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Comparing NLP Tools and AI Generators in the Context of Achieving Optimal Textual Analysis in an Educational Setting

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Abstract-In recent years, automated tools have played a pivotal role in reshaping research within the humanities and social sciences. The term "Digital Humanities," coined in 2001, according to Ref. [1], introduces a groundbreaking approach that empowers researchers to delve into texts without physical contact. This approach highlights the potential benefits of micro and macro analysis when integrated with humanities studies. In this study, students explore the dual facets of digitalization accessible through the Internet: NLP Tools and AI generators. Implemented in a semester-course at the University of Athens under the umbrella of "Digital Humanities," the academic program spans various foreign language departments. Within this framework, students employ NLP online tools to conduct comprehensive textual analyses, including tasks such as extracting term frequencies within corpora and assessing texts based on linguistic attributes, density, readability, and other relevant parameters. Specifically, the integration of ChatGPT is recommended for literary texts in Italian, Greek, or English, offering students a rich exposure to online tools that seamlessly blend applied linguistics with literary analysis. The core of this proposal revolves around the conceptualization of an instructional activity where students employ sophisticated NLP online tools like Voyant Tools. Subsequently, they replicate the same analytical process using ChatGPT [2] for the identical text, leading to a comparative evaluation of the outcomes. In the realm of big data, a Natural Language Processing (NLP) tool proves advantageous due to its specialized design for processing extensive corpora. However, limitations arise in the free edition of ChatGPT, as it doesn't support lengthy texts. Consequently, the applicability of this investigation and the ensuing comparison of these two methodologies are confined to instances where the literary text under consideration is a poem or constitutes a small passage from a novel.

Index terms-Applied Linguistics, Language Learning, NLP analysis, Open AI, Online Tools.

I. INTRODUCTION

The integration of digital tools in the humanities has become increasingly prominent, offering scholars new avenues for exploration and analysis. This study focuses on the intersection of NLP tools and AI generators within the framework of a semester-course in a tertiary educational setting, where students explore the synergies between these technologies in the realm of "Digital Humanities." Research in the humanities and social sciences has been both aided and transformed in recent years by the use of automated tools and more specifically NLP tools. As Ref. [3] claim “Natural language processing (NLP) is an AI technology that follows a string of operations such as speech recognition”.

Moreover, NLP techniques, facilitate access to information for users, and allow for new paradigms in the usage of information-system services, but -most important for the FLT- NLP has a crucial role in designing the study [4]. Artificial intelligence and language are closely related, and they cannot be separated Ref [5] claim, due to its application in many linguistic sectors such as language recognition, language analysis, automatic translation. In the present study we will demonstrate the utilization of NLP tools and AI generators in the class, aiming to make a comparison concerning their ease-of-use by students.

II. BACKGROUND

Over the course of the past year, the academic landscape has witnessed an inundation of research papers delving into the multifaceted realm of AI generators. These studies span a wide spectrum of topics, from probing the ethical dimensions inherent in the utilization of AI generators [6], to conducting comparative analyses between NLP tools and Chat GPT [7] in the domain of textual analysis. Within this burgeoning literature, researchers have articulated diverse perspectives, ranging from assertions that advanced iterations of Chat GPT (such as versions 4 and 5) have been enhanced by complementary NLP tools [8], to demonstrations showcasing Chat GPT's prowess in Natural Language Processing [9]. Conversely, certain investigations have shed light on the limitations of Chat GPT vis-à-vis traditional NLP tools [10], underscoring the nuanced complexities inherent in the AI landscape.

Moreover, scholars have lauded the potential of OpenAI platforms for educational contexts [11], particularly emphasizing their efficacy in facilitating distance and online learning modalities [12]. This burgeoning interest in leveraging AI technologies for educational purposes underscores the transformative potential of these tools in reshaping pedagogical paradigms. Notably, there exists a niche body of literature specifically dedicated to elucidating the role of Chat GPT as an

NLP tool within the realm of tertiary education [13], offering invaluable insights into its applicability and efficacy within academic research settings.

