Introduction

In recent years, artificial intelligence (AI) has become a defining force shaping the strategies and narratives of the world's leading technology companies. This assessment seeks to systematically analyze how the "Mag 7" (Apple, Amazon, Microsoft, NVIDIA, Google, Tesla, and Meta) describe AI across their quarterly earnings calls, and how their sentiment and commentary on AI have evolved over time. By applying advanced natural language processing techniques, including keyword and statistical analysis, topic modeling, retrieval-augmented generation (RAG) and intent/emotion-based sentiment analysis using Claude 3.7 Sonnet, this study aims to uncover not only the major themes around AI in Mag 7 companies, but also the underlying emotional tone and strategic intent. Understanding these narratives is significant because they provide insights into future investment priorities, perceived risks and opportunities, competitive positioning, and the evolving role of AI within the broader technology and economic landscape.

Data Preparation

The provided data includes text files of all Mag 7 companies' quarterly earnings calls, and an excel file containing the exact date associated with each earnings call. It was first necessary to merge all files together to have a final data frame containing the earning call's ticker, quarter, filename, text, and date for easier metadata lookup. A public dataset (The Language of Trustworthy AI: An In-Depth Glossary of Terms) from the National Institute of Standards and Technology (NIST) was also used to have a validated list of 400+ commonly used terms within trustworthy and responsible AI for future keyword analysis. This is present as ai_terms.csv in the source code directory, and can be referred to for in-depth definitions of AI keywords. All source code was hosted via Georgia Tech's Partnership for an Advanced Computing Environment (PACE) for higher computing power for advanced model building.

Exploratory Data Analysis (EDA)

Keyword Analysis

An AI frequency data frame was created to contain the normalized frequency per 1000 words of each AI keyword in each earnings call as well as the overall AI keyword frequency per call. The keywords were used in subsequent analyses as well. **The top 10 AI-related keywords used across all transcripts were: AI, data, operator, customer, model, service, example, environment, copilot, and system**. The keywords are split between more technical and customer facing terms, showing the Mag 7's commitment to balancing both. There is also a clear upward trend in AI-related term usage across earnings calls (Visualization in Appendix A), with total mentions per 1,000 words **tripling from early 2022 to mid-2025**. Notably, there's a sharp spike around **Q3 2024**, indicating a surge in AI focus likely tied to major product launches, model releases, or strategic pivots.

Next, the top 3 AI keywords per company by frequency were extracted (Visualization in Appendix B). Overall, **NVIDIA and Microsoft lead in explicit AI discourse**, with NVIDIA heavily emphasizing "AI" and "data", while **Microsoft uniquely highlights "copilot"**, its branded AI assistant. In contrast, **Tesla and Apple show more reserved AI terminology**, suggesting narrower or less vocal strategies.

The top 3 AI keywords per year were also considered (Visualization in Appendix C). The term **"AI" has surged dramatically** in frequency from 2022 to 2024, reflecting its growing prominence in corporate narratives. While terms like "data" and "operator" remain relatively stable, newer terms such as "model" and "copilot" emerge by 2024, indicating **a shift toward productization and generative AI**. The evolution suggests that discussions have moved from foundational AI infrastructure to applied and branded AI tools.

Correlation Analysis

Using a Pearson correlation matrix, analysis was conducted between highly correlated keyword pairs to extract key themes (Visualizations in Appendix E and F). The perfect correlation between **"robust AI" and "situational awareness"** suggests a focus on **resilience and reliability in dynamic environments**, often relevant to autonomy or safety-critical applications—language frequently used by companies like Tesla or in discussions around AI deployment in unpredictable real-world scenarios. The pair **"requirement" and "segmentation"** also shows a perfect correlation, indicating that discussions around **technical prerequisites or product scoping** are often paired with **data partitioning or labeling tasks**. The strong correlation between **"data preparation" and "fraud detection"** ($\rho \approx 0.90$) highlights the importance of preprocessing pipelines in **risk-sensitive domains**, where clean, labeled, and structured data is critical to building performant AI models in industries like finance or e-commerce. Lastly, the connection between **"prototype" and "variance"** ($\rho \approx 0.83$) may suggest that when companies talk about experimental AI features or MVPs, they often acknowledge **performance instability or uncertainty**—a common framing when AI capabilities are still being evaluated or tested in production environments.

