summarization, which involves generating summaries by paraphrasing the content.

The second task is sentiment analysis, which involves determining the sentiment or emotional tone expressed in the text. Sentiments are typically categorized as positive, negative, or neutral, and this analysis is useful in various domains, including product reviews, social media posts, and news articles. By merging these two tasks, text summarization with sentiment analysis can provide valuable insights by not only condensing information but also gauging the emotional context in which it is presented. This

integrated approach has applications in brand monitoring, market research, and customer feedback analysis, making it a versatile tool in the world of NLP.

Text Extraction Using Pytesseract :

Text extraction using Pytesseract is a valuable process for automating the conversion of text from images or scanned documents into machine-readable text. Pytesseract, a Python library, serves as a user-friendly interface to Google's Tesseract-OCR Engine. This OCR engine is renowned for its accuracy and versatility in recognizing text from various sources. To initiate text extraction, you need to ensure you have both Pytesseract and Tesseract installed on your system. You can obtain Pytesseract with a simple 'pip install pytesseract' command, while Tesseract requires a separate installation, typically available for various operating systems.

Cleaning of extracted text:

Cleaning the extracted text is an essential step in the text extraction process, as it helps ensure the accuracy and usability of the extracted content. Cleaning involves removing any noise, artifacts, or unwanted characters that may have been introduced during the OCR process or were present in the original image. This step typically includes tasks such as removing extra spaces, correcting misinterpreted characters, and eliminating any special characters or symbols that are not part of the actual text. Additionally, it may involve spell checking and ensuring that the resulting text is properly formatted. Cleaned text is crucial for various applications, including data analysis, information retrieval, and natural language processing tasks, as it ensures that the extracted content is accurate and ready for further processing or analysis. Properly cleaned and preprocessed text enhances the quality of downstream tasks, making it a crucial step in the text extraction pipeline.

Performing sentiment analysis using Transformers:

Performing sentiment analysis and text summarization using Transformers represents a cutting-edge approach in natural language processing (NLP). Transformers, which are deep learning models, have revolutionized NLP by capturing intricate contextual relationships in textual data. When applied to sentiment analysis, these models can discern the emotional tone in a given text, categorizing it as positive, negative, neutral, or even more fine-grained sentiment categories. Similarly, for text summarization, Transformers leverage pre-trained models to automatically generate concise and coherent summaries of longer texts. Their proficiency in understanding context and relationships within text makes them highly effective for summarization tasks. To implement these techniques, one typically installs the Hugging Face Transformers library, providing access to a diverse range of pre-trained models. Once installed, a suitable pre-trained sentiment analysis or summarization model can be loaded and employed to analyze sentiments or generate summaries, respectively. This utilization of transformer-based models has significantly enhanced the quality and efficiency of sentiment analysis and text summarization tasks across various applications.

Transformer Models:

Transformer models, like BERT (Bidirectional Encoder Representations from Transformers), GPT-2 (Generative Pre-trained Transformer 2), and RoBERTa, are among the most popular choices for sentiment analysis. These models have been pre-trained on large text corpora and have achieved remarkable performance on various NLP tasks. Hugging Face Transformers Library: The Hugging Face Transformers library is a widely used Python library that provides easy access to a variety of pre-trained transformer models for NLP tasks. It simplifies the process of loading, finetuning, and using these models for tasks like sentiment analysis. Loading Pre-trained Models: To perform sentiment analysis, you can load a pre-trained sentiment analysis model from the Transformers library using a single line of code. These models have been fine-tuned

on sentiment analysis datasets, making them ready for sentiment classification tasks. Sentiment Analysis Pipeline: The Transformers library provides a high-level API called the "pipeline" for performing sentiment analysis. This pipeline takes in a text input and returns sentiment labels (e.g., 'positive,' 'negative,' 'neutral') and associated confidence scores. Interpreting Results: Sentiment analysis results typically include sentiment labels and scores. Labels describe the sentiment, while scores indicate the model's confidence in the prediction. For instance, a high positive score with a 'POSITIVE' label suggests a strong positive sentiment.

Customization and Fine-tuning:

Customization and fine-tuning of natural language processing (NLP) models are fundamental techniques that enhance the applicability and performance of these models in various real-world tasks. These techniques are widely used, particularly with transformer-based models like BERT, GPT-2, and RoBERTa. Here's a more detailed explanation: Customization: Customization refers to the process of training an NLP model from the ground up on a specific dataset for a particular task. It involves initializing the model's weights with random values and training it to learn the patterns and features relevant to the given task. Customization is resource-intensive and time-consuming, typically employed when no suitable pre-trained model is available for a specific use case. Fine-tuning: Fine-tuning, on the other hand, is the process of taking a pre-trained model and adapting it to a new, task-specific dataset. During pre-training, models are trained on a massive corpora of text data to learn general language understanding. Finetuning takes advantage of this pre-learned knowledge and further trains the model on a smaller, task-specific dataset. The model retains its understanding of language and context while adapting to the specific requirements of the task or domain. Fine-tuning is a more efficient and widely used approach.

