

A Dual-Approach System for Efficient News Article Summarization

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Abstract—In an era characterized by an overwhelming influx of information, individuals often struggle to keep pace with the constant stream of news and lengthy articles. This research presents a novel text summarization system designed to enhance the accessibility and comprehension of extensive news content. By leveraging advanced natural language processing (NLP) techniques, our hybrid summarization tool effectively distills long articles into concise summaries that retain essential details without sacrificing context. The system employs the BART (Bidirectional and Auto-Regressive Transformers) model for abstractive summarization, complemented by extractive methods based on Term Frequency-Inverse Document Frequency (TF-IDF) scoring. This dual approach ensures both accuracy and readability, allowing users to navigate complex news topics effortlessly. What sets this system apart is its ability to seamlessly handle articles of varying lengths by breaking them into manageable segments before processing. Built on a user-friendly web platform, the system offers features such as categorized news exploration, topic searches, and article bookmarking, making it a comprehensive solution for modern news consumption. Additionally, functionalities like personalized recommendations and real-time updates further enhance user engagement and facilitate informed decision-making. By redefining how users interact with information, this tool provides a fast, reliable, and intuitive way to stay updated in an increasingly data-driven world. Ultimately, our research aims to contribute to the ongoing discourse on effective information retrieval methods while addressing the challenges posed by information overload in contemporary society.

Index Terms—first term, second term, third term, fourth term, fifth term and sixth term.

I. INTRODUCTION

The digital landscape has led to an explosion of information, particularly in the form of news articles and online content. As people strive to keep up with this constant flow of information, they often find themselves overwhelmed by the volume of lengthy articles that require significant time and attention to read. Traditional methods of consuming news—reading full-length articles—can be inefficient and may contribute to cognitive overload, making it difficult for individuals to stay informed about current events. This situation highlights the urgent need for effective information retrieval systems that can extract key insights from extensive texts without compromising comprehension. Automatic text summarization has emerged as a viable solution to this challenge, enabling users to quickly grasp essential points from lengthy articles.

This research focuses on developing a sophisticated text summarization system that integrates both abstractive and extractive summarization techniques to improve the quality of news article summaries. Our approach utilizes a dataset comprising 250,000 diverse news stories from various sources, ensuring comprehensive coverage of topics and writing styles. By employing the BART model for generating coherent summaries alongside extractive methods based on Term Frequency-Inverse Document Frequency (TF-IDF) scoring, we aim to create a robust tool that enhances user experience while navigating complex information. In addition to its summarization capabilities, our system features an intuitive web interface that allows users to explore categorized news content, search for specific topics, and save articles for future reference. By incorporating personalized recommendations and real-time updates, our tool not only streamlines information consumption but also promotes a deeper understanding of current events among users. This paper outlines the methodology employed in developing this system, presents the results of its evaluation against established benchmarks, and discusses its potential impact on public media literacy in today's fast-paced digital landscape. Through this research, we aspire to contribute meaningfully to the ongoing discourse on effective information retrieval methods while addressing the challenges posed by information overload in contemporary society.

II. LITERATURE SURVEY

Ranjeeta Krishan et al. presented a frequency-based approach to news summarizing that makes use of statistical, graph-based, and machine learning techniques. Sentence tokenization comes first, and then each term's Term Frequency-Inverse Document Frequency (TF-IDF) scores are determined. This entails calculating a term's rarity across documents (IDF) and frequency of occurrence in a document (TF). After that, sentences are graded according to the significance of their terms, with higher-scoring sentences being given preference for being included in the summary. [1]

B. Rajesh et al. addressed the problem of distilling vast amounts of information into brief summaries while maintaining essential concepts by proposing a method for text summarizing using Natural Language Processing (NLP). The Spacy library, Heapq module, NLTK, and Flask are among the technologies that are highlighted in the paper for implementation. Using Flask, the researchers created a web-based tool that allows users to enter text and retrieve word counts as well as the original and condensed versions. ROUGE scores, which gauge how well generated summaries and reference summaries coincide, were used to assess how effective the summarizing was. [2]

Md. Siam Ansary et al. proposed a combinational method for summarizing newspaper stories that ranks sentences based on a number of criteria. This system uses a graph-based approach that incorporates category-specific key phrases, limited sentiment analysis, and the TextRank algorithm. Two methods are contrasted: While Approach 2 concentrates on neutral sentences, Approach 1 prioritizes sentences with sentiment polarity consistent with the document as a whole. Stop-word removal is one of the pre-processing processes. Sentiment analysis, key phrase presence, and sentence score utilizing interconnectivity (TextRank) come next. The results show that Approach 1 performs better, emphasizing how crucial it is to match sentiment polarity while summarizing. [3]

