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1. INTRODUCTION:

In the era of advance artificial intelligence, the race to dominate the GPU market has intensified, with industry giants NVIDIA, AMD, and Intel at the forefront. These companies are not just competing in terms of raw processing power but also in how they are shaping the future of AI-driven technologies. GPUs have become the backbone of modern AI, powering everything from cutting-edge research to everyday consumer applications. NVIDIA has seen a sudden rise, becoming one of the most valuable companies in the world due to its groundbreaking innovations in AI chipsets. Its leadership in this space has revolutionized AI applications, from large language models to autonomous vehicles.

However, this dominance has triggered a competitive response, with AMD and Intel striving to create their own space in this fast-evolving market. As AI potential grows, so does the competition to deliver the most efficient, scalable, and innovative solutions. The battle for supremacy is not just about technical specs—it's about shaping the future of AI and impacting the broader tech ecosystem.

Our analysis seeks to find the public perceptions of GPU models from NVIDIA, AMD, and Intel, during the AI chipset revolution. By diving into social media conversations from Reddit and YouTube, we aim to uncover the nuances of public sentiment, identify dominant themes, and analyse the impact of these brands on each other as they compete for leadership in the AI revolution.

2. DATA EXTRACTION:

We worked as a three-person team to collect data from Reddit and YouTube to gain insights for our study project. Each platform provides distinct options for analysis; thus, we divided the jobs according to our combined skills to ensure rapid and complete data extraction. Using the PRAW (Python Reddit API Wrapper) module, we were able to communicate with Reddit's API and extract pertinent data such as posts, comments, upvotes, and community involvement metrics. This gave us with useful information for analysing sentiment, popular subjects, and trends in certain communities.

a. REDDIT

For this project, we extracted data from three of the most popular subreddits in the tech industry: **r/nvidia**, **r/amd**, and **r/intel**. Each subreddit provides valuable user-generated content, including discussions, opinions, and news, which allowed us to gather comprehensive insights.
From **r/nvidia**, a subreddit with **1.9 million followers**, we collected data over a span of approximately 2.5 months, **from August 1, 2024, to October 10, 2024**. A total of **10,055 observations**, including both submissions and comments, were gathered. The data was initially extracted in JSON format using Reddit's API and the Python library PRAW and was later converted into a Pandas Data Frame for streamlined analysis.

Similarly, we gathered data from **r/amd**, which boasts **2 million followers**. The data collection period spanned about five months, **from June 1, 2024, to October 15, 2024, resulting in 11,595 observations**. This dataset also consisted of both submissions and comments. As with the previous dataset, the information was extracted using Reddit's API via PRAW, stored in JSON format, and then processed into a Pandas Data Frame for easier analysis.

Lastly, we collected data from **r/intel**, a subreddit with **889,000 followers**. Data collection took place over a 10-month period, from **January 1, 2024, to October 7, 2024**. In total, **11,109 observations were recorded**, including submissions and comments. The extraction and processing followed the same approach as with the other subreddits, ensuring consistency across all datasets.

By organizing the data into Pandas Data Frames, we were able to efficiently handle and analyse the large volumes of information collected from these active communities. The variation in post date ranges across communities is due to the limitations of the PRAW library for post extraction. The data suggests that NVIDIA has the strongest community presence, with 10,000 submissions in just 2.5 months. In comparison, AMD had 11,500 submissions over a span of 5 months, while Intel received 11,100 submissions within a 10-month timeframe. This indicates the relative strength and engagement levels of each brand's community.

- **NIVDIA**

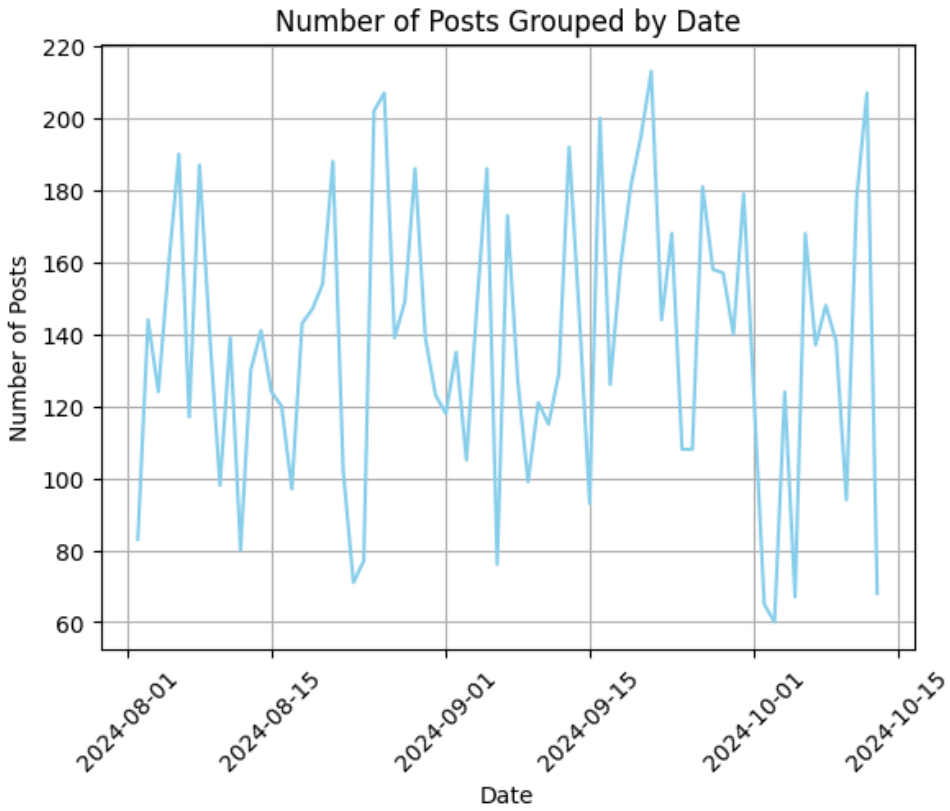


Figure 1: Time series of number of submissions on NVIDIA community (Reddit)

The graph illustrates the number of posts grouped by date from August 1, 2024, to October 15, 2024, revealing a dynamic pattern of user activity. The number of posts

fluctuates significantly over time, ranging from as low as 60 to over 200 on certain days. There are noticeable peaks in activity, where post counts exceed 200, indicating heightened user engagement during specific periods. Conversely, there are several valleys where the post count dips below 100, suggesting periods of reduced interaction. Despite these fluctuations, the general trend remains consistent, with most days recording between 100 to 180 posts. These variations may reflect key events, announcements, or discussions that sparked different levels of interest throughout the observed timeframe. One major event was NVIDIA's participation in the Goldman Sachs Communacopia + Technology Conference on September 11, 2024. Here, they highlighted advancements in AI and their impact on industries like gaming and autonomous driving, which likely stirred discussion online.

- **AMD**

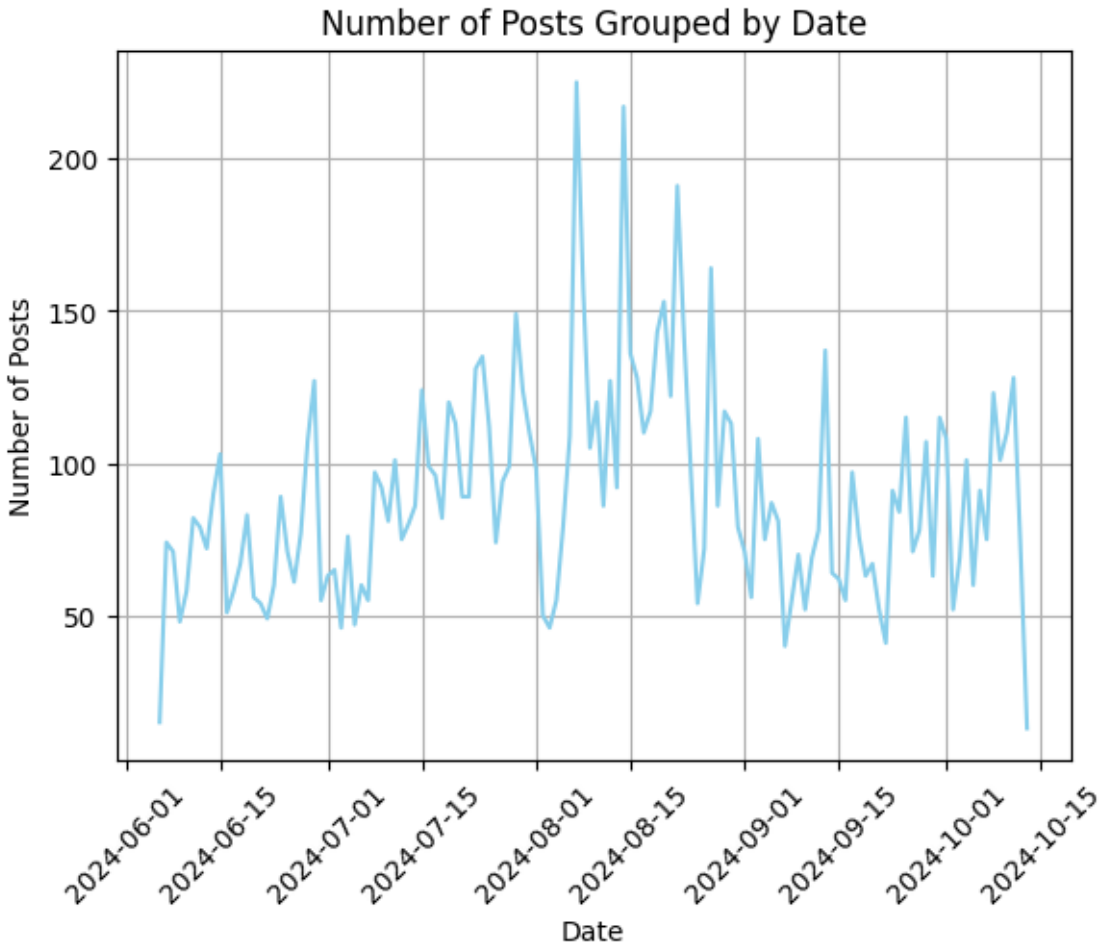


Figure 2: Time series of number of submissions on AMD community (Reddit)

This graph shows the number of posts grouped by date for AMD-related content between June 1, 2024, and October 15, 2024. The post frequency steadily rises from June to early August, after which there is a noticeable spike in mid-August and another around early September. Following these peaks, the number of posts begins to decline slightly but remains relatively high, fluctuating between 50 and 150 until mid-October.

The significant spike in mid-August can be attributed to several news events, including the launch of new AMD hardware and developments in the CPU and GPU markets. For example, in August 2024, AMD announced its new generation of Ryzen and EPYC processors, which generated substantial buzz due to performance improvements and their competitive positioning against Intel and NVIDIA. Additionally, AMD's advancements in AI and machine learning, especially in collaboration with software partners, likely contributed to the rise in discussions.

