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# A comprehensive literature review on automated text summarization and evaluation using NLP approaches

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**Abstract:** This paper proposes a comprehensive review on current developments in the area of Natural Language Processing (NLP), covering a wide variety of methodologies and technologies, including sentiment analysis, machine learning (ML) approaches, chatbots along with speech recognition approaches. The paper is designed to support both commoners and technically skilled personnel to understand the fundamentals of traditional and advanced NLP methods. The authors provide a comprehensive survey of previous literature in NLP technologies from the year 2013 to 2023 to understand the current state of affairs. While few parts of the work might have been roofed in additional depth, yet an in-depth current exploration of the approaches might have to be considered. Nevertheless, this paper is still a valued resource for investigators and researchers in the field of NLP.

**Key words:** Natural Language Processing (NLP), Text data, Literature review, Machine Learning (ML)

## I. INTRODUCTION

NLP approaches encompasses a diverse array of techniques designed to empower computers for understanding and interacting with human language. From the last 10 years, this field has seamlessly integrated into our daily lives, with automatic machine translation being prevalent in web and social media.

Text classification is an instance of NLP, that plays a pivotal role in managing email inboxes, by shielding human beings from inundation of spam. Search engines, like Google, have been evolving beyond mere string-matching approaches, by exhibiting a high level of linguistic sophistication. Furthermore, dialog systems offer an increasingly prevalent and effective means of accessing and disseminating information.

These diverse applications of NLP share a common foundation, drawing upon principles from fundamentals of algorithms, linguistics, logics, statistics, and much more. The objective of current study is to present a comprehensive survey of foundational and application aspects in NLP. In this perspective, the current study serves as a preamble, elucidating the interconnectedness of NLP approaches with broader intellectual domains. The study also highlights the interdisciplinary nature of NLP field, underscoring its reliance on diverse methodologies.

The study also captures the complexities of NLP approaches but underscores its practical applications in the digital landscape. Machine translation, as an instance, is one the prominent applications of NLP. It has become ubiquitous, by breaking down language barriers on a global scale.

On the other hand, spam filters, which is an essential NLP application, showcases the effectiveness of text classification technique by managing overwhelming amounts of data. Some of the sophisticated search algorithms that are rooted in linguistic sophistication, enhances online exploration, while dialog systems provide efficient means of information retrieval and sharing.

Within this multifaceted landscape, NLP emerges as a dynamic and evolving field. This study encourages readers to recognize the dynamic nature of this discipline by adapting to its fundamentals accordingly. This study also serves as a guide, by offering high-level insights about contemporary NLP approaches. The study also emphasizes tangible impact of NLP and its applications in our everyday experiences. The next chapter focuses on current developments in the area of NLP.

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## II. LITERATURE SURVEY

**Table 1**: Prominent studies highlighting the significance of NLP approaches towards text analysis

| Sl. No | Year of publication | Title of paper | Description |
|---|---|---|---|
| 1. | 2023 [1] | Research on Generative Text Summarization Fusing Multidimensional Semantic Information | The model is built on the pointer generation network; to improve the fine-grained features of the original text, global semantic information is extracted using the BiLSTM encoder, and local semantic information is extracted using the local convolution extractor. |
| 2. | 2023 [2] | Abstractive Text Summarization Using Keywords with Transformers Model | To create a summary of a given document that only contains the most important and relevant information is the aim of abstractive text summarizing. In recent years, BERT and transformer models have dominated the deep learning space for abstractive text summarization. |
| 3. | 2023 [3] | "Text Analysis Tool," | Among the most widely used text processing functions are text summarization, language translation, emotion classification, and news story headline creation. Text summarization's primary objective is to take a text's most relevant information and present it in a clear, succinct manner. |
| 4. | 2022 [4] | Automatic Thai Text Summarization Using Keyword-Based Abstractive Method | Since extraction-based summarizing adds the words in their original form to a summarized version, it is used in this paper. It will assist in suggesting an alternative to the conventional technique of product reviews that preserves the spirit and substance of the reviews through the use of machine learning and natural language processing (NLP). |
| 5. | 2022 [5] | Medical Reports Summarization Using Text-To-Text Transformer | The new development of deep learning and large language models (LLM) can greatly aid in the critical task of summarizing medical reports so that the general public can easily access them. |
| 6. | 2022 [6] | "Text-based Emotion Recognition using Sentiment Analysis," | The reason for emotional analysis is the local differentiation of the basic ways of thinking of individuals. |
| 7. | 2022 [7] | "A Review of the Trends and Challenges in Adopting Natural Language Processing Techniques for Education Feedback Analysis," | This research focuses on existing NLP methods and applications which can be modified and utilized by any of educational applications such as sentiment tagging, entity tagging, text summarization, and topic modeling. Contextual challenges in NLP such as sarcasm, domain-specific language, ambiguity, and facet-based sentiment analysis are explained with existing methods to overcome them. |
| 8. | 2022 [8] | "The Usage of NLP-Based text Representation Techniques to Support Requirement Engineering Tasks: A Systematic Mapping Review," | A literature survey which is in the form of a methodological literature review (classification) to find out (1) what are the representations of RE tasks used in the literature, (2) what is the main focus of those works, (3) which are the main research directions in this field, and (4) which will be the gaps and possible future directions. |
| 9. | 2022 [9] | "Sentiment Analysis Using Neural Network: Application and Future Direction," | This article describes its importance in all aspects of daily life and discusses its contribution to public administration. Humans are emotion-oriented creatures; therefore, the study of emotions has considerable developmental potential. This article reviews three basic algorithms and several new improvements that use neural networks in sentiment analysis. |

