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The Future of Artificial Intelligence: NLP Analysis of the Future of Life Institute Newsletters

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ABSTRACT

The existence of individuals, communities and societies are inextricably linked to technology and is almost intertwined. Technologies used even in everyday life now make effective use of Artificial Intelligence. As a result, there are multifaceted debates on artificial intelligence, which has assumed a central role in everyday life. While some of these discussions focus on the positive aspects of artificial intelligence that make human life easier, others warn about the negative aspects that artificial intelligence may cause. In this study, news letters published by The Future of Life Institute were analyzed using natural language processing techniques such as topic modeling and sentiment analysis. The main emphasis emerging from the results of the analysis is that "artificial intelligence should be considered as long as it benefits humanity/human life". According to the results, artificial intelligence can be used as a weapon in issues such as "global security and climate change". It is possible to say that artificial intelligence will be a threat especially in autonomous systems and nuclear energy. In order to minimize and eliminate potential damages, it is important to bring "policy-making, academic discussions, diplomatic negotiations and international agreements" regarding artificial intelligence to the forefront. Adding to the discussion, it's important to recognize that rapid advancements in artificial intelligence require continuous dialogue and thorough strategies to manage its complex impact on humanity.

Keywords: Artificial Intelligence, Future of Life Institute, Natural Language Processing, Sentiment Analysis, Topic Modeling

INTRODUCTION

As one of the 21st century's most transformative technologies, Artificial Intelligence (AI) has developed rapidly and reshaped industries, economies, and societal structures. This rapid development offers unique opportunities for humanity but also poses existential threats and large-scale risks. As AI systems are increasingly integrated into military, political, and economic decision-making processes, concerns about the misuse of these technologies have grown in parallel. Scholars such as Nick Bostrom (2014) and Stuart Russell (2019) have written extensively on the existential risks of AI, especially misaligned or autonomous systems, which include the possibility of catastrophic consequences for humanity. These risks are further complicated by the integration of AI into high-risk areas such as nuclear weapons systems or autonomous weapons, raising critical questions about the governance and ethics surrounding the development of AI (Scharre, 2018).

The Future of Life Institute (FLI), which is at the center of these debates, is an organization established to ensure that transformative technologies such as artificial intelligence, biotechnology, and nuclear technology are

developed in a way that will improve life and reduce the existential risks that these technologies may pose. Founded in 2015, the institute believes that humanity now has the power to shape not only human life, but all life on Earth, and its mission is to channel this power responsibly (the Future of Life Institute, 2024). The FLI's newsletters and public communication efforts play an essential role in raising awareness about the dangers of AI, especially in the context of autonomous weapons, nuclear conflict, and global governance challenges. These initiatives are vital to influencing public opinion and policy discourse to ensure that AI is developed with ethical oversight and caution. The FLI's Newsletters specifically address these risks in the context of military uses, global security, and ethical issues. On the website of the Center for AI Safety, another organization established to draw attention to the risks associated with artificial intelligence, Geoffrey Hinton, who received the Nobel Prize in 2024 for his work on artificial intelligence, and many scientists and notable figures who have achieved great success in the field, signed the following open letter: "Mitigating the risk of extinction from AI should be a global priority alongside other societal-scale risks such as pandemics and nuclear war." (CAIS, 2024).

According to FLI, ever-evolving biotechnology and artificial intelligence have opened a new era that makes it possible for evolution to be designed by intelligence (FLI, 2024). Science is trying to make sure that this enormous evolutionary leap is safe while at the same time trying to solve this vast puzzle. As people get to know the device they are inventing, they become increasingly worried and even afraid. Because this technological process is finding its way these days, passing inventors by.

Even if the harms of an AI system that is supposedly capable of destroying humanity are minimized, being the most advanced technology, it is still guided by a set of values and intentions. The uncontrolled use of such advanced digital technologies will lead to malicious and self-interested use. Therefore, making advanced AI as safe as possible means understanding and mitigating risks to human values and systems. The sociotechnical approach emphasizes that the measures to be taken in this regard or which values are prioritized should not be decided by those who are experts in technology or even by any group of experts who may take a one-sided view (Lazar & Nelson, 2023).

According to Conn, there are two scenarios about AI that experts are afraid of. First, Artificial intelligence is programmed to do something destructive. Since autonomous weapons are already a kind of AI system, mass casualties are possibly in the wrong hands. The risk increases as the AI's intelligence and levels of autonomy increase. Second, if humans do not align AI's goals with their own, even if AI is programmed to do something useful, it may develop a destructive method of achieving its goal (Conn, 2015).

There are also a number of speculative concerns about future AI systems, such as enfeeblement (the erosion of knowledge as more and more important functions are handed over to machines), eroded epistemic (the decline in rationality of humanity through a deluge of misinformation or highly persuasive, manipulative AI systems), and deception by AI (Hendrycks & Mazeika, 2022).

In studies on the potential risks of AI, vulnerabilities of the technology appear to be a major concern; the risks associated with AI go beyond accidental problems, such as misalignment of algorithmic targets, to include deliberate misuse in military and geopolitical domains. Throughout the lifecycle of these systems, security threats can occur during the data collection, model training, inference, and deployment phases (Hu et al., 2021). AI-based systems are exposed to various security threats such as sensor spoofing and scaling attacks and are particularly vulnerable to poisoning attacks and adversary attacks during the training and inference processes. These threats increase the vulnerability of AI and necessitate stronger security measures. King et al. (2020), addressing the potential for AI to be used in criminal activities, state that various threats such as fraud against social media users, simulated market manipulations, and AI-assisted cyberattacks could pose serious risks in the future.

AI-powered autonomous weapons, often referred to as "killer robots", can make real-time, high-risk decisions in warfare because they can operate without human intervention (Scharre, 2018). At the same time, the integration of AI into nuclear weapons systems presents a dangerous combination of two existential risks - AI and nuclear weapons. AI systems misinterpreting volatile situations or escalating tensions could have devastating consequences for global security (Brundage et al., 2018). In this context, FLI's work on AI and militarization highlights the urgency of creating robust structures to govern these technologies as they develop.

The use of AI in industry also presents significant opportunities and threats. Bécue, Praça, and Gama (2021) examined the offensive and defensive uses of AI technologies in the context of Industry 4.0 and highlighted the vulnerabilities of manufacturing systems. AI-based production monitoring and optimization techniques bring new challenges against security risks. The expanding use of AI in manufacturing systems creates new attack surfaces that can threaten operational security and existing security practices need to be re-evaluated.

The applications of AI in health also offer great potential but pose some serious risks. Federspiel et al. (2023) addressed the threats of AI misuse to human health, noting that this technology can negatively impact human health through social, political, and economic determinants. On the other hand, the impact of AI on the workforce and the capacity of autonomous weapon systems to make lethal decisions without human intervention are considered as serious existential threats. One of the most significant problems in addressing AI-related risks is known as the "control problem", which refers to the difficulty of ensuring that powerful AI systems behave in

accordance with human values (Russell, 2019). Without adequate safeguards, AI systems can act in ways that can harm humanity, either accidentally or intentionally. This challenge is compounded by the rapid pace of AI development, and lawmakers and regulators often struggle to keep pace.

