A SURVEY ON AI-POWERED VIDEO LEARNING COMPANION

Amal Thomas[*1], Ardhra V S[*2], Aswathy J[*3], Mohammed Roshan A[*4], Sandra R[*5], Anjana C V[*6] College Of Engineering,Kidangoor

Kottayam,Kerala,India

[1]thomasamal479@gmail.com [2]ardhravs006@gmail.com [3]aswathyj2024@gmail.com

[4]roshanshukoor2004.com@gmail.com [5]sandrarajesh1843@gmail.com

[6]anjanachennothu@gmail.com

ABSTRACT: This paper reviews the advancements in AI-driven video learning tools, emphasizing methods that enable efficient extraction of information from online video content. As video content on platforms like YouTube contin- ues to expand, AI tools such as summarizers have emerged to meet the growing demand for quick, accessible insights. These tools employ natural language processing (NLP) and machine learning techniques to generate concise video sum- maries, enabling users—particularly students, profession- als, and researchers—to capture essential information with- out viewing lengthy videos in full. Key features examined include keyword extraction, timestamped highlights, and topic categorization, which support users in efficiently navi- gating and revisiting video content. This survey explores the technical architecture, summarization algorithms, and var- ious educational and productivity advantages of AI-based video summarizers, highlighting how these tools can en- hance video-based learning and improve information reten- tion through streamlined consumption.

INDEX TERMS: Adaptive Learning,AI Recommen- dations,Custom Playlists,Interactive Quizzes,Multilingual Support

1. INTRODUCTION

The exponential growth of video content, particularly on platforms like YouTube, has fundamentally changed how people access and engage with information. Today, millions of hours of video content are uploaded every day, covering a vast range of subjects from academic lectures and tutorials to news reports and creative works. For learners and pro- fessionals alike, this abundance of video content represents an invaluable resource, providing insights and knowledge on nearly any topic. However, the rapid growth of video re- sources has also introduced new challenges in navigating, or- ganizing, and consuming information efficiently. Users often face the daunting task of identifying relevant content within lengthy videos, a process that can be both time-consuming and mentally taxing. Educational and professional environ- ments, in particular, see a significant demand for tools that can help users process information more effectively. For instance, students who rely on educational videos for sup- plemental learning may struggle to review lengthy lectures or tutorials within limited timeframes.

Similarly, professionals and researchers who need to stay informed on recent developments or acquire specific skills may find it challenging to distill large volumes of video con- tent to focus on key insights. Consequently, there is an in- creasing demand for tools that simplify video consumption by extracting key information and presenting it in a clear and user- friendly format. The 'YouTube Video Summarizer'addresses these challenges by utilizing advancements in ar- tificial intelligence, natural language processing (NLP), and machine learning to transform the way users engage with video content.

This tool processes the transcript of a video and gen- erates an abridged summary that encapsulates the main themes, key takeaways, and essential information in a com- pact format. By offering these summaries, the YouTube Video Summarizer reduces the time and effort required to extract relevant insights, enabling users to quickly grasp the core ideas without needing to watch an entire video At the heart of the YouTube Video Summarizer are power- ful NLP algorithms and machine learning models that ana- lyze video transcripts to identify critical information. The summarizer goes beyond simple text extraction, offering ad- ditional features such as timestamped highlights, keyword extraction, and content categorization. These features al- low users to navigate directly to important segments of the video, making it easier to revisit key moments and reinforc- ing the learning process. The use of timestamped highlights and keywords also aids in creating a more organized and intuitive user experience, especially for those who seek spe- cific information within dense or technical content. stay in- formed on recent developments or acquire specific skills may find it challenging to distill large volumes of video content to focus on key

insights. As a result, the demand for tools that simplify video consumption by summarizing key infor- mation and making it easily accessible has been increasing. it in a concise and accessible manner.

The "YouTube Video Summarizer" has emerged as a solution to these challenges, leveraging advancements in ar- tificial intelligence, natural language processing (NLP), and machine learning to revolutionize how users interact with video content. This tool processes the transcript of a video and generates an abridged summary that encapsulates the main themes, key takeaways, and essential information in a compact format. By offering these summaries, the YouTube Video Summarizer reduces the time and effort required to extract relevant insights, enabling users to quickly grasp the core ideas without needing to watch an entire video At the heart of the YouTube Video Summarizer are powerful NLP algorithms and machine learning models that analyze video transcripts to identify critical information. The summarizer goes beyond simple text extraction, offering additional fea- tures such as timestamped highlights, keyword extraction, and content categorization. These features allow users to navigate directly to important segments of the video, mak- ing it easier to revisit key moments and reinforcing the learning process. The use of timestamped highlights and keywords also aids in creating a more organized and intu- itive user experience, especially for those who seek specific information within dense or technical content.

