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Comparative Analysis of National AI Strategic Policies and Regulations for Great Economies Using NLP and Knowledge Graphs*

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Abstract

Background: This study presents a thorough comparative analysis of national AI strategic policies and regulations on the economies of the most advanced AI nations using natural language processing (NLP) and knowledge graph (KG) techniques. By leveraging NLP and KG, our investigation systematically examines and compares the AI policies for AI leading nations to identify common themes, differences, and emerging trends: Purpose: The study aims to elucidate the strategic policy priorities and regulatory frameworks for AI leading nations that represents hope and a model for other nations. Significance: This study highlights the importance of NLP and KG as a powerful technique for policy analysis and provides insights into how AI leading nations approach AI governance to spearhead advance developmental issues. Practical implications: Knowledge graph represents an important task in data mining that assists in identifying database entries similarities, extracting information from large documents, and classifying text into organized content that can assist policy makers advance economic developmental knowledge from other nations. Method: This study utilizes Pearson correlation coefficient, natural language processing (NLP) and knowledge graph (KG) to analyze and compare the AI strategic policy regulations of the economies for leading AI nations. Findings: Based on the Pearson correlation coefficient, the study concluded that NLP and KG are great models needed for predicting and identifying AI strategic policies and regulatory similarities. Our investigated analysis reveals that there exists similarities and differences in the AI strategic policies and regulations which explains the linear economic developments from these nations.

Keywords: Artificial intelligence, natural language processing, knowledge graph, national AI strategies, AI policy regulations, Great Economies

Introduction

Knowledge graph is an important task in data mining that assists in 1) identifying similar database entries, 2) extracting information from large documents, and 3) classifying text into organized content (Xuen, 2023). The process of identifying similarities in data required extensive deep-learning knowledge. The process of data extraction requires a broad knowledge of natural language processing. The process of classification of text content into an organized structure requires machine learning knowledge. Knowledge graph development of artificial intelligence (AI) to assist the review of scholarly publications (Rajabi et al., 2024). This study aims to analyze various AI techniques that use knowledge graph-driven chatbots to discuss the possibility of how to implement these techniques.

Artificial Intelligence (AI) has emerged as a pivotal technological advancement across multiple domains, including education, healthcare, finance, agriculture, transportation, and defense. The growing interest in AI is driven by diverse objectives that warrant strategic focus (Ulnicane, 2022). This strategic focus encompasses various initiatives such as Innovative AI for Education, Innovative AI for Healthcare, Innovative AI for Business Development, Innovative AI for Transportation, Innovative AI for Infrastructure Development, Innovative AI for Telecommunications, Innovative AI

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for Media and Social Platforms, Innovative AI for Defense and Security, Innovative AI for Agriculture, and Innovative AI for Energy. The Transformer architecture has demonstrated remarkable efficacy in natural language processing, graph mining, and computer vision tasks (Bi et al., 2024). A study was conducted to explore the relationships depicted by knowledge graphs, employing a novel enhanced structural self-focus to encode these information relationships. By linking related information, the study facilitates the grouping of similar components to a certain degree. Knowledge graphs are utilized in this research to assess strategic policy regulations in the United States, China, the European Union, Japan, Australia, Canada, and New Zealand. Additionally, a BERT model designed to streamline dialogue tracking is proposed (Lai et al., 2020). This model is capable of operation and modification without necessitating a dynamic increase in parameter count. Furthermore, a material knowledge graph known as MatKG (Venugopal and Olivetti, 2024) is introduced, which serves as a repository of entities and relationships derived from scientific literature.

Globally, nations are formulating strategic policies to engage their citizens with the benefits of AI while addressing ethical, legal, and social implications. This study applied natural language processing (NLP) to analyze and compare the AI strategies of leading nations. We aim to elucidate the strategic policy priorities and regulatory frameworks shaping AI-leading nations through the global AI landscape.

Literature Review

The application of artificial intelligence may appear straightforward; however, its practical implementation is considerably intricate (Kaplan, 2016). Various nations and governmental bodies perceive AI primarily as a tool for enhancing systems, services, and sectors. In contrast, it is fundamentally a technology that serves the populace, influencing governance, sectors, and services. The utilization of structured data through coding has significantly advanced natural language understanding (Bi et al., 2024). The representation of concepts via knowledge graphs is a critical component of effective information management. Natural language processing, as a facet of artificial intelligence, has led to the development of more sophisticated methodologies in knowledge graph construction. AI does not function autonomously; rather, it relies on knowledge derived from human-generated data. To gain a comprehensive understanding of AI strategies, we examine policy initiatives from the four leading economies: the United States, China, the European Union, and Japan. This analysis aims to elucidate the implications of AI strategies for these experienced nations before considering a global perspective. Knowledge graphs are constructed from natural language text and logical expressions. Employing machine learning necessitates a more conscientious approach to text analysis. Natural language processing facilitates text summarization, while machine learning contributes to the organization of structures. A neural network model has been proposed that can produce a variety of coherent responses based on TransferTransfo (Li et al., 2020). This model incorporates intent and semantic slots. In this research, we employed thematic training to accurately forecast artificial intelligence strategy policy regulations for the United States, China, the European Union, Japan, Canada, Australia, and New Zealand..

