Does News Media Spread Fear of AI?

RAISE 2024 Competition
Team: AInsight
March 2024

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Part 1

Introduction
Our team & Project

Project Objective

Our project seeks to answer the intriguing question: 'Is the media spreading fear about AI?'

We delved into this by first preprocessing and exploring a dataset of 10,000 headlines. Our journey continued with a thorough analysis using three sentiment analysis models to assign emotions to these headlines.

We focused on tracking the shift in sentiment in AI-related articles from May to November 2023.

The culmination of our research not only sheds light on the emotional trends in media but also offers a critical evaluation of the models used and provides insights that could guide the media's narrative around artificial intelligence.

Team member

Nayeon Kwak
Bentley University
Master of Business Analytics, candidate

Hyomin Yoo
University of Illinois, Urbana-Champaign
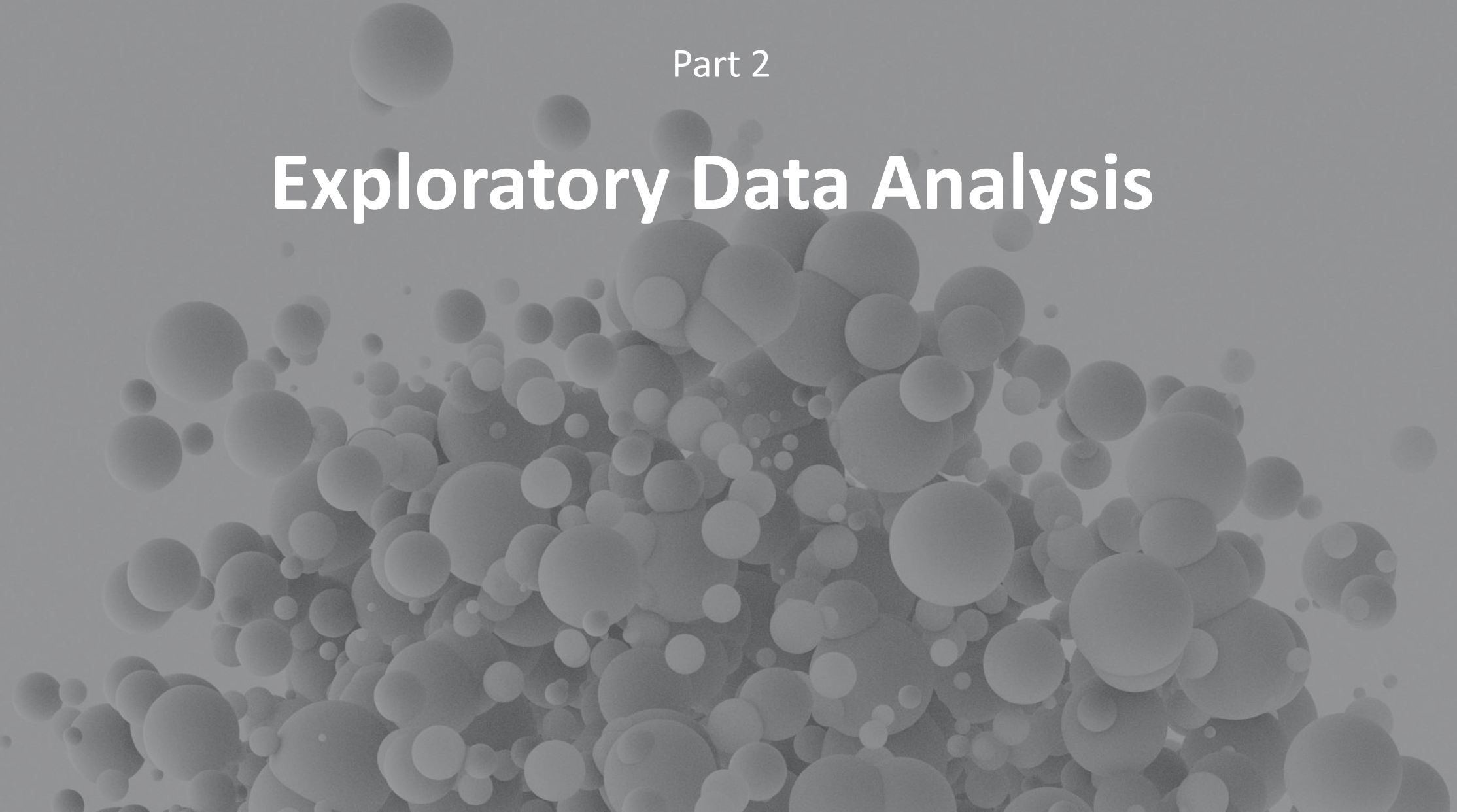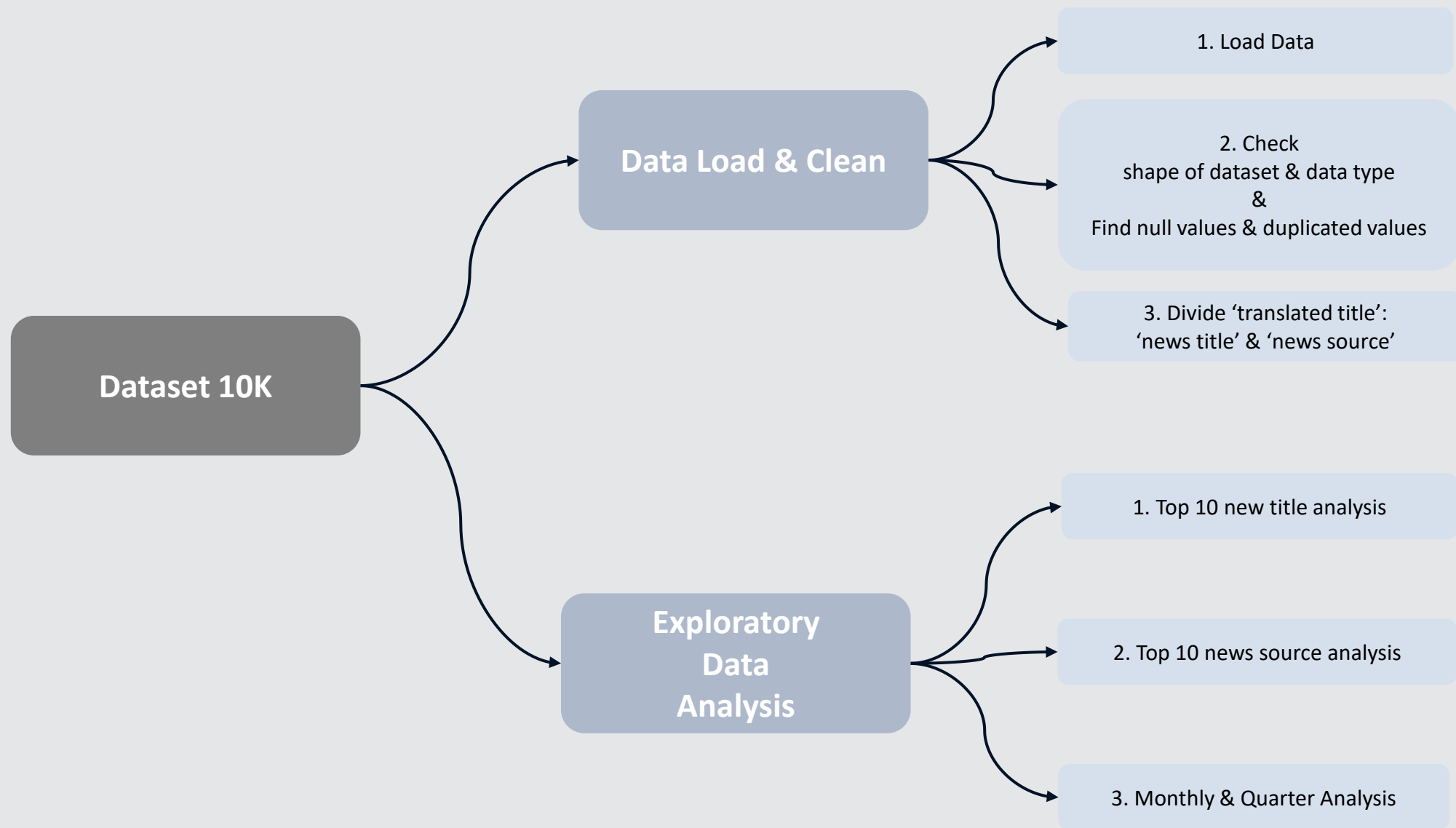Master of Statistics, candidate

Kyungjin Kwak
Illinois Institute of Technology
Master of Data Science, candidate

Part 2

Exploratory Data Analysis

Exploratory Data Analysis & Visualization

- Feature Data type check: We changed data type of 'date' column. 'object' -> 'datetime'
- Missing value check: We find that total of 237 article URLs were missing
  But we primarily focused on the content of the news titles for our main analysis, so the missing URL values were not a significant issue
- Check if all the 'translated_title' values are unique

```
1 #2.Check the shape of the dataset and data types
2
3 shape_of_data = data.shape
4 data_types = data.dtypes
5
6 print(shape_of_data)
7 print(data_types)
```

```
(10000, 23)
title                        object
link                         object
date                         object
source                       object
country                      object
language                     object
translated_title             object
number_of_characters_title    int64
number_of_words_title         int64
day_of_week                  object
month                         int64
year                          int64
quarter                       int64
is_weekend                     bool
is_holiday                     bool
source_type                  object
final_redirected_URL         object
domain_of_URL                object
subdomain_of_URL             object
URL_depth                     int64
top_level_domain             object
url_length                    int64
author                       object
dtype: object
```

```
1 # 3. Check for any null values
2 null_values = data.isnull().sum()
3 null_values
```

```
title                          0
link                           0
date                           0
source                         0
country                        0
language                       0
translated_title               0
number_of_characters_title     0
number_of_words_title          0
day_of_week                    0
month                          0
year                           0
quarter                        0
is_weekend                     0
is_holiday                     0
source_type                    0
final_redirected_URL           0
domain_of_URL                237
subdomain_of_URL             237
URL_depth                      0
top_level_domain             237
url_length                     0
author                         0
dtype: int64
```

```
1 #3. Check if 'translated_title' has unique values
2 unique_translated_title = data['translated_title'].nunique() == data.shape[0]
3 unique_translated_title
```

```
True
```

## 1) Top10 news title words Analysis

▪ News Title Word Analysis: The word 'AI' ranked as the most frequent term, exhibiting more than double the frequency of the second most common word, 'artificial.'
  However, the term 'AI' itself does not convey a fear or negative impression