PCA (Principal Component Analysis)

PCA clustering was conducted to reveal differences in AI vocabulary across companies and capture how their language has evolved over time (Visualizations in Appendix G, H, I). A clear example is **Microsoft**, which migrates upward over time along **PC2**, indicating a growing emphasis on terms like **“security,” “copilot,”** and **“user”**—consistent with its shift toward enterprise-grade, productized AI offerings like Copilot and trust-centered frameworks. **NVIDIA**, by contrast, remains consistently far to the right along **PC1** throughout all years, reinforcing its **infrastructure-centric identity**, dominated by high contributions from terms like **“processing,” “gpu,” “data,”** and **“inference.”** Other companies, such as **Meta** and **Google**, show modest drift upward over time along PC2, suggesting increased discussion around responsible AI and governance. Meanwhile, **Tesla** and **Apple** remain relatively clustered and low in both PC1 and PC2, reflecting their more reserved or narrow AI communication strategies.

BERTopic Topic Modeling

BERTopic was used for topic modeling to discover abstract themes across transcripts and assign keywords to each topic. This is present as bertopic_topic_summary.csv in the directory and can be referred to for an in-depth explanation of the keywords and files associated with each topic. The topic clusters also align closely with company identities: for example, topic 3 is driven by **NVIDIA's AI and**

data center language, while topic 0 captures **Microsoft's financial and Azure-related messaging**, showing how BERTopic isolated company-specific themes from the transcripts.

An interactive Intertopic Distance Map is shown in the source code. It shows that **Topic 2** is the most isolated in the positive D2 direction, suggesting it represents a uniquely distinct theme (possibly customer-focused AWS language). **Topics 3 and 4** are moderately similar but diverge along D1—likely reflecting different flavors of AI infrastructure or product language. **Topic 1**, farthest in the negative D2 direction, stands out as the most conceptually distinct from the rest, potentially capturing Apple's unique product-cycle tone that is less AI-focused than others.

A hierarchical clustering diagram (Visualization in Appendix J) was also made to show relationships between company themes. **Topics 0 (Microsoft) and 3 (NVIDIA)** are the most closely related, reflecting shared emphasis on AI infrastructure, cloud, and data. **Topics 2 (Amazon) and 6 (Meta)** form another tight cluster, likely due to similar customer- and product-centric AI narratives. In contrast, **Topic 4 (Tesla)** stands out as the most distant, highlighting the distinct tone and content of Elon Musk–driven commentary, which differs markedly from the more standardized AI themes discussed by other companies.

Claude 3.7 Sonnet for RAG and Sentiment Analysis

Claude 3.7 Sonnet was used to perform sentiment analysis that captured the intent and emotional tone behind each company's AI commentary, going beyond simple polarity. By combining it with retrieval-augmented generation (RAG), Claude contextualized shifts in AI discourse over time and across companies, producing more grounded and comparative insights. The full output can be found in claude_sentiment_responses.csv.

Model Structure

First, AI-relevant paragraphs were extracted from the transcripts and organized by company and year. An initial data frame of all the prompts to be sent to Claude was created through two tailored prompts: **prompt_describe_current** to analyze how each company describes AI in the most recent year and **prompt_compare_tone** to analyze how each company's outlook on AI has changed over time. When sent to Claude, **followup_prompt_extract_sentiment** was called to create a prompt to create a sentiment score from -2 (negative outlook) to +2 (positive outlook) and an overarching phrase to describe the company's view on AI either in the current year or over time. **Parse_sentiment_output** then extracted the sentiment score and phrase from the prompt's output.

Emotional Intent and Sentiment Score Analysis

The emotional intent phrases reveal that all Mag 7 companies express strong optimism about AI, but with varying strategic tones. Companies like Microsoft, Apple, and Meta emphasize **confidence coupled with competitive urgency**, signaling a race to solidify leadership. In contrast, Amazon and NVIDIA convey **intense ambition and infrastructure-driven strategy**, while Tesla's messaging stands out as **visionary but less structured**, reflecting its unique personality-led approach. Amazon holds the highest average

sentiment score at **2.0**, indicating the most consistently enthusiastic and confident tone toward AI among the Mag 7. NVIDIA follows with a **1.5**, reflecting its strong and ambitious infrastructure-focused messaging. All other companies maintain a solid but more **measured optimism (1.0)**, suggesting steady confidence.