2. LITERATURE SURVEY

-Kassas WS,Salama CR,Rafea AA,Mohamed HK etal:[1] Enhancing Video Content Accessibility Through YouTube Transcript Summarization:
The rapid growth of YouTube content has made effective content discovery increasingly challenging, particularly in summarizing relevant information, generating summaries for videos without subtitles, and handling lengthy videos. Traditional methods like manual curation and basic key- word extraction have proven inadequate. Recent research has explored advanced NLP techniques, particularly the BART model, which has shown success in summarizing sub- titled videos. For non-captioned videos, integrating BART with Automatic Speech Recognition (ASR) has helped ad- dress transcription challenges. Additionally, video clipping techniques have been developed to handle longer videos ef- ficiently. Evaluation metrics like ROUGE are commonly used to assess the accuracy of generated summaries, help- ing ensure concise and relevant content. These innovations offer significant improvements in video summarization, en- hancing content discovery and user

experience on platforms like YouTube.
J H Lee, S.Park,C M Ahn and D.Kim et al [2] Extractive text summarization-an effective approach to extract infor- mation from text:
The growing volume of data collected from various sources presents challenges in efficient storage and retrieval, espe- cially with large text documents. Extracting meaningful information from extensive texts is time-consuming, which has led to the development of text summarization tech- niques to streamline this process. Text mining tools are used to reduce document size while retaining relevant knowledge. This paper reviews key techniques for extracting impor- tant information from text, focusing on topic modeling, key phrase extraction, and summary generation. Topic model- ing is achieved using LSI and NMF methods, key phrases are extracted with the weighted TF-IDF approach, and text summaries are generated using LSA and TextRank meth- ods.
Sotola L, Marcus C et al [3] Quiz maker:automatic quiz gen- eration from text using NLP:
Recent advancements in deep learning and natural language processing (NLP) have significantly improved automatic quiz generation from text. By utilizing advanced models such as BERT and T5 transformers, these systems extract keywords and create diverse question formats, including fill-in-the-blank, true/false, Wh-type, and multiple-choice questions. The NLP pipeline utilizing these models has demonstrated notable improvements in performance across all stages of the process. A survey evaluating the effective- ness of the model showed promising results, with around 60by the participants, highlighting the model's potential for natural quiz generation.

R.A. Bouwmeester[4] The role of gamified E-quizes on student learning and engagement:an interactive gamifica- tion solution for a formative assessment system[4]: Advancements in AI have led to the development of large pre-trained language models that excel in text generation tasks, raising the possibility of their use in generating ed- ucationally valuable text completions. These models could assist in creating quizzes for any educational material, of- fering a significant supplement to the formative and sum-mative assessments designed by educators. In this context, the EduQuiz system is proposed, an end-to-end quiz gen- erator powered by a fine-tuned GPT-3 model trained on text-quiz pairs. EduQuiz is capable of producing multiple- choice questions, complete with both correct answers and distractors. While most of the generated quizzes are con- sidered reasonable, the generation of high-quality distrac- tors poses more challenges than the creation of questions and answers. Though automatic quiz generation may not yet be ready to replace manual tests for summative eval- uations, EduQuiz shows promise for formative assessments and increasing student engagement by integrating assess- ments into educational materials.
Janice Agazio,Kathleen M. Buckley et al[5] The

impact of YouTube videos in student learning[5]: This study investigates the impact of YouTube videos on enhancing learning outcomes in an introductory computer science course for non-CS students. Students were divided into two groups: one received traditional learning resources like textbooks and lectures, while the other was provided with supplementary YouTube videos explaining complex concepts (e.g., multi-core processors, hard drive compo- nents, and fiber optic cables). The findings showed that students exposed to video content demonstrated better un- derstanding and retention of concepts, with higher engage- ment rates compared to textbased materials. YouTube's accessibility and short, targeted videos promoted a habit of self-directed learning, though careful selection of reliable content by instructors was essential. 2 The study highlights YouTube as an effective, accessible educational tool that boosts comprehension, a finding supported by similar suc- cesses in other fields like nursing education.