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| 10. | 2022 [10] | Text Summarization Clustered Transformer (TSCT) | Text summary using clustered transformer models. The utility of incorporating a contextual illustration that will be captured in different linguistic contexts and use surface features to improve understanding of words and sentence elements. |
| 11. | 2022 [11] | "Survey on Sentiment Analysis using Deep Learning," | Deep learning is the most effective machine learning technique used to extract the feature from the text and use the recognized feature to make predictions about the different text. Opinion mining helps identify the feelings and sentiments of social people, which are used as input for various business decisions. This article provides an overview of deep learning and sentiment analysis. |
| 12. | 2022 [12] | Text Summarization using Transformer Model | This study proposes a text summarization technique based on the model of text-to-text transmission transformer (T5). University of California Irvineand (UCI) Drug Evaluation Database. manually generated human summaries for a given drug for the ten most useful ratings for 500 different drugs from a dataset |
| 13. | 2021 [13] | "A Survey of Automatic Text Summarization: Progress, Process and Challenges," | This article contains information about the summary of the text and much more. |
| 14. | 2021 [14] | "A Study of Automated Evaluation of Student's Examination Paper using Machine Learning Techniques," | HAES is an automatic answer scoring system that enables text recognition on the answer sheet and can score each answer depends upon the model's prior knowledge. |
| 15. | 2021 [15] | "AutoEval: An NLP Approach for Automatic Test Evaluation System," | "AutoEval - Automated Test Scoring System" is a computerized or automated test paper scoring system. Manual paper grading is time consuming and exhausting, but computerized exam paper grading helps to standardize the paper marking process efficiently and reliably. |
| 16. | 2020 [16] | A review on text detection from multi-oriented text images in different approaches. | This article discusses various techniques such as image processing, data mining, machine learning or neural network techniques used for text extraction from multidimensional images and their comparative study. |
| 17. | 2020 [17] | A Survey on NLP based Text Summarization for Summarizing Product Reviews | A summary of the text may be useful in this regard. Many NLP researchers are interested in summarizing text. This article is an overview of different types of text summarization techniques, from basic techniques to advanced techniques. According to this study, seq2seq model and LSTM and attention mechanism are used to increase accuracy. |
| 18. | 2020 [18] | Optical Character Recognition for English Handwritten Text Using Recurrent Neural Network. | Helps in recognition of handwritten characters. |
| 19. | 2020 [19] | A Topical Keywords Fusion Based on Transformer for Text Summarization | A transformer as a feature separator to improve the performance of the model, which alleviates the poor parallel computing ability or poor remote feature extraction ability of the traditional model. Second, creatively integrate up-to-date keywords that also make the generated summary closer to a regular summary. Data experiments show that the ROUGE index and the readability of the model are significantly improved, indicating that the proposed model can effectively integrate keywords and generate keyword summaries. |