The relevance of artificial intelligence analysis has been underscored (Curtis et al., 2016). The research illustrates that correlation analysis techniques resemble quantitative analytical approaches. This study employs correlation techniques to further highlight the significance of correlation analysis in deriving crucial data essential for decision-making processes. The correlation matrix possesses multiple significances and applications (Gogtay and Thatte, 2017). This research perceives correlation analysis as a vital tool for handling large datasets. The healthcare sector is one area of the economy that is actively employing the correlation matrix, as medical professionals often need to infer relationships among data. A number of studies have applied correlation analysis to address various societal challenges, including those related to healthcare, education, industry, and transportation. Mah, (2024) analyzes the accessibility of remote healthcare services through the lens of artificial intelligence in the Proceedings of the AAAI Symposium Series. The study integrates deep learning approaches with natural language processing-based knowledge graphs to enhance the efficacy of digital diagnostics. By employing advanced AI methodologies, it addresses significant challenges in the realm of remote healthcare delivery, with a particular emphasis on improving both diagnostic accuracy and accessibility. This work is instrumental in the development of innovative, AI-driven strategies that aim to ensure equitable healthcare access in digitalized settings, thereby mitigating disparities in medical service availability on a global scale.

Knowledge Graph AI Policies for G4AI Nations

This section delineates the strategic policies and regulations concerning artificial intelligence for the four leading AI nations, referred to as G4AI. The knowledge graph serves as a meticulously organized framework for the natural language processing model focused on entity analysis. It facilitates the representation of a network comprising real-world data entities, including objects, events, situations, and concepts, while also elucidating the interconnections among them. The integration of natural language processing with a knowledge graph enables the attainment of critical data identity and representation. Large language models (LLMs), such as ChatGPT and GPT-4, are significantly transforming the domains of natural language processing and artificial intelligence, primarily due to their emergent capabilities in knowledge representation. However, LLMs are often characterized as black-box models (Pan et al., 2024)

and frequently struggle to accurately capture and associate factual knowledge. To address this limitation, a Knowledge Graph-based Retrofitting (KGR) approach has been proposed (Guan et al., 2024, March), which combines LLMs with knowledge graphs to reduce instances of factual hallucination.

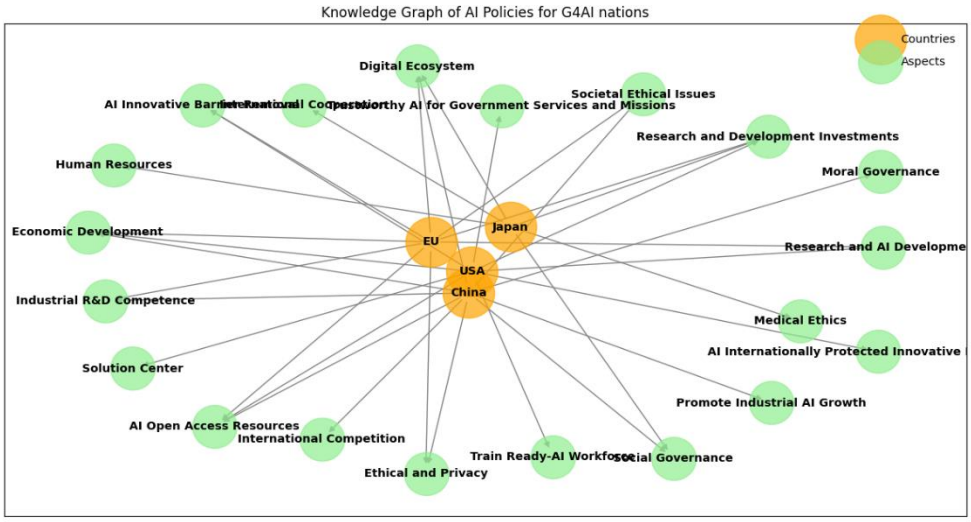

Figure 1: Knowledge graph great four AI nation (G4AI

Figure 1 represents the Knowledge graph of the great four AI nations (G4AI). The following paragraph explains in detail the great four artificial intelligences. A feature-rich system was investigated to design and support research literature using natural language processing (Schopf and Matthes, 2024). Natural language processing is a system of artificial intelligence that permits text visualization. Knowledge retrieved is an essential part of machine learning that assists scientists in obtaining required data from scientific publications. A variety of data can be obtained using natural language processing. In this study, we extract essential keywords from national AI strategic policy regulation for the great four AI (G4AI) nations.

Trust, transparency, and openness among Nordic countries' cultural values compared to its AI strategies. The study revealed that Nordic AI strategies strongly rely on privacy policies, ethical considerations, and autonomy (Robinson, 2020). Recently, lots of mixed opinions have been seen regarding the use of ChatGPT in education. Many universities support ChatGPT on education while many also oppose it (Parker, 2020). The practical AI application has shown in a more practical environment with lots of ease of use and implementation. Yet fear looms across academics, policymakers, lecturers, and learning institutions. The much-needed attention has further attracted policy dive into AI by government sectors with various strategies. Wilson calls for public connectivity and participation in AI governance with a public interest (Wilson, 2022). The author believes public opinion will influence AI strategy implementations. The author warns of the impact of neoliberal technology frames associated with AI that they believe have ethical issues. AI policy cycle enumerates four (4) lists of AI policy cycles and explains their rule in enabling strategies across nations Galindo, L., (Perset and Sheeka, 2021). The study investigated the way AI is applied to economic sectors based on policy design, implementation, intelligence approaches, and multi-stakeholder cooperation pillars.