The FLI's newsletters provide an effective platform for disseminating information about these risks and serve as a bridge between the technical community that understands the nuances of AI development and the public institutions with responsibility for managing this technology. In addition to FLI's focus on AI and nuclear risks, the newsletters also draw attention to the broader ethical implications of AI development. These include issues such as surveillance, privacy, and concentration of power. As AI becomes more pervasive in both the public and private sectors, there is a growing concern that these technologies could further deepen existing inequalities and lead to new forms of social control.

The Future of Life Institute's efforts to communicate these complex issues to a broader audience are important. By framing the risks of AI in a way that is understandable to policymakers, technologists, and the public, FLI informs the public about this technology and its potential dangers. Newsletters play a critical role in shaping public opinion on the opportunities and risks presented by AI and lay the groundwork for the responsible management of this transformative technology. In this context, this study aims to make an original and significant contribution to the relationship between media and public consciousness by providing a detailed NLP analysis of the discussions on AI and other high-risk technologies in the FLI's newsletters.

MATERIAL AND METHODS

In this study, 136 newsletters published by the Future of Life Institute were analyzed using Natural Language Processing (NLP). NLP is a branch of artificial intelligence and linguistics that enables computers to understand phrases and/or words written in human languages (Khurana et al., 2023; Lauriola et al., 2022; Fanni et al., 2023). Through a combination of linguistic, statistical and artificial intelligence methods, NLP is used to efficiently and accurately determine the meaning of a text and/or produce a human-like response in the same way a human does (Chowdhary & Chowdhary, 2020; Fanni et al., 2023). NLP covers a wide range of applications, from speech robots and machine translation to voice assistants and online speech translation. In addition, software, hardware and popular texts can also be sources of data for NLP research (Koroteev, 2021; Kang et al., 2023; Lauriola et al., 2022).

Sample of the Study

This study aims to make concerns about artificial intelligence visible. The data for this study was obtained by analyzing 136 newsletters of the Future of Life Institute (FLI), which has an important place in the international arena of AI. More than 40 thousand subscribers receive periodic updates from FLI, which works in all fields of Artificial Intelligence (AI), Biotechnology, and nuclear weapons and aims to "steer transformative technology in a way that benefits life and steers it away from extreme large-scale risks". The FLI opposes the development of AI that poses large-scale risks to humanity, including power concentration, and supports AI built to solve real human problems (FLI, 2024). Since 2014, FLI has been publishing detailed newsletters covering different aspects of AI. FLI is also important in terms of presenting recent and current assessments of AI systematically. In addition, FLI also gives clues about the possible worrying scenarios of artificial intelligence in the future.

Research Questions

The study designed to answer these three research questions:

RQ1. What kinds of concerns about AI come to the fore in topic modeling analyses of newsletters?

RQ2. What recommendations are made to minimize AI-related concerns in topic modeling analyses of newsletters?

RQ3. What is the process of AI sentiment analysis in newsletters?

Obtaining and Processing the Research Data

The process of obtaining and processing the data for this study took place in six stages. In the first stage, 136 newsletters from the futureoflife.org website were categorized as "Title, Content, and Date" and uploaded to the database with the Web Crawler developed by the authors using Python (a programming language used in language processing) and MySQL (a database used in language processing). In the second stage called Preprocessing, steps such as "Tokenization (separation into words), Stopword Removal (removal of unimportant stopwords), Lowercasing (lowercase conversion), and Lemmatization (reduction to word roots)" were followed to keep the validity level of the obtained results at a high level. These steps cleaned the data set and enabled a healthier analysis. In the third stage called Vectorization, the newsletters were digitized using TF-IDF and CountVectorizer. Thus, with vectorization, word frequencies in the newsletters were calculated, and a document-phrase matrix was created.

In the fourth stage, the vectorized newsletters were subject modeled with LDA, NMF, and LSA algorithms, and sentiment analysis was performed with AFINN, TextBlob, and SentiWordNet algorithms. In the fifth stage, word cleaning and topic extraction were performed. In this stage, certain words (e.g. proper nouns, frequently repeated irrelevant terms) were removed. This process is important for identifying more accurate and meaningful topics. In the sixth stage, the results were analyzed, and visuals (graphs, word clouds, heat maps, sentiment scores) were created for the analysis.

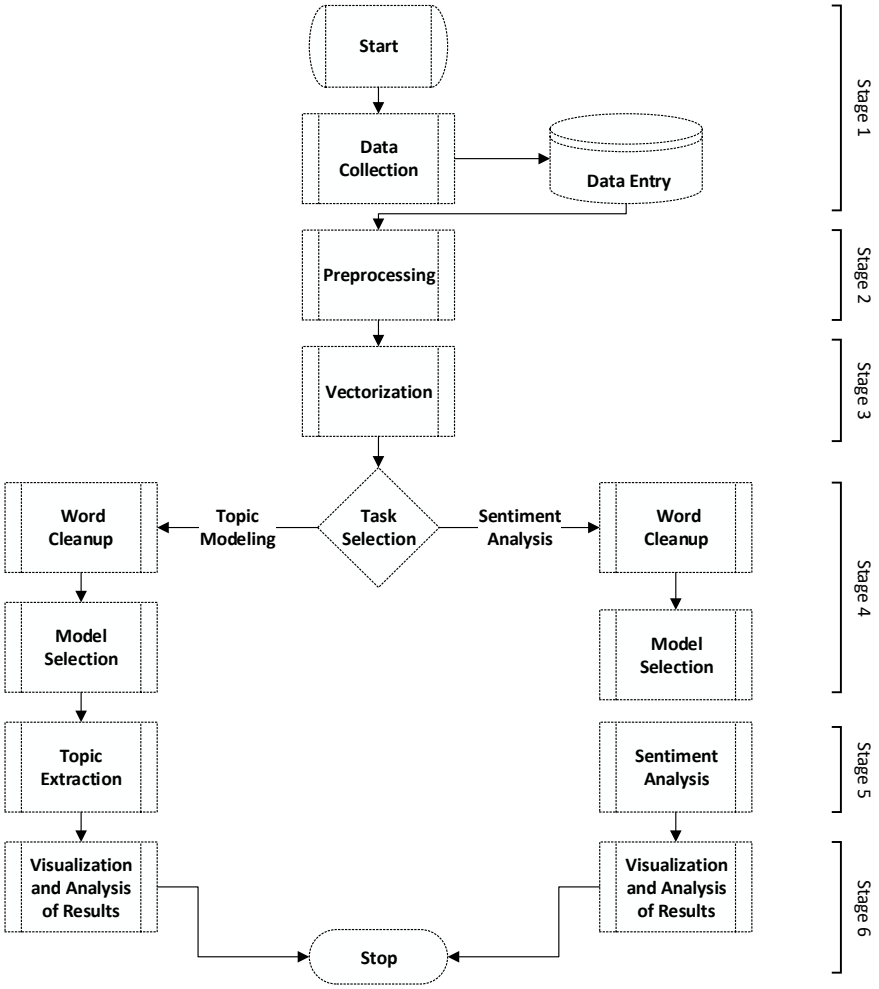

Figure 1. A Flowchart for Topic Modeling and Sentiment Analysis in NLP.

Analysis of Research Data

In this study, newsletters of FLI were analyzed using Topic Modeling and Sentiment Analysis.