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| 20. | 2020 [20] | Recent Progress on Text Summarization | This article reviews recent approaches in three categories: extractive, abstract, and hybrid text summarization, and specific methods for each category. Most authors focus on an extraction approach, but the summaries produced are very different from human summaries, regardless of the techniques used. |
| 21. | 2019 [21] | Enabling Semantic Search Based on Conceptual Graphs over Encrypted Outsourced Data | This article discusses the limitations of searchable encryption in existing cloud services, particularly keyword-based search systems. We present a semantic search based on concept graphs (SSCG). The paper focuses on capturing users and semantic intentions. The approach uses a "sentence scoring formula; and Tregex extracts key topic phrases and converts them into concept graphics (CG). The new method quantitatively calculates CG and classifies the results as "texture summary scores". The proposed SSCG scheme improves the security guarantees provided by searchable symmetric encryption (SSE) and has been validated by experiments on the CNN dataset, showing its effectiveness. |
| 22. | 2019 [22] | Read, Watch, Listen, and Summarize: Multi-Modal Summarization for Asynchronous Text, Image, Audio and Video | This work presents a multimodal summarization (MMS) method that combines NLP, speech processing, and computer vision to improve multimedia news summarization under increased data throughput. The convergence of text, image, audio and video bridges semantic gaps by selectively using audio transcription, inference from audio signals, and learning shared representations with a neural network. Visual information coverage is achieved through text-image matching or multimodal topic modeling. The final text summary optimizes visibility, redundancy, readability and scope. |
| 23. | 2019 [23] | Recommending Personalized Summaries of Teaching Materials | This paper presents a method for summarizing personal teaching documents using formative assessment data. In connection with the electronic teaching support, the text comprehension check is done with the mobile phone application after the previous lectures. In parallel, theme-based document summaries containing key phrases are created. Personal recommendations for these summaries are from students and test results. The approach has been validated in a real university-level course, demonstrating its applicability in tailoring learning materials to the needs of individual students. |
| 24. | 2019 [24] | Language Model-Driven Topic Clustering and Summarization for News Articles | This paper presents a linguistic model-based topic model (LMTM) for unsupervised topic clustering in topic identification and tracking tasks. Unlike existing models, LMTM uses a language model to incorporate semantic and syntactic information, thus eliminating the lack of readable topic descriptions. The proposed method outperforms four baselines across multiple evaluation metrics on different datasets, showing superior performance in JC, FMI, precision, recall and F1 scores. In addition, the generated summaries present the rationality and readability of the model components, highlighting the effectiveness of LMTM in improving an unsupervised subject group. |
| 25. | 2018 [25] | Predicting Contextual Informativeness for Vocabulary Learning | This work uses a statistical learning approach to develop a system that predicts contextual information for 1,000 words spanning high school and high school levels. The open-source database contains 70,000 contextual examples collected from the Internet; each context evaluated by 10 |

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| | | | people. A system based on random forest regression, using a new set of 600 numerical features that capture a variety of linguistic information, outperforms human judgment. For words outside the dataset, the system provides students with curated contexts, 54 percent of which contain rich contextual cues and less than 1 percent of which are confusing, as confirmed by high school language arts teachers. |
| 26. | 2018 [26] | Summarization of Methodical review over Reinforcement Ranking on Semantic Link Network | This paper explains about a new and efficient type of text summarization method, called Semantic Link Network, which is applied to research papers. The approach involves decomposing a network of language units with semantic links, classifying nodes based on set assumptions, and selecting Top-k sentences for summarization. Six ranking models are designed and analysed, showing that semantic connection networks significantly improve the acknowledgement of representative sentences. The projected technique not only provides a new approach to text summarization, but also confirms the efficiency of semantic links to detention the important topics of the text data. |
| 27. | 2018 [27] | *Doccurate*: A Curation-Based Approach for Clinical Text Visualization | Physicians often struggle to effectively review patients' extensive medical histories. Current text rendering methods attempt to solve this problem, but have limitations such as error rates and the need for healthcare providers to refine algorithms. This article introduces Doccurate, a new system that uses a treatment-based approach to visualize large clinical text files. Doccurate provides automated review, editability and maintains extensive links to the original text to overcome the limitations of current clinical practice. The study includes a qualitative assessment with experts in the field, highlighting doctors and information needs and the importance of customization, supported by Doccurate and use case scenarios that demonstrate practical utility. |
| 28. | 2017 [28] | An Information Distillation Framework for Extractive Summarization | Representational learning has emerged in natural language processing, especially for words. However, in the context of tasks such as a document summary, traditional methods of paragraph embedding can be misleading with frequent stop or function words. This paper presents the Essence Vector (EV) model, which is an unsupervised part that distills representational information while discarding background information. A plugin, the Denoising Essence Vector (D-EV) model, solves the challenges of processing speech content. The proposed summary framework considers both relevance and redundancy. A height comparison evaluation shows the efficiency of EV and D-EV and confirms their superiority over state-of-the-art summarization methods. |
| 29. | 2017 [29] | Automatic Summarization of Lecture Slides for Enhanced Student Preview Technical Report and User Study | This paper extends previous research by proposing a new method for summarizing lecture slides for students. Grounded on a review of 326 students who showed a preference for summary material, the authors developed an automatic summarization approach using image and text processing. In an experiment with 372 students, it was found that those who watched summaries scored better on quizzes, although they spent less time on the preview than those who used the original material. |
| 30. | 2016 [30] | Heterogeneous Knowledge Transfer in Video Emotion | This paper presents a new approach to understanding sentiment in user-generated videos. It deals with the |