US AI Strategic Initiative

The director of the National Artificial Intelligence Office White House published an American artificial intelligence initiative in the US (Parker, 2020). The US AI strategic initiative was launched by President Trump's Executive Order 13859. The initiative has the following vital policy implementations. The rise of artificial intelligence was examined in business, industry, and other sectors of America. Figure 1 represents the US artificial intelligence strategy initiatives that guide and regulate the development and implementation. Artificial intelligence with American values and China characteristics on the global scale of AI leaders in the world (Hine and Floridi, 2024). The study uses natural language processing to compare the geopolitical aspects of AI implementation for both countries. The study examines AI strategy based on three eras which start with President Obama to President Trump and President Biden. The study views AI in terms of countries' philosophy on technology. An evaluation based on natural language processing on documents determining the artificial intelligence initiative between US and China. The analysis shows more emotional sentiment on Chinese AI initiatives than the US. The analysis went further to evaluate the US documents in comparison with other countries like China. Indications revealed the US using examples from the Chinese artificial intelligence counterparts, but China's artificial intelligence initiative focuses only on examples within China. The analysis shows bias in Chinese

strategy and a higher level of dominance than cooperative. URLs tracking referenced from the Europe Council for AI initiatives assessed 463 AI documents (Roche et al., 2023). US-Europe contributions were enormous, global North also substantial except global south especially Africa with the least contributions. Artificial intelligence advances have stimulated diverse discussions on the potential use of AI. Artificial intelligence is very important in the context of our modern-day society, but the approach of applications and use raises a lot of attention to privacy and ethical implications. There exists a dispersed body of knowledge that is loosely centered around the artificial intelligence framework concept (de Almeida et al., 2021). This study analyzes artificial intelligence literature and reviews regulatory data published between 2010 and 2020. The study aims to achieve gold-standard societal values with higher levels of fairness, freedom, and long-term sustainability. Artificial intelligence contributes to public governance and there is active use of AI as a system of e-governance. Artificial intelligence can effectively manage redundant activities for the administrative tasks officials do daily. The level of inconsistency in administration is what is giving rise to artificial intelligence's growing ethical implications.

China AI Strategies Initiative

A group of researchers investigated Chinese AI strategy plans and published some revealing facts (Roberts et al., 2021). According to their findings, the Chinese artificial intelligence initiative called the "New Generation Artificial Intelligence Development Plan" aims to lead the world of AI by 2030. The "New Generation Artificial Intelligence Development Plan" China had the following initiative (Ding, 2018). The following paragraph explains China's AI initiative. Figure 1 represents the Republic of China's artificial intelligence strategic initiative that guides the deployment of innovations and practices of AI. Less tolerance for corruption in China has pushed economic growth upwards and industrial AI implementation has benefited the economy. Global research indicates increased artificial intelligence in governance (Tallberg et al., 2023). A study on global AI governance was conducted to determine the prospective for research on global governance. To study global governance, one should be able to determine empirical and normative approaches. These two approaches offer room for questions to answer, concept development, and theories that assist an in-depth understanding of global AI governance. Artificial intelligence is a leading rule in digital transformation (Li et al., 2023). Artificial intelligence would assist governments achieve digital transformation. A study on agile governance as a leading rule of artificial intelligence in China's local government was carried out. Chinese local governments have benefited from advanced services with the support of artificial intelligence-enabled applications. There is increasing value creation in China's digital system for local governments.

The European Union (EU) AI Strategic Initiative

A group of researchers investigated the European Union AI strategy initiative and published some interesting facts (Cohen et al., 2020). Their studies revealed that the European Union's AI strategy focuses on institutionalization and incubation research. The EU plan's objective approach aims to provide business support that prioritizes AI products and services. Apart from their main agenda, the three pillars below provide an overview of EU AI strategies. Figure 1 which guides the research and development of innovations in artificial intelligence amongst its zone of 27 countries. Artificial intelligence activities that place humans as priorities should have stronger regulations that address humans than other activities and verse Versa. A study on artificial intelligence trustworthiness and the EU Act was examined to determine the level of acceptability (Laux et al., 2024). The study believes the EU Act is overselling its concept of trust. As complex as the technology for artificial intelligence, the EU formulated regulations that allow a flexible process for innovations. Depending on public opinion and interests is the best the EU can maintain. The European Union has a very strict privacy policy. Artificial intelligence has a sophisticated system that can easily override some laws. The services provided by artificial intelligence are convincing and convenient that users turn to realize their privacy has been trade-off with sophisticated benefits only afterward. Trust is a positive sign for good regulation and norms. Artificial intelligence requires trustworthy regulations that will push for global acceptance. Governance and big tech companies influence some regular activities in society's perceptions. The just-ended COVID-19 created a lot of mistrust for many governments. Some governments and giant tech believe systems and a greater engagement indicate trust.

Japan AI Strategic Initiative

The national AI strategy for Japan aims to realize a human-centric society called society 5.0. The AI strategy of Japan integrates sustainable development goals with the digital technology of a shared society of humans and machines. Japan's Artificial intelligence coined Society 5.0 reflects its societal challenges. Figure 1 guides its shared approach to the development of artificial intelligence. Japan is currently implementing a system of artificial intelligence known as Society 5.0. The economy of Japan consists of 40 percent of the aging population (Dirksen andTakahashi, 2020).