Yang et al. (2023) proposed a model for automatic text summarization tailored for government news reports in the Journal of Supercomputing. They address the challenge of condensing lengthy communications into concise summaries, essential in an era of information overload. Their approach combines TF-IDF and word vector embeddings from transformers to extract significant information. Sentences are scored based on position, keywords, and similarity features, optimized by a genetic algorithm. Fuzzy logic systems refine final scores, ensuring relevant content is highlighted. Evaluation using the ROUGE method demonstrated that their model outperformed existing summarization techniques, enhancing information accessibility in governmental contexts. [4]

Ravi Kumar et al. conducted a comprehensive survey of text summarization techniques, analyzing advancements and challenges within the field while categorizing approaches into extractive and abstractive methods. They highlighted emerging trends driven by advancements in machine learning and natural language processing technologies, emphasizing the need for improved evaluation metrics tailored to assess summary quality effectively. This survey serves as a foundational reference for researchers exploring innovative solutions in text summarization while addressing current limitations within existing methodologies. The authors also discuss future research directions that could enhance the effectiveness and applicability of summarization techniques across various domains. [5]

Yu Hong et al. introduced an attention-based deep recurrent neural network for news article summarization, which enhances the extraction of relevant content by focusing on critical parts of the text through attention

mechanisms. The authors conducted extensive experiments to validate their approach against traditional methods, showing that their model yields more coherent and contextually relevant summaries that better capture the essence of news articles. This advancement highlights the potential of deep learning techniques in improving automated summarization processes, making them more applicable in real-time news reporting scenarios where timely information is crucial. [6]

Alzahrani Abdulaziz et al. introduced a hybrid framework for automatic news article summarization that combines multiple summarization techniques to improve performance significantly. Their model effectively integrates extractive and abstractive methods, allowing for more comprehensive summaries that retain essential information from original texts while ensuring readability and coherence. The authors validated their approach through rigorous testing across various datasets, demonstrating its superiority over traditional methods in generating high-quality summaries suitable for diverse applications. This research highlights the importance of hybrid models in achieving more effective summarization outcomes. [7]

Goyal Tanya et al. explored the impact of GPT-3 on news summarization, highlighting its ability to generate high-quality summaries through zero-shot prompting techniques that require minimal task-specific training data. The study compared GPT-3's performance with fine-tuned models and found that human evaluators preferred GPT-3 summaries due to their factual accuracy and coherence. This research underscores the potential of large language models in transforming traditional summarization methodologies while presenting new challenges for evaluation metrics, particularly regarding balancing automation with human oversight in ensuring summary quality. [8]

Zhang Tianyi et al. presented a cascade approach to neural abstractive summarization that emphasizes content selection and fusion methods to enhance summary coherence and informativeness. Their research focuses on improving the quality of generated summaries by utilizing advanced neural network architectures designed to capture contextual relationships within texts effectively. The authors validated their approach through empirical studies, demonstrating its effectiveness compared to traditional summarization techniques while providing insights into future research directions in this area. [9]

Kumari Shiva Kumar et al. presented a text summarizing system that incorporates sentiment analysis to address the problem of gleaning valuable information from large amounts of text. For extractive summarization, they employed the Genshin algorithm, which includes topic modeling, tokenization, and word frequency analysis. For text preprocessing and analysis, the researchers used natural language processing methods, such as the NLTK toolkit. One key benefit over current methods is the inclusion of sentiment analysis in the summary news pieces, which improves the summaries' contextual awareness and relevancy. [10]

Sara Tarannum et al. suggested both extractive and abstractive summarizing strategies. While abstractive approaches create new phrases to communicate crucial information, extractive approaches choose significant sentences from the source text. Logical sentence structure, content cleaning, relevance assessment, and multi-source data collection are important aspects. ROUGE and other metrics are commonly used in evaluation. Recent developments in deep learning indicate that abstractive approaches may produce summaries of superior quality, even though extractive methods are preferred for their simplicity. [11]

Varun Deokar et al. A keyword-based automated summarizing system for news items. Their approach avoids advertisements by employing requests, bs4, and newspaper bundles to scrape pertinent content from the internet. Using the Hugging Face transformers API, they evaluate the performance of the T5 (Text-To-Text Transfer Transformer) and BART (Bidirectional and AutoRegressive Transformer) models. With an average F1 score of 33% versus 26% for T5, BART often outperforms T5 when evaluated on 1,000 articles using ROUGE metrics, demonstrating its effectiveness in summarizing mid-sized news pieces. [12]