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| | | Recognition, Attribution and Summarization | complexity of such content by proposing a technique that uses information from various external sources, including images and textual data. The framework improves video emotion-related tasks such as recognition, attribution, and summarization by learning the emotional image dataset and transferring information from text corpora. Investigational outcomes on several datasets show the efficiency of this data transfer method in improving various aspects of video emotion analysis. |
| 31. | 2015 [31] | Does Summarization Help Stock Prediction? A News Impact Analysis | The study investigates the synergy between news summaries and stock price forecasting and presents a multifaceted framework for stock price prediction which incorporates various external signals. The authors estimate forecasts at the level of individual stocks, sectors and market indices using five years of data from the Hong Kong Stock Exchange and Finet news. The results show that using summaries of news articles significantly outperforms predictions based on full-length articles, demonstrating performance on validation and independent test sets. |
| 32. | 2015 [32] | IncreSTS: Towards Real-Time Incremental Short Text Summarization on Comment Streams from Social Network Services | This paper addresses the challenge of summarizing short texts in social network (SNS) comment streams. Focused on real-time needs, the IncreSTS algorithm is designed to cluster comments incrementally, enabling efficient updates with the latest input. The persistence of the model is to provide a short summary of opinions on social media, intended for users who want to have a brief idea of the comments without reading the entire list. The approach shows high efficiency, scalability, and effective handling of outliers, which are confirmed by extensive experiments and real-case demonstration, making IncreSTS practical for the targeted problem of SNS comment summarization. |
| 33. | 2013 [33] | Summarizing Online Reviews Using Aspect Rating Distributions and Language Modeling | The article presents Starlet, a new solution to the challenge of efficiently extracting relevant information from a vast and huge number of online products and services reviews. Starlet focuses on multi-document summarization involving aspect ratio distribution and language modelling. The main objective of this approach is to include sentences in the summary that not only reflect the general distribution of opinion, but also reflect the original language used in the reviews. |
| 34. | 2013 [34] | Hierarchical Topics: Visually Exploring Large Text Collections Using Topic Hierarchies | The section discusses the challenges of representing a large number of topics in text corpora and presents a solution called Hierarchical Topic (HT). HT combines a topic rose tree algorithm with an interactive visual interface to create a hierarchical representation of topics. The system allows users to navigate and modify the subject hierarchy based on their understanding of the subject area. The effectiveness of HT was qualitatively demonstrated by a case study and quantitatively confirmed by a user study, showing faster identification of relevant subjects. User comments were considered in the development of the system. |
| 35. | 2013 [35] | Graph-Based Methods for Natural Language Processing and Understanding—A Survey and Analysis | This study evaluates the functional components, efficiency and maturity of graph-based methods for natural language processing. It explores features such as summarization, text search, redundancy reduction, similarity measurement, word sense testing and more. The analysis provides estimated scores for accuracy, coverage, scalability, and performance. It provides a comprehensive overview, using |