The fourth giant nation is struggling to balance its economic situation and at the same time achieve the fast turnaround of artificial intelligence technology. Japan's Artificial intelligence and regional employment were examined (Hamaguchi and Kondo, 2018). The exposure to computer systems among men and women was evaluated using data from the Japanese labor market. Their findings revealed that women are more exposed to computerized services. The rise of ethics and privacy would likely impact the female population of Japan. The female population requires trustworthy regulations and higher levels of protection in every economy. The female population brings forth lives and if impacted by artificial intelligence trust issues, it will go a long way to integrate new developments. A study on artificial intelligence and the Japanese labor market was conducted (YOSHIDA and YENILMEZ, 2022). In the past 40 years, Japan has developed an advanced robot system. Currently, there are 700,000 robots around the world, with Japan representing 500,000. In the wake of artificial, systems are changing. For a country that had heavily invested in robotics to reconfigure into artificial intelligence requires huge capital and skilled engineers. Another fantastic issue will be upgrading skills and getting new artificial intelligence skills from experienced engineers. Japan's labor market has observed a variety of technologies for the past 40 years. Text mining perception amongst Japanese was conducted to find out general opinion towards artificial intelligence (Hoshino and Hirao, 2024). The findings revealed different varieties of opinions across different sectors of the economy. The economy of Japan is expected to face an aging population of about 40 percent by 2030. Taking into consideration the demographic structure of the economy, it is normal to have a complex viewpoint on artificial intelligence. The economy of Japan requires restructuring of organizations and sectors and fulfilling the labor market threshold envisaged soon.

Methodology

This section is made up of Data Collection steps, Data Collection Techniques Analytical Framework, Cosine Similarity Matrix Prospectus, Steps Utilize In the study, and NLP Comparative AI Policies Analysis Summary Table.

To examine AI policies across prominent nations, all relevant datasets and code links were employed, accessible at this link: https://colab.research.google.com/drive/1FLfxHqaGu6cUV2jc9_bt_PuHn-bB6kcn#scrollTo=it44_T-NDghX.

Data Collection Steps
In the process of our investigations to highlight the potential of NLP as a powerful technique for AI strategic policy regulation analysis. We collected AI strategic policy documents for the selected nations via OECD. The dataset includes policies from the United States, China, the European Union, Japan, Germany, Britain, Australia, Canada and New Zealand. The AI strategy policy for the AI leading nations document was transformed into text format to simplify the analysis process.

Data Collection Techniques
The following Natural Language Processing Techniques below are often utilized in analyzing content similarities. In the process of our analysis, we make used of the following NLP techniques:

Text Preprocessing and Tokenization: This is the process of splitting the data text content into individual words also called tokens and removing stop-words, punctuation, and other irrelevant features that exist within data text.

Term Frequency-Inverse Document Frequency (TF-IDF): This is the process of measuring the importance of tokens or words or text content in each document relative to the entire corpus.

Topic Modeling. This is the process of utilizing Latent Dirichlet Allocation (LDA) to identify key topics found within the data content.

Sentiment Analysis. This is the process of evaluating the tone of the policy documents to understand the AI leading nation's sentiment towards AI development strategies and regulation policies.

Cosine Similarity: This is the process of evaluating data content similarity between two or more documents to compare AI national strategies amongst AI leading nations.

Data Analytical Framework
We investigate our model by analyzing strategic policy for AI leading nations in three stages:

Descriptive Analysis: In this section, we summarize and describe the main features for AI strategies policies of each policy document for each AI leading nation.

Thematic Analysis: In this section we Identify and compare key themes across different policies for the AI leading nations.

Comparative Analysis: in this section we assess the similarities and differences between national AI strategies for all the AI leading nations using cosine similarity metrics.

Cosine Similarity Matrix Prospectus

In this section, we compare national AI strategies using the above-mentioned points. We are able to learn artificial intelligence strategies for some selected AI leading nations listed by OECD. This study builds an artificial intelligence model that traces a nation's priority. The model was used to analyze artificial intelligence investments at the international level and at the national level. The following figures represent simulation comparison at the national and international level.

Correlation Strength	Positive	Negative
Perfect	r=0.9 to 1	r=-0.9 to 1
Strong	r=0.5 to 0.9	r=-0.5 to -0.9
Weak	r=0.1 to 0.5	r=-0.1 to -0.5
uncorrelated	r=0 to 0.1	r=-0 to -0.1

Figure 2: Correlation Coefficient

Figure 2 represents correlation coefficient step utilized to evaluate investigations initiative for the great four (G4AI) nations utilized in the study. Figure 2 can be interpreted as follows.

Positive correlation strength:
A correlation of r=0.9 to 1 is equal to perfect correlation.
A correlation of r=0.5 to 0.9 is equal to strong correlation.
A correlation of r=0.1 to 0.5 is equal to weak correlation.
A correlation of r=0 to 0.1 equal to uncorrelated.

Negative correlation strength:
A correlation of r=-0.9 to -1 is equal to perfect correlation.
A correlation of r=-0.5 to -0.9 is equal to strong correlation.
A correlation of r=-0.1 to -0.5 is equal to weak correlation.
A correlation of r=-0 to -0.1 equal to uncorrelated.

In this study, we utilize correlation analysis to compare multiple data. Our aim was to showcase the potential AI investments put in place by various governments. Our study shows the importance of artificial intelligence in the development of systems supporting government sectors and where some nations priorities.

Steps Utilize In the study.

To obtain the results presented in this study, we make use of the following steps.

- Key Information Extraction from AI leading nations strategies policies.
- Summarization of Findings for AI leading nation.
- Visualize Graphs created for each AI leading nation
- **D**iscussion on AI strategic comparative analysis

NLP Comparative AI Policies Analysis Summary Table

The table below represents the summary analysis of the AI strategy policy and regulations for the selected nations identified in this study.