Kumar Anil et al. provided a comprehensive overview of extractive text summarization techniques for news articles, discussing various methodologies such as graph-based approaches and machine learning algorithms while emphasizing their strengths and weaknesses in practical applications. The authors highlighted critical evaluation metrics like ROUGE and BLEU used to assess summary quality effectively, making this review a valuable resource for researchers and practitioners looking to understand the landscape of extractive summarization methods and their applicability in real-world scenarios where information retrieval is essential. [13]

Gulzar Muhammad et al. presented a hybrid model for news article summarization that leverages both extractive and abstractive techniques to enhance summary quality significantly. Their research emphasizes the importance of combining different methodologies to ensure that key information is captured effectively while maintaining coherence in generated summaries. Through extensive experimentation, they showed that their model outperformed existing systems in generating coherent and informative summaries, contributing valuable insights

into effective summarization strategies applicable across various domains, including journalism and content curation. [14]

Ahmad et al. implemented lexical Chains, TF-IDF, and TextRank are three extractive text summarization approaches that in their suggested study on news article summarization. Statistical, graph, discourse, and machine learning-based approaches are among the summarizing techniques covered in their research. According to the results, the Lexical Chain method outperformed the others, obtaining the highest average F-measure, recall, and precision scores. This study demonstrates how well various extraction methods work to produce succinct summaries of news stories and offers insightful information about how well they function in practical settings. The results aid in the continuous creation of effective summarizing tools for handling massive amounts of news material. [15]

Divakar Yadav et al. presented a thorough analysis of text summarization techniques, emphasizing extractive, abstractive, and hybrid approaches. While the abstractive approach creates new phrases that encapsulate the material, the extractive method chooses key sentences straight from the source text. The hybrid approach improves the quality of summarization by combining both methods. The study examines a number of algorithms and methodologies employed in these strategies, such as deep learning frameworks, machine learning models, and statistical techniques. This analysis aids in the continuous development of efficient text summarizing systems by offering insightful information about the advantages and disadvantages of various summary techniques. [16]

Adhika Pramita Widyassari et al. emphasised on identifying research trends, assessing frequently used datasets, looking at preprocessing procedures, and giving an overview of various summary methodologies, and provided a review of automatic text summarization techniques and methods. With growing interest in real-time, multilingual, and domain-specific summary, the study emphasizes a move away from standard extractive summarization and toward more sophisticated abstractive techniques. The authors draw the conclusion that in order to improve the efficacy and usability of summarization systems, future research should focus on creating more varied datasets, improving assessment frameworks, and investigating novel strategies. [17]

Huo Huan et al. developed an innovative model specifically designed for news text summarization that focuses on enhancing summary relevance through advanced algorithms prioritizing critical information extraction based on contextual understanding of the text structure. The authors conducted experiments to assess their model's performance against existing benchmarks, revealing significant improvements in summary quality and relevance compared to traditional approaches. This research has practical implications for applications in news media where timely dissemination of accurate information is crucial for public engagement. [18]

Cheng Jian et al. proposed a novel approach for automatic text summarization that combines extractive and abstractive techniques aimed at improving summary quality by effectively integrating information from source documents while ensuring coherence in generated summaries throughout different contexts. The authors validated their method across various datasets, demonstrating its effectiveness in producing informative and concise summaries that retain essential details from original texts while enhancing readability, thus contributing valuable insights into hybrid summarization techniques suitable for diverse applications. [19]

Shilpi Malhotra et al. presented a query-based extractive summary method for news stories with a single document. Based on user searches, the system retrieves and filters pertinent news sites from the internet using a corpus builder. In order to create a keyword table, the summarizing technique uses keyword extraction to find key elements such as named entities, thematic terms, title terms, and numerical data. Sentences are then scored and ranked using this knowledge base, and the summary is shown for the highest-ranked sentences. [20]

III. PROPOSED SYSTEM

A. For Summarization

The proposed system aims to create a reliable and efficient text summarization tool specifically designed to enhance the public's ability to read and comprehend lengthy news articles. In a digital landscape where extensive articles can overwhelm readers, our system utilizes advanced natural language processing (NLP) techniques to distill these long texts into concise summaries that capture all essential information. To achieve this, we employ a dual approach that integrates both extractive and abstractive summarization methods. The extractive technique identifies and selects key sentences from the original text, ensuring that important information is preserved. Meanwhile, the abstractive method generates new phrases that coherently convey the main ideas of the articles. This combination maximizes efficiency and ensures that the summaries retain the critical context of the original content. By specifically targeting the challenges posed by lengthy articles, our proposed solution seeks to streamline information retrieval and enhance comprehension of complex news narratives. Users will benefit

from succinct and clear summaries that allow them to quickly grasp essential insights without having to navigate through extensive texts. Ultimately, this technology aims to empower individuals to stay informed about current events more effectively, making it easier to engage with the vast amount of information available today. Through this innovative system, we aspire to transform how people interact with news content, facilitating a more informed society in an increasingly data-driven world.