▪ News Source Analysis(1): Yahoo Finance was the top source. However, it represented only 200 out of 10,000 articles, which is 2%, making it challenging to regard it as having a significant influence on the overall media representation of AI
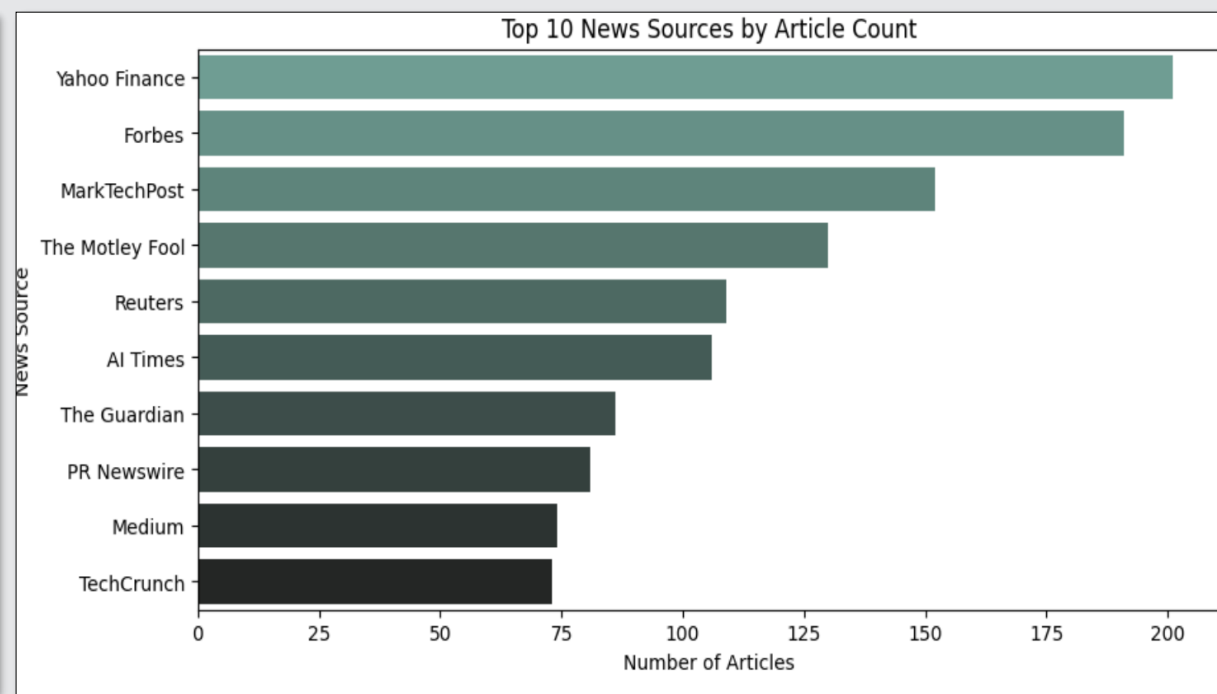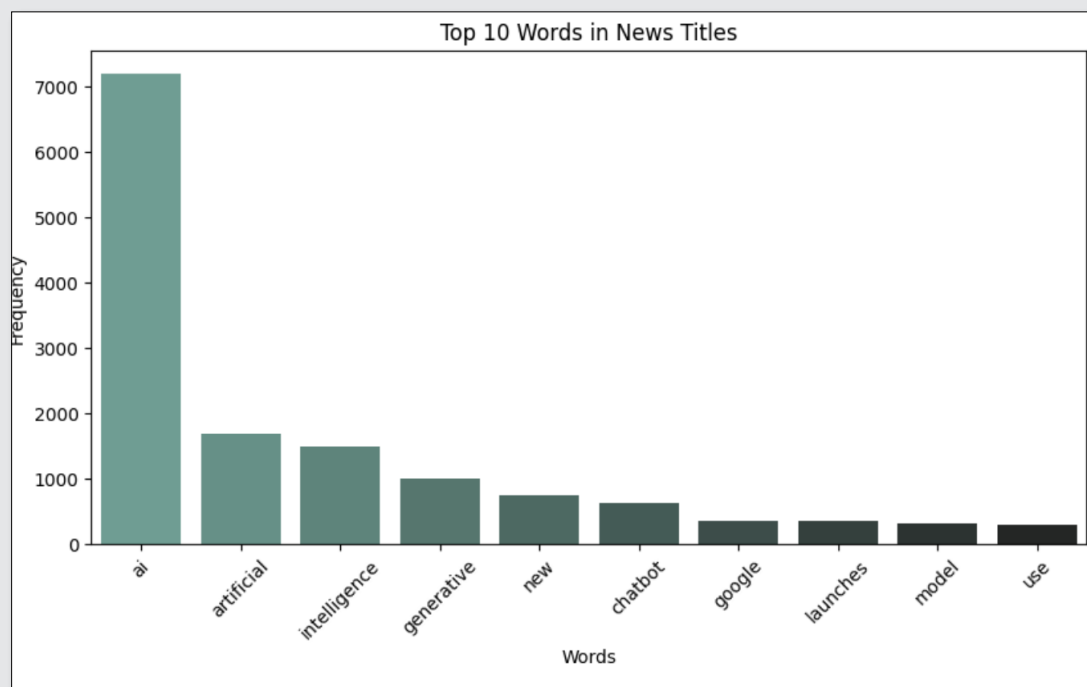
## 2) Top10 New source Analysis

- New Source Analysis(2): In our analysis of the top 10 languages used in news titles, we found that over 80% were in English
  Korean and Japanese follow but accounted for less than 5% each, which does not significantly influence the analysis

- New Source Analysis(3): When examining news release patterns by day, we found that the number of articles is fairly consistent across weekdays
  However, the data revealed that significantly fewer articles are published on weekends



Top 10 Languages Used



Articles Count by Day of Week
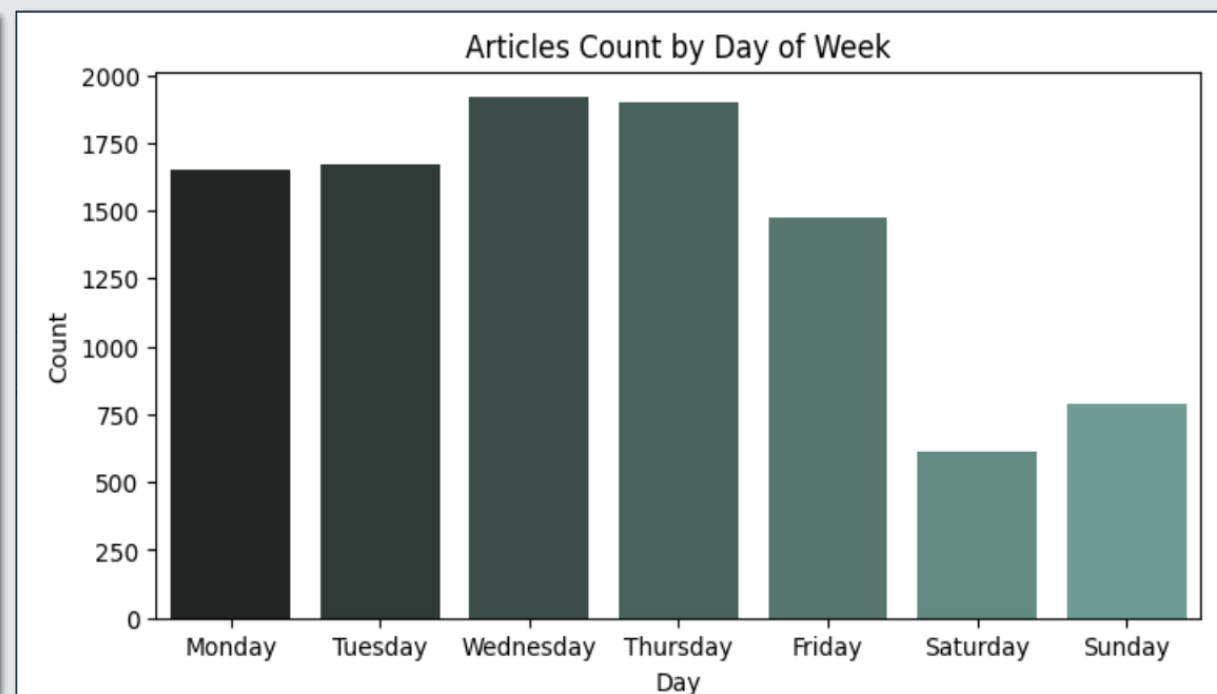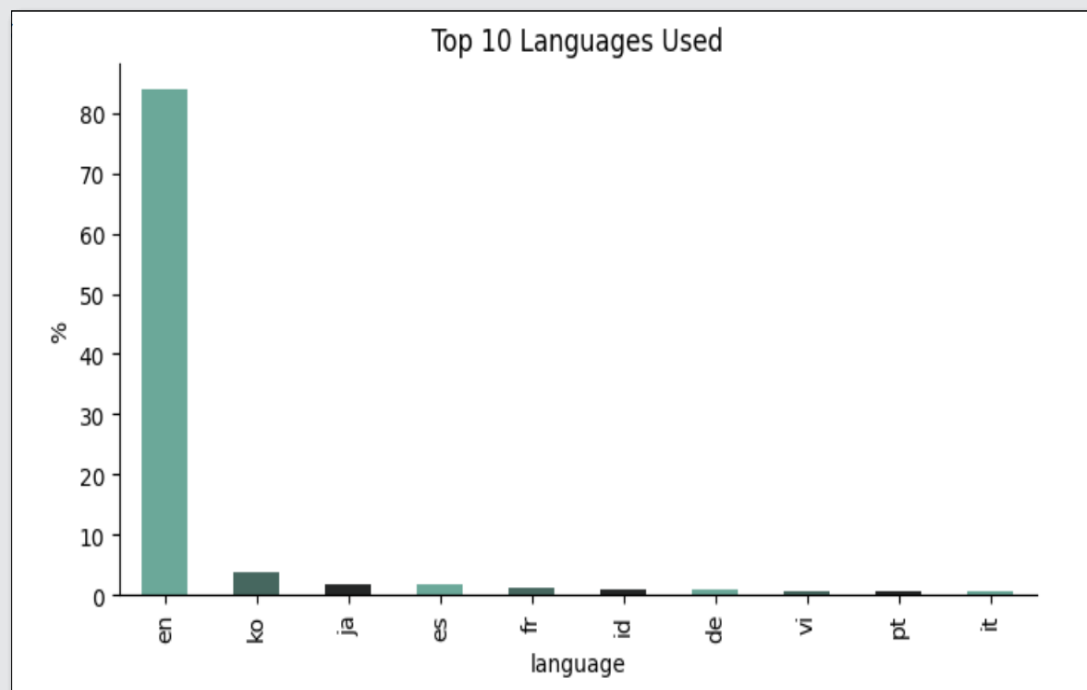
## 3) Articles by Month & Quarter

- Occurrence of Articles by Quarter: In our dataset of 10K, approximately 6K articles, which constitute around **60%, are concentrated within 4Q**
  In our forthcoming text analysis, we examine whether there are significant variations in sentiment and emotion by quarter