Table 1 NLP comparative AI policies analysis..

Aspect	USA	China	EU	Japan	Canada	Australia	New Zealand
AI Policy Goals	Promote innovation, lead globally in AI, ensure national security, and economic prosperity.	Become a global AI leader by 2030, enhance economic development, and ensure state security.	Foster innovation, ensure safety and fundamental rights, and create a single European market for AI.	Lead in AI technology, ensure AI contributes to society, and address labor shortages.	Safe and responsible AI, protect from harms	Enhance economic growth, ethical AI use.	Integrate AI, drive innovation
AI Regulatory Framework	AI initiatives are under voluntary frameworks, with federal agencies providing oversight.	AI development and deployment regulations emphasizing state control and security.	Proposal for the AI Act, a legal framework with mandatory requirements for high-risk AI systems.	Strategic Council for AI Technology creating frameworks for safe AI innovation.	Risk-based, high-impact systems regulation	Investment, responsible use, trust	National strategy, support for R&D
AI Ethical Guidelines	OSTP's guidelines on ethical AI, emphasizing fairness, transparency, and accountability.	Ethical principles emphasizing safety, security, fairness, and inclusiveness.	Ethics Guidelines for Trustworthy AI, focusing on human agency, technical robustness & privacy.	AI R&D guidelines focusing on human-centric AI, transparency, and accountability.	Prevent bias, ensure transparency	Fairness, transparency, accountability.	Human rights, fairness, inclusivity
AI Enforcement	Federal agencies. and National Institute of Standards and Technology	Ministry of Industry and Information Technology (MIIT) and other government bodies.	European Commission and relevant member state authorities	Various government ministries, including METI (Ministry of Economy, Trade, and Industry).	AI and Data Commissioner, compliance	Collaboration with industry, government	Collaborative approach, adaptive regulations

The table above represents the thematic aspect of artificial intelligence strategic policies retrieved from policy documents from the US, China, EU, Japan, Canada, Australia and New Zealand. We utilized natural language processing to retrieve the themes listed above for our machine learning model classification.

Results

This result section is made up of the following subtitles: descriptive analysis, key comparison areas, data content, NLP comparative AI policies visual knowledge graph, and cosine similarity comparative AI policies analysis.

Descriptive Analysis

Analysis in this section revealed that all the AI leading countries emphasize the significance of AI for economic growth and innovation. Although all AI leading nations emphasize economic growth and innovation, they both have an extensive focus on regulatory measures. Their regulatory measures vary significantly.

Key Comparison AI Policies Aspects.

This section describes the key areas that the study uses natural language processing to compare policies strategies for the leading AI nations identified in this study.

- AI policy goals and objectives for the AI leading nations.

- AI regulatory frameworks for the AI leading nations
- AI ethical guidelines principles of the AI leading nations.
- AI enforcement mechanisms for the AI leading nations.

Data Content.
This section represents the various datasets used in this study and links to the files. In the investigation process, we make use of the following data content. Extract text from each document

US = US artificial intelligence iv-1.parker.nist-vcat-ostp-ai-june-2019.

Australia = Australia_AI_Action_Plan_2021.

Canada = Canada The Artificial Intelligence and Data Act.

New Zealand = New Zealand artificial-intelligence-shaping-a-future-new-zealand.

China = China AI Act translation-fulltext-8.1.17.

European Union = EU AI regulatory_EPRS_BRI(2021)698792_EN.

Japan = Japant Artificial_Intelligence_Technology_StrategyMarch2017.

The links available above allow academic holders to also investigate the strategic policies regulations governing AI. The following data content provided above can also be traced from various government websites. Also, respected readers and researchers in the field of artificial intelligence can trace data content in the OECD website. As per the links for the US, China, EU, Japan, Canada, Australia and New Zealand national AI strategic policy regulations, we are confidence that future researchers will require this data content.

NLP Comparative AI Policies Visual Knowledge Graph
This section represents AI policies visual knowledge graph for the selected nations investigated in this study. The selected nations are the US, China, the EU, Japan, Australia, Canada and New Zealand. The figures 3 below represent comparative analysis based on natural language processing. Our investigation on similarity analysis, results shows that there are common similar themes across the AI policies nations. The said AI policies significantly differ in governance, international competition, and human resources and medical ethics. The heatmap provides a clear visual representation of these similarities and differences, allowing policymakers and researchers to identify areas of convergence and divergence in global AI strategies