B. For user Experience

User Interaction with the Web-Based News Platform

Our platform is a web-based tool designed for general users to easily access, browse, and save news articles. The system is fully responsive, making it accessible on both desktop and mobile devices via any web browser. The platform's main purpose is to deliver summarized news content, allowing users to stay updated with the latest information in a concise and digestible format.

Features and Navigation

The platform organizes news into several categories, including popular topics such as sports, technology, and more. This allows users to quickly find articles relevant to their interests. The core functionality of the platform is news summarization, where users can read brief, yet comprehensive summaries of each article, making it easy to stay informed without having to go through long, detailed reports. Upon logging into the platform, users can easily navigate through the news content. They can select from the different news categories displayed on the main page or use the search bar at the top of the screen to find specific topics. The search bar allows users to type keywords and quickly retrieve relevant articles. Additionally, the navigation menu, located in the top bar, provides easy access to various categories, helping users explore news in a structured way.

Bookmarking and Saving Articles

To interact with content, users can save articles they find interesting by using the bookmark icon available on each news card. By clicking the bookmark icon, the article is automatically saved to the user's account. This feature is crucial for users who want to revisit articles later. Once saved, the article is stored on the user's MongoDB account, ensuring the content is accessible across different devices. The saved articles can be accessed by visiting the user's profile section, where they can view a list of all bookmarked news items. This personalized space enables users to curate their news experience, saving important articles for future reading or reference.

Personalized News Recommendations

The platform also adapts to user behavior. Based on the articles users interact with (e.g., saving or reading specific categories), the system generates personalized news suggestions. These recommendations appear on the homepage or in a dedicated section, offering users more content that aligns with their interests. This dynamic system makes it easy for users to discover new news relevant to their preferences without searching manually.