- **Intel**

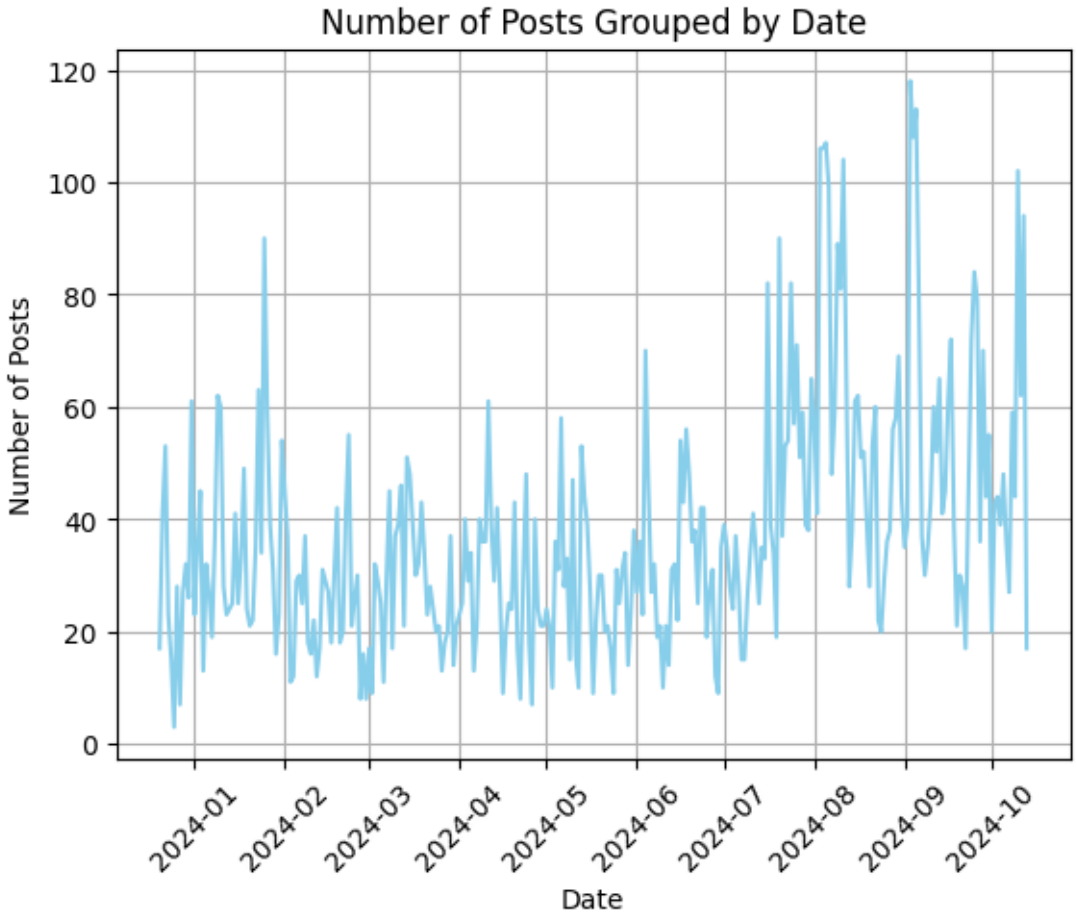


Figure 3: Time series of number of submissions on Intel community (Reddit)

The graph shows the number of posts about Intel, grouped by date, from January to October 2024. From the beginning of the year through June, the volume of posts remains relatively low and fluctuates between 20 and 60 posts. Around July, there is a gradual increase, with post frequency consistently rising through August, peaking in September, and tapering off slightly by October. The most noticeable spikes occur in mid-September and early October, with the number of posts reaching above 100.
The spike in September can likely be linked to Intel's major announcements and updates during the Intel Innovation 2024 event, which was held on September 19-20. During this event, Intel revealed significant advances in AI capabilities, including new chips aimed at AI computing, which generated a lot of discussion across social media platforms.

b. YouTube

Data extraction using python **based on Video IDs** allows for the retrieval of metadata from video-sharing platforms like YouTube. This was done via the YouTube Data API, which provides access to various video attributes like title, description, view count, likes, and comments. After creating an API key, a simple script was written which required the video ID and API key and the desired data was extracted. Different video ids were passed to gather comments for NVIDIA, AMD and INTEL and were finally loaded into the python environment as a Data Frame for further analysis. A comprehensive analysis of YouTube post submissions has not been conducted due to the varying time periods for data extraction. The analysis is influenced by the unique video IDs and the spikes in activity, which indicate when each video was uploaded.

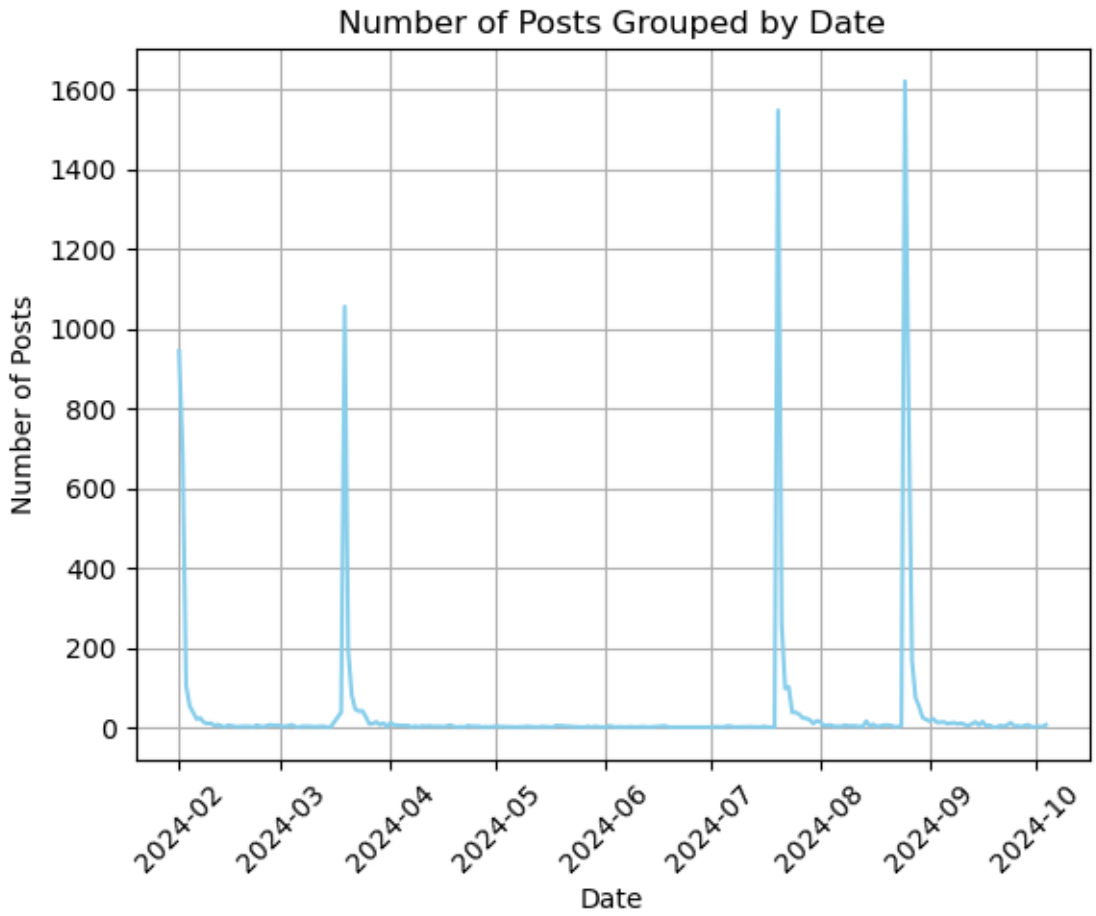


Figure 4: Time series of number of submissions on NVIDIA community (YouTube)

Figure 4 shows the time series chart for number of comments on a video related to NVIDIA. The spikes indicate the period when the video was posted.

3. DATA CLEANING:

The very first step of any analysis is data cleaning. Around 80% of the time is spend on data cleaning before doing any kind of analysis. The data cleaning steps used for this assignment were as follows:

1. **Lower casing**: Lower casing the words is very important as it can lead to duplication of words although the words have the same meaning. For example, Amd with capital 'A' is the same as amd with small 'a' or Intel with capital 'I' is the same as intel with small 'i'.

2. **Removal of white spaces**: This is done to get cleaner input for tokenization.

3. **Tokenization**: Splitting the words into individual tokens. This is very crucial for sentiment analysis, topic modelling or simply getting the word count of different words.

4. **Lemmatization**: Lemmatizing the word into its original form such that different variations of the words are treated as the same. For example, "running" to "run".

5. **Removal of stop words**: Stop words are the words that don't really add any meaning to the sentence. Removal of stop words help in focusing more on the words that add value or importance for analysis.

6. **Removal of digits, special characters and emojis**: Ensuring only significant words are retained that helps in understanding the context and sentiment of the text.

4. DATA EXPLORATION

4.1 MOST FREQUENT WORDS:

4.1.1 NVIDIA

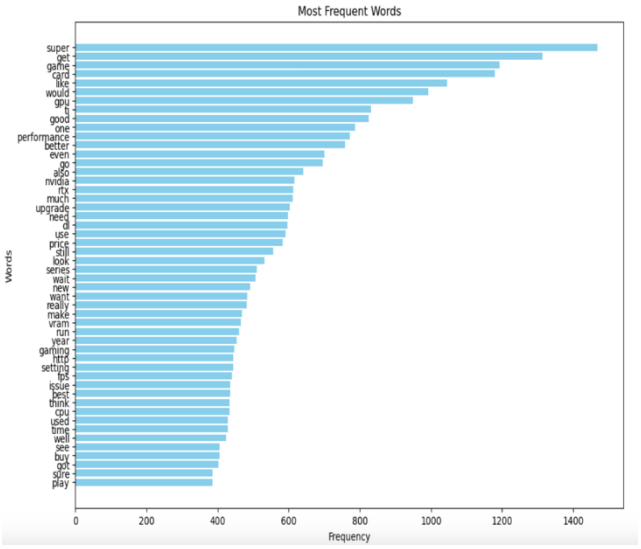


Figure 5: NVIDIA top 50 common words (Reddit)

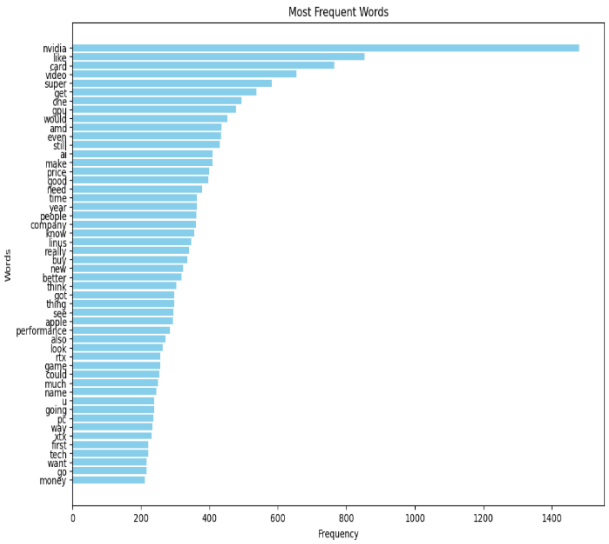


Figure 6: NVIDIA top 50 common words (YouTube)

In Figure 1, the top 50 words chart based on Reddit comments highlights the prominence of terms like "super," "get," "game," and "performance," reflecting a strong focus on gaming performance and user experiences with NVIDIA technology. Frequent mentions of words such as "gpu," "nvidia," "upgrade," and "fps" suggest that the discussion is primarily centered around graphics processing units (GPUs) and their impact on gaming experiences. This trend indicates a customer interest in enhancing performance and staying up-to-date with hardware advancements. Figure 2, which displays the top 50 words from YouTube comments, features similar terms like "super," "game," and "performance" indicating a significant overlap.