In essence, this proliferation of research underscores the dynamic interplay between AI technologies and scholarly inquiry, with scholars grappling with the ethical, pedagogical, and methodological implications inherent in the adoption of AI generators. As we navigate this rapidly evolving landscape, it becomes increasingly imperative to critically interrogate the affordances and limitations of these tools, ensuring that their integration aligns with ethical imperatives and pedagogical objectives alike.motivation and objective According to Ref. [14] NLP can be split into two main sub-branches: in the first category, we find tasks related to language structure, such as, language modeling, morphological analysis, syntactic processing, or parsing, and semantic analysis; in the second branch, we deal with topics such as automatic extraction of relevant information from texts, translation of text between languages, summarization of documents, automatic answering of questions, classification, and clustering of documents.

This study predominantly engages with the latter category of NLP processes within a higher education milieu. Our pedagogical approach entails a structured activity wherein students undertake textual analysis using advanced NLP tools and subsequently replicate the analysis using ChatGPT. Our overarching objective is twofold: firstly, to familiarize students with both tools and cultivate a modern approach to scholarly inquiry, thereby gauging the speed and accuracy of results produced; secondly, to ascertain the comparability of tasks traditionally conducted using the NLP tool Voyant Tools [15] with those performed using an OpenAI generator.

This research is based on qualitative approach. We are not interested in evaluating the tools in themselves, but we are searching for the feedback of our students trained to use those tools in the FL teaching and in textual analysis. The widespread use of ChatGPT and simultaneously the broad scientific interest in this tool prompted us to observe what is happening in an academic environment in our country.

III. THE RESEARCH

A. The Course Structure

The academic curriculum under consideration aims to impart students with a comprehensive understanding of digital tools and their application in linguistic and literary analyses. Encompassing various foreign language and Humanities departments such as English Language, Italian Language, and Studies in Greek Philosophy, the course is situated within the University of Athens, catering primarily to Greek-speaking students. Integrating applied linguistics with literary analysis, the curriculum offers a dynamic educational milieu. While the ongoing work engages over 60 students, this study presents preliminary results derived from a subset of 25 students from the Italian Department. Conducted in a hybrid format, with both online and in-person participation, the course leverages NLP tools, notably Voyant Tools, for rigorous textual analyses. Students undertake tasks such as extracting term frequencies within corpora and evaluating texts for linguistic attributes, thereby harnessing NLP tools' efficacy in handling extensive corpora and processing big data. To augment the depth of analysis, the proposed activity incorporates ChatGPT for literary texts in Italian, Greek, or English, thereby introducing students to AI generators alongside traditional NLP tools.

B. The Text and the Corpus

Prior to tool utilization, students select two succinct literary texts: a standalone text and a corpus comprising works from the same author. For corpus compilation, while Voyant Tools offers pre-assembled corpora in English, students in this course had previously curated a corpus titled "I nostri antenati," comprising Italo Calvino's trilogy [16], [17], [18], as part of a prior semester's activity. The standalone text selected was a collection of poems from Francesco Tomada's "Affrontare la gioia da soli." [19]. The choice of authors, representing both modern and contemporary eras, aligns with international and Italian-speaking community recognition, catering to students' needs for literary discourse and the experimental requisites necessitating digitized texts.

C. Steps of the process

The analytical process unfolds in several steps. Initially, the students upload their material onto Voyant Tools. Consequently, the student uses the NLP tool to conduct a comprehensive analysis, identifying textual elements such as the most frequent words, the readability index, or the density index (see Fig. 1).

Subsequently, it is necessary to save the obtained results. At the end of this phase, we give them a brief module to compile. The form consisted of two parts. In the first part, they were required to note the results of their search: the ten most frequent words, the readability index, and the density index.

In the second part, they were supposed to note: the time it took them to extract the requested information, rate as positive or negative the ease of use of the Voyant Tools environment in terms of the assistance it provided them, and the aesthetic impact.

Finally, they had to comment on whether they would be willing to use it in their classroom as future foreign language teachers. Following this, they should employ ChatGPT to extract the same textual elements, including most frequent words, readability index, or density index, for the same selected text and the same Corpus.

As soon as the student has the response generated by ChatGPT the data must be preserved and the students must complete the same brief questionnaire.

