

# Project 2: How did the sentiment path of news articles about AI change as the tech layoffs progressed?

Econ 1680: Machine Learning, Text Analysis, and Economics

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## 1 Introduction

The fear that AI and automation would one day take over human jobs is nothing new, but it has become increasingly prevalent in the last couple of years, as developments in the field of machine learning and natural language processing have arguably made some white-collar work redundant (such as with the big rise of generative AI in 2023 (Lynch (2023))). Most job cuts that have been explicitly tied to AI have been in the tech sector, such as IBM's and Klarna's (Constantz (2024)). Simultaneously, the period in the aftermath of the pandemic has been a tumultuous time for the tech sector, with numerous layoffs happening going into 2023 and as the year progressed. Hence, it would be interesting to explore how the news coverage of AI has evolved over this particular time period, to see if public hysteria surrounding new technology could potentially be linked to very public job cuts.

This paper seeks to identify how the sentiment paths of news articles about AI have changed over the recent years, and how this has coincided with the timing of mass tech layoffs. Using transfer-learning methods and lexicon-based methods, to identify sentiment trends in news articles is not new (David Rozado (2022)), and this paper will borrow on that, but will use it to look at sentiment trends for articles about AI specifically. This paper also uses a dictionary-based approach to classify articles into two different topics (employment and ChatGPT-related) in order to show more segregated sentiment paths. All in all, this paper's main contributions will be in helping us better understand the trends in AI news coverage and technology news coverage as a whole, and how the sentiment of such coverage changes when certain economic developments or shocks occur.

## 2 Data Sources and Descriptions

To look at the coverage of news articles related to AI over recent years, I used the New York Times' API . This API allows users to search for titles, abstracts and leading paragraphs of articles relating to a certain keyword within a certain date frame. For every month in the years 2020-2023, I searched for the top 50 articles that were related to artificial intelligence. I received a total of 1370 articles, an average of 28-29 articles per month. An overview of

what the API returns can be found in Table 1. A disadvantage to using the API was that it only returns abstracts and leading paragraphs instead of the full body text, but this is still sufficient for the purposes of analyzing overall article sentiment, which should be captured in the abstract that summarizes each article.

In order to analyze trends for articles that related to employment as well as AI, I assembled a list of words related to employment (employment, jobs, job, occupation, work, trade, profession), and created a "mentions employment" dummy variable. Should the abstract contain any of these words, the dummy was set to 1. I utilized a similar method to analyze articles related to ChatGPT, where the dictionary was as follows: (chatgpt, gpt-3, Sam Altman, OpenAI, large language model).

In order to access data about tech layoffs, I used a Kaggle dataset that contains the details of tech layoffs up until 2024 that was put together by scraping layoffs.fyi. This database records each round of layoffs, keeping record of the date of the layoff, the company that laid off employees, and in some cases, the number of people affected by layoffs. Figure 1 shows the number of tech layoffs over time in recent years, whereas Figure 2 shows the number of NYT articles related to AI over time during the same period. As visible from these graphs, coverage of AI seems to have increased as the number of tech layoffs increased.

### 3 Method

In order to analyse the sentiment of these articles, I used the default pre-trained model for sentiment analysis developed by Huggingface (DistilBERT-base-uncased). This model was pre-trained and fine-tuned on the Stanford Sentiment Treebank corpora, and operates on a Transformer architecture, which is a type of deep learning model designed for processing sequential data, such as text. Specifically, it uses the DistilBERT architecture, which is a distilled version of the BERT model, making it computationally lighter while retaining much of its performance (Victor Sanh (2019)). The advantage of using transformer models is that they tend to be better at understanding relationships between words and phrases, as opposed to handling each article like a simple bag of words. In addition to classifying an article as either "positive" or "negative", this DistilBERT model also provides a sentiment score from 0-1, which indicates how strong the sentiment in either direction is. I multiplied this score by either 1 (if the article was labelled as positive) or -1 (negative) to get a final sentiment score between -1 to 1, where 0 is neutral.