- Occurrence of Articles by Month: Similar to the quarterly article occurrence, we observed that around 6K articles are concentrated in October and November over the seven months from May to November
  We plan to investigate whether there are pronounced changes in fear and emotion in the headlines of articles published in **October and November**
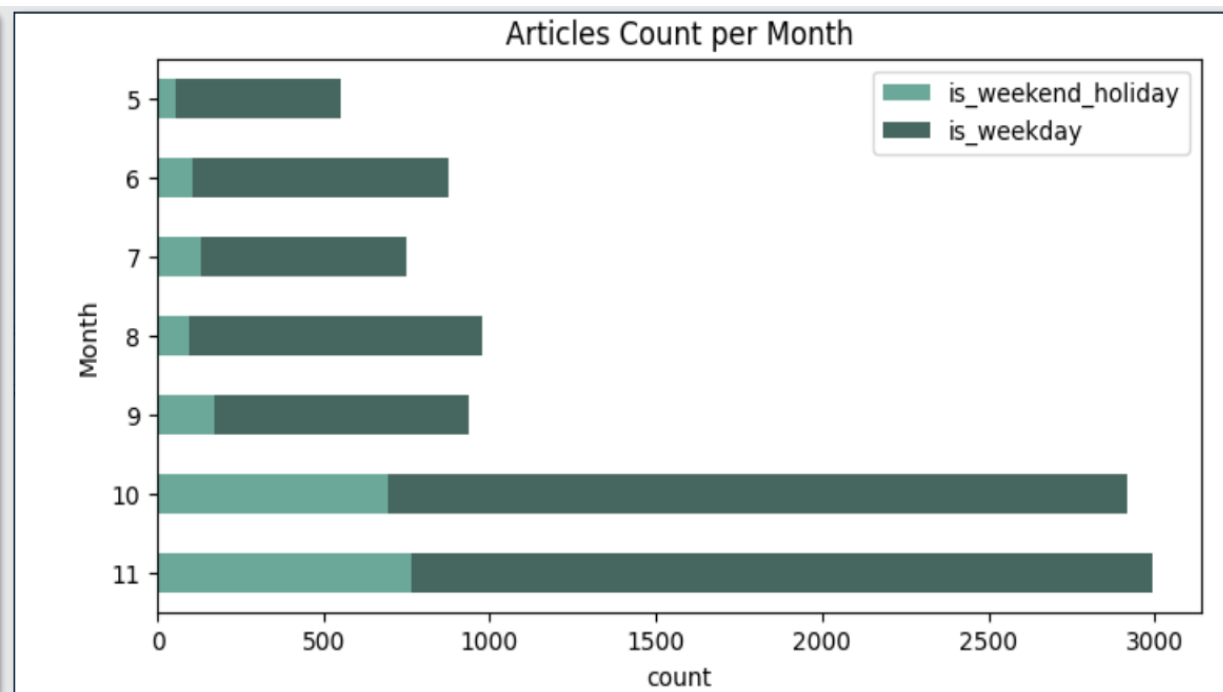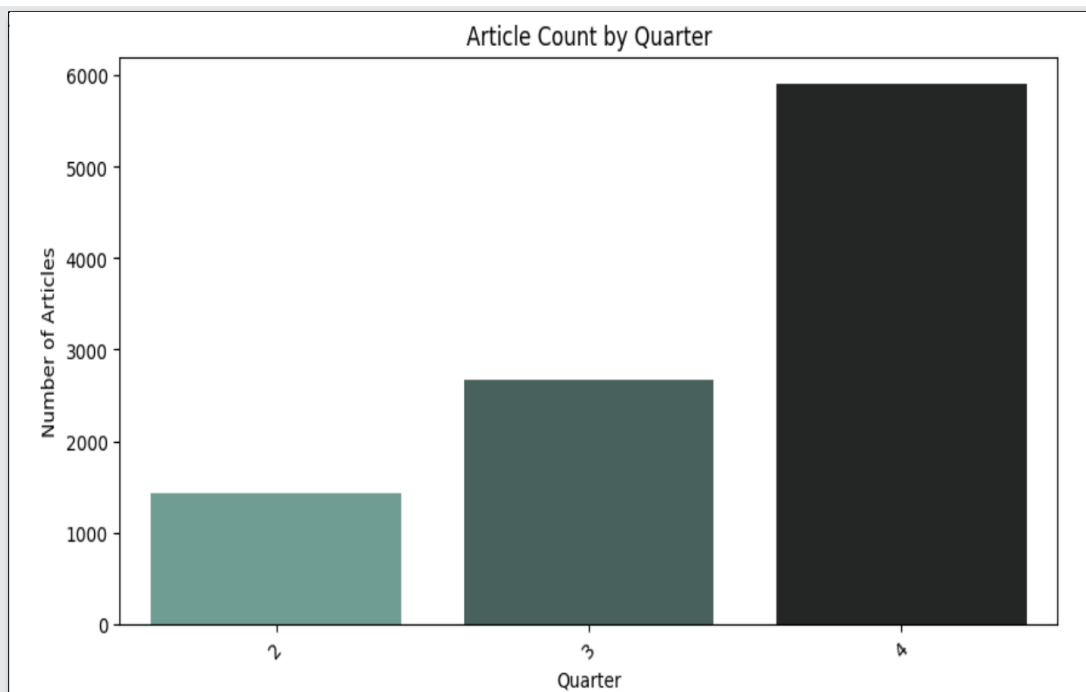
*Seeing that the count of articles changes,*
*we became curious about how media might* *spread* *fear*

*So, we're now looking into* *'How fear spreads over time'*
*in the next chapter*

Part 3

# Analysis & Interpretation

# Sentiment Analysis

Figuring out the news title by sentiment, 'Negative', 'Neutral', and 'Positive'

## 1 )  S e n t i m e n t  A n a l y s i s  u s i n g  ' T e x t b l o b '

```python
1  from textblob import TextBlob
2
3  ## Analyzing sentiment of the news titles
4  data['sentiment'] = data['news_title'].apply(lambda title: TextBlob(title).sentiment.polarity)
5  data['sentiment_category'] = pd.cut(data['sentiment'], bins=[-1, -0.01, 0.01, 1], labels=['Negative', 'Neutral', 'Positive'])
6
7  ## Map the categorical sentiment labels to numerical values
8  sentiment_numerical_mapping = {'Neutral': 0, 'Positive': 1, 'Negative': -1}
9  data['sentiment_numerical'] = data['sentiment_category'].map(sentiment_numerical_mapping)
10
11 ## Checking the first few rows to ensure the process went as expected
12 data[['translated_title', 'news_title', 'news_source', 'sentiment', 'sentiment_category','sentiment_numerical']].head()
13
```

	translated_title	news_title	news_source	sentiment	sentiment_category	sentiment_numerical
0	Can artificial intelligence replace small talk...	Can artificial intelligence replace small talk?	View	-0.425	Negative	-1
1	People trust chatbots more easily. Emotional A...	People trust chatbots more easily. Emotional A...	iDNES.cz	0.250	Positive	1
2	How to implement AI in online commerce? - Digi...	How to implement AI in online commerce?	Digital HR	0.000	Neutral	0
3	Controlling AI: Be careful, AI! | ZEIT ONLINE ...	Controlling AI: Be careful, AI! | ZEIT ONLINE	ZEIT ONLINE English	-0.125	Negative	-1
4	Tips to win the Artificial Intelligence lotter...	Tips to win the Artificial Intelligence lottery	C5N	0.100	Positive	1

We categorize original data's 'translated_title' into 'news title' and 'news source', to analyze news title
Utilizing the 'textblob' library, we analyze the sentiment of the news title and categorize it into 'Negative,' 'Neutral,' and 'Positive.'
Based on the sentiment category, we assigned a sentiment numerical value of -1 for 'negative,' 0 for 'neutral,' and 1 for 'positive

Analysis & Interpretation

1) Analyzing Average Sentiment Score by Month

We aimed to examine clear emotional differences in news titles on a monthly basis. Each month's average sentiment for news titles, characterized by -1 for Negative, 0 for Neutral, and 1 for Positive, is presented alongside.

- **May 2023**: The sentiment is slightly positive, almost neutral.
- **June 2023**: The sentiment turned slightly negative.
- **July 2023**: July experienced a more pronounced negative sentiment compared to June.
- **August 2023**: The sentiment in August shifted back towards positive, though still close to neutral.
- **September 2023**: September witnessed a positive sentiment, marking an improvement from August.
- **October 2023**: October displayed a significantly positive sentiment, the most substantial within this period.
- **November 2023**: The sentiment in November remained positive but was less pronounced than in October.

Date	Average Sentiment
2023-05-31	0.001818
2023-06-30	-0.031891
2023-07-31	-0.050667
2023-08-31	0.008172
2023-09-30	0.020343
2023-10-31	0.085420
2023-11-30	0.055221