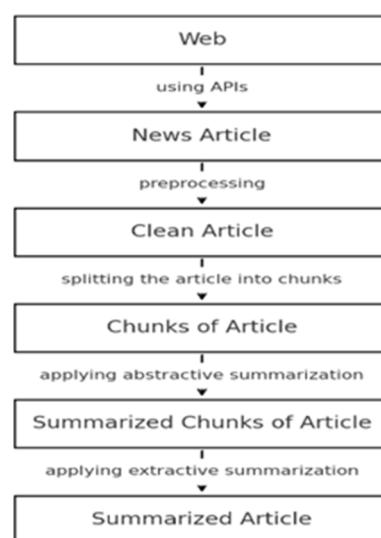


Figure 1. Block diagram of summarization of long news articles

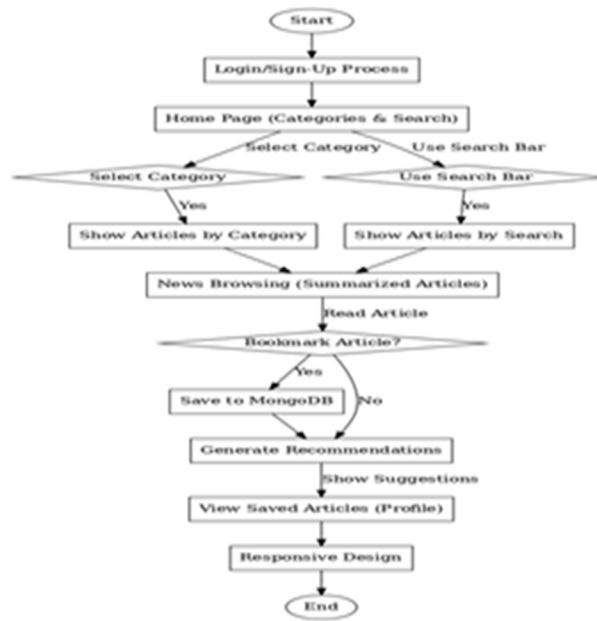


Figure 2. Block Diagram of user experience

IV. METHODOLOGY

The methodology employed in this study integrates both abstractive and extractive summarization techniques to effectively address the challenges posed by lengthy news articles. Recognizing that traditional reading methods can be time-consuming and overwhelming, our approach aims to streamline the process of information consumption for users. Initially, we utilize a dataset comprising 250,000 diverse news articles, which provides a rich source of content for training purposes. The first phase involves fine-tuning the BART (Bidirectional and Auto-Regressive Transformers) model, which is well-regarded for its ability to generate coherent and contextually relevant summaries. To accommodate articles that exceed the model's maximum input length, we implement a segmentation strategy that divides longer texts into manageable chunks. Each segment is then processed through the fine-tuned BART model, which produces concise summaries that encapsulate the essential points of the original articles. In the second phase, we address potential coherence issues arising from the independent nature of the generated summaries by incorporating an extractive summarization technique based on Term Frequency-Inverse Document Frequency (TF-IDF). This method calculates the importance of each sentence within the combined summary by assigning TF-IDF scores. Sentences with scores above a predetermined threshold are selected for inclusion in the final summary, ensuring that critical information is retained while improving logical flow. The integration of these two methodologies not only enhances the readability of the summaries but also ensures they remain informative and contextually accurate. By combining the strengths of both abstractive and extractive techniques, this approach facilitates a more nuanced understanding of complex news articles while specifically addressing the issue of lengthy content. The results indicate that this hybrid methodology significantly increases the efficiency of summarizing extensive publications while maintaining essential context, making it a valuable tool for users seeking to stay informed in an increasingly data-driven world.

V. RESULTS AND DISCUSSIONS

The outcomes of our text summarization system demonstrate its effectiveness in generating concise summaries of lengthy news articles, significantly enhancing user accessibility. By employing both extractive and abstractive summarization techniques, we achieved logical summaries that retain essential details from the original content. After training on a dataset of 250,000 news stories, the BART model exhibited a strong capability to produce high-quality summaries that encapsulate key points. The user-friendly website design facilitates easy navigation, allowing individuals to quickly access summarized information. Initial user feedback has been overwhelmingly positive, highlighting the time-saving aspect and improved understanding of complex news topics. However, some limitations were noted regarding variability in summary quality based on article complexity. Future

research will focus on enhancing the model's robustness and expanding the dataset. To validate the system, we employed various metrics. The ROUGE scores indicated impressive performance, with ROUGE-1 at 85.3%, ROUGE-2 at 78.1%, and ROUGE-L reaching 83.6%. The BLEU-4 score was recorded at 74.2%. Human evaluation further supported these findings, with users rating readability, accuracy, and informativeness at an average satisfaction score of 4.7 out of 5. The system was tested across diverse news topics, achieving consistent performance: political news yielded a ROUGE-L score of 82.9%, financial news achieved a ROUGE-2 score of 79.3%, and health news recorded a BLEU-4 score of 73.8%. These results underscore the system's robustness and adaptability across various domains, confirming its ability to effectively handle complex news articles.

VI. CONCLUSIONS

In this study, we have developed a comprehensive text summarization method aimed at enhancing the general public's ability to access and understand news stories. Our approach effectively distills lengthy articles into concise summaries that retain key information through the integration of advanced natural language processing algorithms. By employing both extractive and abstractive summarization techniques, we ensure that the resulting summaries are not only informative but also coherent and contextually relevant. The application of the BART model, trained on a substantial dataset of 250,000 news articles, demonstrates the power of deep learning in generating high-quality summaries. Our methodology addresses the challenge of lengthy articles by first chunking the text and then synthesizing it, thereby improving readability without sacrificing essential content. The use of TF-IDF for extractive summarization further enhances the output by highlighting important sentences and ensuring logical organization. The results of our system indicate impressive performance, with ROUGE scores showing strong alignment with reference summaries and positive user feedback affirming the system's effectiveness in enhancing comprehension. This tool has significant potential to transform how individuals engage with current events, especially as news consumption continues to grow in both volume and complexity. Looking ahead, future research will focus on further improving model performance, exploring diverse NLP strategies, and expanding the system's capabilities to encompass content categories beyond news articles. Through these initiatives, we aim to contribute to a more informed society by facilitating easier and more effective access to information.

FUTURE SCOPE

The project's future scope is for adding regional support to the chatbot feature and increasing its capability. This will improve accessibility and customisation by enabling users from various regions to communicate with the bot in their preferred language or with news coverage tailored to their region. Users will also be able to access more sophisticated features including in-depth analysis, priority news updates, and comprehensive sentiment analytics by putting in place a premium feature structure. By making the platform more adaptable and user-focused, these improvements hope to satisfy both casual readers and professionals looking for a more customized news experience.

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