### 4 Results

Figure 3 shows that the average sentiment score of NYT articles related to AI started to become more negative after the start of the layoffs, reaching a local minimum at the peak of layoffs, and continued being similarly negative even as the number of layoffs started to taper off. Figure 4 demonstrates that this trend could be driven by a disproportionate increase in the number of articles that have negative sentiment during this time.

One way to make sense of these trends is to take a deeper dive into what type of negative articles popped up during the peak layoff period. Table 2 shows a sample of these articles,

which shows that whilst some of these articles are directly about layoffs, others are about other aspects of tech companies or general developments in AI.

Besides looking at overall trends, I wanted to look at trends for articles of different topics within AI. I focused on two topics: employment and ChatGPT-related articles. I expected that focusing on articles that mentioned employment-related keywords would yield sentiment results that were more closely tied to the layoffs, whereas focusing on articles related to ChatGPT would yield sentiment results more closely tied to the increasing usage of ChatGPT (which also happened over the same time period). Figure 5 compares the sentiment path of articles related to employment against the path of articles unrelated to employment - we see that the average scores were more negative for articles that were employment-related, and that non employment-related articles only started becoming more negative towards the peak of the layoffs, whereas employment-related articles started becoming more negative on average earlier on. This could reflect that the intensity of layoffs gradually influenced the sentiment of articles surrounding AI even if they were not explicitly employment-related, but could also reflect another trend in AI that is resulting in a more negative sentiment over the same time period.

Figure 6 attempts to account for one of these other trends - the rise of ChatGPT and similar large language models, that occurred over the same time period. Overall, there were not many articles that covered ChatGPT or its related keywords specifically (only 89 articles across the time period sampled), but those that did tended to trend negatively in sentiment between the peak and the end of the tech layoffs. Removing these articles did not change the overall sentiment path from Figure 3 by much.

## 5 Conclusion

This paper sheds light on the evolving sentiment surrounding AI in news coverage, particularly in the context of tech layoffs, offering insights into how public perception of AI has been influenced by economic developments and technological advancements.

The sentiment analysis of New York Times articles related to AI indicates a noticeable shift towards negativity coinciding with the period of mass tech layoffs, suggesting a correlation between economic upheavals in the tech sector and public sentiment towards AI.

Furthermore, the differentiation between articles mentioning employment-related keywords and those focusing on ChatGPT-related topics provides additional nuance to the analysis. Employment-related articles exhibited a more pronounced negative sentiment earlier on, reflecting the direct impact of layoffs on public perception. ChatGPT-related articles, while fewer in number, also displayed a negative sentiment trend during the peak of layoffs, indicating potential broader concerns or skepticism regarding AI technologies that may or may not be related to the employment shocks.

It is important to note that these findings are purely descriptive and not necessarily causal, hence further work could include exploiting differences in the extent of tech layoff shocks to try to uncover causal effects on sentiment surrounding AI. It would also be good to replicate this study by using different sentiment analysis techniques, such as lexicon-based techniques or other pre-trained models, to validate the findings made in this paper. Finally, it would be interesting to consider classifying the articles into subtopics using a more robust

manner as opposed to a dictionary the author comes up with, or look into differences in trends between different types of articles (e.g. Op-Eds vs editorials vs newsdesk).

