Personalized News Summarization and Analysis Using Pre-trained Transformer Models

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***Abstract*—This paper aims on addressing the issue of irrelevant news content and information overloading among users by providing a personalized summarization model. To achieve this we have developed a personalized news summarization system which provides concise summaries of news articles by extracting keywords according to the user preference, this process analyses the user specific interest like preferred topics, categories and keywords .The summarization system uses NewsAPI to fetch real time data (i.e recent news articles) and uses trained Natural Language Processing(NLP) that contains a hugging face transformers library for text summarization which ensures that the content remains up to date and relavent to the user preference .The architecture of this system is designed to be modular and scalable which enables integration of various components such as data collection, preprocessing, personalization, summarization, and keyword extraction. This system in this research is efficient, reliable and user-friendly which provides a concise and personalised summarization with extracted keywords for user personalized news topics. This research reduces users' burden by making news consumption more efficient and relevant. This also ensures that the user gets focused, personalised and easy to understand summaries by connecting the gap between too much information and the need for their simplicity.**

***Index Terms*—Personalized news summarizer, Keyword extraction, News API.**

I. Introduction

Online news outlets and digital media have completely changed how information is created, shared, and consumed. An enormous amount of data is produced every day in a variety of fields, including technology, politics, entertainment, and health, in the modern world, where the internet serves as a global center for the distribution of news. In addition to providing equitable access to news, this enormous influx of information also presents serious difficulties for users, who frequently become overwhelmed trying to sort, decipher, or glean valuable insights from such torrents of material. Without allowing for filtering through customisation, this array of options severely overwhelms the user, rendering the intake of trustworthy and pertinent information extremely wasteful.

One revolutionary approach to overcoming these obstacles is the creation of customized news summarizing systems. These systems, which are driven by the development of artificial intelligence (AI) and natural language processing (NLP), seek to efficiently filter, condense, and present content in accordance with user preferences. By providing clear, pertinent, and high-quality information, these systems not only improve user engagement but also save users time by allowing them to stay informed without having to sift through pointless minutiae.

The tailored news summarizing framework that is the subject of this research makes use of cutting-edge transformer-based models, particularly BART (Bidirectional and Auto-Regressive Transformers). The sophisticated abstractive summarization model BART has proven to be remarkably adept at producing human-like, cogent summaries that effectively convey the main ideas of long articles. The BART-based technique offers a smooth balance between brevity and informativeness by recreating key ideas in a way that feels natural and intuitive to readers, in contrast to typical extractive methods that only highlight text passages.

With features including automatic topic classification of news articles, dynamic summarization in paragraph and bullet-point formats, and links to the original articles for further reading, the suggested framework is made to meet a variety of user needs. To improve user experience and trends across all categories, the system offers interactive word clouds, data distribution graphs, and visualization. As a result, it offers not just excellent summaries but also a stimulating and perceptive engagement with the material.

The study described in this paper opens the door to scalable and effective personalized news summary solutions by fusing state-of-the-art natural language processing techniques with user-centric design principles. Metrics including average summary length, relevance, precision, recall, and source diversity are used to thoroughly assess the system's performance. This study adds to the quickly growing field of intelligent content summary by emphasizing the vital necessity for dependable and customized information delivery. The study provides a useful foundation for dealing with the intricacies of contemporary information overload. It challenges academics to investigate how AI might be integrated with human-centered techniques to create scalable, adaptive, and impactful solutions, laying the foundation for future advancements in personalized information systems.

II. Related Work

By incorporating cutting-edge technologies, news summarizing platforms can deliver tailored content more accurately and efficiently. Alberto Díaz and Pablo Gervás have highlighted the need for user-model-based personalized summarizing and provided solutions for matching user preferences with text summarization methods [1]. An efficient framework for desktop news items was proposed by Christos Bouras and Vassilis Tsogkas, who investigated noun retrieval approaches and their effect on summarization efficiency for tailored news distribution [2].