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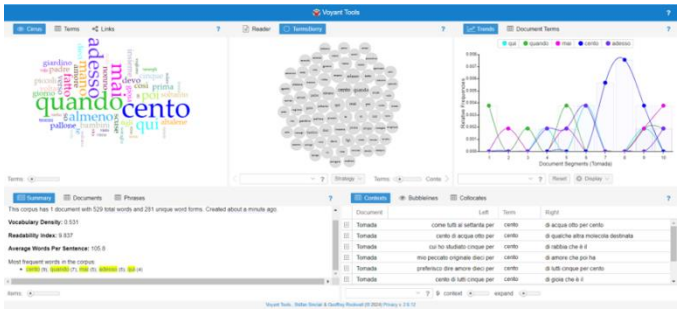

Figure 1: Lay out of Voyant Tools

The process is concluded by undertaking a comparative analysis of the outcomes derived from both Voyant Tools and ChatGPT. The effectiveness of each tool in capturing and presenting relevant textual elements is evaluated, providing insights into the strengths and limitations of their respective analytical capabilities as well as evaluating their application in the FL classroom. The essence of the study lies in the comparative evaluation of outcomes obtained through NLP tools and AI generators. Students replicate the analytical process for the same texts using both Voyant Tools and ChatGPT, providing insights into the strengths and limitations of each approach.

IV. Results

A. Findings of the search

The initial findings of the search highlight several noteworthy observations regarding the analysis of texts, particularly poems. A notable divergence arises between the outcomes derived from the two analytical tools. While all students generated identical results in the first three queries, discrepancies emerged between Voyant Tools and ChatGPT analyses, with each providing differing numerical outputs, including variations in the identification of the most frequent words (refer to Table I).

Table I: The data registration

	TEXT		**CORPUS**	
	Voyant Tools	ChatGPT	Voyant Tools	ChatGPT
Most frequent words	**cento** (9); **quando** (7); **mai** (5); **adesso** (5); **qui** (4)	**io**: 8 occurrences **di**: 7 occurrences **che**: 7 occurrences **per:**7 occurrences	**e** (4584); **di** (3481); **che** (2791); **a** (2606); **il** (2348); **la** (2082); **un** (1882);	-
Readability Index	**9.837**	**12.513**	**10.290**	-
Vocabulary Density	**0.531**	**0.3472**	**0.147**	-

Consequently, it can be inferred that there are distinct methodologies employed by the two tools for calculating word frequencies. Indeed, the sole means of assessing the efficacy of ChatGPT was to verify whether it employed proper word tokenization.

In terms of readability assessment, it is appropriate to mention a momentary confusion experienced by students when ChatGPT presented an index based on the Flesch-Kincaid scale [20], diverging from the Coleman-Lieu formula [21] utilized by Voyant Tools (see Fig. 2).

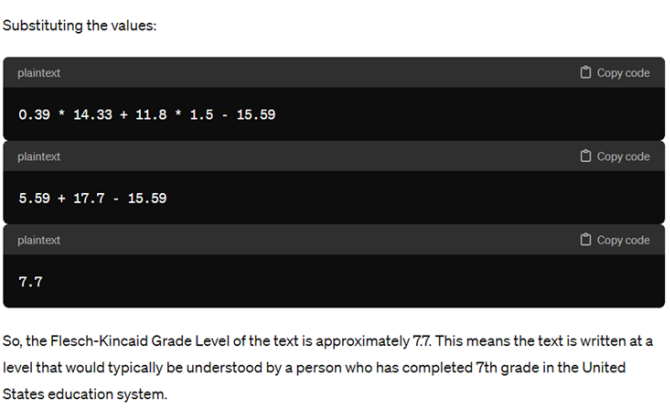

Figure 2: The answer of ChatGPT about the readability index

However, a clarifying question resolved the problem (see Fig. 3).