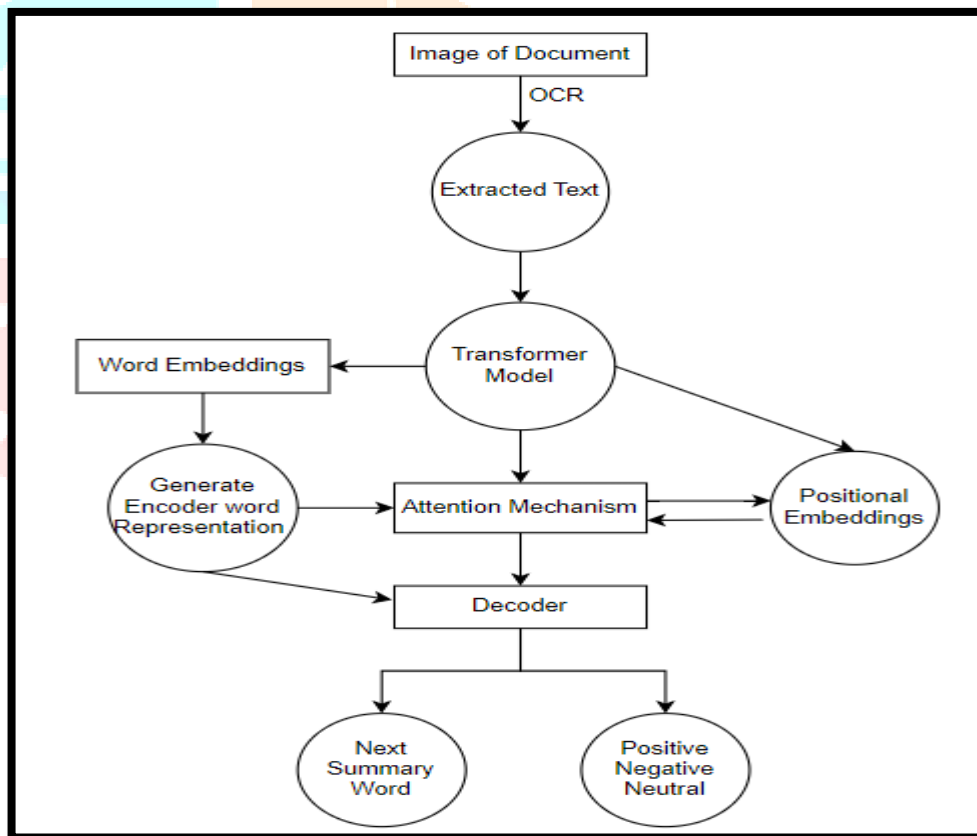


Fig 1. Block Diagram

Text Extraction Using Pytesseract:

- a. **Installation and Libraries:** Install Pytesseract and import the necessary libraries, including PIL or Pillow.
- b. **Load Image:** Open the image using PIL or Pillow and use Pytesseract to extract the text.
- c. **Text Preprocessing:** Perform text preprocessing to clean the extracted text.

Text Summarization Using Transformers:

- a. **Install Libraries:** Install the Hugging Face Transformers library for working with transformer-based models.
- b. **Import Libraries:** Import the required libraries, including 'pipeline' from Transformers.
- c. **Load Pre-trained Model:** Load a suitable pre-trained summarization model, like BERT, GPT-2, or T5.
- d. **Fine-tuning (Optional):** Fine-tune the pre-trained model on your specific summarization task if needed.
- e. **Generate Summaries:** Use the loaded model to generate summaries for the extracted text.
- f. **Evaluation and Metrics:** Assess the quality of the generated summaries using metrics like ROUGE, BLEU, and METEOR.
- g. **Deployment (Optional):** Deploy the summarization system, making it accessible via an API or integration into your application.
- h. **User Interface (Optional):** Create a user-friendly interface if necessary for user interaction with the summarization system.
- i. **Scalability and Performance Optimization (Optional):** Optimize the system for scalability and efficient handling of a large volume of requests.
- j. **Monitoring and Maintenance:** Implement monitoring for the deployed system and regularly update the model if necessary.
- k. **Documentation:** Create comprehensive documentation for the summarization system, explaining how to use it.
- l. **Testing with Real Data:** Verify that the summarization system meets your project's goals and user requirements using real-world data.

IV. CONCLUSIONS

In conclusion, By automating various natural language processing tasks such as text summarization, sentiment analysis, and entity extraction using Transformers. We finished making a fast and good text processing system by using Transformers. These can do things like summarizing, feeling analysis, and finding important names and places in texts. They change the field of computer language understanding a lot. We put these powers together and made a strong machine that can work with a lot of different text jobs. This machine save time and things we use, and it make sure we do text checking the same way and right each time. It is very good at making long writings short, seeing feelings, or pulling out good information, so it help us understand big text data better.

V. ACKNOWLEDGEMENT

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