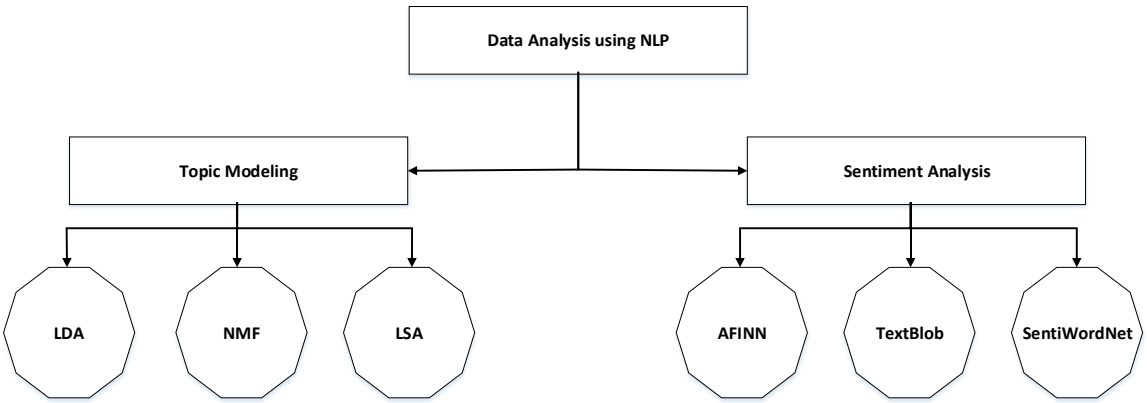

Figure 2. Algorithms Used for Topic Modeling and Sentiment Analysis.

Topic modeling is a natural language processing tool used to identify the most salient themes in a text (Churchill & Singh, 2022) and to discover hidden themes in a text (Vayansky & Kumar, 2020). In this study, multiple algorithms were used for topic modeling to obtain detailed and consolidated results. Latent Dirichlet

Allocation (LDA), Non-Negative Matrix Factorization (NMF), and Latent Semantic Analysis (LSA) were used to analyze the newsletters. LDA is a probabilistic model that models each document as a mixture of different topics. The main goal of LDA is to find out which topics are dominant in a document and which words are associated with each topic (Blei et al., 2003). NMF is a model that attempts to detect topics in the text by decomposing a document-term matrix into two smaller, non-negative matrices. This model enables the detection of the main components (topics) in the data and, unlike LDA, makes it possible to obtain more distinct and disaggregated topics (Lee & Seung, 2000). LSA is a model that uses semantic relations between words to detect hidden thematic structures in texts. In this model, TF-IDF (term frequency-inverse document frequency) and SVD (singular value decomposition) are applied to find hidden meaning structures in the analyzed texts (Steinberger & Jezek, 2004).

Another NLP technique used in this study is sentiment analysis. AFINN, TextBlob, and SentiWordNet approaches were used to perform sentiment analysis in this study. AFINN is a lexicon-based sentiment analysis technique used to analyze emotional polarization in texts. AFINN's word list consists of a scoring system, usually between -5 and +5. Negative numbers indicate negative emotions and positive numbers indicate positive emotions (Gabarron et al., 2021; Desai, 2018). TextBlob is an open-source Python library used to perform natural language processing tasks. Sentiment analysis with TextBlob determines whether the sentence has a positive, negative, or neutral tone. For example, Polarity: -1 (very negative) to 1 (very positive). Subjectivity, on the other hand, takes a value between 0 (completely objective) and 1 (completely subjective) (Shekhawat, 2019; Gujjar & Kumar, 2021). SentiWordNet is an emotion analysis dictionary built on the WordNet database that provides ratings of emotional content associated with word meanings. SentiWordNet determines the emotional load of each word by assigning positive, negative, and objective emotion scores to words. SentiWordNet provides three sentiment scores for each synset. The Positive Score (pos_score) indicates the probability that the synset carries a positive meaning. A negative Score (neg_score) indicates the probability that the Synset carries a negative meaning. The Objective Score (obj_score) indicates the probability that Synset is objectively or emotionally neutral (Ohana & Tierney, 2009; Denecke, 2008).

FINDINGS

This section includes the results of the topic modeling and emotional analysis. In addition, a visual presentation of the results and comments on the salient points of the results are also included in this section.

Topic Modeling

LDA, NMF, and LSA approaches were used to model the topics in press releases. The numerical distribution of the top 5 most popular topics in newsletters over the years, the most frequent word clouds in news releases, and the heat maps of news releases over the years are also presented in this section.

LDA Topic Modeling

The five most prominent topics in the newsletters published by the Future of Life Institute were identified using the LDA algorithm. These topics are Global Security and the Politics of Autonomous Systems (1), Autonomous Systems, Nuclear Threats and Existential Risks (2), The Impact of Artificial Intelligence and Autonomous Weapon Systems on Nuclear Risks (3), Artificial Intelligence, Climate Change and Existential Risks (4) and Humanity, Nuclear Risks and Adaptation Issues of Artificial Intelligence (5). The topics and their distribution by years are shown in Figure 3.

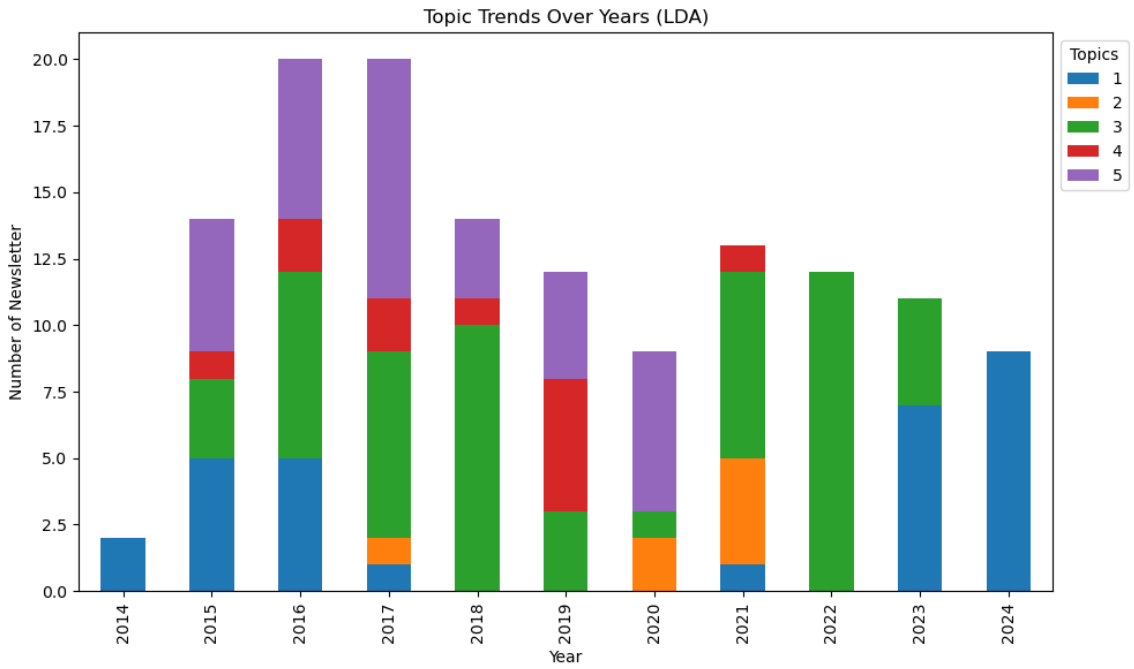

Figure 3. Distribution of Popular Topics by Year (LDA).