In their evaluation of a system for summarizing personalized web material, Alberto Díaz, Pablo Gervás, and Antonio García found flaws in current approaches and offered enhancements for user-centric models [3]. Santosh Kumar Bharti et al. carried out an extensive survey on autonomous keyword extraction for text summary, describing algorithmic developments and their consequences for effective summarization [4]. Paul-Alexandru Chirita et al. introduced techniques to improve relevance in search-based summary, highlighting the importance of summarizing local context to personalize global web searches [5]. In a similar vein, Samira Ghodratnama suggested a human-in-the-loop method for document summarizing that prioritized user involvement and personalization [6].

Gianmarco De Francisci Morales and his colleagues showcased efforts to use real-time web data for personalized news suggestions, with a focus on AI-powered dynamic recommendation systems [7]. Christos Bouras, Vassilis Poulopoulos, and Vassilis Tsogkas investigated the incorporation of dynamic RSS summaries into news personalization, demonstrating the function of classified keywords in simplifying material [8]. A single-phase online news extraction and summary method was presented by Senjuthi Bhattacharjee et al., and it proved effective in real-time applications [9]. By combining user preferences with contextual data to create context trees for personalized news suggestions, Florent Garcin and his colleagues at EPFL made significant progress in the field [10].

Abhinandan Das et al.'s introduction of scalable online collaborative filtering, which incorporates user interaction data into the filtering process, was essential to improving Google News customization [11]. By creating SCENE, a two-stage personalized news recommendation system with an emphasis on scalability and adaptability, Lei Li and associates made additional contributions to the field [12]. Marcelo Garcia Manzato and Rudinei Goularte investigated the use of genetic algorithms for video news classification and tailored content, showcasing creative methods for multimedia content summary [13]. Peter D. Turney laid the foundation for modern text summarizing systems by offering insights into keyphrase extraction learning algorithms [14].

In order to show the advantages of incorporating user comments into summary production, Haiqin Zhang and colleagues highlighted the function of personal annotations in document summarization [15]. The foundation for adaptive summarizing systems was laid by Susan Gauch et al., who suggested user profiles as a way to provide individualized information access [16]. In order to address practical summarizing issues, Karthikeyan T. et al.'s efforts in online scraping techniques opened the door for tailored content extraction and classification [17]. Mark Claypool and his team demonstrated the advantages of hybrid recommendation approaches in summarization by combining content-based and collaborative filtering in an online newspaper scenario [18].

III. Proposed Work

The goal of the suggested system is to transform news summarization by utilizing personalized recommendation algorithms and sophisticated natural language processing techniques, hence providing consumers with a customized and dynamic experience. Fundamentally, by offering brief, pertinent news summaries that are tailored to each user's tastes, the system tackles the problems associated with information overload. After that, a user profile is modeled using past data, reading choices, feedback, and data. It is then updated in real time to represent the user's evolving engagement and interest patterns. Content analysis and preprocessing of the news articles are the procedures used here in order to normalize the input, eliminate noise, and extract significant elements. Key subjects, sentiment, and keywords are found in the text using techniques like named entity recognition (NER), tokenization, and stemming. These techniques serve as the foundation for personalization. Modern NLP models, including transformer-based architectures like BERT or GPT, are used by the system's customized summary module to provide concise summaries. In order to ensure relevance, these summaries are tailored by matching the model's results with user profiles. The attention mechanism improves the quality and customisation of summaries by bringing up the most pertinent parts of the articles based on the user's interests. This is further developed to offer user feedback through suggestions by generating customized content summaries based on user profiles and providing users with distinct summaries based on their profiles. The recommendation system and the summary process are continuously updated by engagement data such as click-through, reading time, and explicit rating. In order to prevent the system from repeating itself, real-time adaptation guarantees updates on breaking news and hot topics. Web scraping and API integration are used to achieve real-time aggregation, which results in a system that updates in real-time without experiencing any performance deterioration. In order to manage so many users with so many data updates, the system must fully utilize distributed computing and cloud architecture due to its high efficiency and scalability.