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| | | | tables and line charts to highlight key aspects of these methods. |
| 36. | 2012 [36] | "TSCAN: A Content Anatomy Approach to Temporal Topic Summarization." | The paper presents a study of anatomy and the goal is to summarize and connect the key elements of the topic over time. The proposed TSCAN model extracts the most important topics using a temporal block association matrix and eigenvectors, identifying important events and producing summaries. Test results show that TSCAN and temporal summaries outperform existing methods in terms of content coverage, coherence and consistency, and comprehensibility compared to human-generated benchmark summaries. |
| 37. | 2012 [37] | A Context-Based Word Indexing Model for Document Summarization | This paper presents a new approach to document summarization, addressing the limitations of existing models based on sentence similarity without considering context. The proposed model uses a Bernoulli randomization model to create a context-sensitive document indexing system that uses lexical relations between expressions. These index weights are then used to compute a context-aware sentence similarity matrix, which is used in conjunction with basic graph-based ranking models for sentence extraction. Experiments on DUC benchmark datasets show that the proposed Bernoulli-based phrase similarity model consistently outperforms baseline methods. |
| 38. | 2011 [38] | Movie Rating and Review Summarization in Mobile Environment | This article presents a mobile movie rating and review summary system. Ratings are derived from sentiment classification and aggregated insights are created using feature-based summarization. The new approach uses Latent Semantic Analysis (LSA) to identify product features, which reduces summary size. Both emotion classification accuracy and reaction time are taken into account when designing the system. The proposed system is adaptable to multiple product evaluation domains. |

## III. ADVANTAGES & DISADVANTAGES OF NLP APPROACHES

Based on the contributions identified in the above table, this section highlights the strengths and pitfalls of NLP approaches in handling text data towards knowledge extraction.

**Advantages of NLP approaches:**

This subsection highlights the strengths of current NLP technologies

***Improved Human-Computer Interaction:*** More intuitive and natural communication between people and machines is made possible using NLP approaches. Currently, voice commands, chatbots, and virtual assistants are used as applications that benefits from improved human-computer interaction.

***Text Analysis and Sentiment Analysis:*** NLP approaches are centered towards analysis of large volumes of text data. Sentiment analysis, text summarization, and language translation are some of the applications that help businesses in gaining insights from textual information.

***Efficient Information Retrieval:*** NLP techniques enhances knowledge extraction from search engines and information retrieval systems, making it easier for users to find relevant information at a quicker pace. Search engines like Google utilizes NLP approaches towards understanding user queries for delivering accurate results.

***Automation and Efficiency:*** NLP technologies aid in automation of certain tasks that involve understanding and generation of human languages, thereby reducing the need for manual intervention in numerous applications like customer support, data entry and content generation.

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***Language Translation:*** NLP approaches also supports language translation services, thereby enabling automatic translation of text or speech from one language to another. This characteristic of NLP approaches has broad implications towards global communication and business.

***Personal Assistants and Chatbots:*** NLP applications are crucial contributors towards progression of chatbots and virtual assistants. Such NLP driven assistants aids in enhanced understanding and respondence to user queries. They also perform other text-oriented tasks which converts data into informal content.

**Disadvantages of NLP approaches:**

This subsection highlights the pitfalls of current NLP technologies:

***Ambiguity and Context Understanding:*** Natural language is frequently ambiguous, and understanding its context can be challenging for NLP systems. This often leads to data misinterpretation and errors, especially in complex or context-dependent conversations.

***Biases in Language Models:*** NLP models trained on large datasets could inherit biases in data processing. This may affect the output knowledge, potentially perpetuating societal prejudices and reinforcing stereotypes.

***Data Privacy Concerns:*** NLP applications often involves processing of large amounts of text data, which could sometimes lead to uncertainties about data secrecy. In such circumstances, there is a possibility of personal and sensitive information being unintentionally exposed or mishandled.

***High Resource Requirements:*** Training and deploying sophisticated NLP models can be computationally expensive and resource-intensive. This could possibly restrict the availability of advanced NLP technologies in smaller organizations or in resource-constrained environments.

***Lack of Common-Sense Understanding:*** NLP models often struggles with understanding common intelligence and reasoning abilities that humans possess naturally. They may misinterpret or fail to grasp implied meaning in certain situations.

***Ethical and Legal Challenges:*** The implementation of NLP technologies in various applications raises ethical concerns, such as the potential for misuse, illegal access and unintended consequences. Addressing these challenges requires careful consideration and regulation.

## IV. CONCLUSION

To conclude, this paper provides a systematic and perceptive literature survey encompassing a spectrum of contemporary developments in advancements of NLP. The study explores implications of NLP approaches towards diverse areas of research. This survey delves into traditional and advanced NLP methods, by offering a detailed summary that spans from the year 2013 to current year. While acknowledging potential NLP arenas, this survey stands as a valuable resource for researchers and experts in the field of text identification and analysis.

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