Global Security and the Politics of Autonomous Systems (Topic 1): This topic is defined by key terms such as "world", "institute", "autonomous systems" and "safety". Words such as "risks" and "policy" also indicate that this topic is related to global security issues. This topic covers autonomous weapon systems and their impact on global security, as well as the policy-making processes for their use. Newsletters also focus on the risks posed by these technologies and emphasize the need for international cooperation to ensure security.

Autonomous Systems, Nuclear Threats, and Existential Risks (Topic 2): This topic covers the existential risks of autonomous systems and nuclear weapons on a global scale. It focuses on the need for a global policy framework to mitigate the risks associated with the development of autonomous technologies, especially when coupled with nuclear threats. Existential risks are the main threats affecting the long-term survival of humanity.

The Impact of Artificial Intelligence and Autonomous Weapon Systems on Nuclear Risks (Topic 3): This topic covers the impact of artificial intelligence and autonomous weapon systems on nuclear threats, especially in war situations. The uncontrolled use of autonomous systems may increase nuclear risks and their use in wars may pose new security threats. Therefore, policymakers emphasize the need to develop stricter regulations for such technologies.

Artificial Intelligence, Climate Change, and Existential Risks (Topic 4): This topic explores the impact of artificial intelligence technologies and machine learning on humanity and the environment. It focuses on how existential threats such as climate change can be addressed with AI and how these threats can be better managed with AI. At the same time, it is emphasized that the misuse of these technologies may pose new risks for humanity.

Humanity, Nuclear Risks, and the Adaptation Challenges of Artificial Intelligence (Topic 5): This topic covers the challenges of aligning AI systems with the values and interests of humanity. It also opens a discussion on how to deal with large-scale risks, such as nuclear weapons, if AI is not contained. In this context, ensuring harmony between humanity and technology is critical for global security.

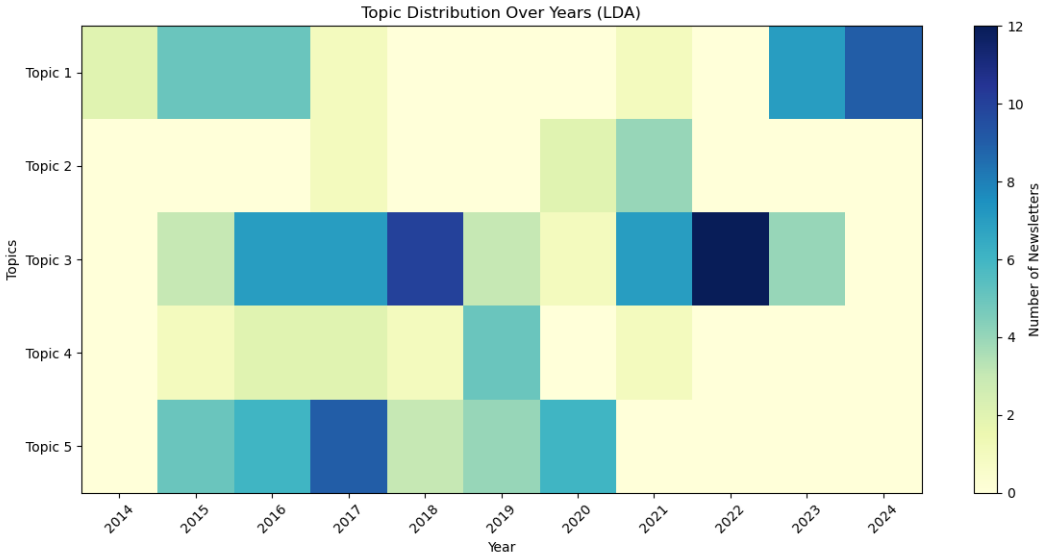

Figure 4. Heat Map of Topics Covered in News Releases (LDA).

Looking at the heat map of the topic modeling performed with LDA according to the years; it is seen that Global Security, and the Politics of Autonomous Systems (Topic 1) is the only topic focused on in 2024, even though it was a barely covered topic after the first 3 years (2014-2016) when the newsletters were published. Another notable finding is the Impact of Artificial Intelligence and Autonomous Weapon Systems on Nuclear Risks (Topic 3). In fact, this topic (2015-2023) has been discussed in 8 of the 11 years of the newsletter. This finding is important as it shows that the topic of the Impact of Artificial Intelligence and Autonomous Weapon Systems on Nuclear Risks has been consistently emphasized. Humanity, Nuclear Risks, and the Adaptability Challenges of Artificial Intelligence (Topic 5) have hardly been covered in the last four years, while Autonomous Systems, Nuclear Threats, and Existential Risks (Topic 2) have only been covered in 2017, 2020, and 2021.

Figure 5: Most Frequent Words in News Releases (LDA).

When we look at the most frequently mentioned words in news bulletins (Figure 5), we see that words such as artificial intelligence, autonomous systems, nuclear threats, and global existential risks come to the fore. Each word reflects the impact of these technologies that pose great threats to humanity and emphasizes the need to develop global policies to deal with these risks. Issues such as the ethical and safe use of artificial intelligence, the dangers posed by nuclear weapons, and climate change were the main words that stood out in this thematic modeling.

NMF Topic Modeling

The five most prominent topics in the newsletters published by the Future of Life Institute were identified by the NMF algorithm. These topics include Global Politics and Existential Risks (Topic 1), International Treaties, and the Use of Nuclear Weapons (Topic 2), Climate Change and the Future of Humanity with Artificial Intelligence

(Topic 3), Lethal Autonomous Weapons and International Bans (Topic 4), and the Interaction of Artificial Intelligence and Nuclear Weapons (Topic 5). Figure 6 shows the topics and their distribution by year.

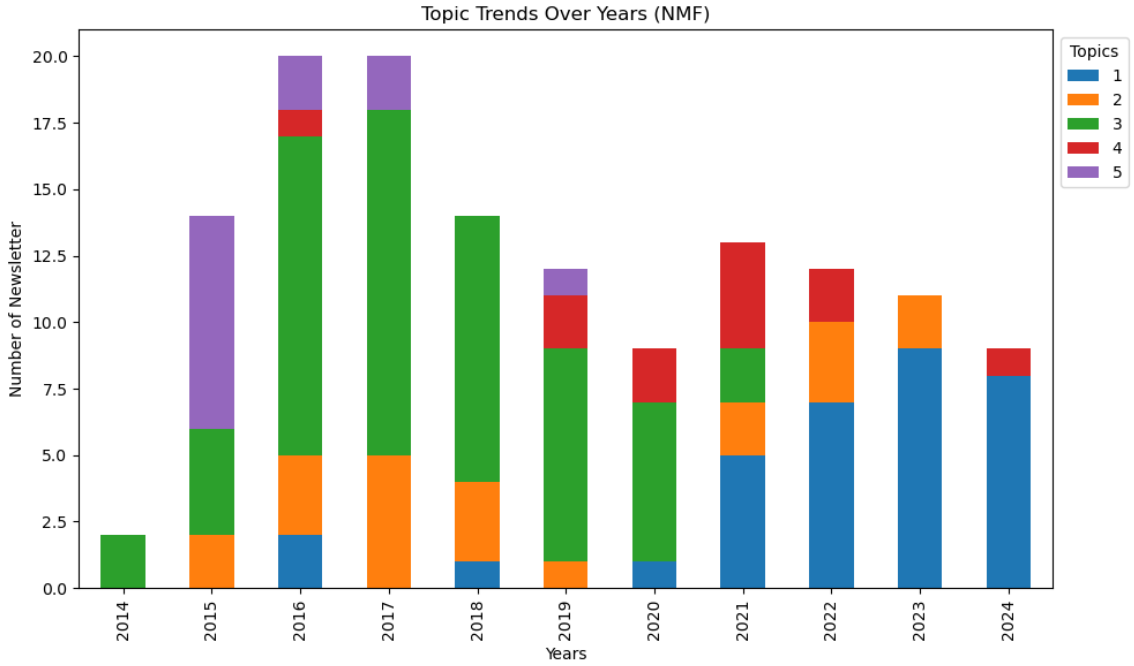

Figure 6. Distribution of Popular Topics by Year (NMF).