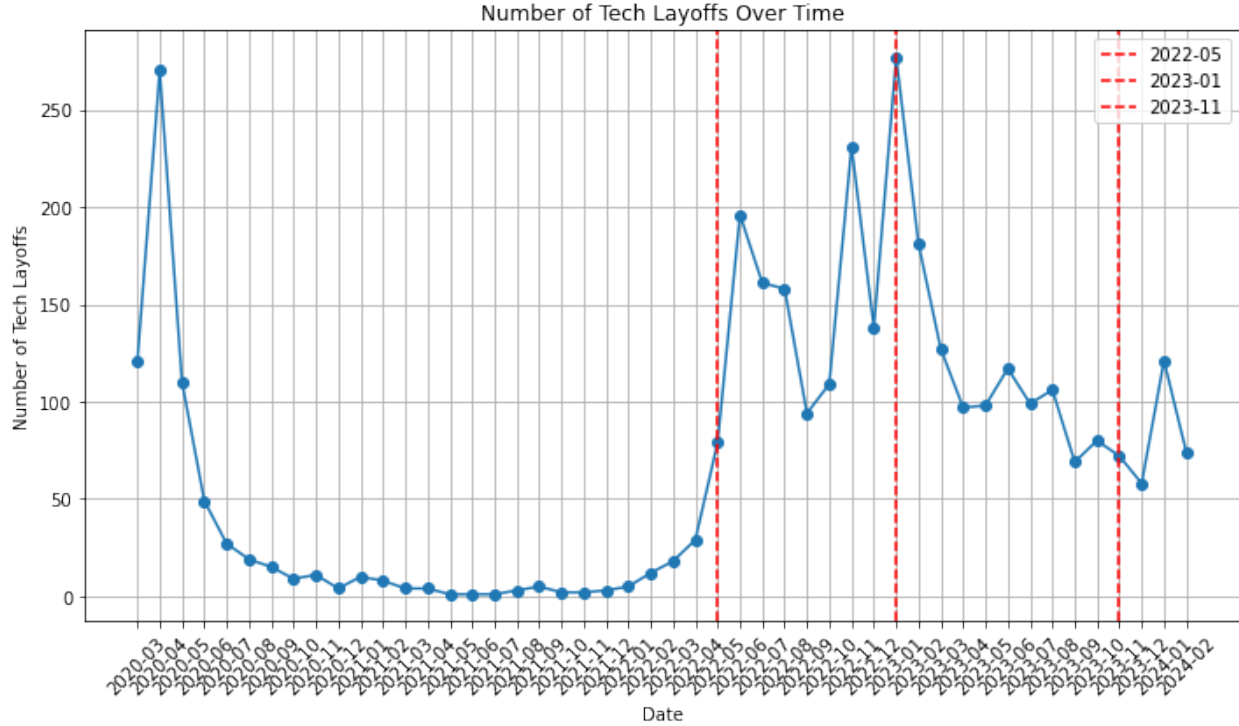
## References

- Constantz, Jo (2024) “AI Is Driving More Layoffs than Companies Want to Admit,” *BNN Bloomberg*.
- David Rozado, Jamin Halberstadt, Ruth Hughes (2022) “Longitudinal analysis of sentiment and emotion in news media headlines using automated labelling with Transformer language models,” *Plos One*.
- Lynch, Shana (2023) “13 Biggest AI Stories of 2023.”
- Victor Sanh, Julien Chaumond Thomas Wolf, Lysandre Debut (2019) “DistilBERT, a distilled version of BERT: smaller, faster, cheaper and lighter,” *NeurIPS*.

Table 1: Sample of Articles Retrieved by NYT API

Date	Title	Paragraph	Abstract
2022-11	What Riding in a Self-Driving Tesla Tells Us About the Future of Autonomy	We took a ride with Tesla’s experimental self-driving system. It was by turns intriguing, impressive and scary.	We took a ride with Tesla’s experimental self-driving system. It was by turns intriguing, impressive and scary.
2022-12	May I Speak to a Human, Please?	Breana Jones started investing in 2014, building up her retirement savings and putting aside money to buy a house...	Younger investors who are navigating market volatility and trying to save for retirement are finding that roboadvisers lack the personal touch
2023-03	How Siri, Alexa and Google Assistant Lost the A.I. Race	On a rainy Tuesday in San Francisco, Apple executives took the stage in a crowded auditorium to unveil the fifth-generation iPhone...	The virtual assistants had more than a decade to become indispensable. But they were hampered by clunky design and miscalculations, leaving room for chatbots to rise.