4.1.2 AMD

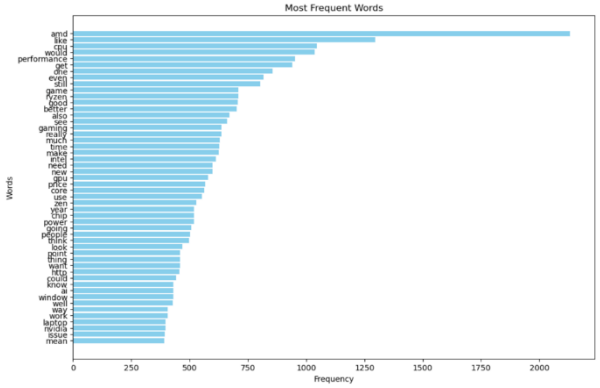


Figure 7: AMD top 50 common words (Reddit)

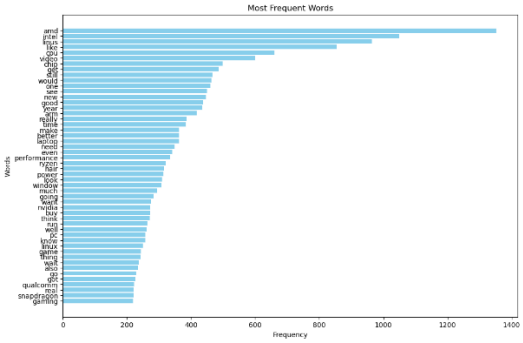
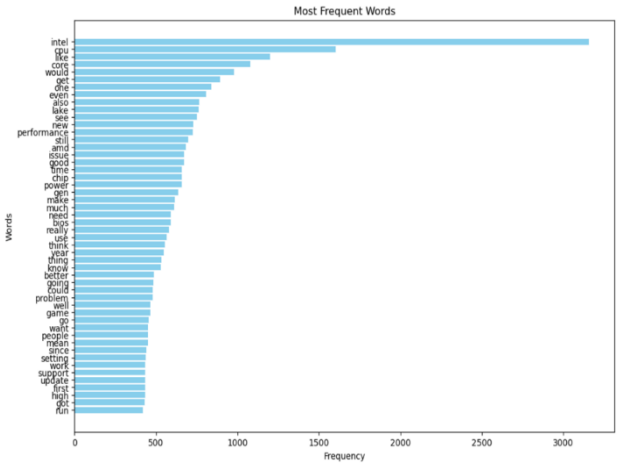


Figure 8: AMD top 50 common words (YouTube)

In Figure 2, the AMD top 50 terms list highlights the frequent use of words such as "amd," "cpu," "performance," and "game," pointing to a focus on CPU performance in gaming and computing. Terms like "ryzen," "gaming," "price," and "laptop" suggest that customers are particularly interested in AMD's Ryzen series, known for its strong performance in gaming and multitasking, especially in laptops. This trend reflects a customer base that values both high performance and affordability in computing products. When compared to the top 50 words from YouTube in figure 4, there is a noticeable overlap, with similar terms like "ryzen," "gaming," and "laptop," showing a closer alignment between the AMD communities on Reddit and YouTube.

4.1.3 INTEL



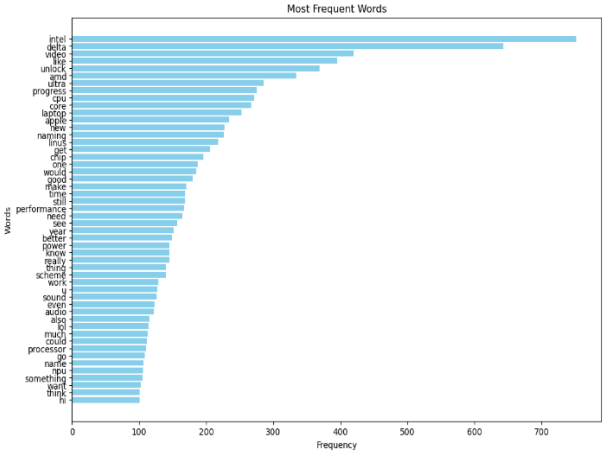


Figure 9: Intel top 50 words(reddit)

Figure 10: Intel top 50 words (youtube)

The Intel top 50 words list in Figure 5 highlights key phrases commonly associated with Intel, likely reflecting customer reviews and discussions about their products. Prominent terms such as "intel," "cpu," "core," and "performance" indicate a strong focus on Intel's CPU offerings and performance capabilities. Additionally, words like "chip," "problem," "game," and "support" suggest that customers are concerned not only with performance but also with potential issues related to Intel CPUs, particularly in gaming contexts. The presence of adjectives like "update," "high," and "good" underscores consumers' expectations for regular software updates that enhance performance and resolve any existing problems. In Figure 6, the top 50 words from YouTube also show a significant overlap, reinforcing similar themes across both platforms.

5. DATA ANALYSIS

5.1 SENTIMENT ANALYSIS

To understand and get the overall attitude of the users towards these Graphics processing units (GPUs), we would use the Vader-based sentiment analysis. The Vader-based sentiment analysis uses a lexicon dictionary which is explicitly designed for sentiment analysis.

We will start by analysing the sentiment of each of gpus' before comparing them with other brands.

5.1.1 NVIDIA

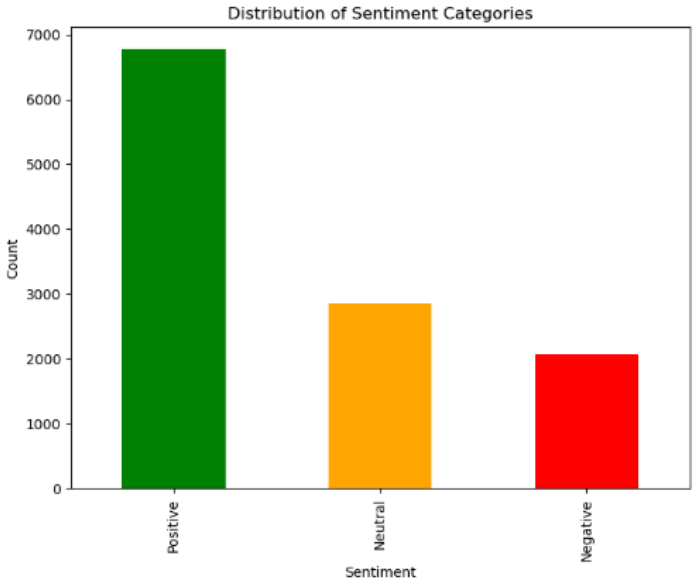


Figure 11: Nvidia Sentiment analysis distribution

From the graph above, it is evident that most of the posts about Nvidia express more positive opinions than negative ones, suggesting a generally favorable perception of the brand.

NVIDIA TIME SERIES ANALYSIS

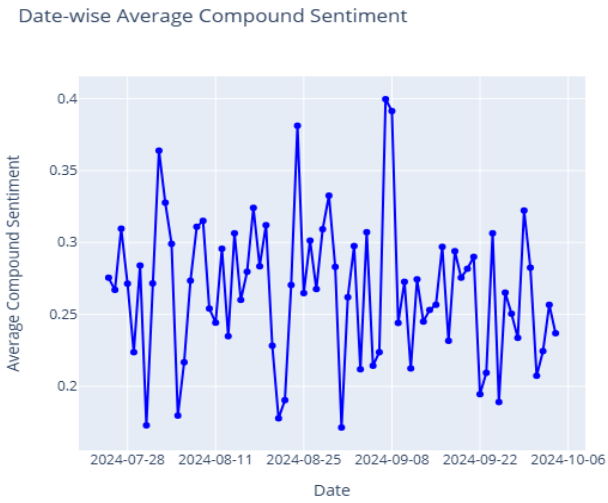


Figure 12: Date wise average compound Sentiment for NVIDIA

Here we use the compound sentiment score which indicates the overall sentiment, and we average that for each day. There are fluctuations in the date-wise chart, which suggests some days have an extremely high positive sentiment as compared to other days.

a. Nvidia time series analysis (Day with Highest Sentiment)

To gain better insights to the cause of these fluctuations we would analyse the highest sentiment day and the lowest sentiment day. From the graph above, we can see that the day with the highest sentiment is 2024-09-07. And we would like to find out why this day has the highest sentiment and what being talked about.

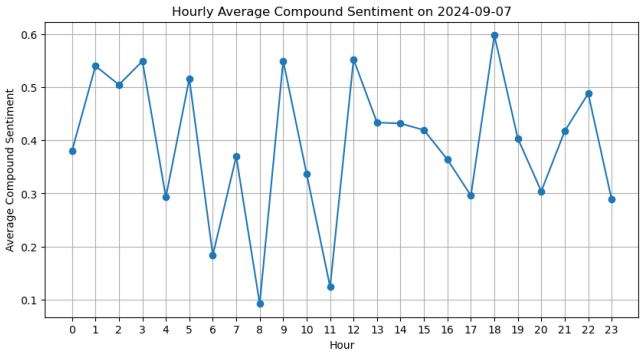


Figure 13: Nvidia highest sentiment day hourly compound graph

A deeper dive into how the sentiment changes hourly on that said date would help us understand, what was going, and what being talked about, that influenced this day to have the highest sentiment.

Timestamp: 2024-09-07 18:10:14
Text: Doesn't doesn't matter on the distro much as Pop OS is just a deri
vative of Ubuntu which is a derivative of Debian. Overall Nvidia always
has a ways to go with Linux (which has been the case for a quarter centu
ry) but what is there works quite well. The drivers in the past year hav
e been great. It would be hard to say AMD or Nvidia is categorically bet
ter in Linux since there are pros/cons. I definitely recommend an RTX ca
rd within your budget they are great GPUs. If you can stretch your budge
t to a 4060 Ti 16GB ($450 USD) it'll be a great card with plenty of VRAM
too.
Sentiment Score: 0.99

Timestamp: 2024-09-07 06:24:39
Text: I think 4070 super is more bang for buck for Nvidia But to have t
he best experience it would be 4070 ti super
Sentiment Score: 0.94

Timestamp: 2024-09-07 10:28:37
Text: Enjoy bro and congratulations I have the 4070ti and I love it
Sentiment Score: 0.91

Figure 14: Reasons for Nvidia's positive sentiment score

These posts show the reason why the sentiment for that day is high because most of the comments are talking about how the Nvidia gpu (especially the 4070 Ti version) is great and how the users love it.

b. Nvidia time series analysis (Day with Lowest Sentiment)

The day with the lowest sentiment is on 2024-08-31 and we will delve deep into understand why this day has the lowest sentiment.

We also checked the hourly average compound sentiment on this day.

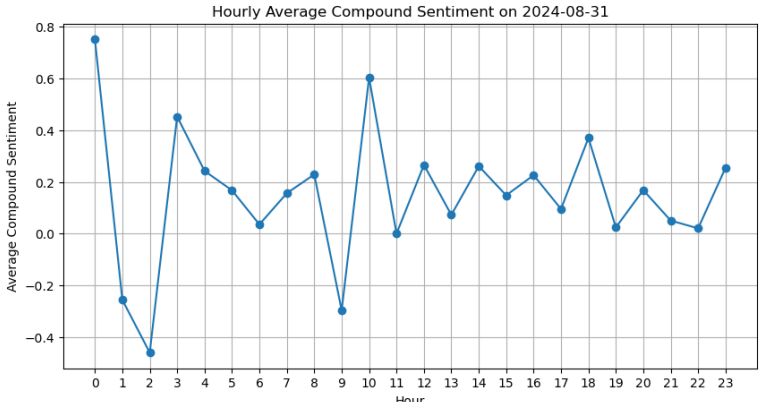


Figure 15: Nvidia lowest sentiment day hourly compound graph

Timestamp: 2024-08-31 17:24:45
Text: 1. DLSS Quality on 1080p at max 2. DLSS Balanced on 1440p at max
3. DLSS Performance on 2160p at max The higher resolution you go, the l
ower you can change dlss cause it works better beyond 1080p. Cause you c
an dlss performance on 1080p for example but it will look blurry on moti
on and anti aliasing will be considerably worse
Sentiment Score: -0.83

Timestamp: 2024-08-31 07:28:42
Text: No words on making hairs and foliage looks like shit :(
Sentiment Score: -0.74

Timestamp: 2024-08-31 13:44:02
Text: * Quake * Serious Sam: The First Encounter * Doom * Doom 2 * Hal
f-Life All those use the same RTGL1 Renderer which utilizes Path Tracin
g.
Sentiment Score: -0.69

Figure 16: Reason for a negative sentiment score

Seems from the comments and posts that the negative comments are around the use of DLSS in generation game animation. DLSS (Deep Learning Super Sampling) uses AI to upscale from lower resolution to higher resolution, however this sometimes causes the animation to lose its quality.