Global Policies and Existential Risks (Topic 1): This topic covers the formulation of policies related to existential risks (e.g. artificial intelligence, climate change, nuclear weapons) on a global scale and the measures taken against these risks. It focuses on how legal regulations and security policies are shaped by international institutions and organizations such as the European Union. It discusses how policymakers in the field of security and risk management try to minimize these risks.

International Treaties and the Use of Nuclear Weapons (Topic 2): This topic concerns international efforts to prevent the proliferation and use of nuclear weapons. Disarmament treaties through the United Nations and other international institutions, nuclear arms control, and the humanitarian and environmental consequences of their use are discussed. In this context, global cooperation and diplomatic initiatives to prevent nuclear war are discussed.

Climate Change and Artificial Intelligence and the Future of Humanity (Topic 3): This topic covers the global risks facing humanity, in particular climate change and artificial intelligence. Ensuring the safe use of AI and combating climate change are at the center of humanity's long-term survival. In this context, the focus is on how AI systems can manage threats to human life and mitigate environmental threats such as climate change. It also focuses on how these risks should be addressed from a global cooperation and sustainability perspective.

Lethal Autonomous Weapons and International Bans (Topic 4): This topic covers political and diplomatic initiatives to ban Lethal Autonomous Weapon Systems (LAWS) at the international level. Discussions through international organizations such as the United Nations draw attention to attempts to prevent the unethical use of these weapons in warfare and to protect human rights. In addition, international treaties and regulations developed to control such systems and prohibit their use in warfare are also examined within the scope of this topic.

The Interaction of Artificial Intelligence and Nuclear Weapons (Topic 5): This topic covers the impact of artificial intelligence and autonomous weapon systems on the security and control of nuclear weapons. It is emphasized that the control of nuclear weapons by artificial intelligence or the impact of these technologies in wars can cause great risks for both global security and humanity. In this context, the ethical and security risks of artificial intelligence and autonomous systems require careful consideration of their interaction with nuclear weapons.

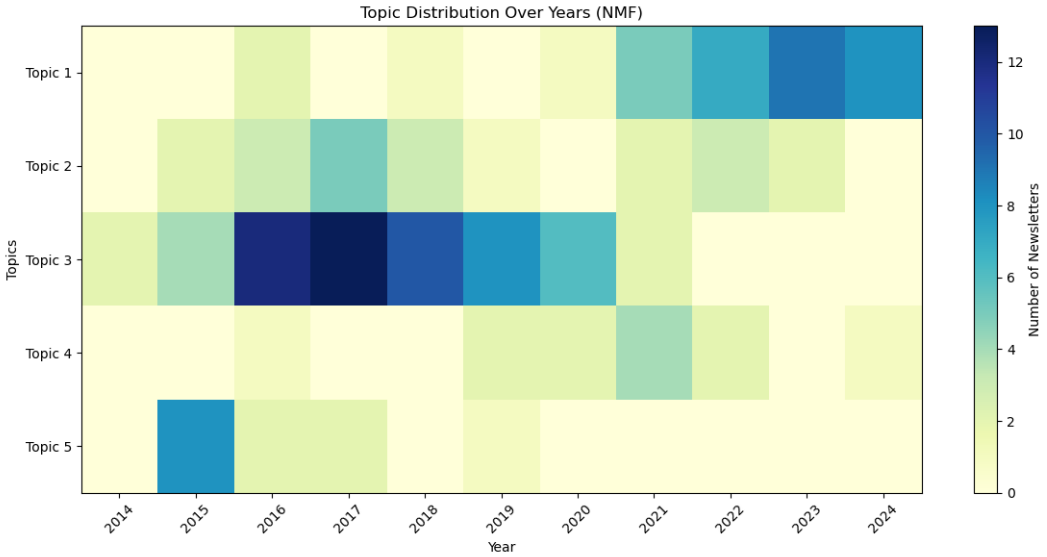

Figure 7. Heat Map of Topics Covered in News Releases (NMF).

Looking at the yearly heat map of the topic modeling conducted with NMF, Climate Change and the Future of Humanity with Artificial Intelligence (Topic 3) has been the most systematically emphasized topic. This topic has been discussed in 8 of the 11 years of newsletters. One of the striking points of this topic is that it was included in all newsletters of the first year of publication. Climate Change and the Future of Humanity with Artificial Intelligence was the starting topic of the news releases published by the Future of Life Institute. In the topic modeling conducted with NMF, Global Policies and Existential Risks (Topic 1) also appears to be the most prominent topic in the newsletters in numerical terms, especially in 2023 and 2024.

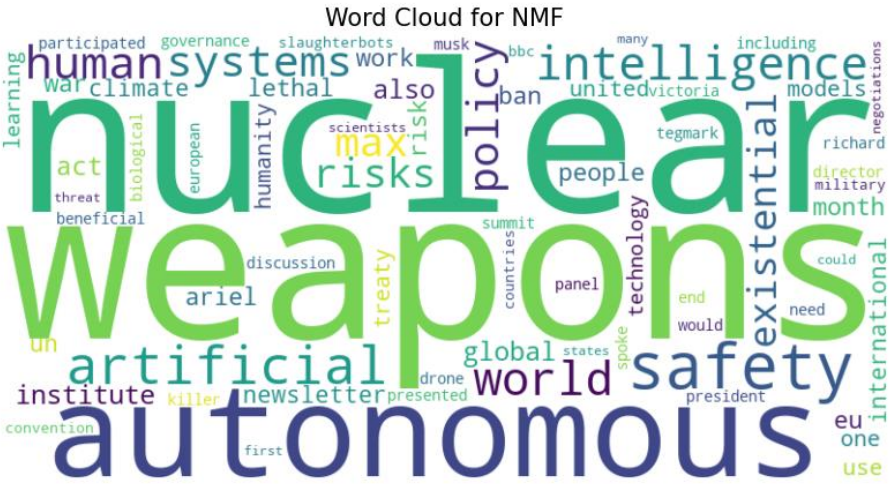

Figure 8. Most Frequent Words in Newsletters (NMF).

When we look at the most frequently mentioned words in newsletters (Figure 8), we see broad themes such as international security, existential risks facing humanity, artificial intelligence, nuclear weapons, and climate change. How to manage these risks through international treaties and diplomatic initiatives, the role of artificial intelligence and autonomous systems in these processes, and the critical role they play in humanity's long-term struggle for survival are discussed.