Figure 1: Number of Tech Layoffs Over Time

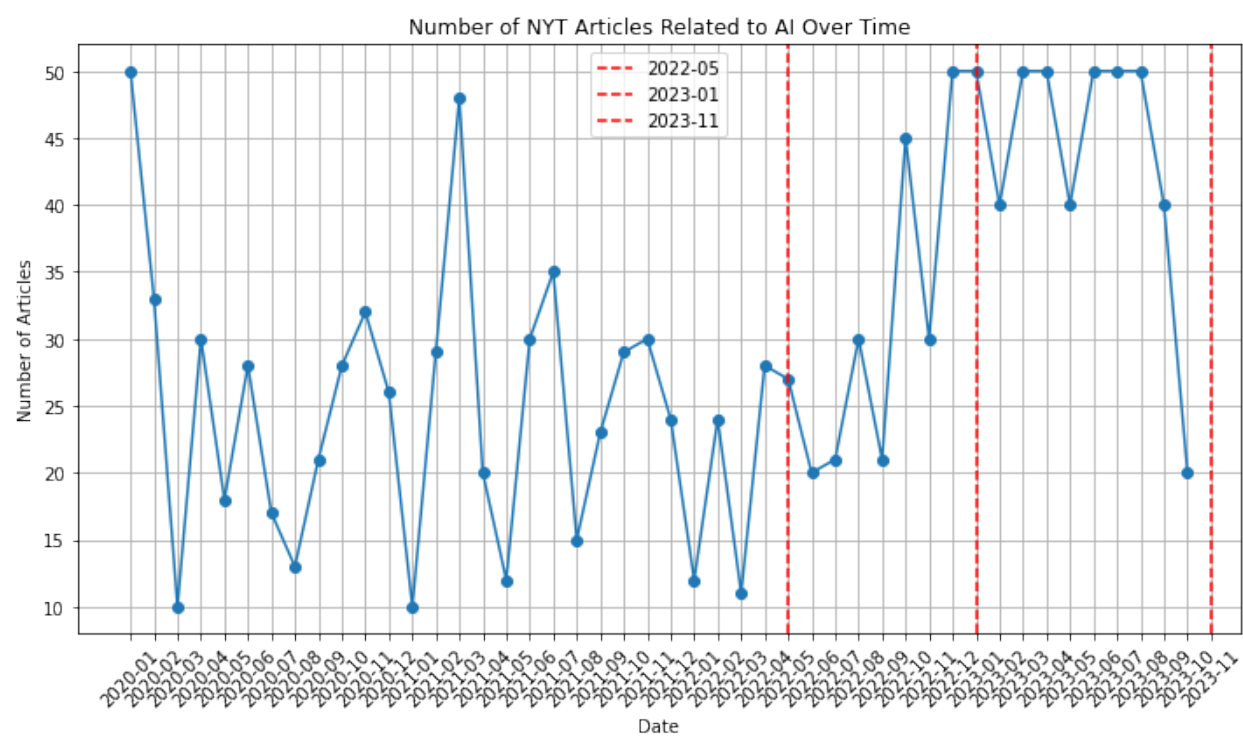


Note: A company-wide announcement of a layoff is counted as one layoff, regardless of the number of individuals impacted. The 3 dashed red lines correspond to the beginning, peak and tail end of tech layoffs

Table 2: Sample of Articles with Negative Sentiment During January 2023 - Peak Layoff Period