5.1.2 AMD

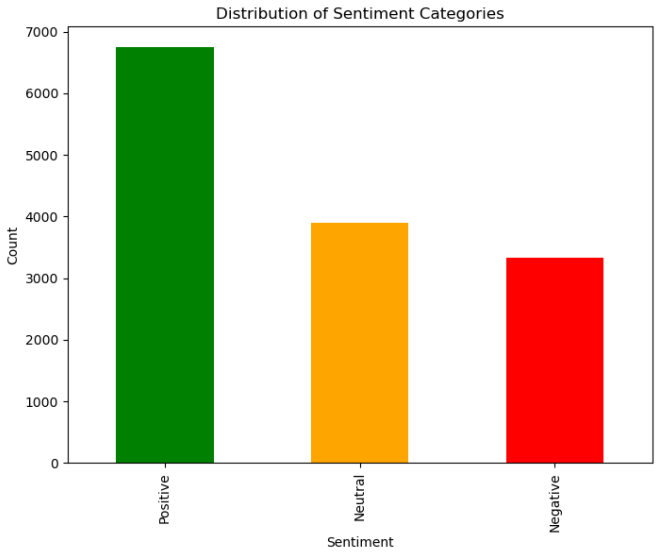


Figure17: AMD sentiment score distribution

Like the Nvidia gpu, the AMD community have an overall positive sentiment around AMD gpu since there are more positive comments than negative and neutral ones indicating users positive experience with the brand.

- **AMD TIME SERIES ANALYSIS**

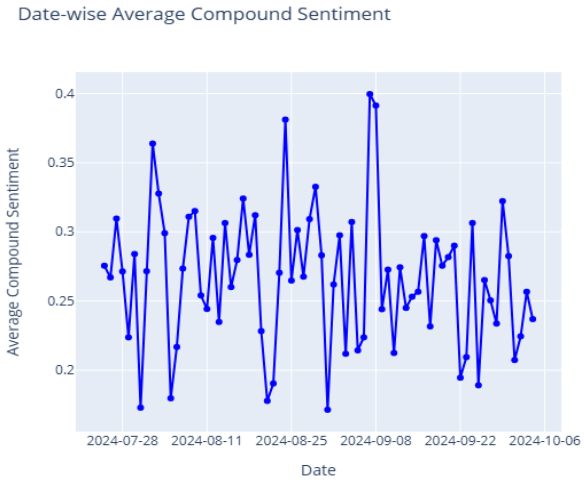


Figure18: AMD time series

The graph above shows the average of the compound sentiment for each day. There exist fluctuations in the sentiments, showing some days have more positive sentiment and some days are a bit lower. We will next delve deep to understand the causes of these higher positive sentiments and lower sentiment.

a. AMD time series analysis (Day with Highest Sentiment)

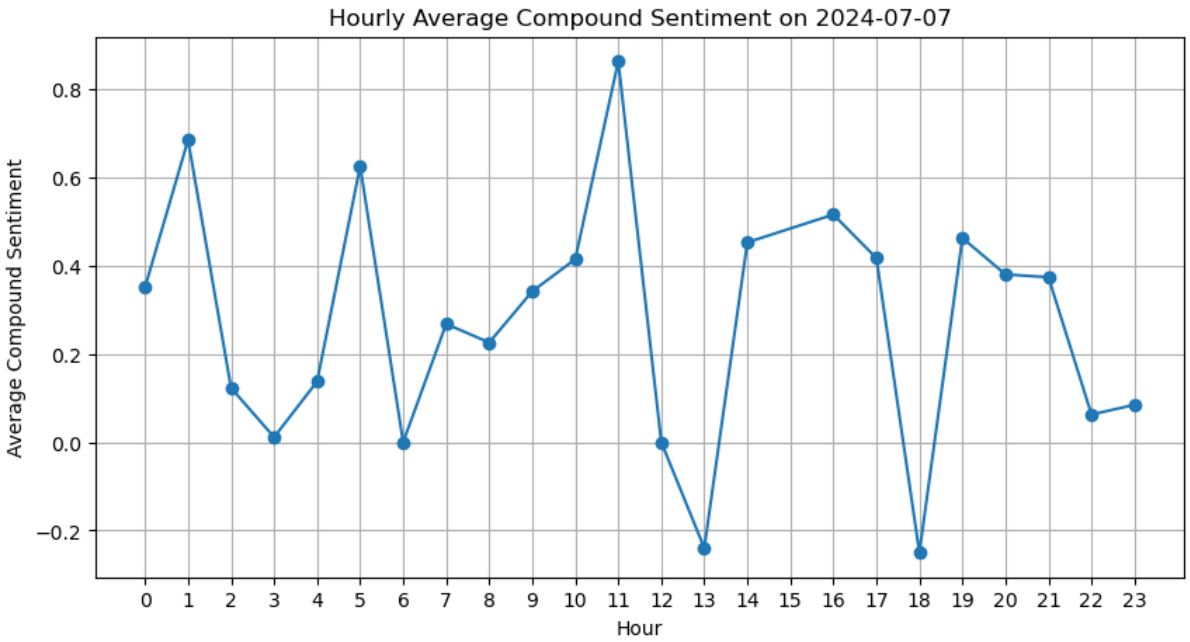


Figure19: AMD highest sentiment day analysis

The day with the highest sentiment is 2024-07-07. We delved in deeper to find out what was happening that caused AMD to get this high sentiment.

```
Timestamp: 2024-07-07 01:44:21
Text: If it supports a 7950x it will support a 9950x. TDP is unchanged. If
it supports a 7950x and you're a gamer so looking at 9800xD, then you're wa
y beyond.  Am5 boards have been pretty solid though
Sentiment Score: 0.89

Timestamp: 2024-07-07 11:08:20
Text: Impressive results. Even more impressive considering this is with an
X670 board, the performance should jump up a bit later when X870 boards com
e out in a few months, with support for faster RAM.
Sentiment Score: 0.86

Timestamp: 2024-07-07 10:06:41
Text: The most interesting thing here is that it says that the 9950x has be
tter gaming performance. This means that the 16 core is better than the 12
core. This is not the case with Zen4.
Sentiment Score: 0.83
```

Figure 20: Reasons for high sentiment

The comments here are all in good opinion of AMD gpu boards and how its performance keeps improving from model to model. This shows that users are happy with these 7950x,

9950x boards, and we can also infer from this that most of our users are gamers, who prefer satisfactory performance coupled with cheaper prices.

b. **AMD time series analysis (Day with Lowest Sentiment)**

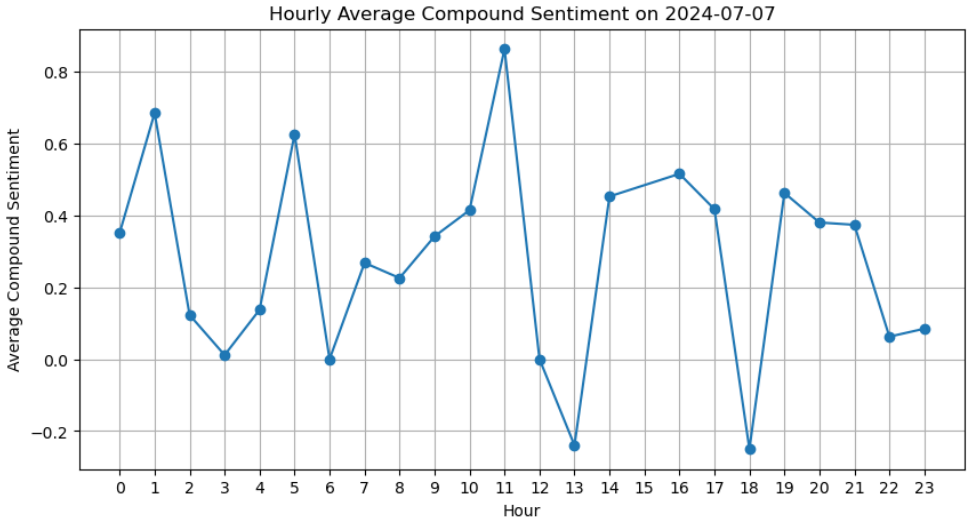


Figure 21: AMD lowest sentiment day hourly compound graph

```
Timestamp: 2024-07-07 23:38:19
Text: never seen so many wrong opinions in a single thread holy shit
Sentiment Score: -0.79

--------------------------------------------------

Timestamp: 2024-07-07 13:47:02
Text: >wccftech  No need to look further, its automatically bullshit.
Sentiment Score: -0.72

Timestamp: 2024-07-07 18:44:02
Text: This Foldable Keyboard Is A Fully Functional Portable PC In Disgui
se, Features AMD Ryzen 7 8840U
Sentiment Score: -0.25

--------------------------------------------------

Timestamp: 2024-07-07 21:03:48
Text: Cool concept, it even has a touchpad so you dont need to carry a m
ouse, even though it looks extremely awkward to use. However you still o
bviously need to find a screen and cable, kinda defeating the point of i
t being so mobile. IMO it would make more sense to just buy a handheld P
C and one of the existing pocketable and foldable keyboards.
Sentiment Score: -0.23
```

Figure 22: Reason for low sentiment score

It seems the most negative day sentiment is related to more of other people's wrong opinions on AMD, and comments on how the foldable keyboard is not so suitable.

