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Slidebot: Automated Presentation Generation Using NLP

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Abstract
NLP SlideBot is a fully developed and advanced system designed to automatically generate professional PowerPoint presentations from unstructured text documents. It utilizes modern Natural Language Processing (NLP) methods to transform unstructured text into well-structured, coherent, and visually appealing slides. At its core, NLP SlideBot employs a hybrid summarization model that combines powerful abstractive models like BART[2] and T5[3] with expressive techniques such as TextRank[1] to extract and organize essential information. This process is further supported by BERT-based semantic segmentation[4], which effectively groups related content to form logical slide topics. In addition to text analysis, the system offers several AI-enhanced features, including interactive knowledge graph visualization, automated speaker notes, text-to-speech audio narration, and image generation using Google Gemini[10]. The architecture of NLP SlideBot is built on a current, modular tech stack with a React-based frontend[9] and a FastAPI[8] backend. It supports a range of input formats, including PDF, DOCX, and images, with OCR functionality for text extraction from images. Performance evaluations on a large scale demonstrate that NLP SlideBot is an efficient tool applicable across corporate, academic, and research environments, significantly reducing the time required to create presentations while maintaining high standards of visual design and content accuracy.

Keywords: *Natural Language Processing (NLP), Automated Presentation Generation, Text Summarization, Semantic Segmentation, AI Image Generation, FastAPI, React, Knowledge Graph, Text-to-Speech (TTS), Python.*

1. Introduction
Creating engaging and polished presentations is a routine activity in both academic and business settings, yet it often demands a significant investment of time and can be quite tedious. Many professionals, educators, and students typically spend hours sifting through lengthy documents, identifying key points, designing slides, and condensing the content into a cohesive format. This manual approach is not only inefficient but also susceptible to personal biases, inconsistent selection, and disorganized presentation of ideas. The challenges become even more pronounced when dealing with large volumes of data or when regular updates are necessary. NLP SlideBot is specifically developed to tackle these challenges by offering a comprehensive, automated solution for generating presentations. The system can effectively parse complex documents, understand their semantic structure, and transform them into well-organized presentation formats. The core innovation of NLP SlideBot lies in its advanced application of natural language processing (NLP), which goes beyond simple keyword extraction to a deeper understanding of content meaning and context. This enables users to focus on higher-level tasks such as delivering the presentation and engaging with the audience. The architecture, algorithms, and implementation of NLP SlideBot are thoroughly explained in this paper. Section 2 outlines the methodology, while Section 3

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presents the results and discussion.

2. Methodology

NLP SlideBot's architecture prioritizes scalability and modularity. It uses a tiered, pipeline-based methodology in which information moves successively through various processing phases, each of which is in charge of carrying out a particular transformation task. Each component is guaranteed to be independently manageable and upgradeable.

Table 1 Technologies or the libraries used for NLP Slidebot

Layer / Module	Technologies / Libraries Used
Input Processing Layer	PyPDF2, pdfminer.six, python-docx, pytesseract
NLP Processing Layer	BERT, Sentence-BERT, TextRank (gensim), BART/T5 (Hugging Face Transformers)
AI Enhancement Layer	Google Gemini API, gTTS/pyttsx3, D3.js
Presentation Generation Layer	python-pptx
Backend System	FastAPI, Uvicorn, SQLite
Frontend Interface	React 18, react-dropzone, WebSockets
Performance Metrics	Intel i7 CPU, 16 GB RAM, no GPU

2.1. Component overview

Input Processing Layer: This is the first part of the system that handles different types of input. It takes care of various file formats. For DOCX and text files, it directly extracts the content. For PDFs, it uses libraries like PyPDF2 and pdfminer. For scanned documents, it uses Tesseract as a backup for OCR. When dealing with images, it uses OCR to convert the visual text into a format that can be understood by machines. This layer ensures the text is clean and ready for the next steps in the NLP process, no matter what kind of input it is.

NLP Processing Layer: This is the core of SlideBot. It does several important things with the raw text. First, Text Segmentation groups sentences into meaningful sections, each acting as a potential slide topic. It uses sentence embeddings from a pre-trained BERT[4] model to make these groups coherent. Then, the Summarization Engine uses a mix of methods. It starts by using TextRank[1] to find the most important sentences. After that, it refines the output with a BART[2] and T5[3] model to create smooth and concise paraphrases. This combination makes sure the content is both easy to read and informative.

AI Enhancement Layer: This part adds more depth and quality to the presentation. The title and content of each slide are used to create smart search terms, which are then sent to the Google Gemini API[10] to get or make relevant, high-quality images. The Speaker Notes Generation tool uses the bullet points on the slides to create a natural language script suitable for different audience sizes. The Audio Generation service converts these speaker notes or slide content into audio files using text-to-speech technology. Finally, the Knowledge Graph service looks through the whole document to find key ideas and how they connect, helping to create a visual summary slide.