Analysis & Interpretation

1) Analyzing Average Sentiment Score by Month

Average Sentiment Score Over Time
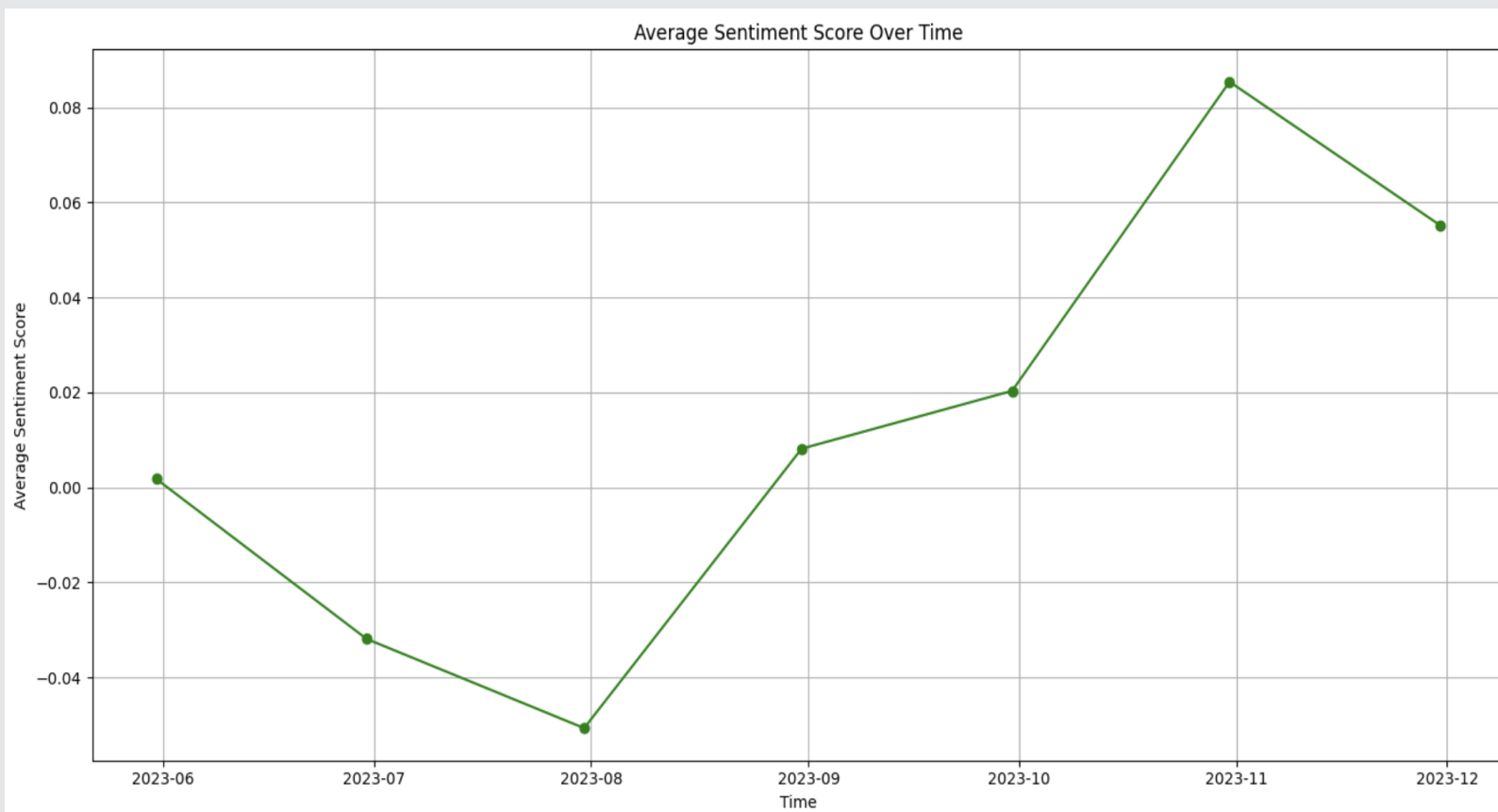
Overall, this sentiment analysis reveals a trend. Initially, media reporting about AI started with a generally **neutral to slightly positive tone.**
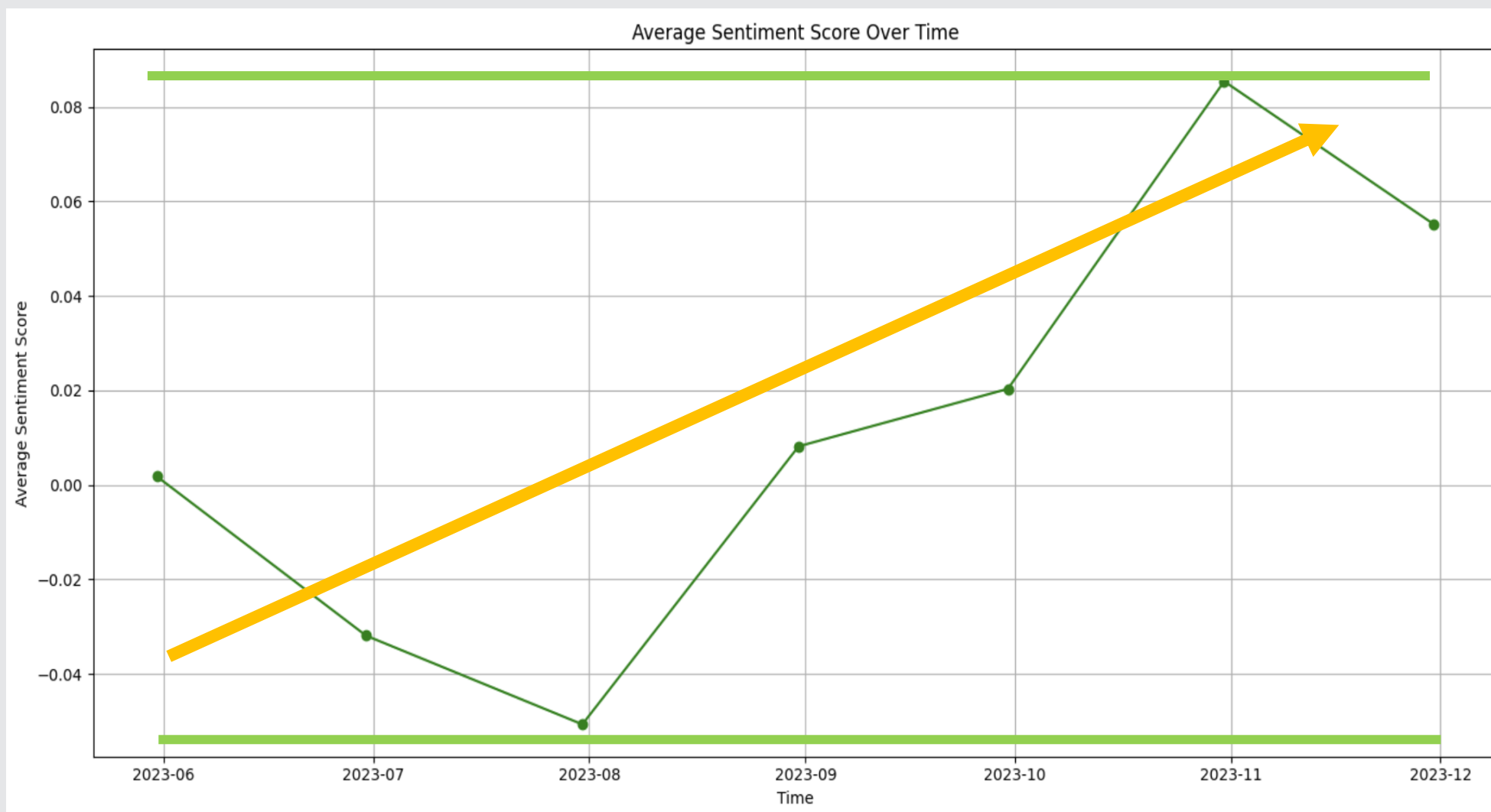
Mid-year, there was a dip towards a more negative sentiment, which then improved over time.

This pattern informs us that, while the media's portrayal of AI has been largely neutral, **there is a gradual shift towards a more positive portrayal as time progresses.**
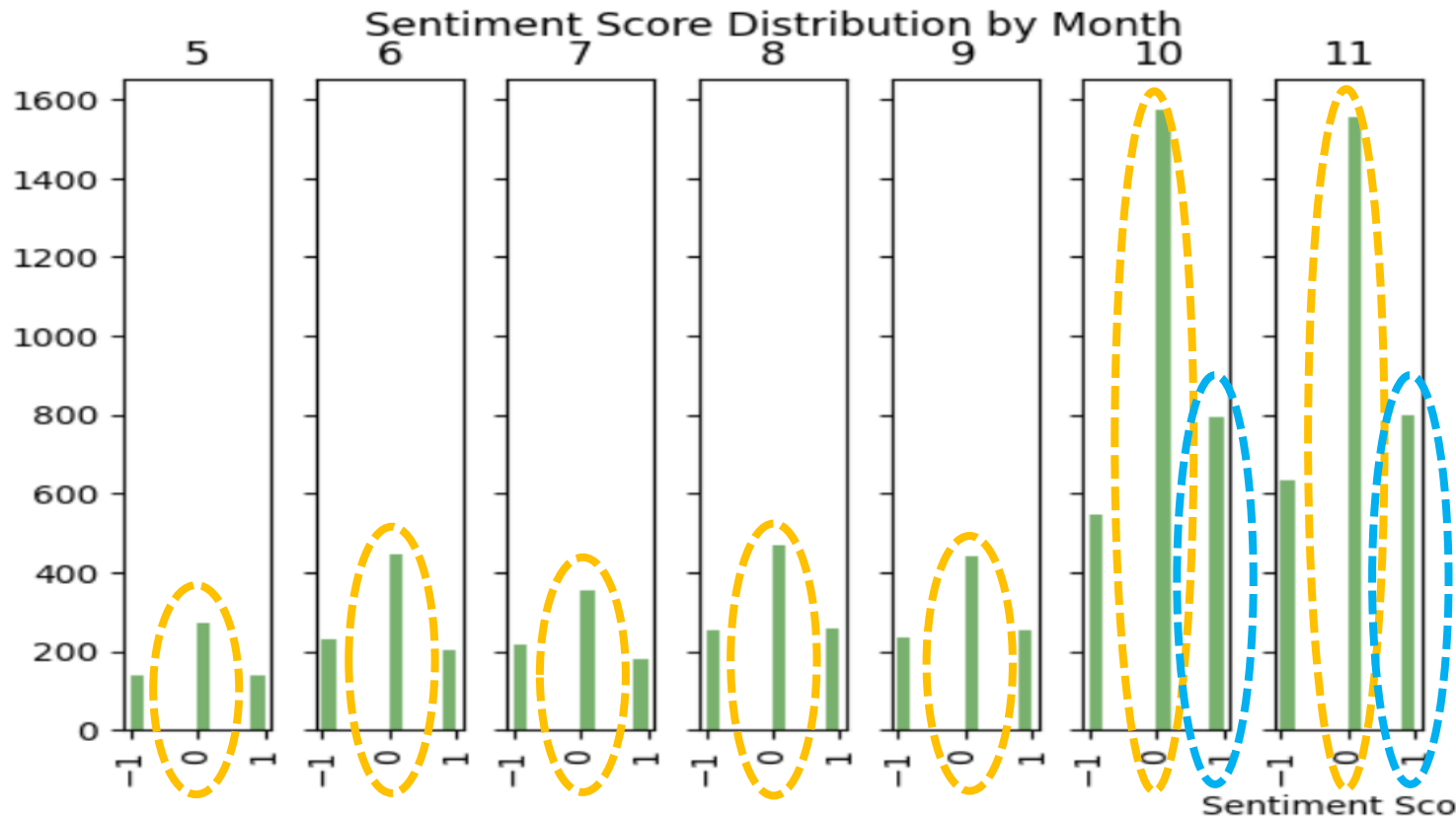
1) A n a l y z i n g A v e r a g e S e n t i m e n t S c o r e b y M o n t h