5.1.3. INTEL

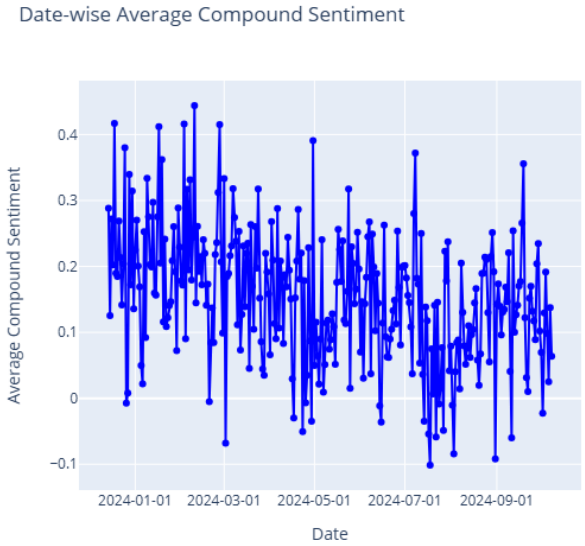


Figure 23: Date wise average compound sentiment for INTEL

a. Intel time series analysis (Day with Highest Sentiment)

The day with the highest sentiment is 2024-02-10. Users have a good opinion of new GPUs like A750 and A770. It looks like Intel graphics are also affordable from the comments. Intel graphics are labelled more as budget GPU for gamers.

```
Timestamp: 2024-02-10 02:34:57
Text: At this point unless you absolutely need a cheap card and are will
ing to test the waters it's not worth getting an Arc card really. Battle
mage is supposed to launch in a few months, it is targeting 4070S~4070Ti
performance and should come with decent amount of memory and affordable
price. It's a no brainer if you want to go Intel. A750 is a great budget
card, but it launched too late to be worth it, pretty much every halfway
decent Battlemage GPU is gonna smoke it.
Sentiment Score: 0.70

Timestamp: 2024-02-10 02:42:28
Text: That’s a reasonable assessment however I am happy to confirm that
the drivers work well now, so you are no longer testing the waters. The
A770 is a good card, just too little, too late for this round.
Sentiment Score: 0.74

Timestamp: 2024-02-10 02:47:19
Text: I was mostly thinking about the A750, apparently there are some mi
nor issues in a few games that occur only when using an A750, the same g
ames run flawlessly on the A770 and the other Arc cards. Maybe it's beca
use this card came out later and Intel didn't have enough time to fix it
s drivers.    Either way the sensible thing right now is to wait for Bat
tlemage or at least get an A770, in my country the price difference betw
een the A750 and A770 is relatively small and it is definitely worth the
extra money.
Sentiment Score: 0.66
```

Figure 24: Reason for positive sentiment score intel

b. Intel time series analysis (Day with Lowest Sentiment)

The day with lowest sentiment is 2024-07-18. The Intel GPUs and CPUs have a lot of issues. According to users, there have been crash issues which resulted in this day being the most negative sentiment.

```
Timestamp: 2024-07-18 13:26:30
Text: Never buying Intel again… I'm pissed  I splurge and buy a 13900k a
nd now have to worry about this thing randomly degrading  Intel should b
e doing a full recall…
Sentiment Score: -0.90

--------------------------------------------------

Timestamp: 2024-07-18 15:57:22
Text: Dev reports Intel's laptop CPUs are also suffering from crashing i
ssues — several laptops have suffered similar failures in testing
Sentiment Score: -0.85


 Timestamp: 2024-07-18 18:44:02
 Text: AMD: Did you ever hear the tragedy of Darth Intelius the Crashed?
 I thought not. It's not a story r-intel would tell you. It's a CPU legen
 d. Darth Intellius was a High Tier of the CPUs, so power-hungry and so h
 igh-clocking he could use the Voltage to influence the microarchitecture
 to create... frames… The dark side of the Voltage is a pathway to many B
 IOS settings some consider to be unnatural. He became so powerhungry… th
 e only thing he was afraid of was losing his power, which eventually, of
 course, he did."
 Sentiment Score: -0.79
```

Figure 25: Reason for negative sentiment score

5.2 COMPARATIVE SENTIMENT ANALYSIS (NVIDIA VS AMD VS INTEL)

Based on our previous discussions regarding the limitations of analyzing YouTube comments for this study, we combined all the comments from Reddit and YouTube for each brand. This allowed us to compare their sentiment scores and provide a comprehensive brand comparison.

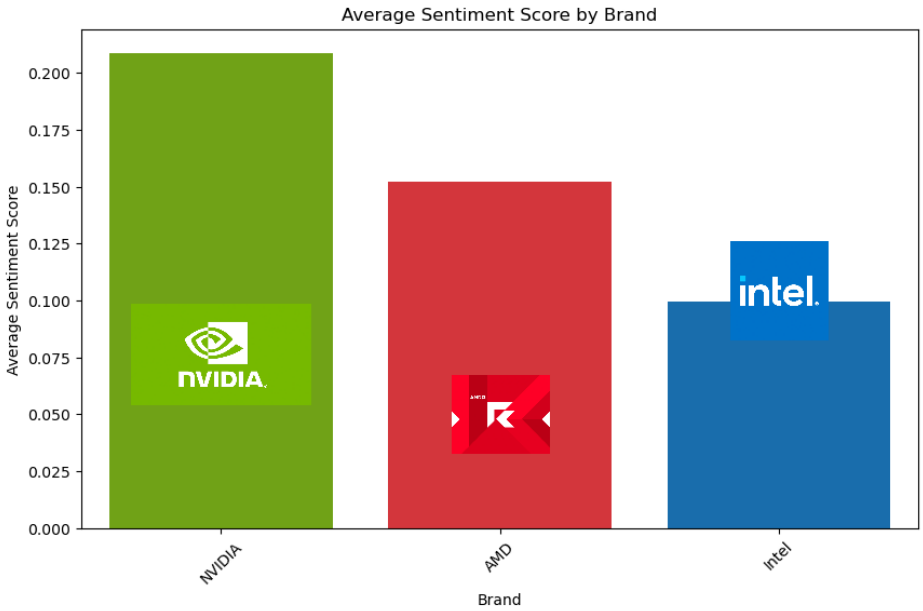


Figure 26: Average Sentiment score by Brand

Using Vader sentiment analysis, we would want to compare the average sentiment score for each brand calculated from the compound scores.
The diagram above shows that Nvidia has the highest average sentiment score among the 3 brands, this suggests users have a more positive view of Nvidia's gpus.
AMD has a lower sentiment than Nvidia, but AMD has a higher sentiment than Intel, this seems to mean users prefer to use AMD as their gpus rather than Intel.

5.3 ASPECT BASED SENTIMENT ANALYSIS (NVIDIA VS AMD VS INTEL)

Aspect-based sentiment analysis is more granular approach where we focus on certain topics and check the sentiment around that subject. We picked 5 different subject to help us understand the users' reviews towards that specific attribute of the gpus. Not only did we use the words to define the aspects, but we added synonyms to able to identify them more clearly.

Aspects	**Synonyms**
Performance	Performance, speed, efficiency
Price	Price, cost, value
Reliability	Reliability, durability, trustworthiness
Design	Design, appearance, look
Battery	Battery, battery life, power, lasts longer

Table 1: Aspect based sentiment

Here, we are going to use both the mean and median sentiment scores to help us gain a balanced unbiased understanding of user sentiments. The mean provides the overall average while the median shows a central tendency, which is less affected by outliers and skewed data.

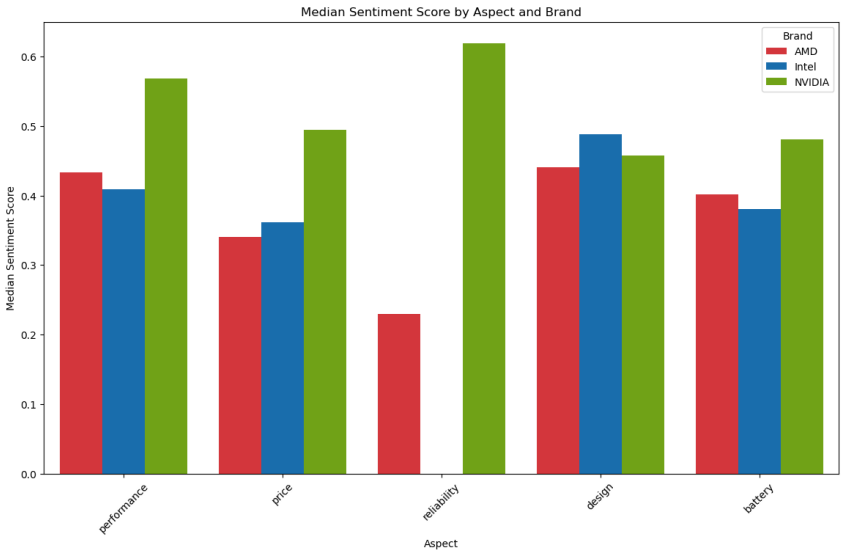


Figure 27: Median Sentiment Score by aspect and Brand

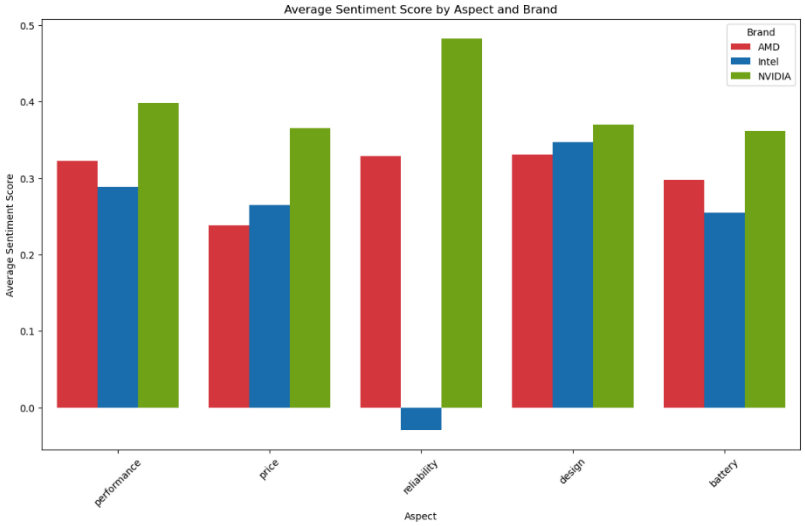


Figure 28: Average Sentiment Score by aspect and Brand

a. Performance

From the mean and median chart, we can conclude that Nvidia has the highest performance, followed by AMD and Intel. This is like what we observed when we analysed them individually, users were more than happy with their Nvidia GPUs whilst Intel was more of a budget GPU than a performance GPU.

b. Price

From both the mean and median chart, we still see that Nvidia has the highest sentiment in terms of price, this might be linked with the performance, and users are likely to buy products that is worth their money. Coming in second, is the Intel gpu in both the mean and median graphs. This is also as expected, because most of the users go for Intel as a budget gpu.

c. Reliability

The chart from both mean and median chart is clearly expected because during the process of analysing Intel separately, we could see that most of negative comments towards Intel was based on their gpus crashing, meaning it wasn't reliable. Nvidia came up on top for reliability as well and AMD in second place

d. Design

In terms of design, we have a bit of contradiction between the median and mean graphs, from the mean graph we can see that Nvidia comes up on top whilst in the median graph Intel comes up on top. This makes it difficult to make a conclusive statement. However, it seems Intel users have a more positive sentiment when it comes to appearance as compared with other aspects

e. Battery

Again, from both the mean and median chart, we can conclude that Nvidia gpus tend to have a longer battery lifespan and lasts longer as compared to AMD and Intel.

5.4 TOPIC MODELLING:

Topic modelling is used in the study of consumer feedback to identify different themes within each sentiment category, both positive and negative. Positive comments emphasised product performance, value for money, and user pleasure, underlining what customers value most about the offers. In contrast, negative comments included worries about product reliability, customer service experiences, and specific complaints about performance deficiencies. By segmenting the study based on sentiment, this technique provided for a more sophisticated knowledge of consumer perceptions, offering useful insights into the goods' strengths and limitations.