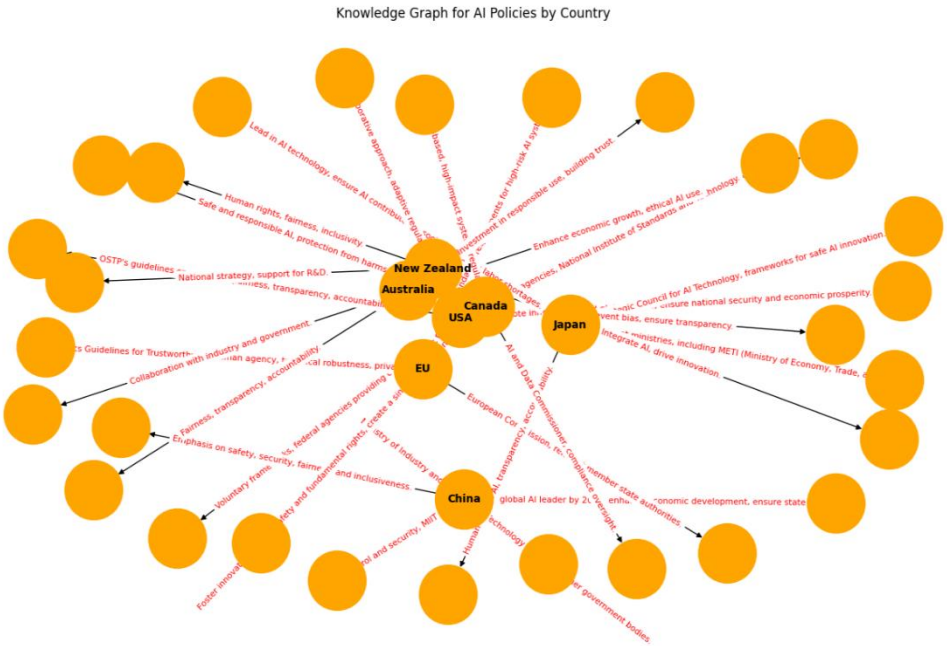

Figure 3: AI Policies Visual Knowledge Graph.

Figure 3 represents the AI policy visualized knowledge graph. Knowledge Graph Completion (KGC) is essential for addressing knowledge graph (Wei et al., 2024). Large language models (LLM) have reasonably solved the challenges associated with triple-based and text-based knowledge graph completion. Triple based knowledge graphs with the help of LlMs have solved the challenges of information structure limitations. Text based knowledge graph completion addresses the training cost for language models. Natural languages have exhibited robust performance across diverse natural language processing application capabilities (Wang et al., 2024). A knowledge graph was constructed to enhance large language capabilities known as TechGPT-2.0. The project represents an essential effort to develop a more robust advance AI graph.

Cosine Similarity Comparative AI Policies Analysis

Cosine similarity scores identified and presented here indicate the varying scale of AI investments between national AI strategies.

Figure 4 represents the positive and negative correlation strength for investment per country compared to other countries: In our investigation the following data relates for positive correlation.
A correlation of r=0.9 to 1 is equal to perfect correlation investment ability compared to the rest of the great four (G4AI) nations.
A correlation of r=0.5 to 0.9 is equal to strong correlation investment ability compared to the rest of the great four (G4AI) nations.
A correlation of r=0.1 to 0.5 is equal to weak correlation investment ability compared to the rest of the great four (G4AI) nations.
A correlation of r=0 to 0.1 equal to uncorrelated investment ability compared to the rest of the great four (G4AI) nations.

The correlation coefficient heatmap shows that out of the *great four (G4AI) nations.* that Invested in artificial intelligence, more than half experienced weak similarity coefficient investments compared to other *great four (G4AI) nations*.

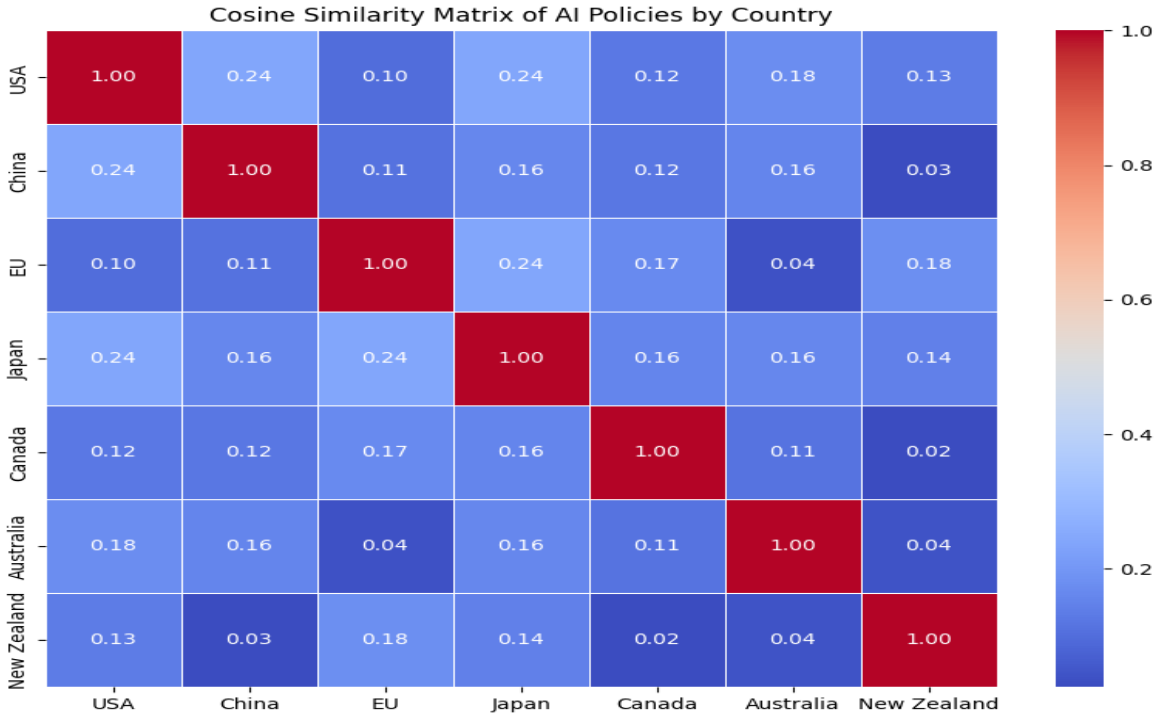

Figure 4: Cosine Similarity Comparative AI Policies Analysis

Figure 4 represents Cosine Similarity Comparative AI Policies Analysis. Our investigated analysis reveals that there exists similarities and differences in the AI strategic policies and regulations for Australia, Canada, and New Zealand. Australia, Canada, and New Zealand lay emphasis on AI ethical use, but their regulatory and enforcement approaches greatly vary. From our initial investigation and analysis, we observed that Australia, Canada and New Zealand share a unique national context and priorities with regards to AI strategic policy regulation. It is important to understand visual aids from this study which illustrate quick reference to stakeholders interested in

understanding the global AI regulatory policies and strategies. The US and China People Republic revealed a lower similarity and higher differences in regulatory and enforcement approaches in AI. The absence of similarities in the AI strategic policy regulation between the US and China shows divergent governance and approaches.