Text Response Analysis

Microsoft frames AI as the defining pillar of its business transformation, having shifted from viewing it as one of many strategic tools in 2022 to positioning it as a core growth driver by 2024, powered by Azure OpenAI, GitHub Copilot, and Microsoft 365 Copilot. **Apple** has moved from vague references to machine learning to a bold narrative around "Apple Intelligence," signaling a strategic pivot to own the AI layer within its integrated hardware-software ecosystem, with a strong emphasis on privacy and on-device processing. **Amazon** highlights a full-stack AI approach underscoring its belief that customer choice, flexibility, and infrastructure depth will drive generative AI adoption and billions in new revenue, especially through AWS and Bedrock. **NVIDIA** presents AI as both the purpose and outcome of its business, portraying itself as the essential infrastructure enabler for the generative AI era, with unparalleled momentum in data centers, software stacks, and custom silicon. **Tesla**'s AI narrative is less formalized but remains anchored in Elon Musk's vision, often blending product, personality, and long-term autonomy goals. **Google** integrates AI across all product lines—from Search and YouTube to Cloud—presenting a unified strategy around AI-enhanced user experience and monetization, while reinforcing its commitment to safe and scalable innovation. **Meta** positions AI as a driver of content personalization, ad performance, and business growth, particularly through Reels, Llama models, and infrastructure investments, reflecting a pragmatic, product-led approach to AI integration.

Conclusion and Key Findings

This study reveals that the Mag 7 collectively describe AI as a transformative force that is now deeply embedded in their business strategies, but each company frames its role differently based on product focus, business model, and strategic posture. As of the most recent earnings calls, companies like Microsoft and Meta emphasize AI's role in productization and ecosystem integration, while Amazon and NVIDIA adopt an infrastructure-first approach, highlighting their ambition to lead the generative AI economy. Apple communicates AI through a privacy-first, user-experience lens, and Tesla continues to frame AI through Elon Musk's visionary but loosely structured narrative.

Over time, sentiment toward AI has shifted from cautiously optimistic to strategically urgent, with a clear escalation in emotional intensity and keyword usage—particularly around Q3 2024, when AI-related language spiked across the board. Emotional intent analysis shows that while all companies are optimistic, firms like Amazon and NVIDIA demonstrate more intense ambition, and others like Apple, Google, and Microsoft convey confident urgency as they compete to define leadership in AI. Ultimately, the evolution of sentiment reflects both the maturity of AI integration within each company and the broader competitive dynamics of the emerging AI-driven economy.

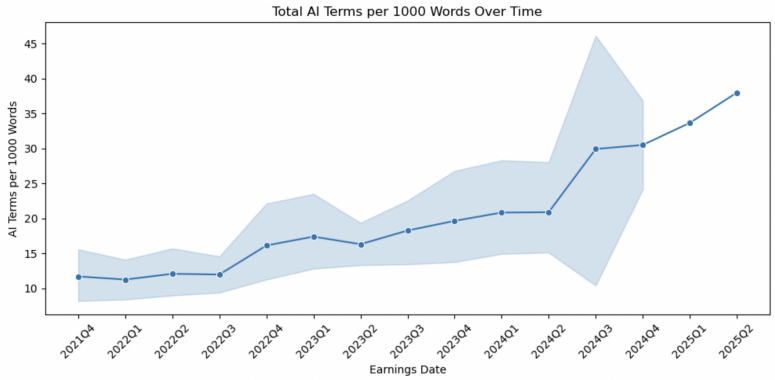
Appendix

Directory structure

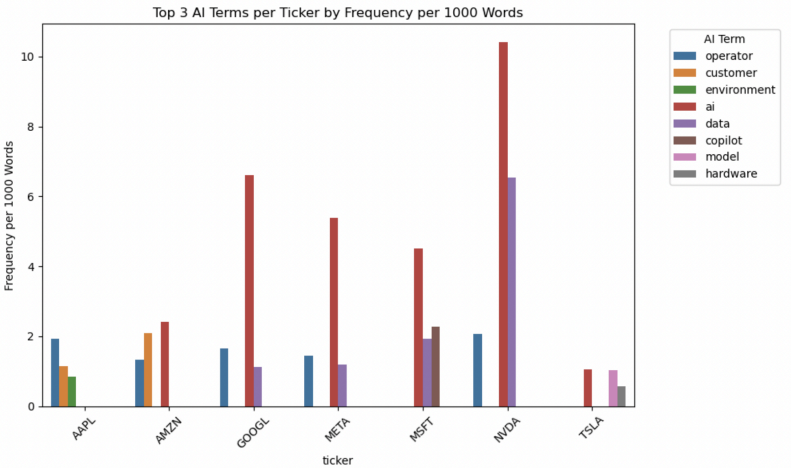
- **Source code:** case_study.ipynb
- **AI keywords and definitions:** ai_terms.csv
- **Topic modeling output:** bertopic_topic_summary.csv
- **Claude model output:** claude_sentiment_responses.csv
- **Mag7_transcripts.xlsx converted to csv:** mag7_transcripts.csv