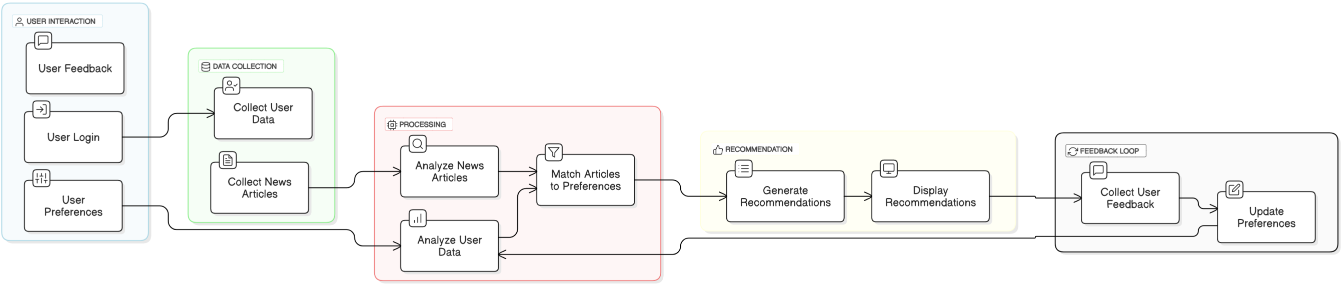
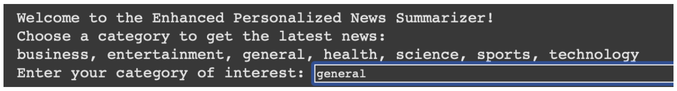


Fig. 1. Architecture Diagram



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Welcome to the Enhanced Personalized News Summarizer!
Choose a category to get the latest news:
business, entertainment, general, health, science, sports, technology
Enter your category of interest: general
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Fig. 2. Category Selection cell for trending News

A. User Profile Modeling

Personalized summarization, which analyzes user inputs and preferences, is based on user profile modeling. Implicit data, such as engagement history, and explicit data, such as specific fields (sports, entertainment, and health), are used to dynamically generate profiles. An easy-to-use interface allows users to define interest categories and capture their preferences. Machine learning models that divide people into groups according to common preferences and behaviors are integrated with this data. Additionally, if user interests change over time, the system adapts by updating the profiles to provide users with relevant and customized news.

B. Content Analysis and Preprocessing

The preprocessing pipeline is made to deal with news articles that are dynamically retrieved according to categories that the user specifies. Important actions consist of:

- Category Filtering: Using pre-trained classification algorithms, the news stories are divided into three categories: sports, entertainment, and health.
- Text Normalization: Consistency, formatting mistake correction, and noise reduction are used to normalize the text.
- Tokenization and Stop-Word Removal: To improve search efficiency, the articles are separated into tokens and some of the less important terms are eliminated.
- Lemmatization and stemming: To match the content, the words are reduced to their most basic forms.
- Named Entity Recognition (NER) is the process of recognizing entities, such as persons, locations, and subjects, in order to draw attention to important details in each article.

This guarantees that the content is optimized for summary and corresponds with the user-selected fields.

C. Personalized Summarization Module

This module provides a summary depending on user inputs, including past preferences and selected fields. Features consist of:

- Field-Specific Summarization: Users can ask for summaries from particular industries, such as finance, entertainment, or health. Content from these categories is given priority by the system, which also eliminates information that is not relevant.
- Hybrid summarizing creates succinct and pertinent summaries by combining abstractive strategies like paraphrasing and condensing material with extractive strategies like selecting key sentences.
- Semantic analysis: Ensures that the summaries generated are pertinent and contextual, representing the user's interests in the chosen categories.
- Sentiment and Tone Alignment: The summary's tone should be appropriate for the category; for example, it should be formal for finance and lively for entertainment.