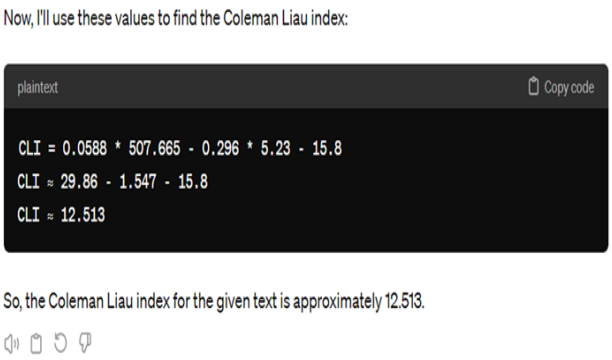

Figure 3: The answer of ChatGPT about the Coleman Liau index

Nevertheless, the second and more significant problem that arose in the textual analysis of the Corpus remained unsolved: the inability of ChatGPT to process large texts or Corpora, in the online and free version, resulting in the absence of recorded results from this tool's search (see Table I and Fig. 4).

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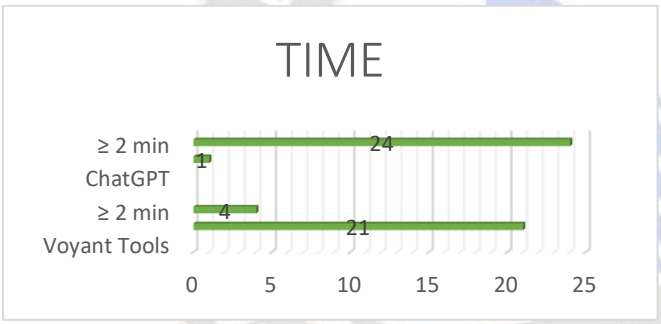
Figure 4: ChatGPT answer about its capability in elaborating long texts/corpora

B. Conditions of the search

Regarding the search conditions, students provided responses after recording the requested quantities pertaining to the text (poems). No responses were elicited regarding the corpus, as the query remained incomplete due to ChatGPT's inefficiency with lengthy texts. Following the compilation of the mini questionnaire, a hybrid meeting was conducted to facilitate discussion on the two tools, during which students shared their experiences.

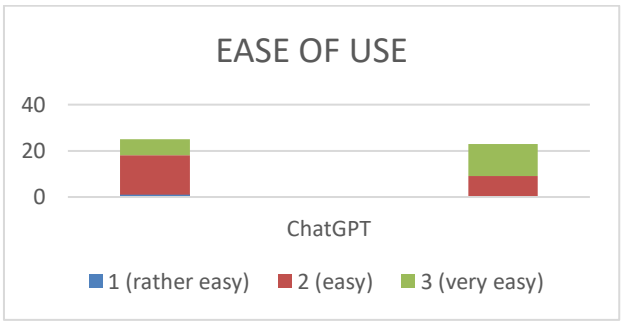
Upon reviewing the students' recordings regarding time, a delay is observed in obtaining results from ChatGPT (see Graphic1).



Graphic 1: The time consumed for the query in both tools

This delay can be justified to some extent, given that the question needs to be formulated in this tool. However, it should be noted that the same students did not have prior familiarity with Voyant Tools, as they might have had with ChatGPT due to its use for other activities. It is evidently the format of the tool itself that led them to quickly extract results without even formulating the question. After all, it is a tool designed for the text analysis alone.

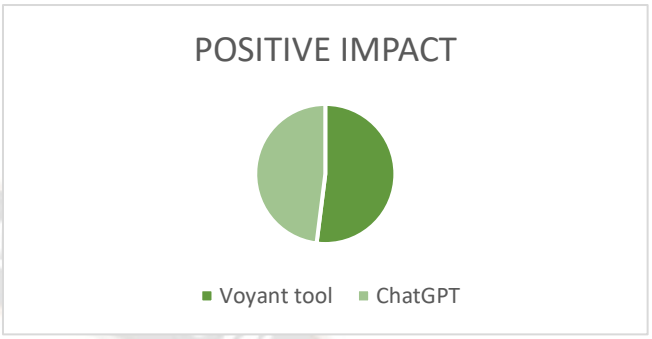
On the contrary, concerning ease of use, students rated Voyant Tools as moderate, but ChatGPT as excellent (see Graphic 2).