Discussion on AI Comparative Analysis

This section is made up of discussion on AI Strategic Similarities for Great Four AI, and topic modeling of identified several recurring themes across the documents.

Discussion on AI Strategic Similarities for Great Four AI Nations

This section discusses artificial intelligence regulations for the US, China, the EU and Japan. These four nations are coin in this study as great four AI (G4AI) nations. Discussion on artificial intelligence strategies for the most developed four nations in the world. This national approach is very good and educational. It is essential to highlight their differences. The AI strategy used by this great four nations should be a model for other nations to follow when planning to develop AI strategies. In the European Research Studies Journal, (Mah, 2024) analyzes National AI Strategies. The paper focuses on the role of artificial intelligence in fostering economic development, research investments, ethical governance, and innovation across various regions. It highlights the strategic policies and frameworks that encourage AI growth, examining their implications for global competition, education, and societal challenges. This detailed analysis sheds light on the evolving AI landscape and its transformative impact on economic sectors, industries and nations.

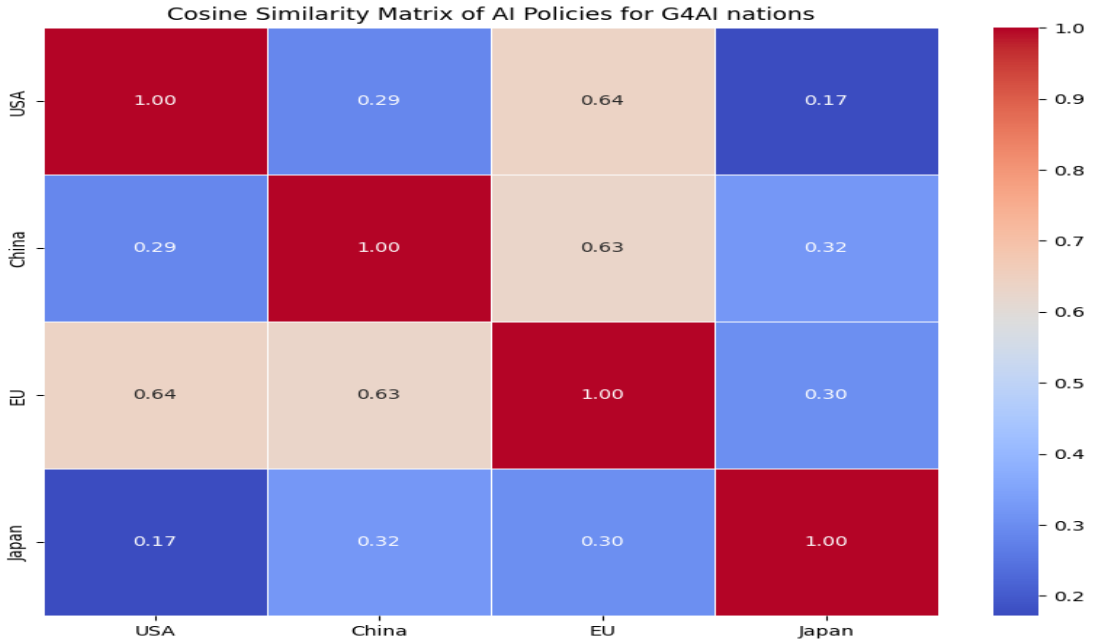

Figure 5: AI Strategic Similarities for Great Four AI Nations

From the figure 5, there is high similarity between the USA and the EU. The US and EU emphasis on research, ethical guidelines, economic development and open access resources. The US and China share a moderate similarity in the economic development ethics and open access resources but greatly differ in governance and international competitiveness. Japan compared to the US, China and EU share very low similarity due to Japan's unique focus on human resource, cooperation, and ethical issues

Great AI nations	USA	China	EU	Japan
USA	1.000000	0.286419	0.640760	0.171946
China	0.286419	1.000000	0.629552	0.322061
EU	0.640760	0.629552	1.000000	0.303029
Japan	0.171946	0.322061	0.303029	1.000000

Figure 2 comparative analysis of the artificial intelligence policies across four Nations.

Table 2 presents a comparative analysis of the artificial intelligence policies across four distinct regions: the United States, China, the European Union, and Japan. This comparison is based on an examination of the textual descriptions that outline their strategic priorities. The following section provides a concise overview of the methodology employed in the similarity analysis.

1. The various components of AI policies from each country are amalgamated into a unified string, creating textual representations.
2. The TF-IDF Vectorizer transforms textual information into numerical vectors that signify the significance of words across different countries, taking into consideration both term frequency and inverse document frequency.
3. Cosine Similarity: The code employs cosine similarity to calculate the pairwise similarity scores among the AI policy vectors. This metric quantifies the degree of similarity between two vectors, with scores that span from 0, indicating no similarity, to 1, signifying complete identity.
4. A heatmap visualization of the cosine similarity matrix effectively demonstrates the similarities in AI policy strategies among the United States, China, the European Union, and Japan. Higher values in the matrix indicate a stronger alignment in their strategic areas of focus

This framework enables a comprehensive comparison of AI policy themes internationally, based on the textual narratives of each nation.