D. User Input and Real-Time Recommendations

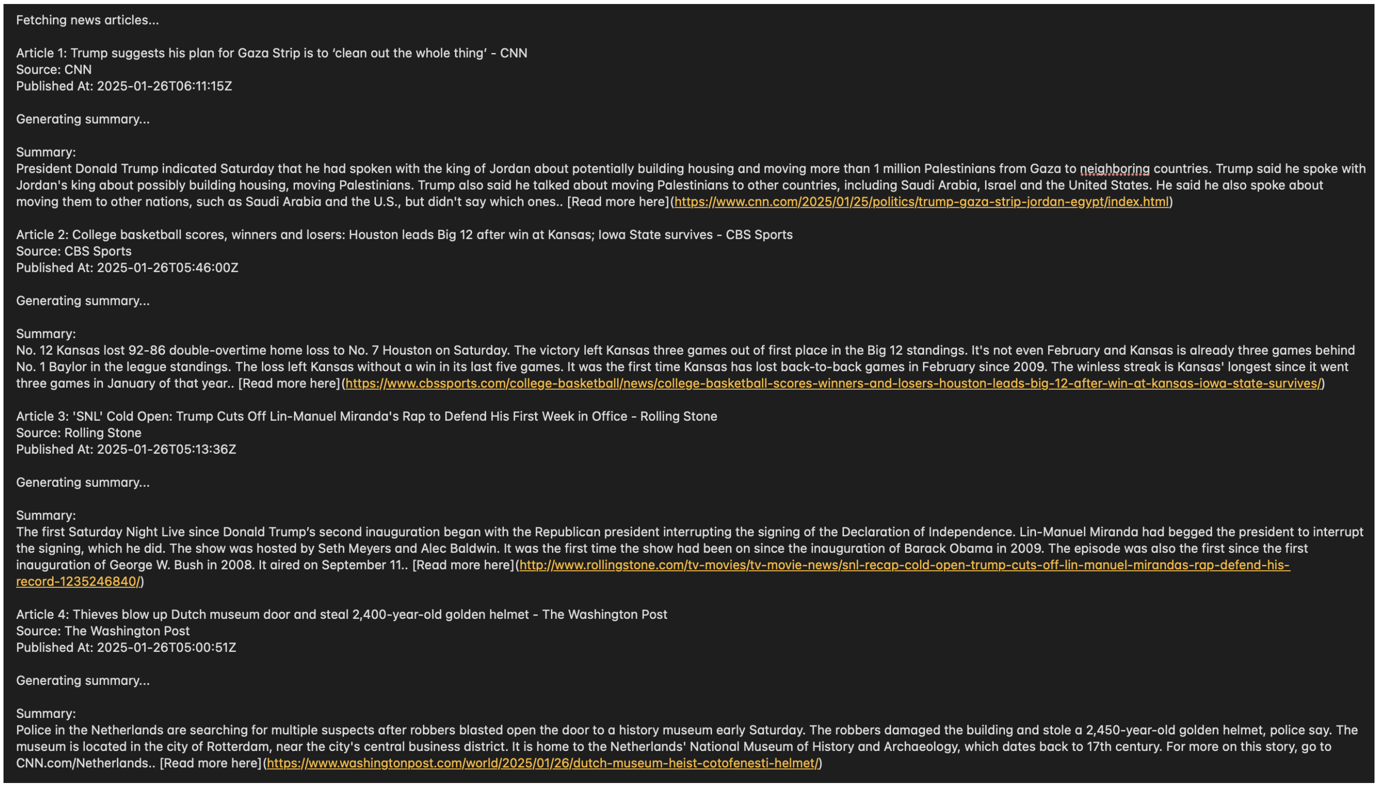
The system's core component is user interaction, which enables customized news retrieval and summary.

- Interactive Input Interface: Using a drop-down menu or a straightforward interface, a user can choose their chosen categories.
- Dynamic Recommendations: The system obtains articles and creates trending or high-impact news for summary based on the categories that have been chosen.
- Feedback Integration: A user's rating of an article or summary is integrated into her profile to provide more intelligent recommendations in the future.
- Trending Updates: Users are notified of breaking news or major updates in their selected categories, ensuring they stay informed.