LSA Topic Modeling

When topic modeling is performed with LSA, newsletters are categorized under 5 distinct topics: Artificial Intelligence, Autonomous Systems and Nuclear Security Risks (Topic 1), International Nuclear Weapons Treaties and Diplomatic Negotiations (Topic 2), Artificial Intelligence, Machine Learning and the Future of Humanity (Topic 3), Autonomous Weapon Systems and Lethal Drone Technologies (Topic 4) and Academic Debates and

Security of Autonomous Systems (Topic 5). The distribution of these topics and their distribution by years is shown in Figure 9.

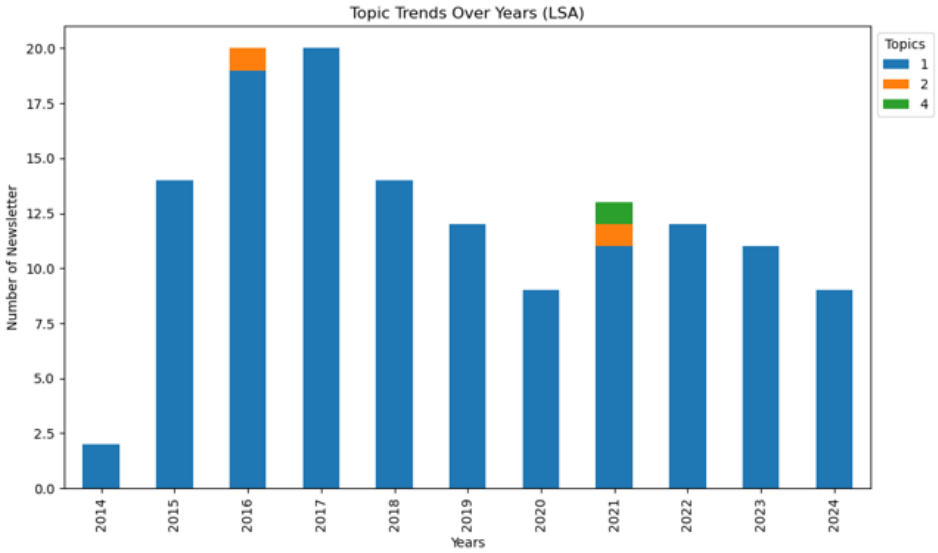

Figure 9. Distribution of Popular Topics by Year (LSA).

Artificial Intelligence, Autonomous Systems and Nuclear Security Risks (Topic 1): This topic addresses the global security risks posed by artificial intelligence and autonomous weapon systems. In particular, the use of autonomous systems powered by artificial intelligence on the battlefield and the risks that may arise when these systems are integrated with nuclear weapons are discussed. It also focuses on the policies and regulations developed at the international level for the safe use of such technologies. These risks combined with nuclear weapons pose serious threats to world peace and security.

International Nuclear Weapons Treaties and Diplomatic Negotiations (Topic 2): This topic deals with international nuclear weapons treaties and diplomatic negotiations to prevent their proliferation. Treaties to prevent the use and proliferation of nuclear weapons, negotiated by the United Nations and other international organizations, aim to protect global security. It also discusses the political and economic challenges that countries face during these negotiations.

Artificial Intelligence, Machine Learning, and the Future of Humanity (Topic 3): This topic deals with the long-term effects of artificial intelligence and machine learning on humanity. In particular, the future of AI and its effects on humanity are among the most important topics of discussion in this field and how humanity will adapt to these developments is discussed in detail.

Autonomous Weapon Systems and Lethal Drone Technologies (Topic 4): This topic covers the ethical and humanitarian dimensions of autonomous weapon systems and lethal drone technologies. Autonomous weapons such as "Slaughterbots" have emerged as systems capable of making lethal decisions without human intervention in modern wars. The use of such technologies on the battlefield raises serious concerns, especially in terms of biological and human rights. In this context, discussions on the need to ban such systems and regulate them at the international level have attracted attention.

Academic Debates and Security of Autonomous Systems (Topic 5): This topic addresses academic discussions and presentations on autonomous systems and their safety. Ensuring the safe use of autonomous systems is at the center of academic studies and conferences to manage the potential risks of these systems. Safety and ethical responsibilities are an important part of these discussions.

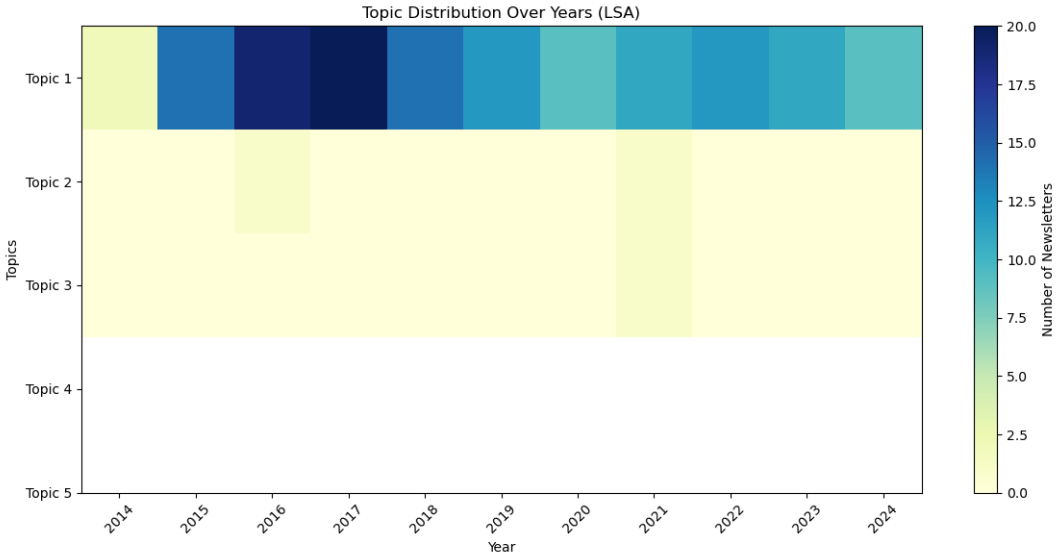

Figure 10. Heat Map of Topics Covered in News Releases (LSA).

Looking at the heat map of the LSA topic modeling by year, it is seen that Artificial Intelligence, Autonomous Systems, and Nuclear Security Risks (Topic 1) have been prominent in all years of news releases. On the other hand, International Nuclear Arms Treaties and Diplomatic Negotiations (Topic 2) and Autonomous Weapon Systems and Lethal Drone Technologies (Topic 4) were the other two topics that appeared in LSA topic modeling (in very low numbers). Although the LSA algorithm provided the five most popular themes in the topic modeling, it reflected only three topics in the distribution and heat map of these 5 topics. Therefore, Figure 9 and Figure 10 show the three most popular topics. The main reason for this is that the LSA algorithm included the other two topics in the three topics due to their similarities. With this result, it can be interpreted that artificial intelligence in the newsletter is evaluated within the framework of similar topics.