5.4.1 NVIDIA:

a. Positive words Topic Modelling for NVIDIA

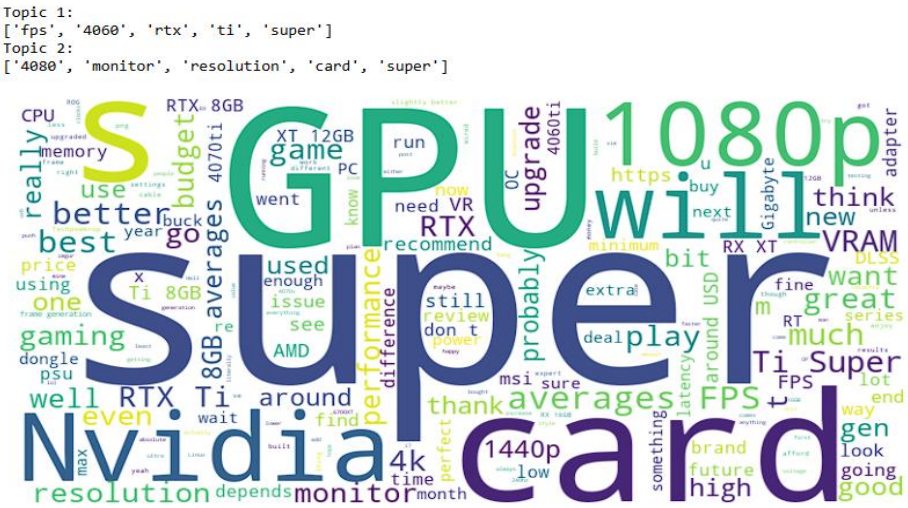


Figure 29: Positive words topic modelling NVIDIA

The topic modelling study of positive reviews for NVIDIA identifies two important themes that emphasise customer pleasure. Topic 1 focuses on graphic cards and their performance, with phrases like "fps", and "super" implying that customers value the whole user experience and performance advantages provided by NVIDIA products.

b. Negative words Topic Modelling for NVIDIA

The topic modelling study of positive reviews for AMD identifies two important themes that emphasise customer pleasure. Topic 1 focuses on gaming, with phrases like "better" "case" and "thing" implying that customers value the whole gaming experience and performance advantages provided by AMD products. Topic 2 focuses on hardware upgrades, with phrases like "just" "board" "new" "gpu" and "ram" showing that buyers enjoy the improvements to their setups, especially with new graphics processing units and motherboards.

```
Topic 1:
['ll', 'like', 'resolution', '4080s', 'gpu']
Topic 2:
['games', 'performance', 'dlss', 'gpu', 'resolution']
```

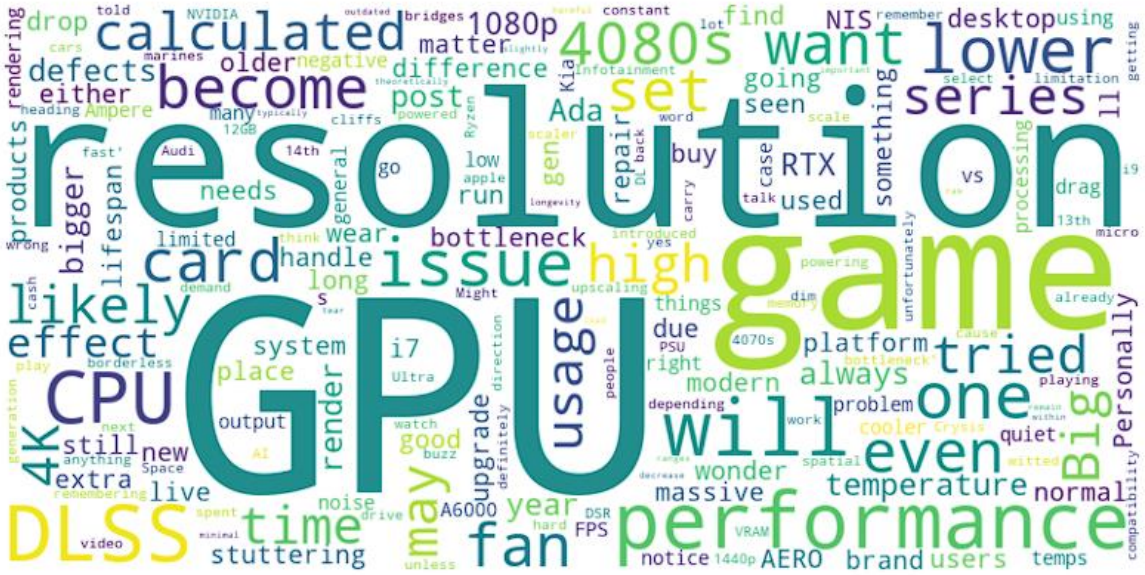


Figure 30: Negative words topic modelling NVIDIA

The topic modelling study for negative reviews for NVIDIA reveals two concerns. In Topic 1, negative connotations suggested by "resolution" and "gpu," expressing displeasure with NVIDIA's performance. Topic 2 includes words like "games" and "performance," indicating frustration or disappointment, possibly related to technical issues or unmet expectations, as "performance" could point to software problems or integration challenges.

5.4.2 AMD:

a. Positive words Topic Modelling for AMD

```
Topic 1:
['better', 'case', 'gaming', 'thing', 'just']
Topic 2:
['just', 'board', 'new', 'gpu', 'ram']
```

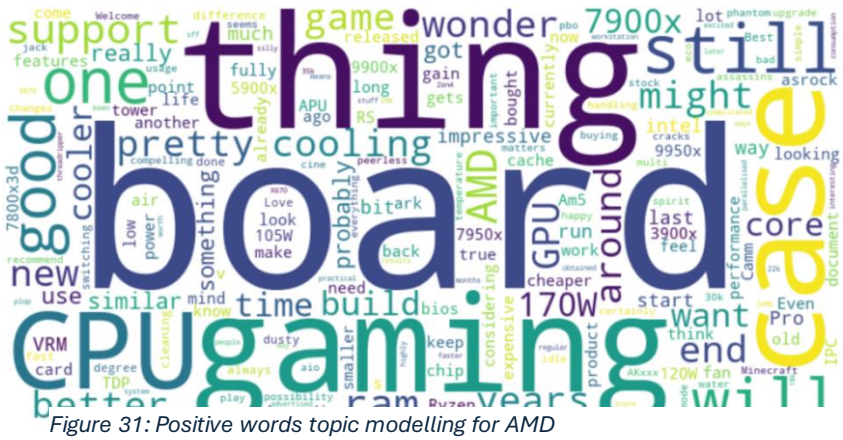


Figure 31: Positive words topic modelling for AMD

b. Negative words Topic Modelling for AMD

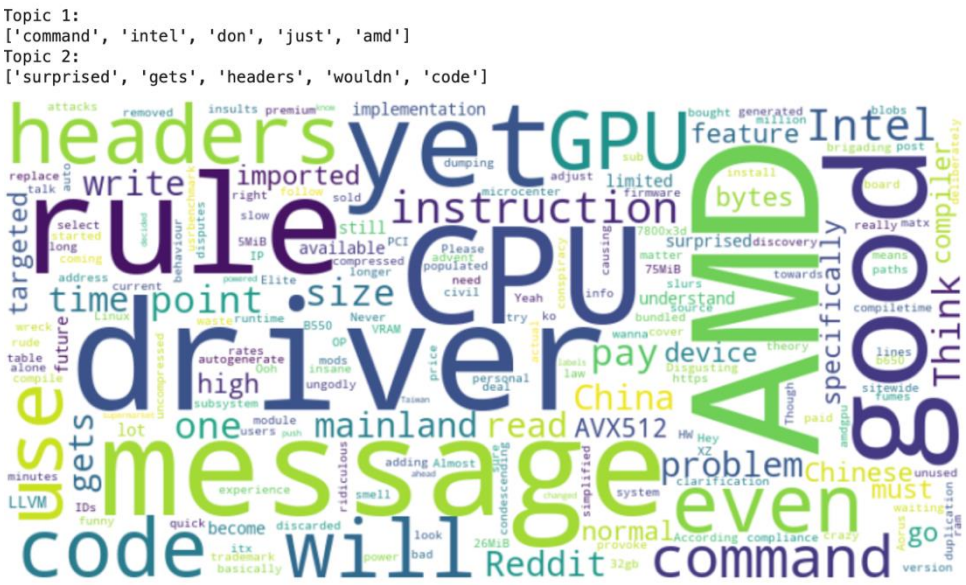


Figure 32: Negative words topic modelling AMD

The topic modelling study for negative reviews for AMD reveals two concerns. In Topic 1, words like "intel" and "amd" suggest a comparison or competition, with negative connotations suggested by "don" and "just," expressing displeasure with AMD's performance or leadership in compared to Intel. Topic 2 includes words like "surprised" and "wouldn," indicating frustration or disappointment, possibly related to technical issues or unmet expectations, as "headers" and "code" could point to software problems or integration challenges.

5.4.3. INTEL

a. Positive words Topic Modelling for INTEL

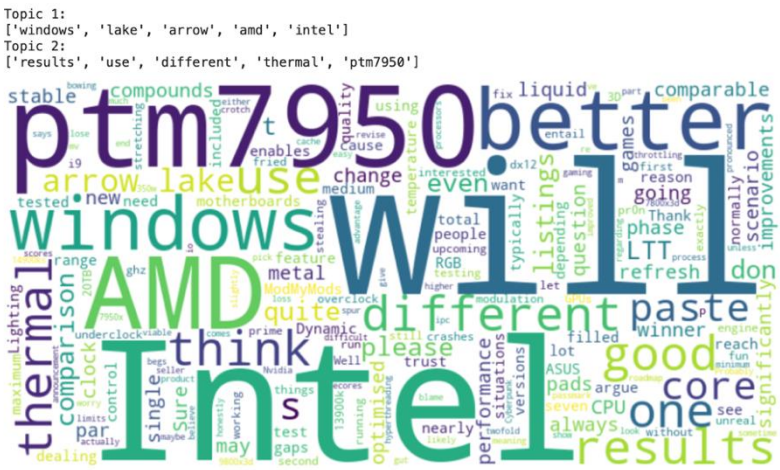


Figure 33: Positive words topic modelling Intel

The topic modelling study of positive comments for Intel indicates two key themes that emphasise customer happiness. Topic 1 includes phrases such as "windows", "lake", "arrow", "amd", and "intel", implying that customers value Intel's performance in certain

situations, particularly when compared to AMD, with product lines such as "Lake" reflecting favourable experiences with modern technology. Topic 2 focuses on technical performance, with phrases like "results", "use", "different", "thermal" and "ptm7950" hinting that consumers are delighted with Intel CPUs' excellent thermal management and performance outcomes.

b. Negative words Topic Modelling for INTEL

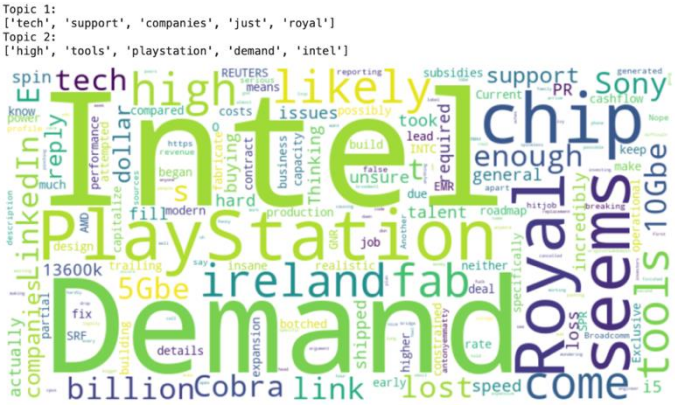


Figure 34: Negative words topic modelling Intel

The topic modelling study of negative comments for Intel reveals two major issues expressed by consumers. Topic 1 has phrases like "tech", "support", "companies", "just" and "royal" that indicate dissatisfaction with Intel's technical support and customer service, implying that people feel let down by the help offered while experiencing problems. Topic 2 focuses on performance problems, with phrases such as "high", "tools", "PlayStation", "demand" and "intel" implying that customers believe Intel products do not fulfil the high needs of specific applications, notably in gaming scenarios. These findings demonstrate consumer unhappiness, emphasising the need for changes in customer service and product performance to improve the user experience.

5.5 PyLDAVis:

PyLDAVis is a strong Python package for visualising the topics generated by Latent Dirichlet Allocation (LDA) models. It provides a user-friendly way to improving the interpretability of topic modelling findings. This application has an interactive visual interface that allows users to investigate the connections between themes and the words that describe them. In the left panel we can see the topic circle. Each circle represents a topic. The size of the circle shows the topic's prevalence in the corpus, with larger circles representing more frequent subjects.
In the right panel we can see the relevance plot. The graph represents the most related terms for each topic. The x-axis depicts the frequency of terms in the topic, while the y-axis indicates their importance to the issue.