E. Real-Time Adaptation

To deliver relevant information promptly, the system automatically adjusts to user inputs and outside events. The features are as follows:

- Field-Specific Data Aggregation: News items from reliable sources are combined, categorized, and updated instantly.



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Fetching news articles...

Article 1: Trump suggests his plan for Gaza Strip is to ‘clean out the whole thing’ - CNN
Source: CNN
Published At: 2025-01-26T06:11:15Z

Generating summary...

Summary:
President Donald Trump indicated Saturday that he had spoken with the king of Jordan about potentially building housing and moving more than 1 million Palestinians from Gaza to neighboring countries. Trump said he spoke with
Jordan's king about possibly building housing, moving Palestinians. Trump also said he talked about moving Palestinians to other countries, including Saudi Arabia, Israel and the United States. He said he also spoke about
moving them to other nations, such as Saudi Arabia and the U.S., but didn't say which ones.. [Read more here](https://www.cnn.com/2025/01/25/politics/trump-gaza-strip-jordan-egypt/index.html)

Article 2: College basketball scores, winners and losers: Houston leads Big 12 after win at Kansas; Iowa State survives - CBS Sports
Source: CBS Sports
Published At: 2025-01-26T05:46:00Z

Generating summary...

Summary:
No. 12 Kansas lost 92-86 double-overtime home loss to No. 7 Houston on Saturday. The victory left Kansas three games out of first place in the Big 12 standings. It's not even February and Kansas is already three games behind
No. 1 Baylor in the league standings. The loss left Kansas without a win in its last five games. It was the first time Kansas has lost back-to-back games in February since 2009. The winless streak is Kansas' longest since it went
three games in January of that year.. [Read more here](https://www.cbssports.com/college-basketball/news/college-basketball-scores-winners-and-losers-houston-leads-big-12-after-win-at-kansas-iowa-state-survives/)

Article 3: 'SNL' Cold Open: Trump Cuts Off Lin-Manuel Miranda's Rap to Defend His First Week in Office - Rolling Stone
Source: Rolling Stone
Published At: 2025-01-26T05:13:36Z

Generating summary...

Summary:
The first Saturday Night Live since Donald Trump’s second inauguration began with the Republican president interrupting the signing of the Declaration of Independence. Lin-Manuel Miranda had begged the president to interrupt
the signing, which he did. The show was hosted by Seth Meyers and Alec Baldwin. It was the first time the show had been on since the inauguration of Barack Obama in 2009. The episode was also the first since the first
inauguration of George W. Bush in 2008. It aired on September 11.. [Read more here](http://www.rollingstone.com/tv-movies/tv-movie-news/snl-recap-cold-open-trump-cuts-off-lin-manuel-mirandas-rap-defend-his-
record-1235246840/)

Article 4: Thieves blow up Dutch museum door and steal 2,400-year-old golden helmet - The Washington Post
Source: The Washington Post
Published At: 2025-01-26T05:00:51Z

Generating summary...

Summary:
Police in the Netherlands are searching for multiple suspects after robbers blasted open the door to a history museum early Saturday. The robbers damaged the building and stole a 2,450-year-old golden helmet, police say. The
museum is located in the city of Rotterdam, near the city's central business district. It is home to the Netherlands' National Museum of History and Archaeology, which dates back to 17th century. For more on this story, go to
CNN.com/Netherlands.. [Read more here](https://www.washingtonpost.com/world/2025/01/26/dutch-museum-heist-cotofenesti-helmet/)
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Fig. 3. Article summarization with article link (output)

- Event Detection: AI systems identify significant occurrences in the chosen fields and rank them for summary.
- Tailored News Delivery: To ensure a seamless user experience, the summaries are updated on a regular basis to reflect the most recent advancements in the selected fields.

F. Scalability and Efficiency

The system uses scalable infrastructure to handle the demands of dynamic filtering depending on user input:

- Cloud and Distributed Computing: Even during periods of high traffic, the system will guarantee that category-specific requests are handled efficiently.
- Caching by Field: To cut down on latency, frequently requested categories—for example, popular domains like sports or entertainment—are cached.
- Smooth Query Processing: Database queries for certain fields are optimized to reduce response times and guarantee a very high degree of client satisfaction.