Running case_study.ipynb in the downloaded file directory will produce the resulting outputs. All other files in the directory were already provided.

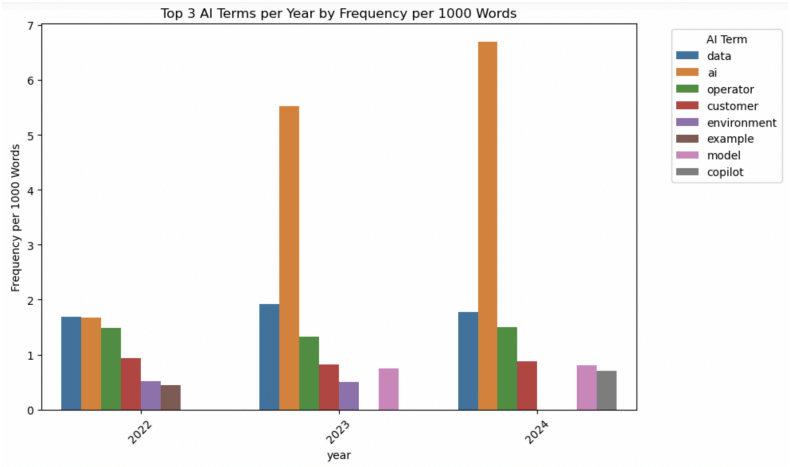
Appendix A: Total AI terms per 1000 words over time



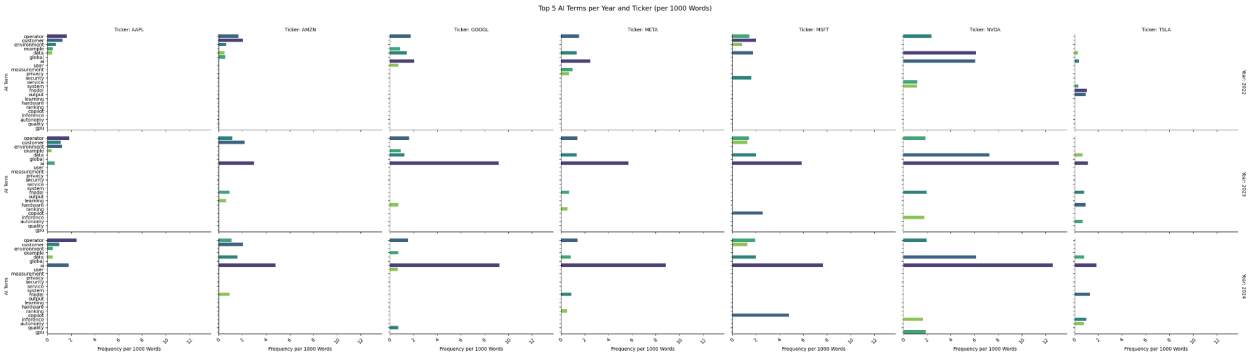
Appendix B: Top 3 AI terms per ticker by frequency per 1000 words