5.5.1 NVIDIA

Figure 35: PyLDAVis for NVIDIA

5.5.2 AMD:

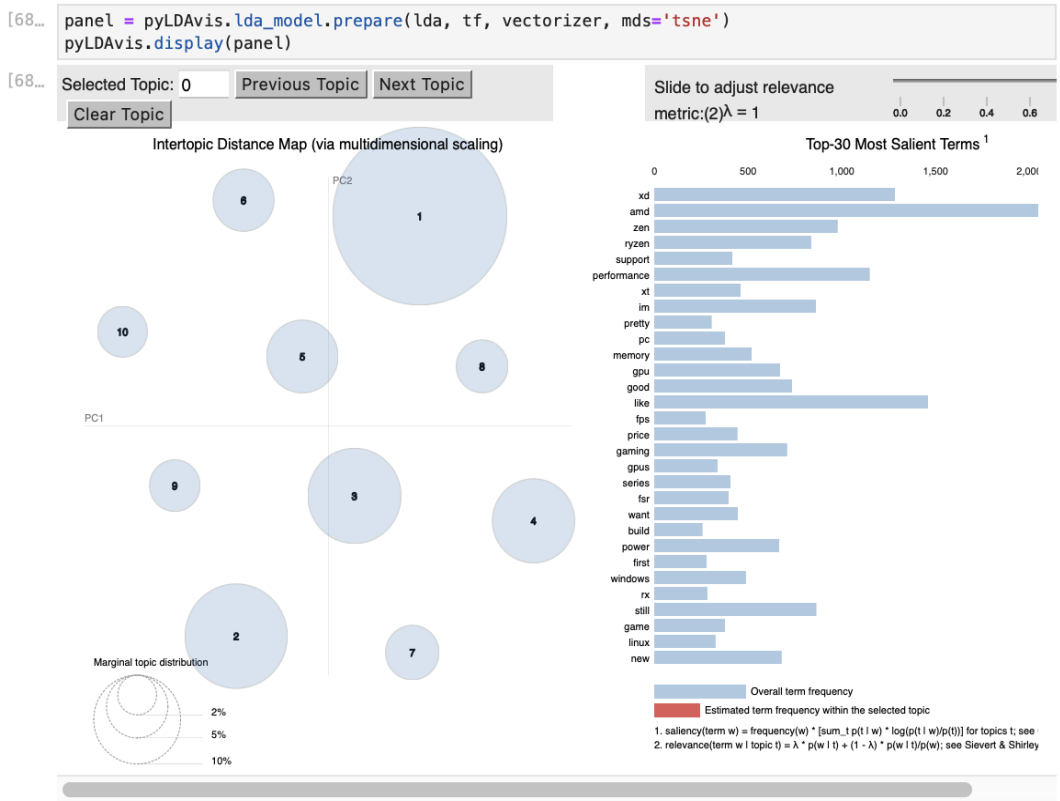


Figure 36: PyLDAVis for AMD

5.5.3 INTEL:

Figure 37: PyLDAVis for AMD

pyLDAvis is utilised to visualize the topics identified in the analysis. This interactive tool allowed us to explore the relationships between the topics and their representative words, providing insights into the distribution of sentiments across comments. By adjusting the relevance of the terms, we were able to focus on the most significant aspects of each topic, enhancing the understanding of how they compare and contribute to the overall discourse surrounding the brands.

5.6 COMMUNITY DETECTION:

Community detection is an important field of network analysis that focuses on discovering groups or clusters inside a network where nodes have more connections among themselves than with the rest of the network. This approach aids in the discovery of hidden patterns and structures that can shed light on the links and interactions within complex systems such as social networks, biological networks, and information networks. Network graphs provide a visual depiction of these interconnections, with nodes representing things (e.g., persons, organisations, or genes) and edges representing the connections between them. For our analysis, we leveraged the NetworkX library from python to build the community and network graphs for the Nvidia, Amd and Intel users.

The very first step of community detection was the filter out the users who very the top contributors in the subreddits and then have a look at how those users interact with other

subreddits. In each of the dataset gathered we were getting 1500+ authors who posted or commented more than once in the subreddit. For our analysis we decided to include only the top 20 contributors in the subreddits. By analysing the top 20 authors based on submission frequency, these graphs provide insight into how discussions about Intel, AMD and NVIDIA are related with other technology and gaming communities.

- **NVIDIA**

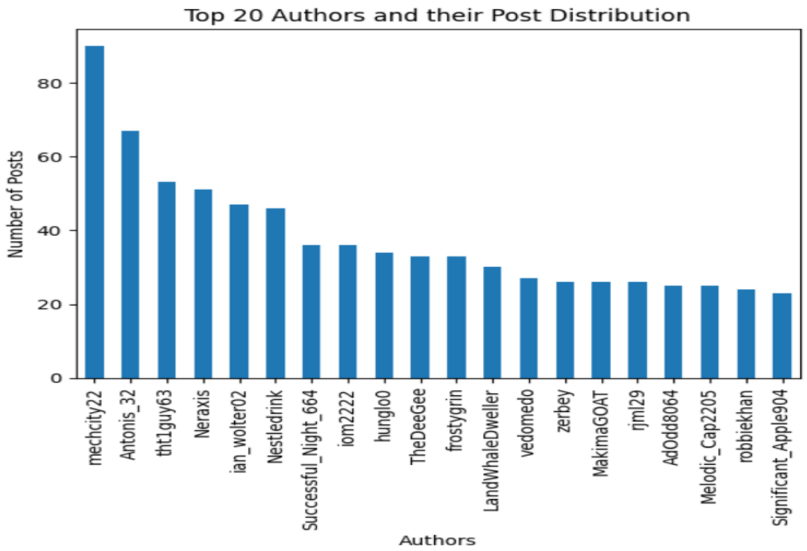


Figure 38: Top 20 Nvidia contributors

In the NVidia subreddit author named 'mechcity22' was the top contributor with more than 90 comments followed by 'Antonis_32' with around 70 comments and then followed by 'tht1guy63' with around 50 comments.

- **AMD**

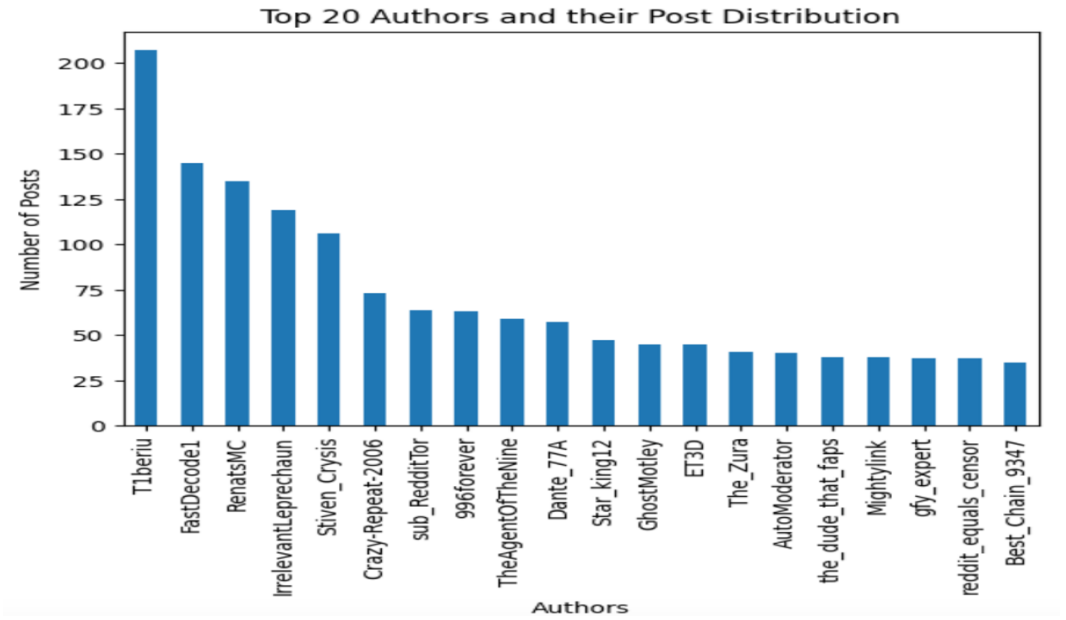


Figure 39: Top 20 Amd contributors

In the Amd subreddit author named 'T1beriu' was the top contributor with more than 200 comments followed by 'FastDecode1' with around 140 comments and then followed by 'RenatsMC' with around 130 comments.

- **Intel**

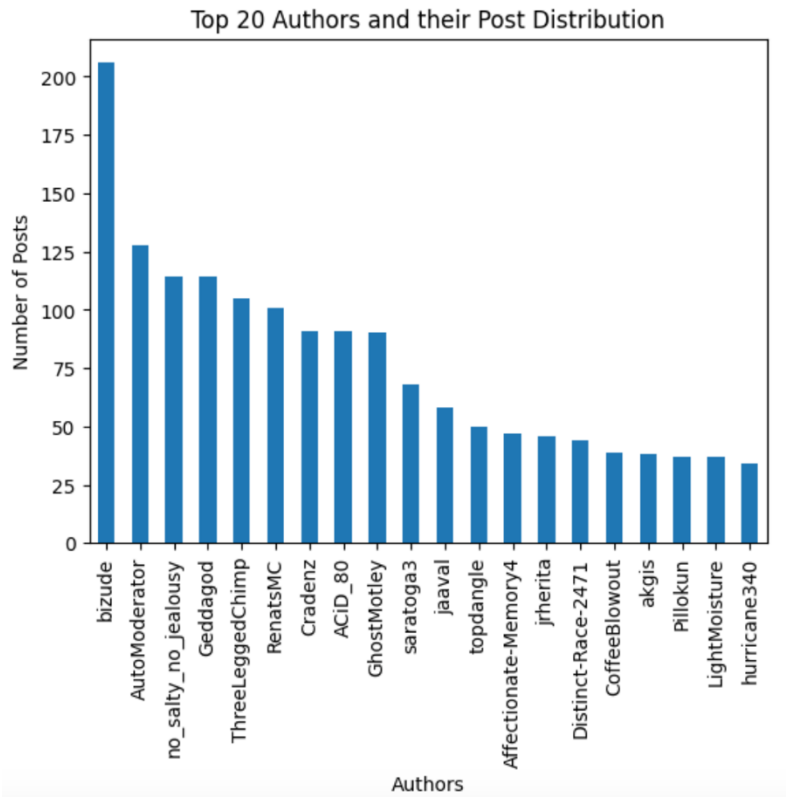


Figure 40: Top 20 Intel contributors

In the Intel subreddit author named 'bizude' was the top contributor with more than 200 comments followed by 'AutoModerator' with around 125 comments and then followed by 'no_salty_no_jealusy' with around 110 comments.

Having a look at the number of comments made by the top 20 contributors, contributors in Intel and Amd subreddits are more active as compared to Nvidia based on the with top contributor posting more than 200 times in Intel and Amd while the top contributor in Nvidia has only around 100 posts.

Each node represents a subreddit, with its size indicating the level of activity, while the edges between nodes reveal the connections and engagement patterns among the communities. This visual representation highlights not only the popularity of discussions surrounding Intel and NVIDIA but also the competitive landscape they operate in, particularly in relation to their main competitor, AMD.