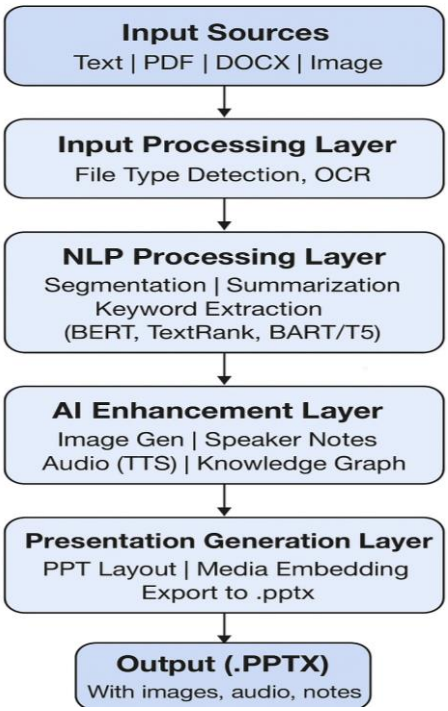

Figure 1 Architecture of NLP Sildebot

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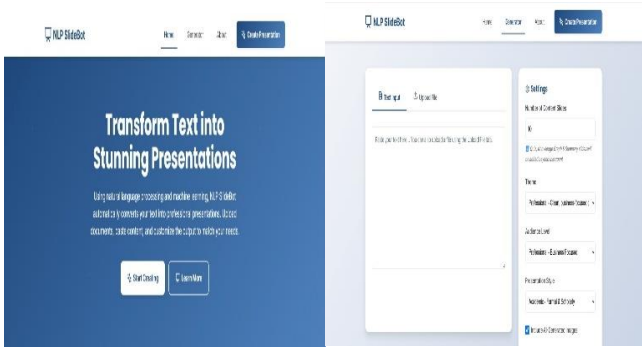
Presentation Generation Layer: This part takes all the improvements and processed content and puts them together into a complete PowerPoint presentation. It uses a design template chosen by the user, creates slides with proper titles and bullet points, adds audio files, inserts generated images, and includes speaker notes in the notes section of each slide, using the python-pptx library, Figure 1.

3. Results and Discussion

3.1. Results

The NLP SlideBot system was tested to check both its performance and the quality of the output when dealing with text, PDF, Word, and image files. It uses a combination of TextRank[1] and transformer models such as BART[2] and T5[3] for summarization. The system scored between 85% and 95% in overall quality, indicating that the content is coherent and relevant. Semantic segmentation, carried out using Sentence-BERT[4], maintained topic accuracy between 80% and 90%, ensuring that the content is well-organized. The system can process text in two to five seconds for every 1,000 words and create each slide in one to three seconds. Entire presentations were completed in less than three minutes. In a test with twenty users, over ninety percent rated the results as good or excellent, appreciating the logical structure, how well the visuals matched the content, and how clear the speaker notes were. These results show that NLP SlideBot can automatically generate professional-quality presentations while keeping the original meaning intact, shown in Figure 2 [5-7].



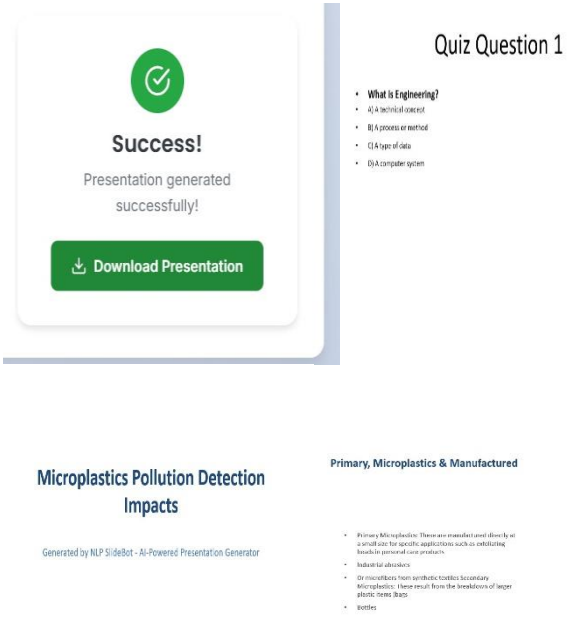


Figure 2 Process of the Dataset

3.2. Discussion

Using a mix of TextRank[1], BART[2] and T5[3] for summarization helps keep the facts accurate while making the language flow naturally, solving the issues that happen when only one method is used. Sentence BERT embeddings are used to split content into meaningful sections, which makes the slides easier to read and better organized. Adding Google Gemini AI[10] for creating images makes the slides more visually appealing and relevant. Including text-to-speech narration also makes the slides more accessible and engaging for users. The frontend made with React[9] lets users watch the slide creation process in real time and control it easily, making the experience more user-friendly. The system is built with separate modules for data preparation, language analysis, AI enhancements, and final presentation creation. This setup makes it easy to expand and connect with other systems using RESTful APIs. Overall, the design shows how well natural language processing, AI image creation, and modern web tools can work together, offering a flexible and ready-to-use solution for real-world uses, shown in Figure 3.

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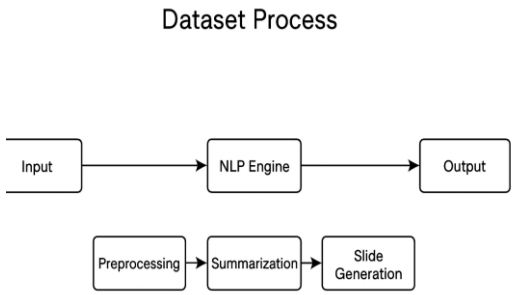

Figure 3 Process of the Dataset [3]

Conclusion

The NLP SlideBot system is a full AI-powered tool that turns messy text documents into clean, professional PowerPoint presentations. It uses Natural Language Processing, Machine Learning, and AI to make the process easier, while keeping the original message and style. The system works well because it uses smart methods like TextRank[1] along with BART[2] and T5[3] models for summarizing text, and Sentence-BERT[4] for breaking down content meaningfully. It also uses Gemini AI[10] to create visuals automatically. These features show that using AI for making educational and professional content is not just possible, but really effective. The system has a real-time web interface built with React[9] and FastAPI[8], which makes the user experience better by giving instant feedback, showing progress visually, and letting users customize things as they like. In short, NLP SlideBot is a big step forward in converting documents into presentations using smart AI. It sets the stage for future work in analyzing different types of documents, making summaries that understand context, and creating content with AI.

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