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# Identifying the Best Text Annotation Tool for the Nih: A Comparative Evaluation Of Non-Web-Based Solutions

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***Abstract***
***Motivation:*** *Text annotation tools are essential in the healthcare industry for organizing and analyzing clinical data, pivotal for AI-driven applications. These tools must accurately process sensitive information like clinical notes and patient records while ensuring confidentiality and adherence to regulations such as HIPAA. Despite the availability of numerous tools, selecting one that meets specific requirements remains challenging. This study focuses on finding an alternative to the NIH's comprehensive VTT tool that is difficult to install.*
***Methods:*** *Our study began with a pool of 49 non-web- based. Out of these, 11 met the primary criteria of free-to- use text annotation. However, these 11 tools were further filtered down to three Gate, Inception, and Label Studio because they met additional crucial criteria such as available support and recent updates, which many others failed to meet. We then conducted detailed evaluations of these three tools to assess their performance in terms of ease of annotation and maintaining originality.*
***Results:*** *The detailed evaluation revealed distinct capabilities and limitations. Gate was robust in user support and interface but fell short in machine readability with its XML-only output. Label Studio and Inception both encountered issues in preserving text originality, crucial for accurate data handling. Inception also struggled with ease of annotation and human readability. Although VTT was challenging to install, it included most of the necessary features for effective annotation, setting a high benchmark for its alternatives.*
***Conclusion:*** *This study underscores the complex need for effective text annotation tools in the healthcare sector and the difficulties in finding suitable alternatives to established tools like VTT. Our findings indicate significant opportunities for development to enhance tool functionality and user experience to meet the specific demands of healthcare data management.*

**INTRODUCTION**
Effective management of clinical data is essential for advancing medical research and improving patient care. Text annotation tools are vital for organizing this data and training AI-driven applications in healthcare. However, selecting an appropriate tool is challenging due to the variety of features offered and the need for compliance with stringent regulations like HIPAA.
The Visual Text Tool (VTT) by the National Institutes of Health (NIH) is well-regarded but complex in this domain. It offers comprehensive features but is difficult to install and use, prompting the need for simpler, yet effective alternatives.
This study evaluates non-web-based, free text annotation tools that have been recently updated. Starting with an initial set of 49 tools, we refined this into three—Gate, Inception, and Label Studio—based on their ease of use, functionality, and compliance with regulatory requirements. These tools were then assessed for their potential to serve as viable alternatives to VTT, focusing on user support, update frequency, and ease of installation.

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## I. OBJECTIVE

The main aim of this research was to find a text annotation tool that fits the needs and working environment of the National Institutes of Health (NIH). This involves assessing web-based free text annotation tools based on how easy they are to use their features, adherence, to regulations, and ability to integrate with existing systems. The objective is to locate a tool that not only meets the NIHs functional requirements but also boosts efficiency and accuracy, in managing and analyzing clinical and research data thereby supporting the NIHs overarching goal of advancing medical research and enhancing public health outcomes.

## II. LITERATUR REVIEW

Annotation tools play a role in digitalizing and organizing data in fields like healthcare, education, and research. However, choosing the tools can be complex due to the need to align with functionalities and user interfaces. In a study by Mariana Neves and Jurica Seva from the University of Oxford they highlight how the

effectiveness of annotation tools can differ significantly depending on the field.

Their study delves into aspects such as features, interface design, compatibility, and support for work. These factors are essential for evaluating how well annotation tools meet the requirements of domains. For example, in healthcare, these tools must not be robust enough to handle types of data like patient records and clinical notes but also comply with regulations like HIPAA. Similarly in education settings having a user interface and support for group projects are key for enhancing learning experiences.

Neves and Seva's research emphasizes the challenges in customizing annotation tools to suit diverse academic and research contexts. They suggest that no single tool can cater perfectly to all discipline's needs hence they advocate for an approach when selecting tools based on specific functional and collaborative demands.

This point of view plays a role in shaping research and advancements in the digital annotation field indicating a path towards customizable tools that can adjust to the changing requirements of different user groups.