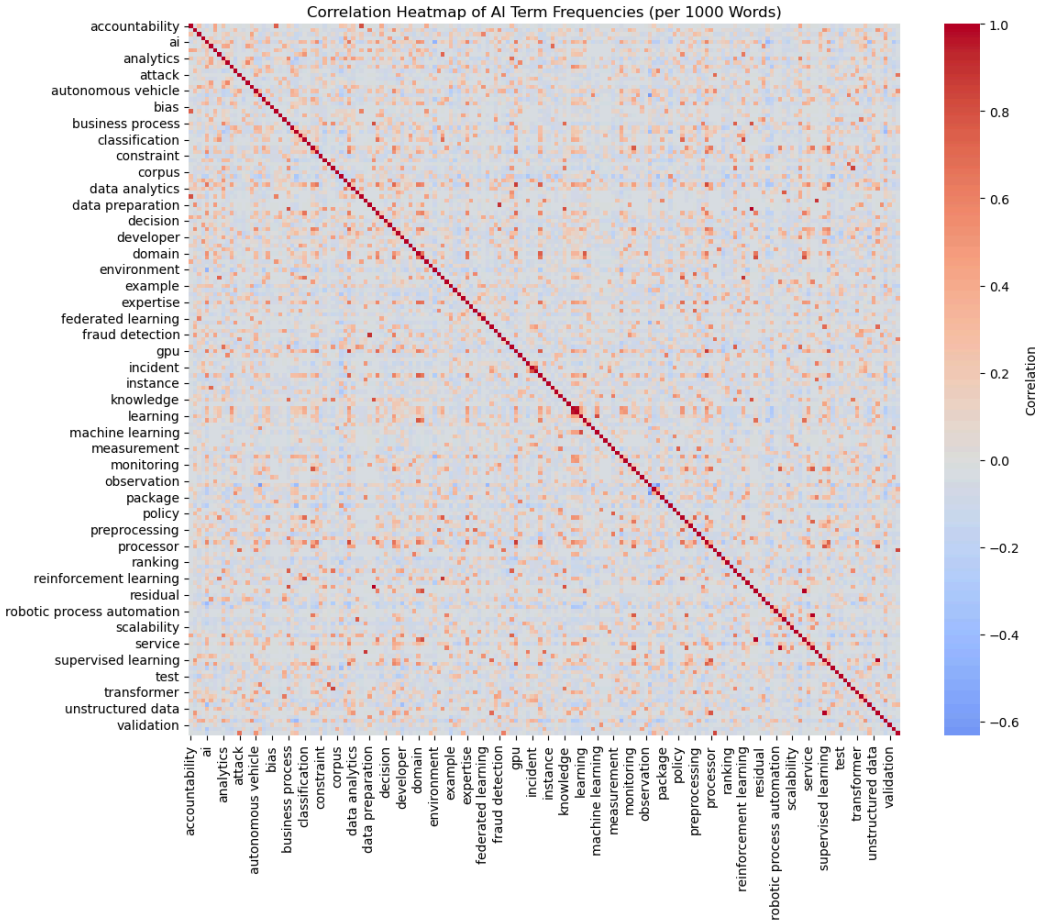
Appendix C: Top 3 AI terms per year by frequency per 1000 words



Appendix D: Top 5 AI terms per year and ticker per 1000 words



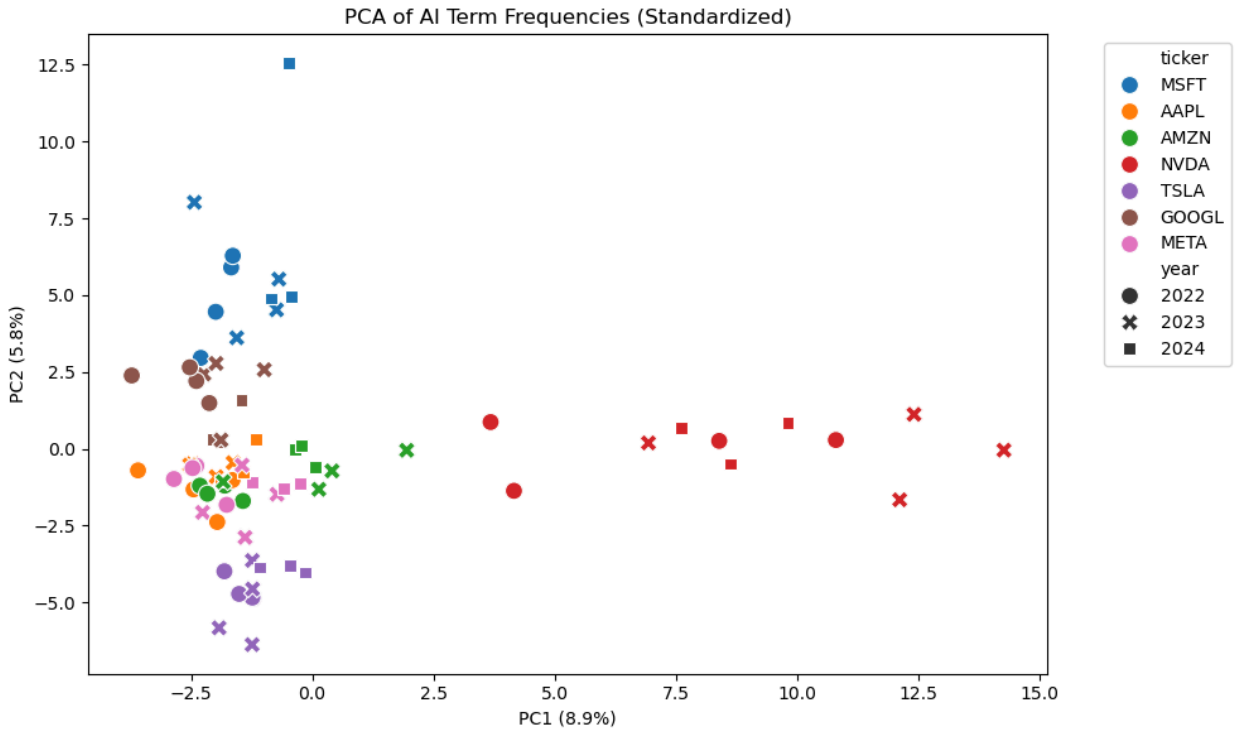
Appendix E: Correlation heatmap of AI term frequencies per 1000 words