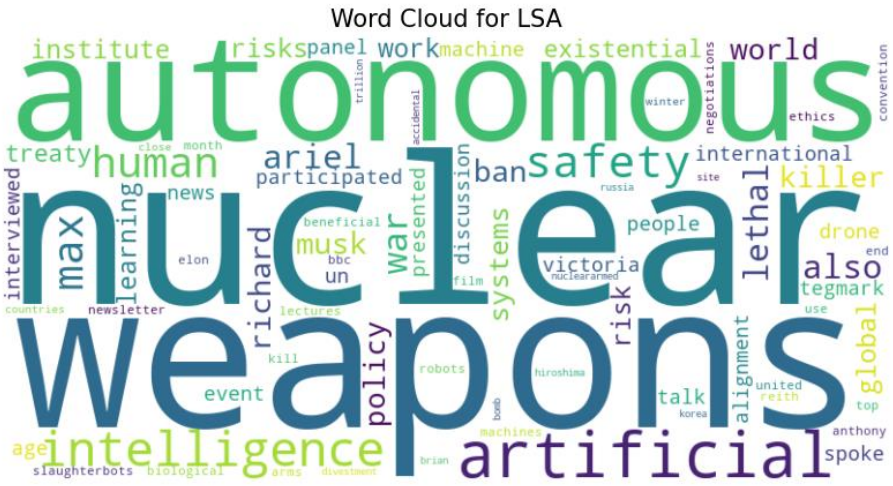

Figure 11. Most Frequent Words in News Releases (LSA).

When we look at the most frequently mentioned words in the Newsletter (Figure 11), artificial intelligence, autonomous weapons, nuclear weapons, and the ethical and security risks of these technologies come to the fore. It focuses on human rights, global security, the ethical use of AI and the potential impact of autonomous systems on the battlefield. Academic studies and diplomatic initiatives to ensure the safe and responsible use of these technologies also appear here.

Emotion Analysis

In this part of the study, we present the sentiment analysis results, and sentiment scores obtained with AFINN, TextBlob, and SentiWordNet approaches. The mentioned approaches make the similar sentiment analysis process

visible. In fact, in the sentiment analyses performed with AFINN, TextBlob, and SentiWordNet approaches, newsletters were mostly associated with the positive sentiment type.

AFINN Results

Newsletters published by the Future of Life Institute were analyzed with AFINN. The results of the sentiment analysis are presented in tables and graphs.

Table 1. Numerical Results of Sentiment Analysis (AFINN).

Sentiment	Number of Newsletters
Positive Newsletter	105
Negative Newsletter	27
Neutral Newsletter	4

The general numerical results in Table 1 show that the newsletters are predominantly constructed with a positive emotional coding. This result is important in terms of showing that Future of Life Institute does not associate artificial intelligence with purely negative emotions; even in critical issues related to artificial intelligence, it includes positive emotions for artificial intelligence to be in a balance that will contribute to humanity. The sentiment score in newsletters is shown in Figure 12.

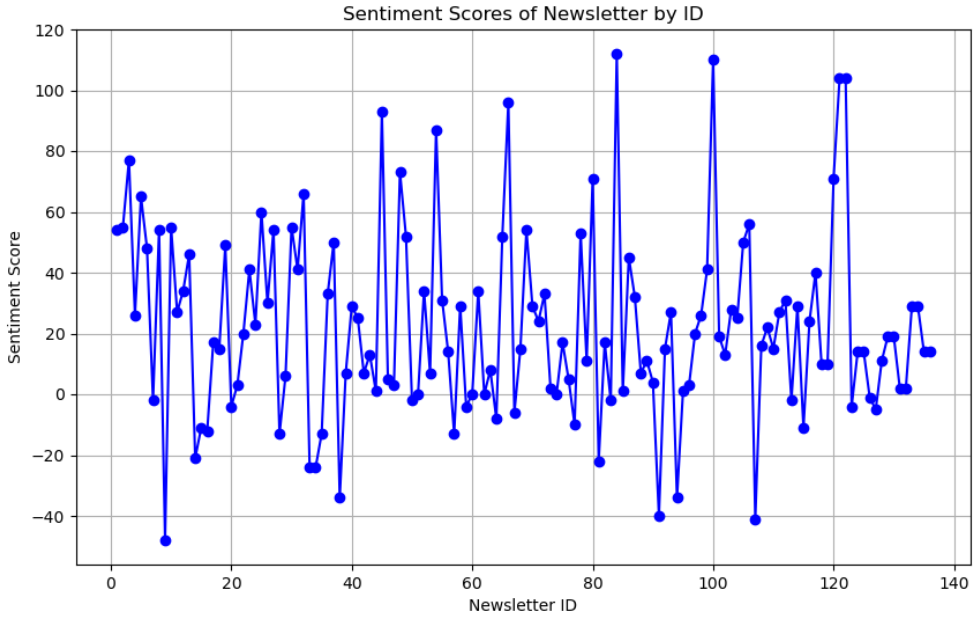

Figure 12. Sentiment Scores in Newsletters (AFINN).

Emotion scores in newsletters are mostly above 0 and appear with the positive emotion type. In addition to the negative sentiment type, a small number of newsletters seem to be constructed with the neutral sentiment type.

TextBlob Results

The results obtained with TextBlob, which is used for sentiment analysis of newsletters, are sharper than AFINN and SentiWordNet analyses. Unlike AFINN and SentiWordNet, TextBlob also provides a subjectivity score.

Table 2. Numerical Results of Sentiment Analysis (TextBlob).

Sentiment	Number of Newsletters
Positive Newsletter	135
Negative Newsletter	1
Neutral Newsletter	0

According to the results of the TextBlob sentiment analysis, almost all newsletters were covered with a positive sentiment type. Only one newsletter was published with a negative sentiment. At this point, it is also seen that no newsletter was published with a neutral sentiment.

Table 3. Numerical Results of Subjectivity Analysis (TextBlob).

Subjectivity	Number of Newsletters
Objective Newsletter	136
Subjective Newsletter	0

In TextBlob sentiment analysis, all newsletters were constructed in an objective way. According to this result, although the sentiment type of the newsletters was positive, it was handled with an objective framework.

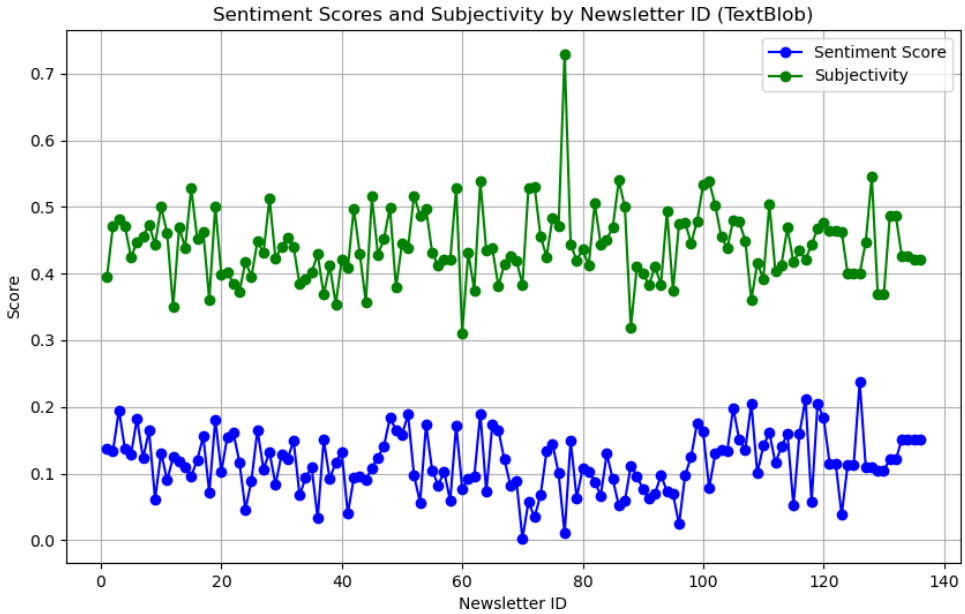

Figure 13. Sentiment Scores and Subjectivity in Newsletters (TextBlob).