The findings from their analysis lay the groundwork for this research, which aims to discover and assess text annotation tools designed specifically for healthcare purposes. By concentrating on tools not on the web that prioritize privacy, facilitate annotations, and are easy to use this study aims to address the gap identified in prior studies by providing alternatives that better cater to the unique needs of healthcare professionals.

## III. METHODOLOGY

The objective of this study was to identify and evaluate non- web-based annotation tools that are best suited for handling sensitive and secure data. We initiated our search using a variety of search engines and platforms, including Google, Bing, Bing Copilot, ChatGPT, Perplex AI, Gemini, and Google Scholar, which collectively yielded an initial list of 49 annotation tools.

### 3.1 Initial Screening and Criteria Definition:

Our primary focus was on non-web-based tools, reflecting the need for tools that can be used in secure or offline environments. This criterion significantly refined our initial list.

### 3.2 Support and Availability:

We assessed each tool for the presence of accessible developer support, which is critical for resolving potential issues and ensuring continuity. Only 11 tools with clear support mechanisms, such as developer contact information, were considered further.

### 3.3 Developer Engagement:

To test the quality of support, we contacted the developers of these 11 tools. Responses from the developers of three tools were notably prompt and helpful, leading us to select these tools for more in-depth evaluation.

### 3.4 Detailed Evaluation Criteria:

We employed a binary "yes or no" metric to evaluate each tool against the following detailed criteria:

**Free to Use**: The tool must be available at no cost, enabling unrestricted access to all features without financial barriers. **Supported**: The tool must have active, accessible support, either from the developers directly or through a dedicated user community, to assist with troubleshooting and updates. **Maintain Originality**: The tool must ensure the integrity of the data is maintained during the annotation process, without altering the original text unless specified by the user.

**Ease of Reading:** Annotations created with the tool should be easily interpretable by both human users and machine processes, facilitating clear communication and data processing.

**Ease of Installation:** The installation process should be straightforward, requiring no extensive technical skills, and accomplishable within a reasonable timeframe.

**Ease of Use**: User-friendliness is key; the tool should have an intuitive interface that simplifies the learning curve and enhances user productivity.

**Supports Multiple Formats:** The ability to handle various file formats is essential, allowing users to work with different types of data seamlessly.

**Ease of Annotation:** The process of adding annotations should be straightforward and efficient, enabling users to annotate data accurately without unnecessary complexity.

### 3.5 Evaluation Metrics:

Each selected tool was assessed against these criteria using a simple "yes" or "no" rating, determining whether it fully met each specified requirement. This binary metric facilitated a straightforward and decisive evaluation, ensuring that only tools meeting all criteria were considered suitable.

This methodological approach, with its rigorous criteria and clear evaluation metrics, ensures that the annotation tools selected are optimally aligned with the specific needs of NIH.

## IV. RESULTS

The detailed evaluation of the annotation tools—Label Studio, Gate, and Inception/WebAnno—revealed distinct capabilities and limitations essential for data annotation in sensitive and secure environments. Below, we provide a comprehensive analysis of each tool based on the screenshot provided, detailing how each tool meets the specified criteria.

Label Studio:

Easy to Annotate: Yes. Users can create tags efficiently, spending minimal time due to its friendly layout.
Easy to Read by Machine: Yes. Label Studio supports various document formats, enhancing machine readability. Easy to Read by Human: Yes. It provides a clear picture of how annotations appear, ensuring ease of human readability. Maintains Originality: No. While it produces only the necessary annotations, it does not retain the original text, which could be crucial for certain applications.
Gate:

Easy to Annotate: Yes, but with some complexity. Users report spending more time on creating tags due to a moderately easy layout.
Easy to Read by Machine: No. It solely supports XML, which may limit its use in diverse contexts.
Easy to Read by Human: Yes. The clear presentation of annotations aids in readability.
Maintains Originality: Yes. Gate provides the text on top and the annotated text after the original, maintaining the integrity of the data.
Inception/WebAnno:

Easy to Annotate: No. Users find the creation of tags complicated and time-consuming.
Easy to Read by Machine: Yes. It supports multiple formats, making it versatile for machine processing.
Easy to Read by Human: No. The tool does not provide a clear picture of the annotation, mixing annotated and non- annotated texts which can be confusing.
Maintains Originality: No. The tool mixes everything, making it difficult to distinguish between original and annotated texts.
Comparison with VTT:
Despite the challenges in installation, VTT includes most of the necessary features for effective annotation, setting a high benchmark that these tools struggle to meet. Specifically, VTT's comprehensive feature set and easier annotation process highlight areas where the evaluated tools could improve, especially in maintaining text originality and ease of annotation.
Refer to the accompanying screenshot below for a visual summary of these results.