Appendix F: Top 20 most correlated keyword pairs

	Term 1	Term 2	Correlation
0	supervised learning	unsupervised learning	1.000000
1	robust ai	situational awareness	1.000000
2	data quality	remediation	1.000000
3	requirement	segmentation	1.000000
4	language model	large language model	0.964458
5	data preparation	fraud detection	0.901543
6	ethics	reinforcement learning	0.888881
7	data point	statistics	0.878723
8	gpu	processing	0.871543
9	data	gpu	0.859846
10	copilot	transaction	0.848433
11	classification	reinforcement learning	0.834024
12	prototype	variance	0.832323
13	data	processing	0.817504
14	learning	machine learning	0.810740
15	business process	remediation	0.802634
16	business process	data quality	0.802634
17	accountability	data governance	0.799569
18	domain expertise	segmentation	0.796186
19	domain expertise	requirement	0.796186

Appendix G: PCA clustering of AI term frequencies



Appendix H: Top contributing terms to PC1 in PCA analysis

	term	PC1	PC2	abs_PC1	abs_PC2	max_contrib
0	processing	0.233580	-0.003205	0.233580	0.003205	0.233580
1	data	0.223711	0.065188	0.223711	0.065188	0.223711
2	gpu	0.218644	-0.002635	0.218644	0.002635	0.218644
3	inference	0.202232	-0.007957	0.202232	0.007957	0.202232
4	deep learning	0.194562	0.001161	0.194562	0.001161	0.194562
5	expertise	0.184539	0.039092	0.184539	0.039092	0.184539
6	system	0.183884	-0.003917	0.183884	0.003917	0.183884
7	domain	0.172283	0.039352	0.172283	0.039352	0.172283
8	consent	0.169683	-0.004384	0.169683	0.004384	0.169683
9	ai	0.164797	0.092052	0.164797	0.092052	0.164797

Appendix I: Top contributing terms to PC2 in PCA analysis

	term	PC1	PC2	abs_PC1	abs_PC2	max_contrib
0	security	-0.033892	0.236447	0.033892	0.236447	0.236447
1	analytics	-0.033715	0.234884	0.033715	0.234884	0.234884
2	business process	-0.021514	0.218686	0.021514	0.218686	0.218686
3	recognition	-0.001287	0.213096	0.001287	0.213096	0.213096
4	governance	-0.037989	0.208668	0.037989	0.208668	0.208668
5	user	-0.088072	0.193367	0.088072	0.193367	0.193367
6	copilot	-0.010738	0.191096	0.010738	0.191096	0.191096
7	knowledge	0.056620	0.188634	0.056620	0.188634	0.188634
8	developer	-0.002941	0.175224	0.002941	0.175224	0.175224
9	operator	0.066205	0.165529	0.066205	0.165529	0.165529

Appendix J: Hierarchical clustering of topics from topic modeling