1) A n a l y z i n g A v e r a g e S e n t i m e n t S c o r e b y M o n t h
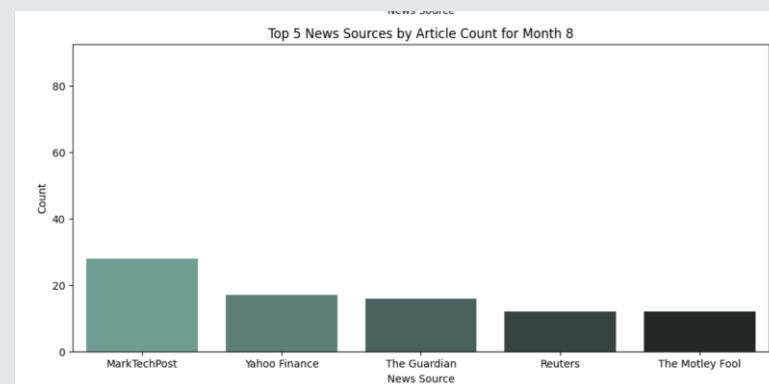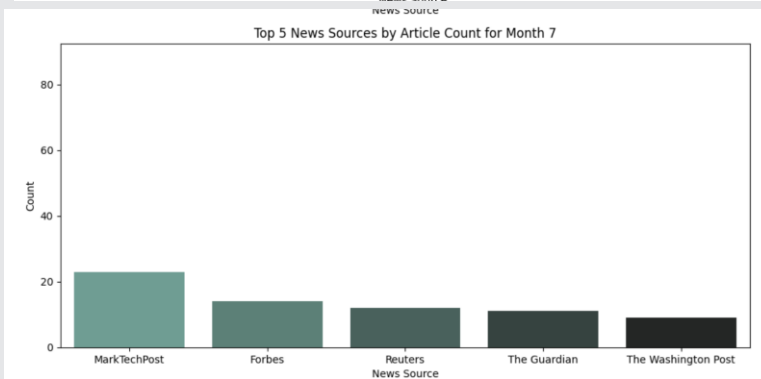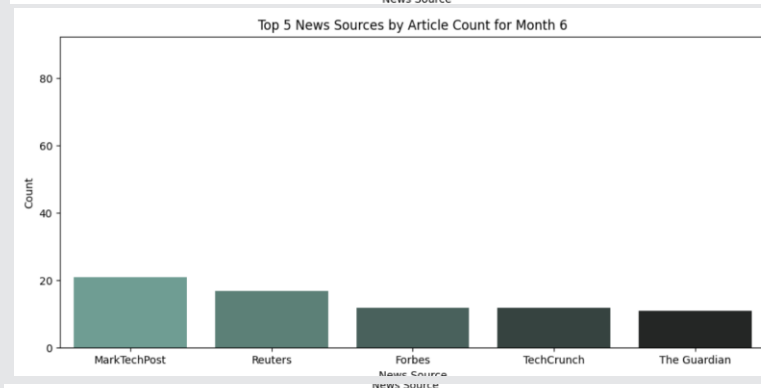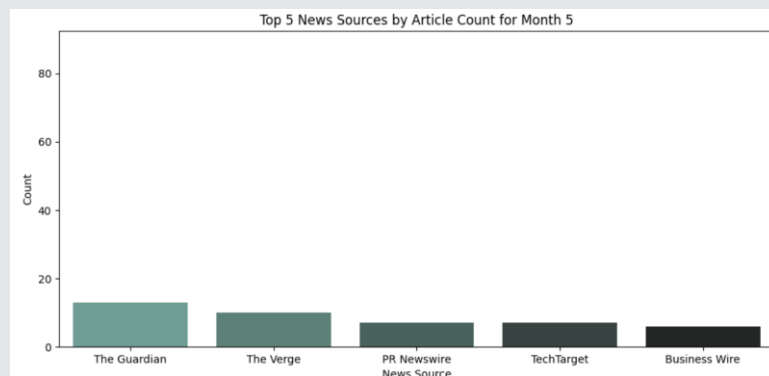

Sentiment Score Distribution by Month

As shown in the sentiment score distribution, the most dominant sentiment for all months is neutral. This is consistent with the analysis of average sentiment scores, which showed an increasing number of positive news titles as we moved into October and November

Thus, through sentiment analysis,
we have concluded that:

1. The overall impression of AI-related news titles is **predominantly** neutral
2. Over time, the general trend in AI-related news titles is shifting **towards** a more positive tone

To analyze the news titles in greater detail and to understand the nuances of public sentiment towards AI, we have begun emotion analysis

2)   M o n t h l y   D i s t r i b u t i o n   A n a l y s i s   b y   N e w   S o u r c e

Top 5 News Sources by Article Count for Month 5

Top 5 News Sources by Article Count for Month 6

Top 5 News Sources by Article Count for Month 7

Top 5 News Sources by Article Count for Month 8

Top 5 News Sources by Article Count for Month 9
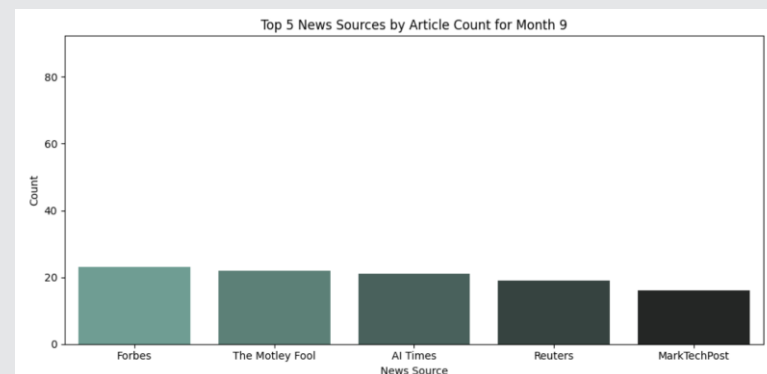
The analysis of sentiment distribution shows a trend that from May to September, neutral sentiment predominated, whereas in October and November, there was a shift towards **positivity**

To further explore the factors underlying the prevalence of neutral sentiment, we conducted an analysis of the news sources for each month, seeking to identify any influential contributing factors to the news releases

Interesting observation is that **'The Guardian'**, a progressive mainstream media outlet, and **'MarkTechPost'**, an AI-focused news platform, accounted for the majority of the news releases during periods of neutral sentiment dominance

This finding contrasts with our initial expectation that progressive and AI-based platforms would exhibit a more positive sentiment

Analysis & Interpretation

2) Monthly Distribution Analysis by New Source
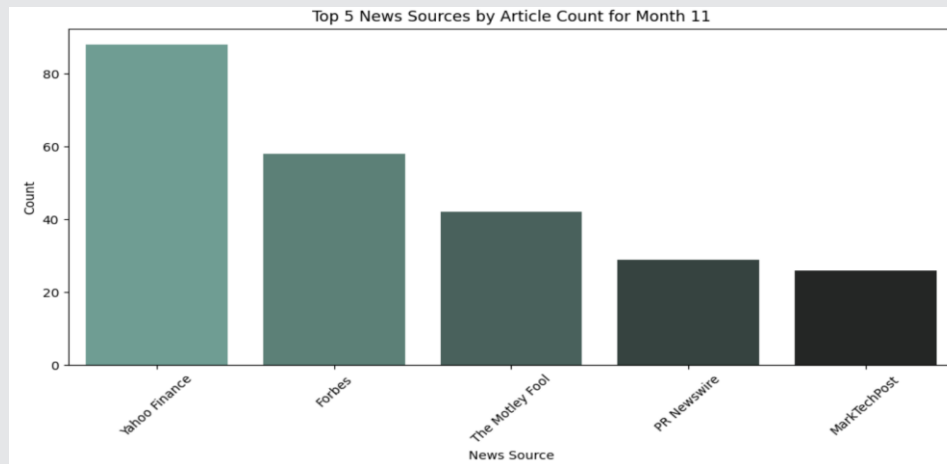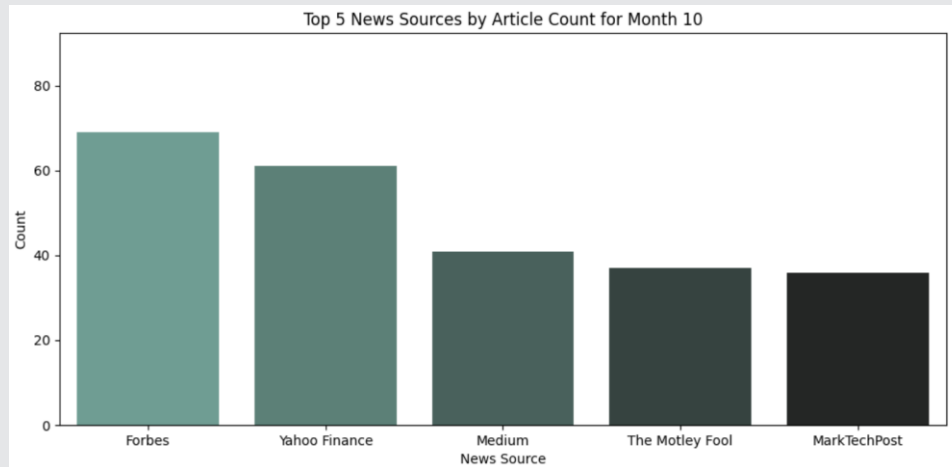
In contrast, during the months of September and October, where positive sentiment was even slightly prevalent, notable contributions to news releases came from finance platforms such as **Forbes** and **Yahoo Finance**

From this observation, we can infer that when viewing AI through the lens of science, neutral and impartial news titles are more prevalent. Additionally, when considering the application of AI in other industries, there appears to be a slight predominance of positive sentiment

Emotion Analysis

Figuring out the news title in dept level of Emotion;
1) Bart-large-mnli with Zero shot classification and Text Blob
2) Emotion-English-distilRoBERTa

1) Bart-large-mnli with Zero shot classification & Text Blob

We applied the Zero-shot classification to Bart-large-mnli model to determine the emotions in the headlines. The classification labels were set as Surprise, Fear, Neutral, and Happiness

The results revealed that **Surprise** **is predominant emotion** of the headlines among four emotions. Following that, Fear and Neutral appeared in a similar frequency, ranked as the second and third most common categories, respectively


Distribution of Sentiment Labels

Analysis & Interpretation
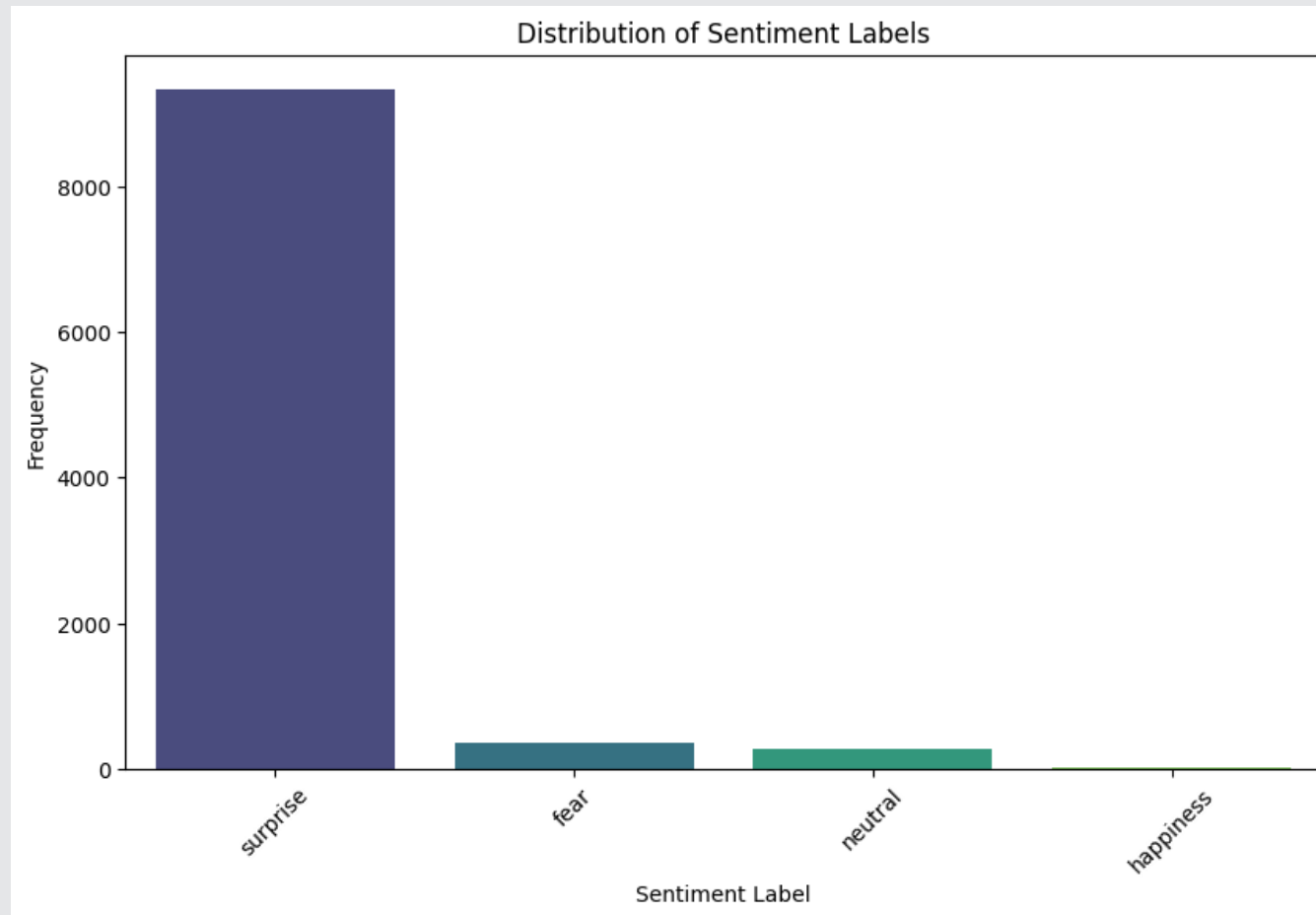
1) Bart-large-mnli with Zero shot classification & Text Blob