## V. PROJECT CHALLENGES

### 5.1 Documentation and Support Issues:

Lack of Clear Documentation: Many annotation tools suffer from insufficient or outdated documentation, making it difficult for new users to effectively utilize and maximize the tool's capabilities. This lack of clear guidance often leads to prolonged setup times and reduced efficiency in deployment.
Most Tools Lack Support: A significant number of tools do not have active support systems in place. This can be particularly challenging when users encounter bugs or need specific guidance on using the tools effectively.
Long Waiting Time to Get Support: For the tools that do offer support, the response time can be excessively long. This not only delays the annotation projects but also frustrates users who may need immediate help to proceed with urgent tasks.

### 5.2 Outdated Software Environments:

Legacy Systems: Many of the tools were developed years ago and have not been updated to work seamlessly with modern operating systems and environments. This compatibility issue can prevent users from even installing or running the tools on contemporary hardware, which often leads to the abandonment of these tools for more modern solutions.
Dependence on Obsolete Technologies: Some tools rely on outdated technologies or libraries that are no longer supported or secure, increasing the risk of security vulnerabilities and further complicating their use in current research settings.

### 5.3 Novelty and Research Gaps:

Emerging Field: The domain of non-web-based annotation tools, especially those that maintain a high standard of data privacy and are suitable for handling sensitive data, is relatively new. This novelty means there are fewer benchmarks and less accumulated knowledge to guide new developments.

Scarce Precedent Research: There is limited existing research on which to build or from which to draw comparisons. This scarcity of precedent can make it difficult to identify which features are most desired or to predict potential challenges that might arise during development and deployment.

**Addressing These Challenges:**
Addressing these challenges requires a multifaceted approach:

**Enhanced Documentation and User Support:** Developers should prioritize creating comprehensive, easy-to-understand documentation and establish more responsive support channels.

**Regular Updates and Modernization:** It is crucial for tool developers to regularly update their software, ensuring compatibility with new technologies and operating systems. Encouraging Research and Collaboration: The academic and development communities should be encouraged to conduct more research in this field and collaborate on projects that push the boundaries of what these tools can achieve, filling the gaps in current knowledge and capabilities.

## VI. CONCLUSION

This project aimed to identify and evaluate non-web-based annotation tools suitable for handling sensitive data, a critical endeavor given the stringent requirements of digital data management in secure and private sectors. Our evaluation, which included an analysis of tools like Label Studio, Gate, and Inception/WebAnno, was motivated by the need for alternatives to the National Institutes of Health's Visual Text Tool (VTT). The VTT, while robust and comprehensive, presents challenges in installation and usability that necessitate exploring other options.

Throughout our research, we encountered significant challenges with many tools lacking in areas such as up-to- date documentation, active user support, and compatibility with modern operating systems. These issues underscore the necessity for continual development and modernization of annotation tools to keep pace with technological advancements and user expectations.

Despite these hurdles, our findings highlight that while some tools approached the high standards set by VTT in certain functionalities, none fully matched its comprehensive feature set combined with NIH-level

compliance and reliability. This observation underscores the gap in the current market for tools that can match the effectiveness and security standards exemplified by NIH's VTT.

Moving forward, there is a clear demand for the development of annotation tools that are not only technically proficient but also accessible and supportive of end-users. Future research should focus on enhancing the usability, support infrastructure, and technological adaptability of these tools. Additionally, fostering a collaborative environment among developers, users, and institutional bodies like NIH will be crucial to refining and expanding the capabilities of annotation tools.

In conclusion, this project has provided critical insights into the limitations and potential of current annotation tools and established a direction for future advancements. By aiming to meet or exceed the benchmarks set by VTT and NIH, future tools can better serve the evolving needs of secure and efficient data management.

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