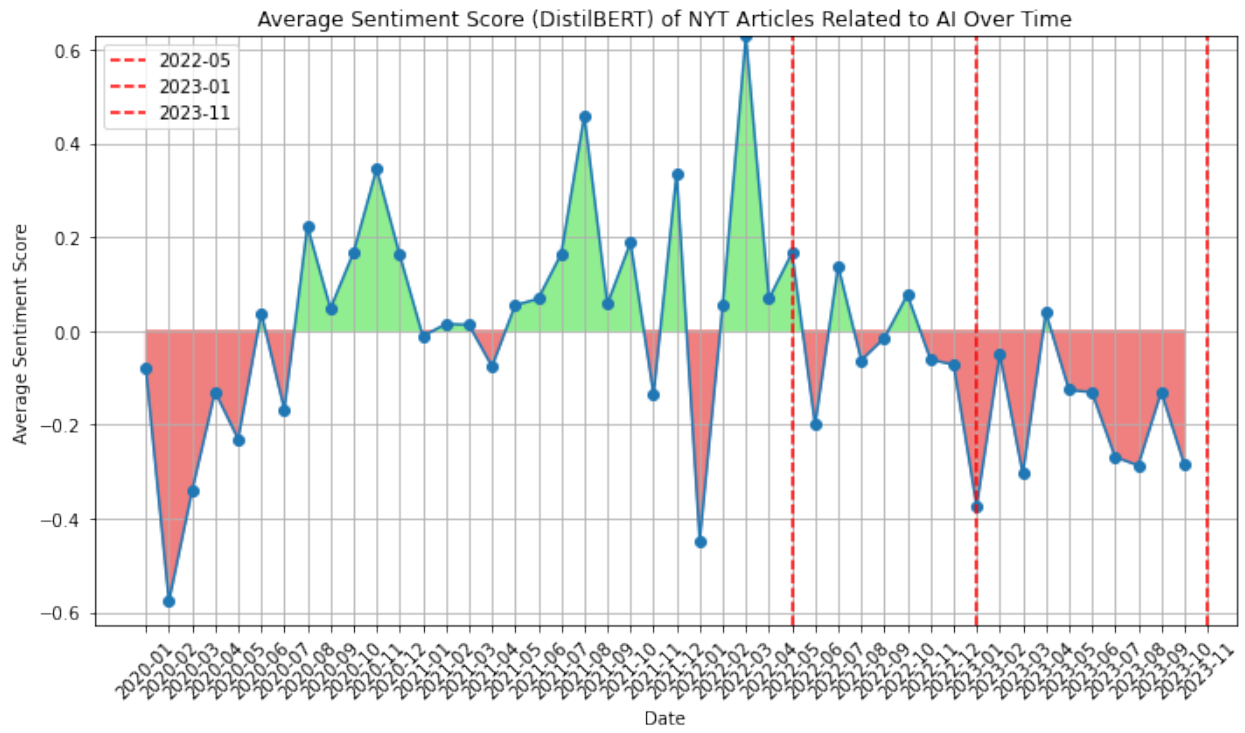
Date	Title	Paragraph	Abstract
2023-01	Why Netflix Is Changing the Guard	For 25 years, Reed Hastings was not only Netflix’s co-founder, but also its most visible cheerleader and advocate...	Reed Hastings’s move to become executive chairman may be a sign that the streaming giant thinks the worst may be behind it.
2023-01	Elon Musk’s Appetite for Destruction	Early on, the software had the regrettable habit of hitting police cruisers. No one knew why, though...	A wave of lawsuits argue that Tesla’s self-driving software is dangerously overhyped. What can its blind spots teach us about the company’s erratic C.E.O.?
2023-01	Microsoft Revenue Up 2 Percent, but Profit Drops 12 Percent	Microsoft on Tuesday reported its slowest growth in six years and cautioned that a broader slump ...	The company, which announced plans to lay off 10,000 workers last week, had warned that was facing a significant slowdown in the growth of its sales