To further analyze the titles previously classified as expressing 'Surprise,' we isolated these specific titles and conducted a sentiment analysis to determine whether they were Negative, Neutral, or Positive

As the figure indicates, **'Neutral' is the most common sentiment** associated with 'Surprise.' The counts for Negative and Positive titles are similar, with Positive titles being slightly more numerous

Based on these results, we concluded that the Bart-large-mnli model indicates that the number of titles with **Negative** emotions overall is comparatively **low**
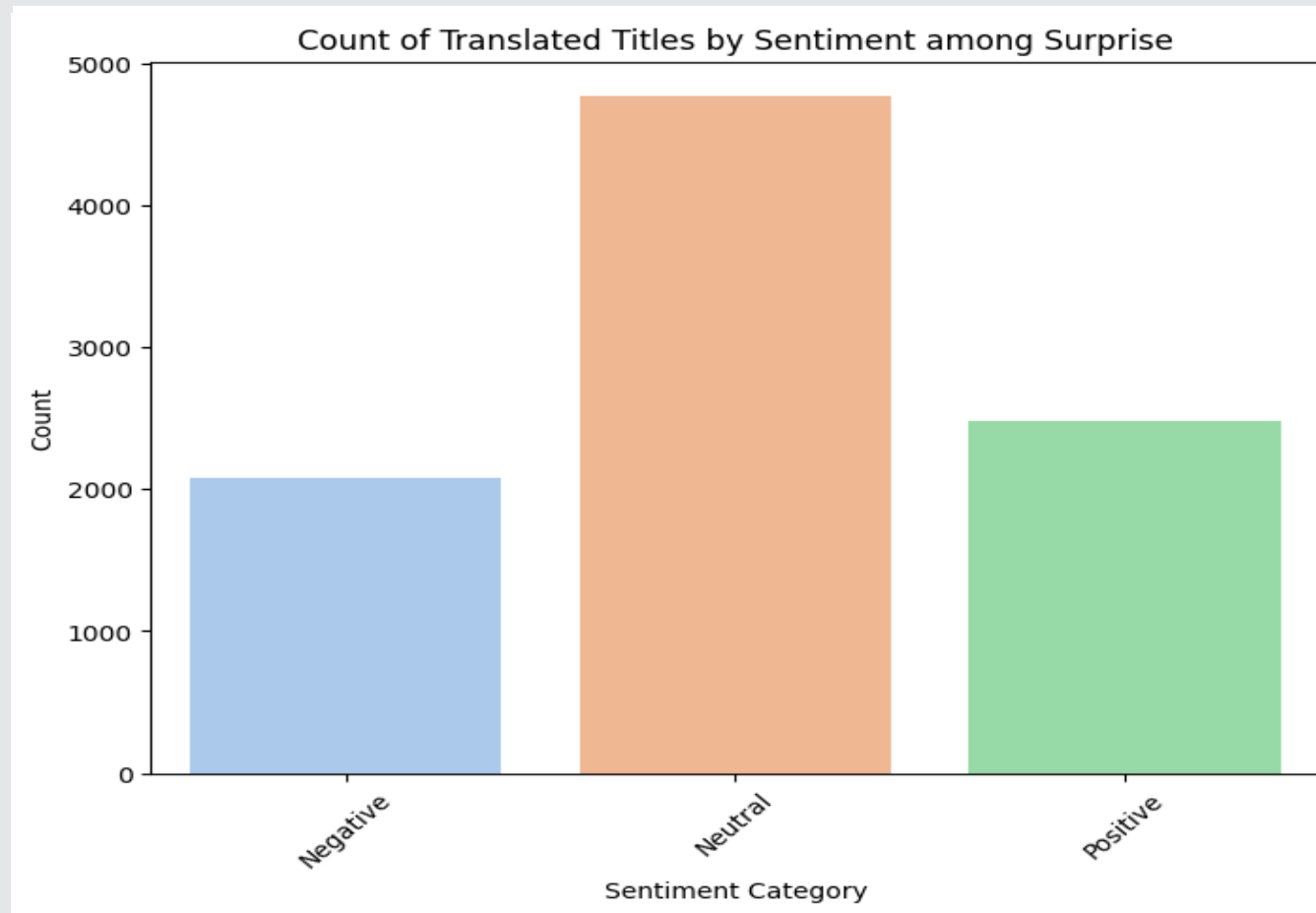

Count of Translated Titles by Sentiment among Surprise

Analysis & Interpretation

1) Bart-large-mnli with Zero shot classification & Text Blob

Type	Title Example
Full sentence title	Can artificial intelligence replace small talk?
Title that ends with '…'	Emotional AI will also help doctors…

We compared incomplete titles, those ending with '...', to those with complete sentences to ascertain if the lack of completion affected the model's output.

The analysis revealed a trend where titles not ending in a full sentence were more often categorized as neutral. Consequently, we decided to conduct further analysis using the 7309 headlines where the entire sentence was provided

Emotion Distribution Comparison
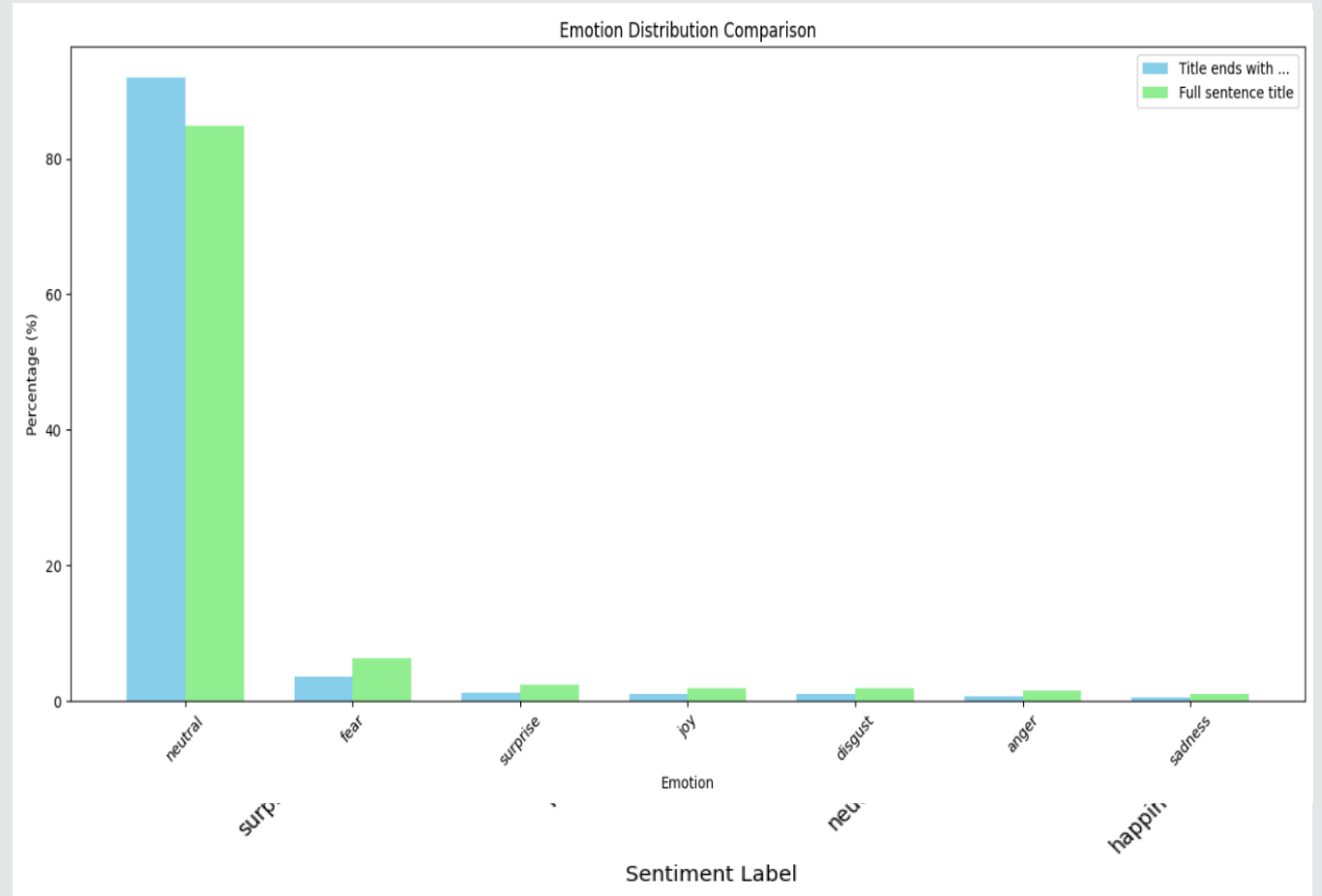
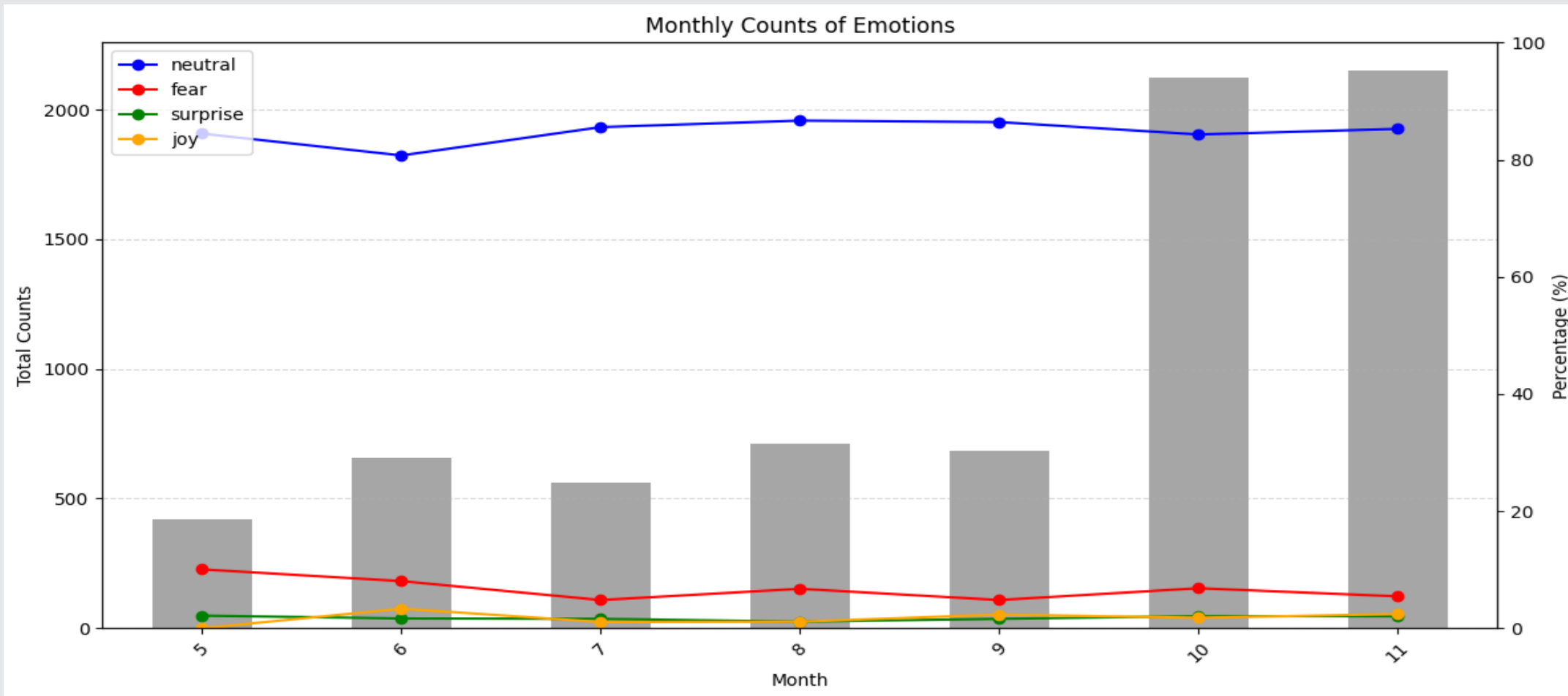**Analysis & Interpretation - Emotion Analysis**