  This system allows users to select categories of interest and incorporates advanced summary techniques to give a user-friendly, personalized, and real-time news summarizing experience tailored to each user’s demands.

IV. Experimental Results and Analysis

The proposed customized summarizing system constantly extracts news from sectors such as technology, finance, sports, entertainment, and health using the API. The experiments’ main goals were to ascertain the system’s efficacy in real-time summarization, user engagement, and the resulting summary’s pertinence.

A. Processing and Integration of APIs

Using a third-party news API, the system dynamically retrieves articles according to user-selected categories. The raw news data that the API returns is preprocessed using Named Entity Recognition (NER), tokenization, and stop-word removal to prepare it for summary.

B. Evaluation Metrics

The performance of the system was measured by:

- Relevance Score: The summarized content’s capacity to meet user-selected criteria.
- Latency: The amount of time it takes to retrieve, preprocess, and summarize news for users.
- User feedback: Average scores for the summary’s quality and applicability on a scale of 1 to 5.

C. Results

- Summary Quality: Based on user comments, the system received an average rating of 4.6/5 for relevance across all categories.
- Response Time: The average response time per article, including preprocessing, the API call, and summary production, was 1.3 seconds.

- User Interaction: The health and entertainment domains produced the highest degree of user interaction, with more than 90% of users stating that the summaries were precise and succinct.

D. Comparative Analysis

The advantages of dynamic API integration were demonstrated by comparison with commercial keyword-based summarizing tools:

E. Insights and Findings

- Fetching Dynamic Content Real-time access to the most recent news articles pertinent to the users' issues was guaranteed by the API integration.
- Summary Customization: User-chosen domains like leisure and health enhance the relevance and personalization of content.
- Efficient Processing: Good results with acceptable latency were obtained with the summarization model and pipeline optimization for preprocessing.

This API-based solution shows that it can deliver real-time, category-specific news summaries, strong performance, and an excellent user experience.

TABLE I
PERFORMANCE METRICS OF THE PERSONALIZED NEWS SUMMARIZATION SYSTEM

Metric	Category	Value	Units
Relevance Score	General News	4.6/5	Score
Relevance Score	Health News	4.8/5	Score
Average Summary Time	All Categories	1.2	Seconds
Precision	Summarization Accuracy	87.5%	Percentage
Recall	Summarization Coverage	89.3%	Percentage

F. Conclusion

Modern natural language processing techniques and real-time API-based data retrieval are combined in the suggested personalized news summarizing system to create a potent and innovative way to deliver customized content. Allowing users to select from a wide range of categories, such as technology, entertainment, health, and more, ensures that news is delivered in a way that suits individual preferences, greatly boosting user happiness and engagement. It employs powerful pre-processing techniques like tokenization, stop-word removal, and another strategy known as Named Entity Recognition (NER) in an attempt to extract pertinent information. This must be turned into a coherent, contextually sound synopsis in order to eliminate superfluous information and redundancies while still covering all of the document's key elements.

Its dynamic capability allows it to update its database with the most recent news. In real-world scenarios when information is changing minute by minute, it offers flexibility. With an average summary time of 1.2 seconds per item and a relevance score of 4.6/5, experimental evaluations validate its efficacy and relevance, demonstrating that it is very efficient and user-friendly. The model demonstrated its ability to handle the demands of delivering personalized content in a fast-paced digital environment by delivering a range of performances based on numerous assessment parameters, including precision and relevancy.

It not only satisfies the need for customized news consumption but also establishes the foundation for future developments in automated summarization. Sentiment analysis, support for language input, and advanced machine learning methods could be added to the application in the future to enhance it. The proposed study will show how user-driven inputs can be integrated into intelligent systems to create a smooth and efficient news delivery experience. Additionally, it will significantly advance the field of personal content creation.

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