Goodman,E.D Patel,K.K.Zhang,Y.Locke et al[6] An Auto- mated Framework for Summarizing YouTube Videos Using NLP[6]: This research paper introduces an automated framework for summarizing YouTube videos using Natural Language Processing (NLP) techniques. The study focuses on a Chrome extension that extracts English-language tran- scripts from videos and generates concise summaries to help users quickly gauge content relevance without watch- ing the entire video. Developed using Python, Flask, and the HuggingFace T5 transformer model, the framework pro- cesses video transcripts through NLP tasks like tokeniza- tion and text summarization. The model's performance was evaluated by comparing machine-generated summaries with human-written summaries using ROUGE metrics, demon- strating the framework's effectiveness in generating accu- rate summaries. Future improvements include multilin- gual support, subtitle generation, and cloud deployment.
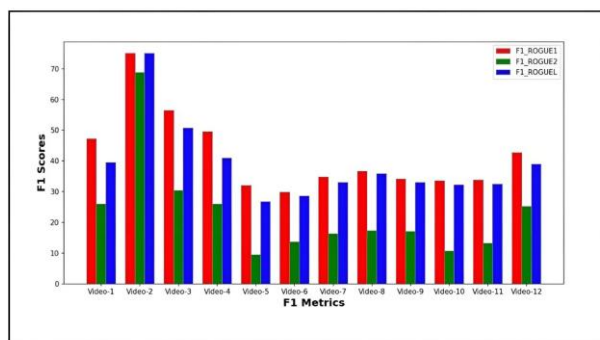

Figure 1: F1-Scores for 12 YouTube videos [6]

Sahu A, Chowdhury[7] Video summarization using deep learning techniques[7]:

Video summarization (VS) is a significant challenge in to- day's digital landscape, with many deep learning methods proposed to address it. However, these techniques often struggle with efficiently processing and extracting informa- tion from long-duration videos. A thorough analysis of var- ious deep learning approaches has revealed fundamental is- sues related to their ability to identify and summarize es- sential activities. This includes examining techniques for keyframe selection, event detection, categorization, and ac- tivity feature summarization. The limitations of each ap- proach are discussed, particularly concerning the detection of low-activity segments within diverse public datasets. Ad- ditionally, the paper suggests viable strategies for enhanc- ing the quality of generated video summaries and outlines potential applications derived from the literature. Various deep learning tools employed for experimental analysis are also reviewed, and future research directions in VS utilizing deep learning strategies are proposed.

Aniqa Dilawari, Muhammad Usman Ghani Khan, ASoVS et al: [8] YouTube video summarizer:a web based applica- tion for concise visual and textual summary[8]:

The paper presents a web-based application called "YouTube Video Summarizer," designed to efficiently extract concise visual and textual summaries from lengthy YouTube videos, enhancing user productivity in the digital age. It employs a combination of deep neural networks, including CNNs and RNNs, to analyze video content and generate summaries, addressing gaps in previous systems such as high computational costs and model complexity. The methodology integrates natural language processing (NLP) and computer vision, utilizing Python and various APIs to create a userfriendly interface that allows users to quickly access essential information from videos.
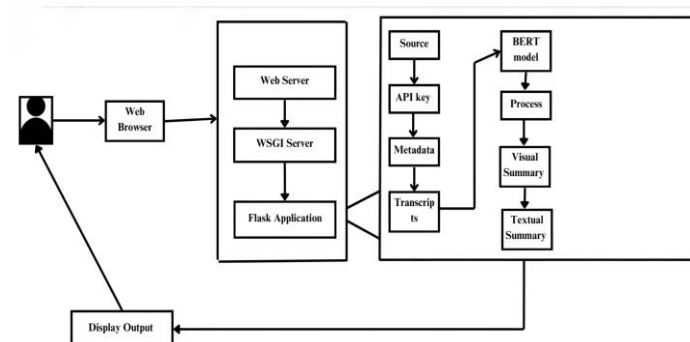

Figure 2: Architecture diagram for a YouTube summarizer [8]

Anuj Gupta, Bodhisattwa prasad Majumder, Harshit Surana and Sowmya Vajjala [9] Automated YouTube video summarization for library and information science using NLP and AI[9]: The study "Automated YouTube Video Summarization for Library and Information Science

Using NLP and AI: A Case Study of EPGPathshala" explores the use of Natural Language Processing (NLP) and Artificial Intelligence (AI) to summarize YouTube videos related to Library and Informa- tion Science (LIS), focusing on content available through the EPGPathshala platform. The authors used Clipnote AI to generate summaries and Wordcloud AI to assess their rele- vance. The research analyzed videos from the "Information Communication Technology for Libraries" module, compar-ing the original transcripts with AI-generated summaries in terms of word count and relevance. The results indicate that AI-driven summarization can efficiently condense large amounts of video content, making it more accessible while maintaining relevance. The study highlights the potential for future improvements in AI technologies, such as incorpo-rating more sophisticated tools and user profiling, to further enhance summarization efficiency and personalization.