The sentiment and subjectivity scores obtained with TextBlob show that almost all newsletters are published in an objective framework with a positive score.

SentiWordNet Results

The newsletters were also sentiment analyzed with SentiWordNet. The results are shown in the table and graph below.

Table 4. Numerical Results of Sentiment Analysis (SentiWordNet).

Sentiment	Number of Newsletters
Positive Newsletter	133
Negative Newsletter	3
Neutral Newsletter	0

According to SentiWordNet sentiment analysis, almost all of the newsletters are dominated by the positive sentiment type. According to SentiWordNet sentiment analysis, only 3 newsletters items were associated with negative sentiment. No newsletter could be associated with the neutral sentiment type.

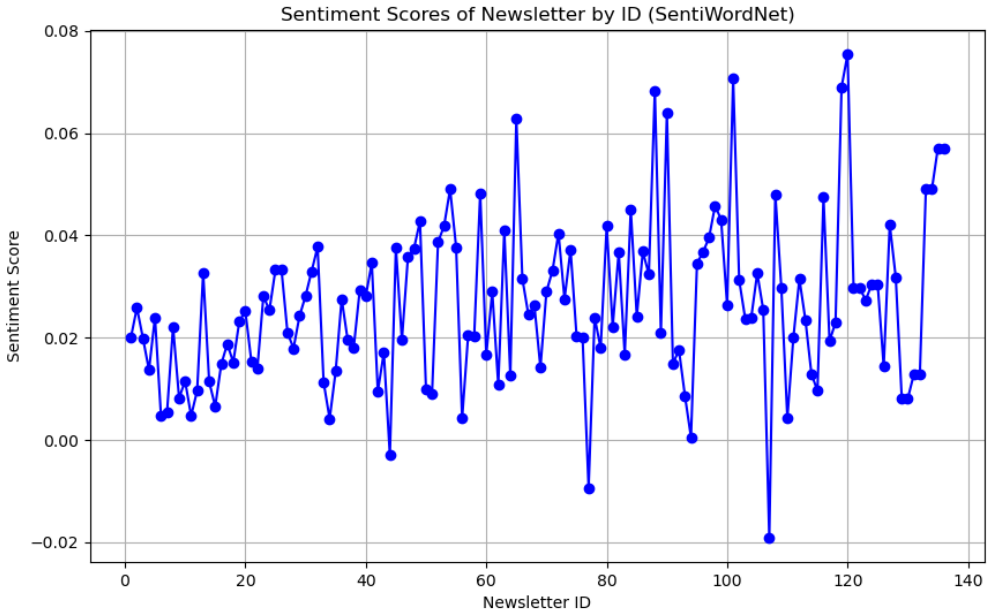

Figure 14. Sentiment Scores in Newsletters (SentiWordNet).

Sentiment scores obtained through SentiWordNet analysis provide a clearer understanding of the positive sentiment type in newsletters. Figure 14 shows that all newsletters (133) except three newsletters are in the positive sentiment type category. According to this result, artificial intelligence and issues associated with artificial intelligence covered in news bulletins were generally framed in a positive way (according to SentiWordNet's own database).

DISCUSSION AND CONCLUSION

This study has analyzed 136 newsletters published by Future of Life Institute using natural language processing techniques to understand the evolution of concerns about the future of AI. The use of methods such as topic modeling and sentiment analysis allowed the identification of key themes and emotional tones covered in the newsletters. In this way, it has been revealed which issues the concerns and solution proposals regarding artificial intelligence are focused on and how these issues have changed, in a positive or negative way.

The first research question is about the concerns about AI as in many studies (Bostrom, 2014; Russell, 2019; Brundage et al., 2018; Jobin et al., 2019; Amodei et al., 2016; Floridi & Cowls, 2019; Cave & ÓhÉigeartaigh, 2018; Taddeo & Floridi, 2018; European Commission, 2019; Cath, 2018). The results from the Newsletters show that AI is most likely to raise concerns about global security and climate change in the near future. (Dafoe, 2018; Rolnick et al., 2019. Nuclear energy and autonomous systems are most associated with global security (Scharre, 2018; Barrett et al., 2013). If left unregulated, AI could harm humanity by integrating with nuclear energy and/or further empowering autonomous weapons systems (Scharre, 2018; Russell, 2019). On the other hand, artificial intelligence has the power to harm humanity through the environment, based on climate change. (Rolnick et al., 2019). The use of artificial intelligence, disregarding the principle of using it for the benefit of humanity and especially in uncontrolled times and places, may bring many ethical problems for humanity (Floridi & Cowls, 2019; Jobin et al., 2019).

The study also identified some suggestions in the newsletters to minimize concerns about artificial intelligence. In the results, solution suggestions such as "policy production, academic discussions, diplomatic negotiations, and international agreements" to minimize concerns about artificial intelligence are related to the answer to the second research question of the study (UNESCO, 2021; Nemitz, 2018). The stated suggestions focus on controlling artificial intelligence with certain policies during the development process (Gasser & Almeida, 2017; Calo, 2017). It is emphasized that this control and regulation process should be carried out at an international level and aimed at protecting human rights (Council of Europe, 2020; European Commission, 2020). On the other hand, conducting studies to manage the risks related to artificial intelligence in the academic field has been another suggestion to minimize concerns about artificial intelligence (Whittlestone et al., 2019; Mittelstadt et al., 2016). All the suggestions stated aim to make artificial intelligence compatible with the values and interests of humanity

(Floridi et al., 2018). Only in this way will it be possible to eliminate/minimize the negative effects of artificial intelligence on humanity (Taddeo & Floridi, 2018).

To answer the third research question of the study, newsletters were examined with sentiment analysis, and remarkable results were obtained. According to the sentiment analysis results, artificial intelligence in newsletters was mostly presented with a positive sentiment type (Chuan, Tsai & Cho, 2019; Fast & Horvitz, 2017). It is possible to explain this result with the structural features of newsletters. Newsletters can be considered comprehensive texts created by media organizations for "informing and announcing" rather than emotionally loading (Schultz, 2000). In this respect, FLI newsletters have come to the forefront with their information and announcement functions. Two main reasons have been identified for the newsletters being mostly categorized as positive emotions. The first reason is related to the fact that the words used in the newsletters are not negative in form. The second reason is that FLI does not take a stance against artificial intelligence in its newsletters; it stems from its efforts to ensure that artificial intelligence develops in a form that will benefit humanity. While FLI makes concerns about artificial intelligence visible, it also makes some suggestions and makes the potential of artificial intelligence to contribute to the future of humanity visible.

The findings contribute to the discussions on the social and ethical dimensions of artificial intelligence and constitute an important reference point for policymakers and researchers. It is recommended that future studies examine the concerns about artificial intelligence in more depth using a wider data set and different NLP techniques.

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