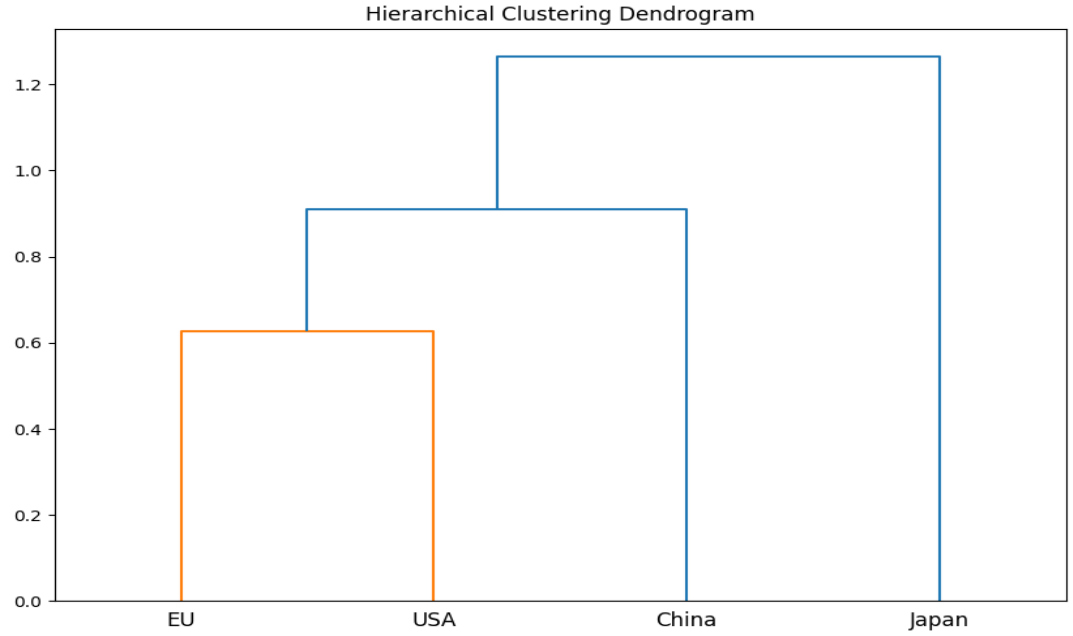

Figure 6: AI hierarchical Clustering Dendrogram for Great Four AI Nations

Figures 6 illustrate a considerable alignment between the United States and the European Union, with both regions prioritizing research, ethical guidelines, economic advancement, and open access resources. The United States and China share a moderate degree of similarity regarding economic development ethics and open access resources; however, they are markedly different in their governance

approaches and levels of international competitiveness. In contrast, Japan shows a significantly lower level of similarity with the United States, China, and the European Union, largely due to its distinctive focus on human resources, collaborative practices, and ethical considerations.

Topic Modeling of identified several recurring themes across the documents.

The following paragraphs represent AI strategic regulation themes extracted using NLP from policy documents. Initial investigation indicates the following themes ethics and governance, research and development, economic impact, security and privacy, and international collaboration.

***Ethics and Governance*:** The first theme we identified was ethics and governance. Amongst the several AI strategic regulations and policies documents from the US, China, EU, Japan, Canada, Australia, and New Zealand, ethics and governance were predominant. The US, China, Japan, Canada, Australia, and New Zealand are still developing their ethical implications while the EU has already built a framework.

Research and Development: Amongst the several themes identified in this study, AI research is a priority. The US and Japan have a special focus on AI research. The US and Japan have pledged heavy investments in funding and collaboration.

***Economic Impact*:** The economic impact has the potential opportunity to grow and transform industries. Artificial intelligence strategic policy regulation highlights AI job creation and economic resilience.

Security and Privacy: The EU and the US have pledged data protection and cybersecurity as a critical priority. The level of unauthorized access to data is an important aspect that warrants regulation. Safeguarding privacy concerns is crucial for information and data management.

International Collaboration: AI is an essential tool for international cooperation, development, and regulation. The US, China, EU, Japan, Canada, Australia, and New Zealand, emphasize in several documents the need for international development and regulations.

Conclusion

To conclude, the analysis of AI policies across the USA, EU, China, and Japan reveals a spectrum of alignment and divergence in their strategic priorities. The USA and EU demonstrate a significant degree of similarity, concentrating on research, ethical frameworks, economic advancement, and open-access initiatives, which reflects a collective emphasis on innovation and regulatory structures. In contrast, the USA and China exhibit a moderate level of similarity regarding economic development and ethical issues, yet they diverge markedly in their governance models and international competitiveness. Japan, on the other hand, is characterized by a low degree of similarity with the other nations, as it prioritizes distinctive factors such as human resource development, international partnerships, and ethical considerations. These differences underscore the varied strategic trajectories pursued by these countries, shaped by their individual socio-economic contexts and global ambitions. The results of this comparative analysis offer critical insights into the alignment and differentiation of global AI strategies, serving as a basis for promoting collaboration and addressing challenges in the development of international AI policies.

Data availability

All datasets and codes links have been included in the manuscript.

Conflict of Interest

No conflict of interest

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