Figure 2: Number of NYT Articles Related to AI Over Time



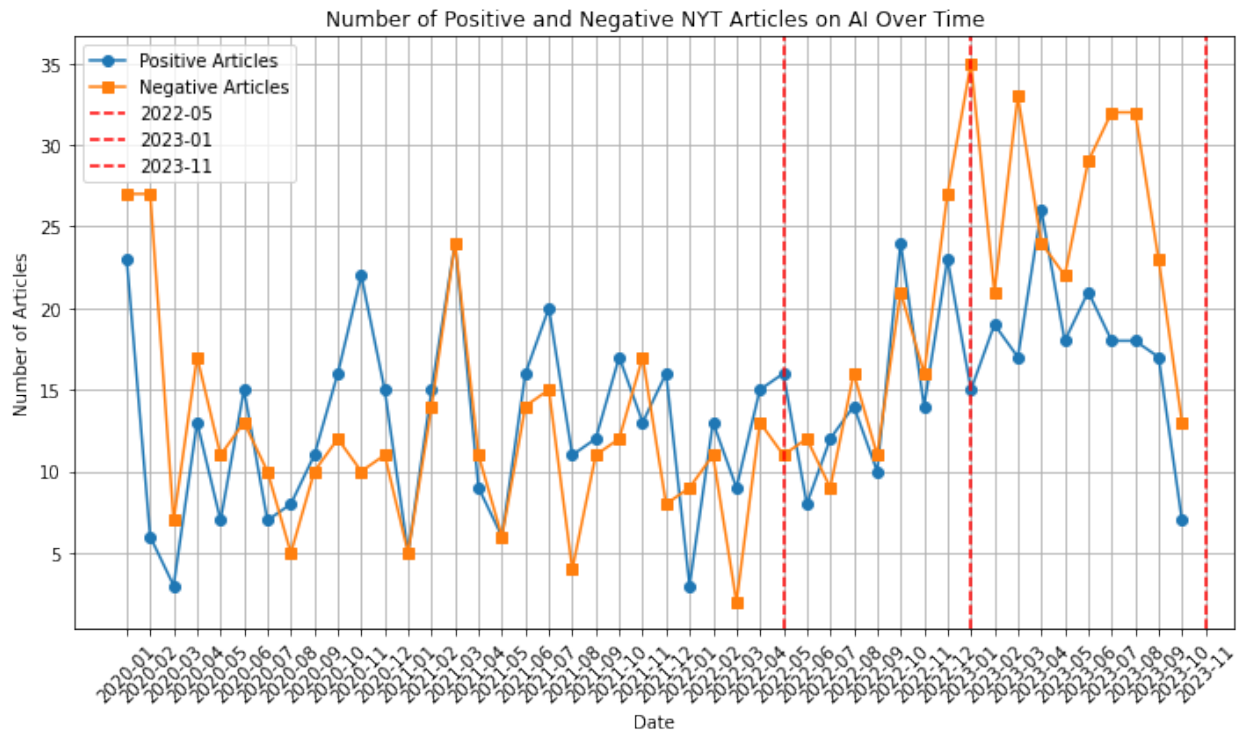
Note: The 3 dashed red lines correspond to the beginning, peak and tail end of tech layoffs

Figure 3: Average Sentiment Score of NYT Articles Related to AI Over Time



Note: The 3 dashed red lines correspond to the beginning, peak and tail end of tech layoffs

Figure 4: Number of Positive and Negative NYT Articles Related to AI Over Time



Note: The 3 dashed red lines correspond to the beginning, peak and tail end of tech layoffs

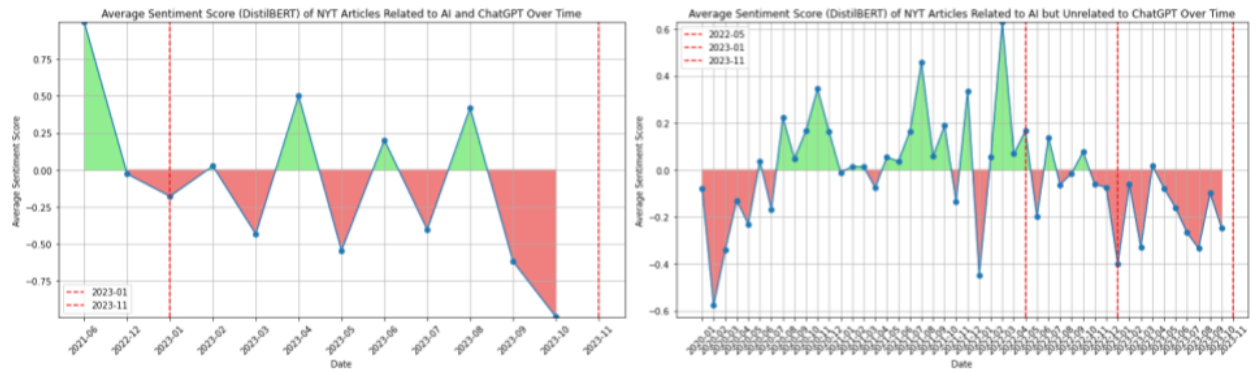


Figure 5: Number of NYT Articles Related to Employment and AI Over Time vs Number of NYT Articles Unrelated to Employment but Related to AI Over Time



Note: The 3 dashed red lines correspond to the beginning, peak and tail end of tech layoffs

Figure 6: Number of NYT Articles Related to ChatGPT and AI Over Time vs Number of NYT Articles Unrelated to ChatGPT but Related to AI Over Time



Note: The 3 dashed red lines correspond to the beginning, peak and tail end of tech layoffs