2) Emotion-English-DistilRoBERTa-base Model

- **Neutral** accounts for more than **80%** in every month and Fear tends to decrease
- Surprise and joy are near 0%

Monthly Counts of Emotions

2) Emotion-English-DistilRoBERTa-base Model

● When focusing solely on the most frequently occurring emotions—**neutral, fear, and surprise**, we can see that majority of the articles are neutral toned, fear is 20~25%, and surprise is 15~20%

Monthly Counts of Emotions
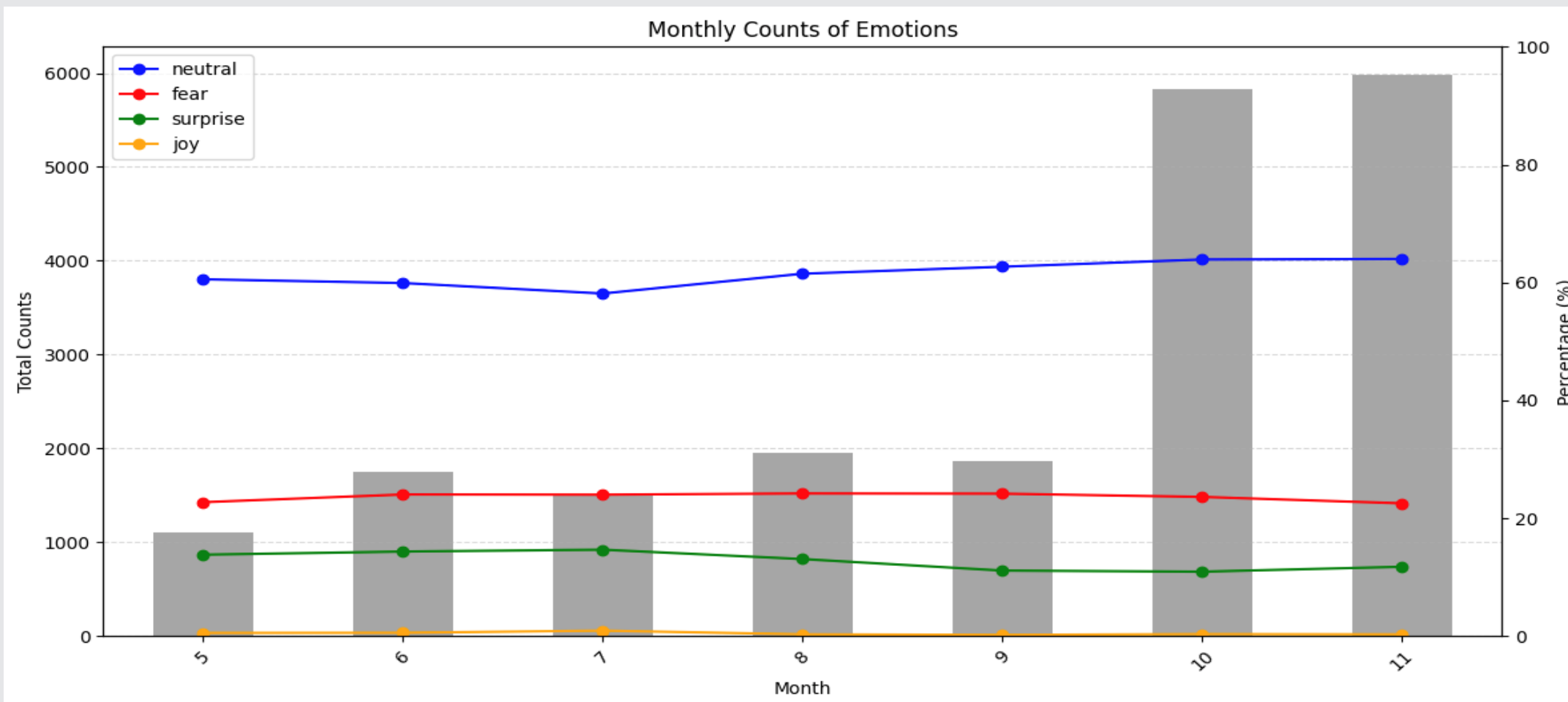
3) E m o t i o n - E n g l i s h - D i s t i l R o B E R T a - b a s e   M o d e l (w/ Human Scoring)

* Inherent assumption

    1) The perception of AI can evoke varied emotions across people depending on **personal background**

    2) The base model is generally known to yield favorable results

       Yet, it's also prone to **discrepancies from human perception**

* A sample of 385 headlines was chosen based on the Central Limit Theorem

$$n = \frac{Z^2 \times p \times (1-p)}{E^2}$$

- n = sample size
- Z = Z-score (1.96 for 95% confidence)
- p = estimated proportion (0.5 used for maximum sample size)
- E = margin of error (e.g., 0.05 for 5%)

1. Human scoring of two people.

2. Tokenizer max length: 512

3. Hyperparameter: learning rates = 5e-5, number of epoch = 8, batch size = 8

Analysis & Interpretation

3) Emotion-English-DistilRoBERTa-base Model (w/ Human Scoring)

- We aimed at enhancing emotion analysis from the previous model using a rigorous hyperparameter
- **Achieving high accuracy, F1 scores, precision, and recall proved challenging** due to the imbalanced emotion of the dataset
- After tuning the hyperparameters, we opted for a model with a learning rate of **'5e-5'**
  Although the performance metrics were similar across different parameters, the model with a learning rate of '5e-5' demonstrated a **lower validation loss compared to the others**

Metrics results (learning rate: 2e-5, epoch = 8, batch size=8)

```
{'anger': 0, 'fear': 1, 'joy': 2, 'neutral': 3, 'sadness': 4, 'surprise': 5, 'disgust': 6}
              precision    recall   f1-score    support

           0       0.00      0.00       0.00          1
           1       0.35      0.30       0.33         23
           3       0.45      0.44       0.44         41
           4       0.00      0.00       0.00          3
           5       0.08      0.11       0.09          9
```

Metrics results (learning rate: 5e-5, epoch = 8, batch size=8)

```
{'anger': 0, 'fear': 1, 'joy': 2, 'neutral': 3, 'sadness': 4, 'surprise': 5, 'disgust': 6}
              precision    recall   f1-score    support

           0       0.00      0.00       0.00          1
           1       0.30      0.26       0.28         23
           3       0.45      0.41       0.43         41
           4       0.00      0.00       0.00          3
           5       0.07      0.11       0.09          9
```

*** Notes***

- This outcome was not entirely **unexpected**

- We tried two different sets of human scoring from two individuals

- However, given the overlapping nature of emotions such as anger, fear, sadness, and disgust, it was quite **hard** to give **emotion scores** even for our team due to their subtle differences.