COMMUNITY GRAPH:

5.6.1 NVIDIA

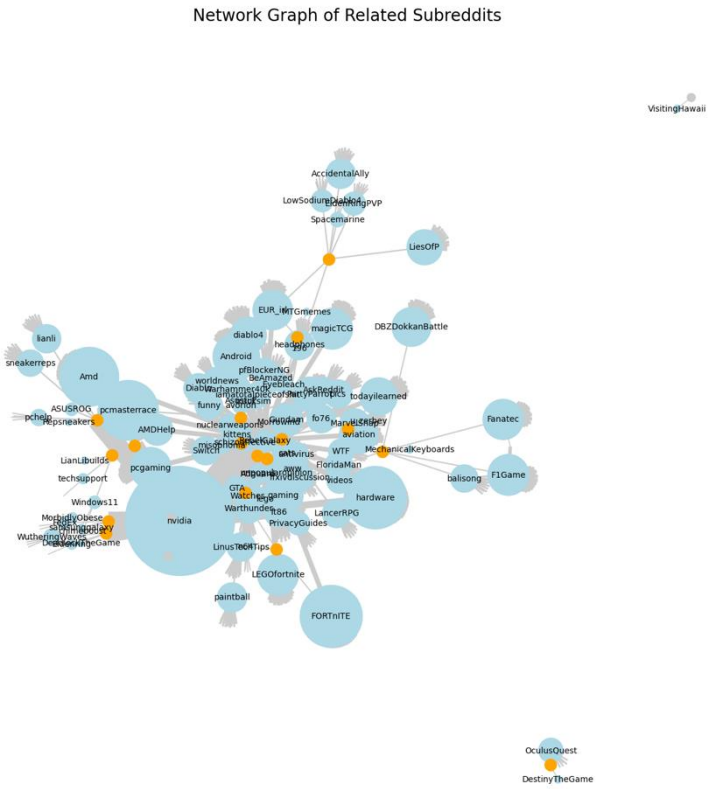


Figure 41: NVIDIA Community graph

The NVIDIA community graph in figure 41 showcases a interconnected network, with a strong focus on gaming and technology discussions. Key subreddits such as “AMD”, “gaming”, “hardware”, and “pcmaster”, highlight the multifaceted interests of NVIDIA users, ranging from performance in gaming to concerns about data privacy. The size of the nodes suggests that NVIDIA's discussions extend beyond just graphics cards; they also engage with broader technological trends and consumer experiences. The edges connecting these subreddits indicate frequent interactions, implying that users actively participate in discussions that impact their perceptions of NVIDIA products. This graph also reflects a community that is deeply engaged in topics such as hardware performance and user experiences, which are crucial in shaping public sentiment toward NVIDIA’s offerings in a competitive market.

5.6.2 AMD COMMUNITY GRAPH:

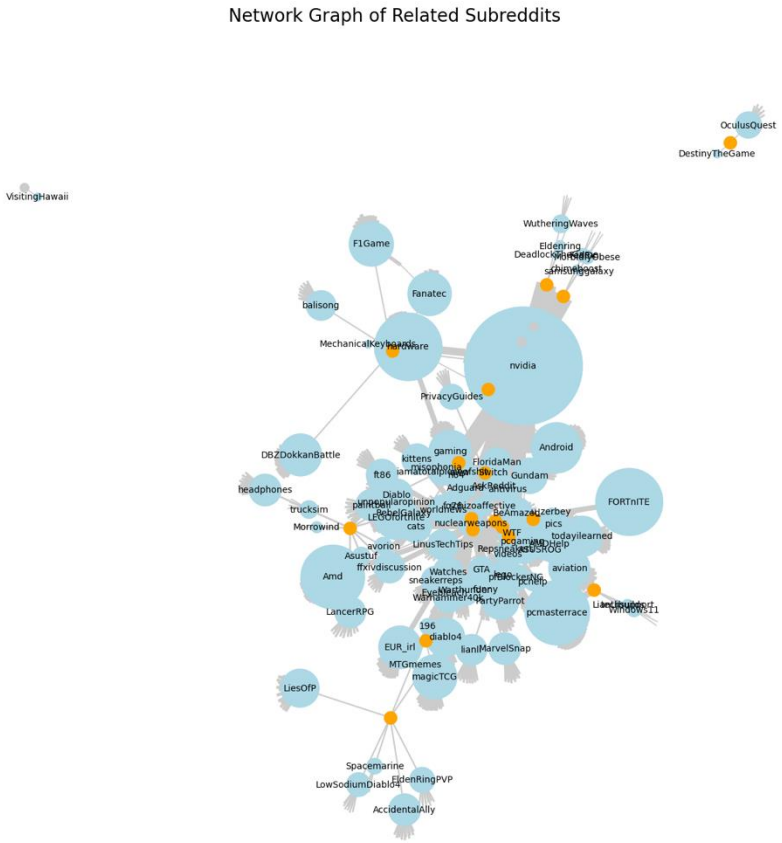


Figure 42: AMD community graph

The AMD community graph in figure 42 also shows a similar network, with a strong focus on gaming and technology discussions. Key subreddits such as “intel”, “nvidia”, “technology”, and “pcmaster”, highlight the interests of AMD users, ranging from performance in
gaming to technology updates. The size of the nodes suggests that AMD’s discussions extend beyond just graphics cards; they also engage with broader technological trends and consumer experiences. The edges connecting these subreddits indicate frequent interactions, implying that users actively participate in discussions that impact their perceptions of AMD products. The presence of AMD and NVIDIA subreddits within this graph indicates to a competitive landscape where users frequently compare products and performance metrics, demonstrating the dynamic interplay between these brands as they compete for market leadership.

5.6.3 INTEL COMMUNITY GRAPH:

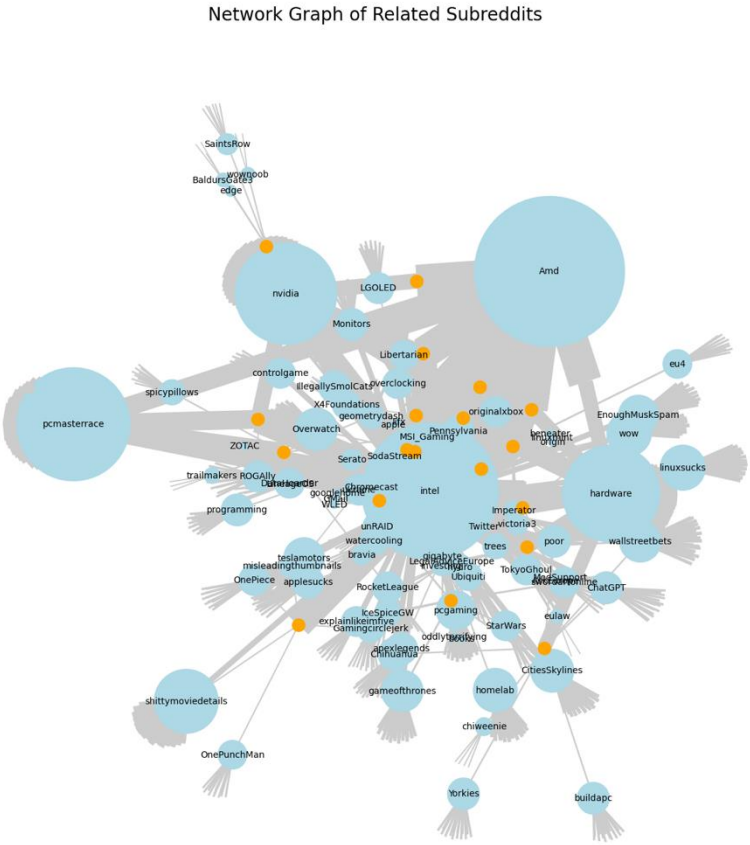


Figure 43: Intel community graph

The Intel community graph in figure 43 reveals a vibrant network of discussions centered around the Intel subreddit and its engagement with related topics. The prominent nodes indicate subreddits such as “AMD”, “NVIDIA”, “pcmaster”, and “hardware”, which reflect the significant interest in high-performance gaming hardware among Intel users. The connections between these nodes suggest that many authors who contribute to Intel discussions also engage with broader gaming and technology communities, indicating a crossover of interests. This interconnectedness signifies that discussions around Intel are heavily influenced by gaming culture, which often drives demand for powerful GPUs. Moreover, the presence of AMD and NVIDIA subreddits within this graph indicates to a competitive landscape where users frequently compare products and performance metrics, demonstrating the dynamic interplay between these brands as they compete for market leadership.

The above community graphs can be interpreted with the help of below information:

1. Nodes:
a. Authors: Represented as grey nodes. The size of these nodes can indicate their activity level (more posts correspond to larger nodes).

b. Subreddits: Shown in light blue. The size of these nodes is proportional to their connectivity; larger nodes may represent subreddits with more active discussions or more authors participating.

2. Edges: The lines connecting authors to subreddits represent the posts made by those authors in those subreddits. The thickness of these edges can reflect the volume of interactions between authors and subreddits, although in your case they are uniformly styled.

3. Colour Coding: Authors who have made more than one connection to different subreddits are highlighted in orange, indicating their prominence or influence in discussions across multiple communities.

In summary, the community graphs for Intel, NVIDIA, and AMD illustrate a dynamic landscape of discussions surrounding GPU technology, gaming, and consumer preferences. All three brands are represented in the Intel and AMD graphs, indicating a competitive ecosystem where users actively engage in discussions comparing the strengths and weaknesses of each brand. However, in the NVIDIA community graph, only the AMD subreddit is present, with Intel notably absent. This could suggest that NVIDIA users may be more focused on comparisons with AMD, perhaps due to AMD's recent advancements in GPU technology or its competitive pricing strategies. Alternatively, it may reflect a perception among NVIDIA users that Intel does not directly compete in the same GPU market segment, as Intel has historically been more focused on CPUs. This lack of representation for Intel in the NVIDIA graph indicates the distinct branding and market positioning of these companies in the eyes of the community, which can significantly influence public sentiment and purchasing decisions.

6. CONCLUSION:

The analysis has provided valuable insights into the public perceptions of these brands of GPU (Nvidia, AMD, and Intel). We used various methods to get the perceptions, patterns and the running theme in users' discussions on platforms like Reddit and YouTube. Our methods included sentiment analysis, comparative sentiment analysis, aspect-based sentiment analysis, and topic modelling and community detection.
The insights discussed above would help the industries to understand the public view of their GPU models, also help them to identify which areas they should focus on for product development. This analysis would help businesses identify their strengths to capitalize on and the weaknesses and issues that need their immediate attention, to ultimately enhance customer satisfaction. As new models of the GPU are released, these companies need to continually stay attuned to the consumers' sentiments and theme to remain competitive and increase their market share.
This understanding can shape future marketing campaigns and product development, ultimately guiding these industries to keep up with the market trend.

7. LIMITATIONS:

Although our analysis provided valuable insights, it is essential to acknowledge some limitations that could have improved the analysis and insights.

The data extraction process was limited to only YouTube and Reddit, however their various platforms that users' share their opinion or experience with a product like amazon reviews. This means the analysis may not capture the full spectrum of the public perception about these GPUs.

The sentiment analysis techniques performed employed finds it difficult to capture nuanced expression like sarcasm and emojis. In future analysis, we suggest using more advanced model like GPT or BERT model to capture these nuanced expressions.

The analysis conducted was restricted within a certain time period, fails to capture the yearly trend of public opinions. In future analysis, it would be advisable to expand the time frame to capture yearly trend and come up with new analysis.

8. REFERENCES

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- **Linus tech Tips (2024) Snapdragon just obsoleted Intel and AMD. YouTube. Available at: https://www.youtube.com/watch?v=C0bEew9dqNs**
- **Linus Tech Tips (2024) AMD is About to CRUSH Intel… Just Like I Predicted. Youtube. Available at:**