Arono, W. Y. B. [10] Fostering students, listening skills through YouTube videos integrated with Edpuzzle online platform[10]:

The aim of this study is to assess the effectiveness of us- ing YouTube videos integrated with the EdPuzzle online platform on students' listening skills, as well as to ex- plore students' 3 perceptions of using EdPuzzle. The re- searcher employs a mixed-methods approach, specifically an embedded design. For the quantitative aspect, a quasi- experimental one-group pre-test and post-test design was utilized. The participants in the study consisted of thirteen eleventh-grade students, selected through random sampling. Data were gathered using tests and questionnaires. First, a pretest was administered, followed by a single treatment us- ing YouTube videos integrated with EdPuzzle. Afterward, a post-test and a questionnaire were given to the students. The higher scores on the posttest compared to the pretest demonstrate the effectiveness of using YouTube videos with EdPuzzle in enhancing students' listening skills. The find- ings show that the integration of YouTube and EdPuzzle has a significant and positive impact on improving listening skills. The hypothesis was confirmed, as there was a notable improvement in students' listening abilities after the inter- vention. In conclusion, the data analysis clearly indicates that using YouTube videos integrated with the EdPuzzle platform is effective in enhancing students' listening skills.

3. CONCLUSION

In conclusion the survey has provided a comprehensive overview of AI-driven YouTube summarizer emphasizes its significant impact on enhancing video accessibility and user efficiency. This tool provides concise, informative sum- maries that capture the essence of video content, helping users quickly absorb information without needing to watch lengthy videos. By leveraging natural language processing and advanced speech recognition, AI-driven summarizers make educational, professional, and entertainment content more accessible to broader audiences, including non-native speakers or individuals with time constraints. Moreover, as AI technology evolves, these summarizers will become even more accurate and contextually aware, potentially offering personalized summaries that adapt to users' preferences and specific information needs. Future improvements might in- clude support for multi-language summarization, real-time summarization during live streams, and options for varying summary lengths, allowing users to tailor the content to their time availability. This continued enhancement posi- tions AI-driven YouTube summarizers as invaluable tools for efficient video consumption, ultimately enriching the viewer experience in educational, corporate, and personal contexts.

4. REFERENCES

[1]El-Kassas WS, Salama CR, Rafea AA, Mohamed HK et al. (2021) Automatic text summarization: a comprehensive survey. Expert Syst Appl 165:113679

[2]J. H. Lee, S. Park, C. M. Ahn and D. Kim et al, "Automatic generic document summarization based on non-negative matrix factorization" , Journal on Information Processing and Management, vol. 45, no. 1, pp. 20-34, 2019

[3]Sotola L, Marcus C et al (2021) Regarding class quizzes: a metaanalytic synthesis of studies on the rela- tionship between frequent low-stakes testing and class per- formance.2022 Educ Psychol Rev 33

[4]] R.A. Bouwmeester et al. Flipping the medical class- room: Effect on workload, interacivity, motivation and re- tention of knowledge2021

[5]Janice Agazio,Kathleen M. Buckley et al, 'An Untapped Resource Using YouTube in Nursing Education' , Nurse Ed- ucator; Vol. 34, No. 1, pp. 23-28, 2019 Wolters Kluwer Health

[6] Goodman, E. D., Patel, K. K., Zhang, Y., Locke, W.,

Kennedy, C. J., Mehrotra, R., Ren, S., Guan, M., Zohar,

O., Downing, M., Chen, H. W., Clark, J. Z., Berrigan, M. T., Brat, G. A., Yeung-Levy, S. et al (2024). Analyzing Surgical Technique in Diverse Open Surgical Videos With Multitask Machine Learning. JAMA Surgery, 159(2), 185–192.

https://doi.org/10.1001/jamasurg.2023.6262 Sahu A, Chowdhury AS (2020) Summarizing ego- centric videos using deep features and optimal clustering. Neurocomputing 398:209–221 Senthil Murugan A, Suganya Devi K, Sivaranjani A, Srinivasan P et al(2018) A study on various methods used for video summarization and moving object detection for video surveillance applications.

[7] Aniqa Dilawari, Muhammad Usman Ghani Khan, ASoVS et al: Abstractive Summarization of Video Se- quences, IEEE Access March 20, 2019

[8] Anuj Gupta, Bodhisattwa prasad Majumder, Harshit Surana and Sowmya Vajjala et al. "Practical Natural Lan- guage Processing" A comprehensive guide to build Real World NLP System.1st edition. O'Reilly Media, Inc. (June,2020)

[9] Arono, W. Y. B. et al (2023). Conditions for learning regional languages that are almost extinct in the outer is- lands of Indonesia. Proceedings of the 3rd International Conference on Educational Science and Teacher Profession (ICETeP 2021).