Part 4

CONCLUSION
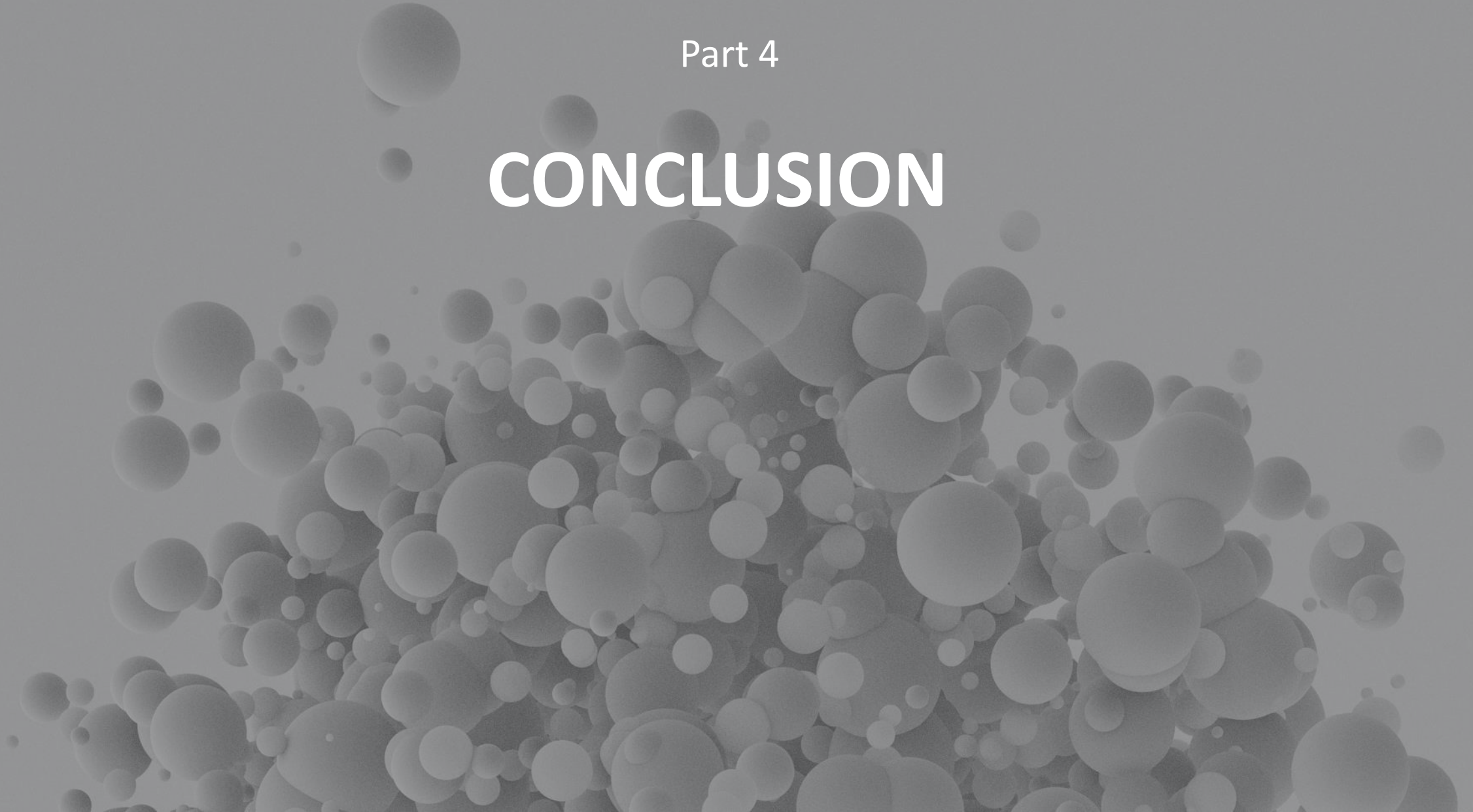
Conclusion - Key Takeaways

\<Key Takeaways and our Final Thoughts\>

From the model we used, we have found that,

- The sentiment of **'neutral' predominates**, accounting for 60-65% of the emotions

- Using the fine-tuned 'emotion-English-distilroberta-base' model, the proportion of fear detected was under **10%**.
  But after **tuning the hyperparameters, it went up to about 20%**.
  This suggests that **the way humans and machines understand fear in the development of AI is different**

- To the question **'Is the media spreading fear of AI?',** the answer seems to be **'Not Quite'.**
  We see that as the number of articles grows in October and November, the emotion of fear decreases or remains the same.

- To get a more complete picture, **we should also look at social media, YouTube, podcasts, and other forms of media**

- **Broader analysis across these platforms would provide a more accurate reflection of sentiment towards AI.**

Media's Portrayal of AI

Given the fact that headlines are generally neutral, focusing on AI advancements, but possibly leading to a more positive public perception, **it is important for media to also address the challenges associated with AI, including ethical concerns, potential job displacement, and privacy issues.**

Therefore, **our recommendation for media is to continue providing a balanced narrative that includes the benefits and challenges of AI to ensure a comprehensive public understanding.**
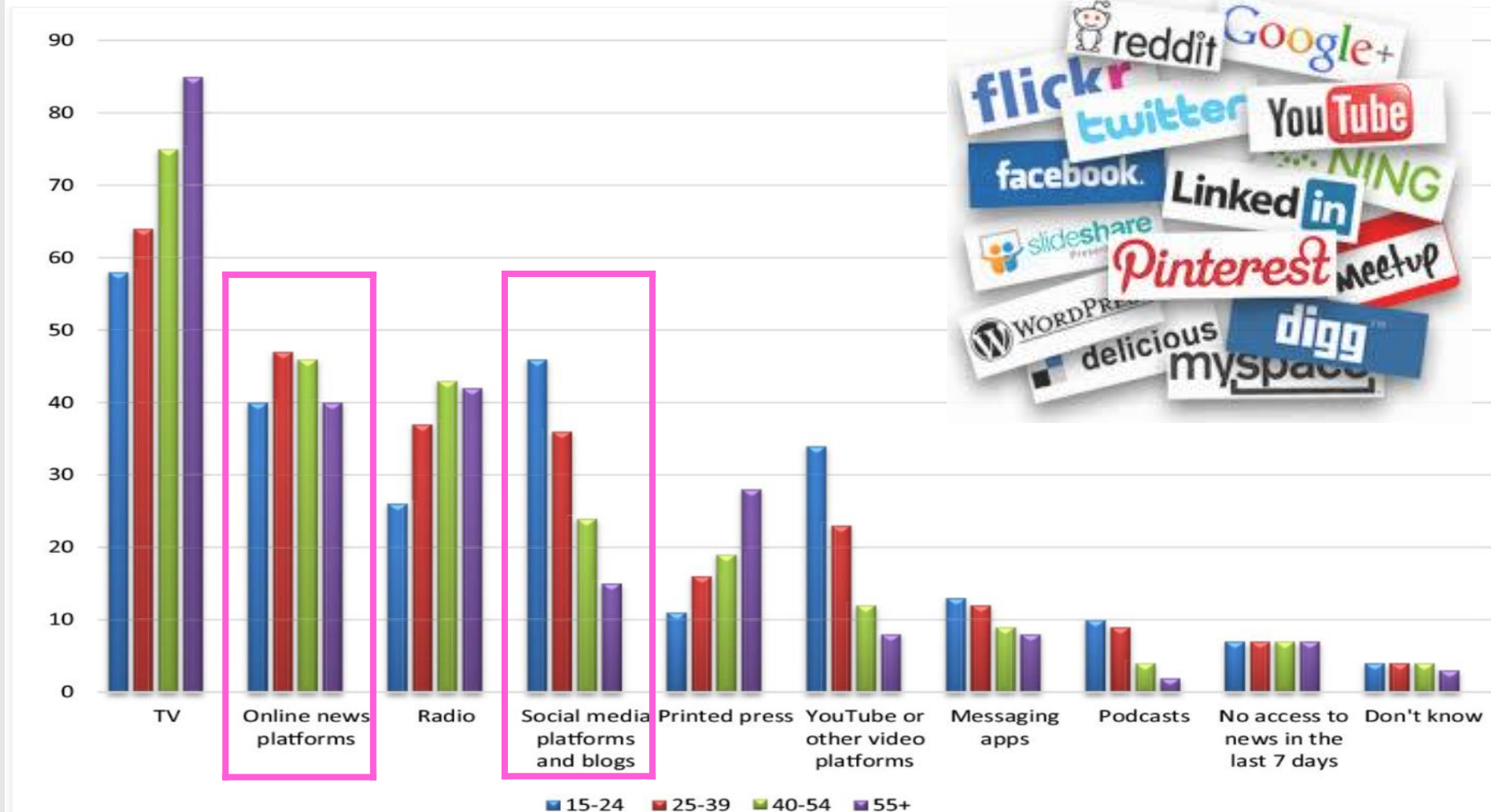
<Key Takeaways>

- The sentiment of **'Neutral' predominates**

- **'Fear' was detected under 10%** with a fine-tuned model and **went up to 20%** after human scoring and training

- So, Does The News Media Spread Fear of AI? Our team would say *"NOT QUITE"*

<Further Research>

Expand
the Datasets
with
Other platforms
of Media
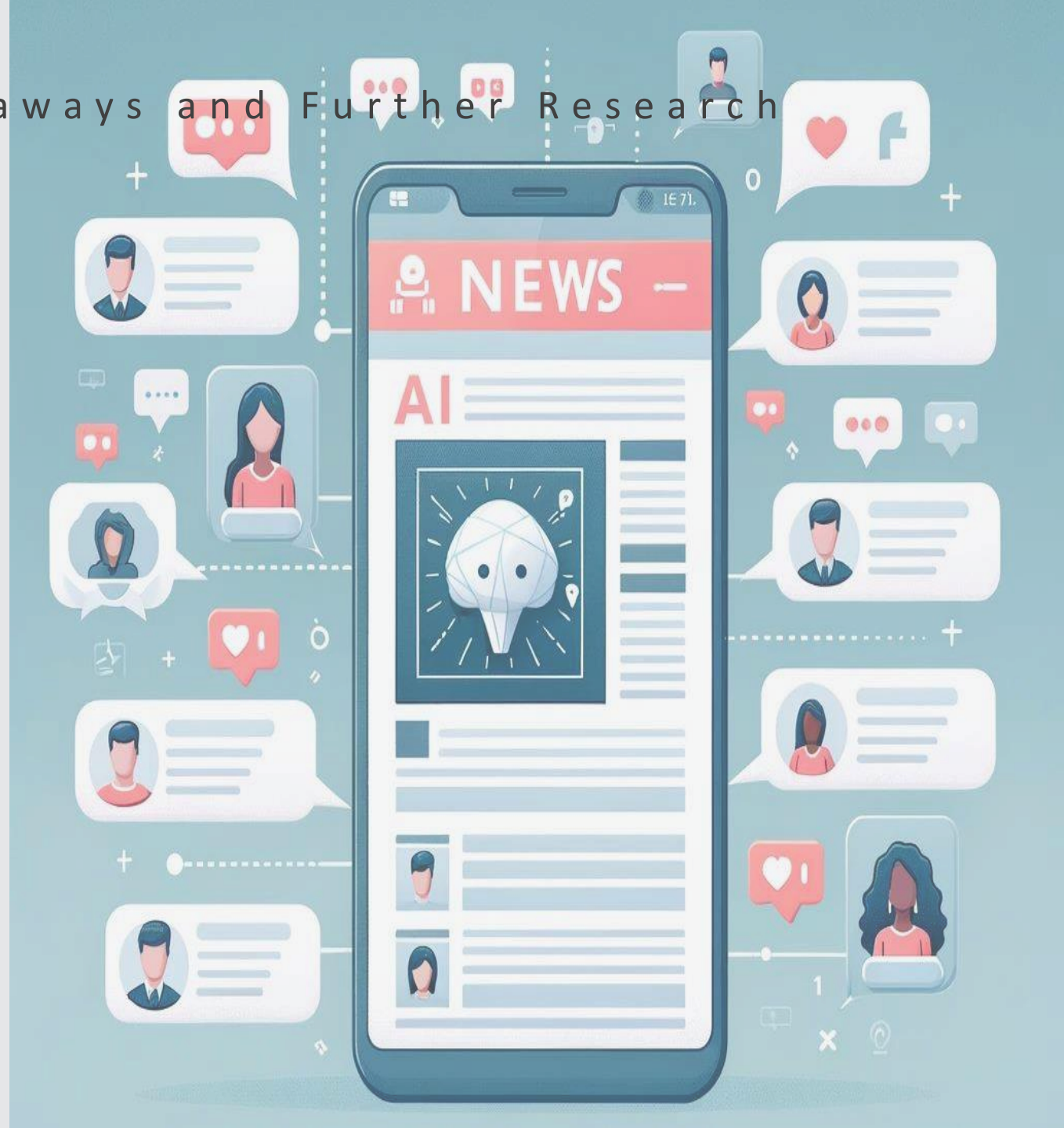
Most popular news sources by age in the EU27 (%)

Source: Eurobarometer (2022)

<Further Research>

Correlation of **comments**

and **headlines**

to figure out the reaction

of the public

<Recommendation>

We would like to recommend
Media to continue providing
a **balanced narrative** of AI

Q & A

THANK YOU