Graphic 2: Students' answers about the ease of use of tools

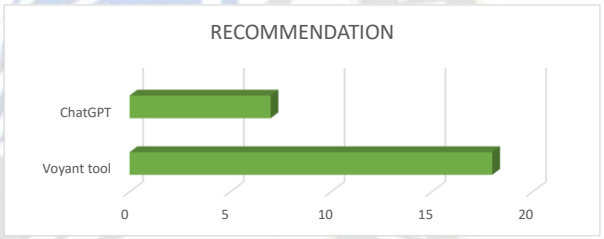
Obviously, the clear process required by ChatGPT positively influences their responses, while the amount of information provided by Voyant Tools, without being requested, creates confusion at least in the first attempt.

The impact of utilizing both tools on students appears comparable (refer to Graph 3).



Graphic 3: Students' answers about the positive impact of tools

Half of the students found Voyant Tools pleasant and visually engaging, while the other half appreciated ChatGPT's clarity and user-friendliness. Despite the above, the overwhelming majority would prefer to conduct similar activities in teaching foreign language using Voyant Tools (see Graphic 4).



Graphic 4: Students' answers regarding the recommendation of tools

The overwhelming issue with the limitation on the texts that the free version of ChatGPT can process, creates hesitation for them. Additionally, they consider Voyant Tools a tool specifically designed for this activity. There were responses to the comments, such as: "It seems more scientific to me," "I can do other activities, like with charts."

V. DISCUSSION AND CONCLUSION

After a brief analysis of the utilization of the tools, we observed advantages and limitations for both tools. NLP tools are specifically designed for handling big data, making them invaluable in the context of extensive corpora. The specialized functionalities of Voyant Tools facilitate in-depth analysis, enabling researchers to uncover patterns, trends, and linguistic nuances within large datasets. While ChatGPT offers a powerful AI-driven approach to textual analysis, limitations arise in the free edition, particularly concerning the insertion of lengthy texts. As a result, the applicability of this investigation is constrained to instances where the literary text is in the form of

a poem or constitutes a small passage from a novel. As Ref. [3] mentions, about searching for answers in Chat GPT, most of the related work found answering the questions is too monotonous, as the approach includes classification and matching of words in Natural Language Question (NLQ) with same words in retrieved texts. There is a need for a better Question Answer (QA) system that can precisely return correct answers, which made the QA community welding towards fields like Natural Language Processing (NLP). According to Ref. [22] in higher education, the Internet has become the major source of information, since being connected is the common way of life for most higher education students all around the world. Applying this online activity in the class the students engage with the language, the literature and the digital ways of textual analysis in an enjoyable way. An NLP tool is valuable for handling big data due to its dedicated design for processing corpora. However, in the free edition of ChatGPT, one cannot insert lengthy texts. Therefore, this activity and the comparison of the two approaches are applicable only when the literary text is a poem or a small excerpt from a novel. In summary, this study undertakes a comparative evaluation of outcomes derived through NLP tools and AI generators, wherein students replicate analytical processes for the same texts using both Voyant Tools and ChatGPT. By explaining the strengths and limitations of each approach, this study contributes to understanding the pedagogical implications of incorporating advanced digital tools in foreign language education.

VI. FUTURE RESEARCH

In a group of university students and future foreign language teachers, it is very easy to experiment, especially when it comes to using online tools that enhance distance learning. However, are all online tools ideal for use in foreign language learning classrooms? As it turned out, no. For this reason, research should evolve in two different directions: a) towards experimentation with more advanced versions of ChatGPT, always for the purpose of learning Italian, in order to reveal the potential for corpus processing and explore possibilities for further textual analysis, but also to make the comparison with NLP tools more reliable. And on the other hand, b) towards expanded textual analysis of small texts or corpora, which will not only include searches for statistical elements but also more complex ones, such as POS tagging, Concordances, Clusters, etc.

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She worked as a teacher of Italian Language and Terminology in High schools and in Tertiary Education. Since 2016 she works in the University of Athens as a lecturer and the last four years as an Assistant Professor teaching courses in Linguistic Analysis, Use of Corpora in Teaching, and the Relationship between Multilingualism and Foreign Language Teaching.

Prof. Florou actively participates in various committees of the Greek Ministry of Education with the aim of evaluating and teaching foreign languages. She is a member of the Italian Association of Applied Linguistics (AitLA), the Italian Association of Computational Linguistics (AILC), Italian Association of Teachers of the Italian Language as FL, and the Learner Corpus Association (LCA).