Are We in the AI-Generated Text World Already? Quantifying and Monitoring AIGT on Social Media

Zhen Sun[1*] Zongmin Zhang[1*] Xinyue Shen[2] Ziyi Zhang[1]

Yule Liu[1] Michael Backes[2] Yang Zhang[2] Xinlei He[1†]

[1] *The Hong Kong University of Science and Technology (Guangzhou)*

[2] *CISPA Helmholtz Center for Information Security*

Abstract

Social media platforms are experiencing a growing presence of AI-Generated Texts (AIGTs). However, the misuse of AIGTs could have profound implications for public opinion, such as spreading misinformation and manipulating narratives. Despite its importance, a systematic study to assess the prevalence of AIGTs on social media is still lacking. To address this gap, this paper aims to quantify, monitor, and analyze the AIGTs on online social media platforms. We first collect a dataset (*SM-D*) with around 2.4*M* posts from 3 major social media platforms: Medium, Quora, and Reddit. Then, we construct a diverse dataset (*AIGTBench*) to train and evaluate AIGT detectors. *AIGTBench* combines popular open-source datasets and our AIGT datasets generated from social media texts by 12 LLMs, serving as a benchmark for evaluating mainstream detectors. With this setup, we identify the best-performing detector (**OSM-Det**). We then apply **OSM-Det** to *SM-D* to track AIGTs over time and observe different trends of AI Attribution Rate (AAR) across social media platforms from January 2022 to October 2024. Specifically, Medium and Quora exhibit marked increases in AAR, rising from 1.77% to 37.03% and 2.06% to 38.95%, respectively. In contrast, Reddit shows slower growth, with AAR increasing from 1.31% to 2.45% over the same period. Our further analysis indicates that AIGTs differ from human-written texts across several dimensions, including linguistic patterns, topic distributions, engagement levels, and the follower distribution of authors. We envision our analysis and findings on AIGTs in social media can shed light on future research in this domain.

1 Introduction

The rapid development of Large Language Models (LLMs) has markedly enhanced the quality of AIGTs, enabling the use of models like GPT-3.5 [30] in daily life to produce high-quality texts, such as in academic writing [11], question-answering [18], and translation [48]. These AIGTs are often indistinguishable from Human-Written Texts (HWTs), presenting AIGT detection as a crucial yet challenging task for effective classification. On social media platforms, the use of LLMs to answer questions can contribute to the spread of misinformation [52]. Furthermore, AIGTs may be deliberately used for information manipulation or the dissemination of fake news, potentially resulting in serious societal impacts [13]. To better understand the prevalence of AIGTs on social media platforms, we aim to quantify and monitor its presence, addressing the question: **On social media, are we already interacting with AI-generated texts?**

Currently, numerous detectors have been developed to detect AIGTs. According to the MGTBench [14], these detectors are broadly divided into two categories: metric-based [9, 28] and model-based detectors [4, 16, 39], some of which have shown high accuracy and robustness. While these detectors have been applied in controlled settings, recent studies have explored their effectiveness in real-world scenarios. Hanley *et al.*[13] conduct AIGT detection on news website articles, with a primary focus on content generated by GPT-3.5 and others from Turing benchmark, which includes various pre-2022 models [46]. Furthermore, Liu *et al.*[24] carry out detection tests for ChatGPT-generated content on arXiv papers. However, they do not consider recent popular models, such as Llama [44] and GPT-4 [31], which also possess powerful text generation capabilities and are widely adopted. We thereby consider a broader range of models in our efforts to detect AIGTs on social media.

To quantify and monitor AIGTs on social media, we collect textual data across 3 popular platforms ranging from January 1, 2022, to October 31, 2024, as most LLMs are released after 2022. After data preprocessing, we obtain 1,170,821 posts from Medium, 245,131 answers from Quora, and 982,440 comments from Reddit. We name it as *SM-D*, short for Social Media Dataset.

[*] Equal contribution.

[†] Corresponding author (xinleihe@hkust-gz.edu.cn).

To identify the most effective detector, we construct a dataset named *AIGTBench*, which consists of public AIGT/Supervised-Finetuning (SFT) datasets and our own AIGT datasets generated from social media data. *AIGTBench* includes AIGTs generated by 12 different LLMs, such as GPT Series (GPT-3.5, GPT-4 and GPT4o-mini [32]), Llama Series (Llama-1, 2, 3 [7, 44, 45]), etc, totaling around 28.77*M* AIGT and 13.55*M* HWT samples. Building on *AIGTBench*, we benchmark AIGT detectors and leverage the best-performing detector as our primary detector for social media AIGT detection, which achieves an accuracy of 0.979 and an F1-score of 0.980 on *AIGTBench*. To better reflect its application in detecting content on online social media, we rename it as **OSM-Det** (Online Social Media Detector).

Based on **OSM-Det**, we quantify and monitor the texts across the 3 platforms and use the AI Attribution Rate (AAR) to represent the proportion of articles classified as AI-generated. We observe several noteworthy phenomena: (1) **A sharp rise in AI-generated content begins in December 2022, with distinct AAR trends emerging across platforms.** Before December 2022, the AAR across platforms remains stable. However, starting in December, Medium and Quora show significant surges, while Reddit shows only a slight increase. This suggests the widespread and diverse LLM adoption on social media; (2) **Linguistic analysis shows similar AAR trends and exhibits stylistic features in AIGTs/HWTs.** Based on the word-level analysis, we find that the usage trend of top-frequency AI-preferred words aligns closely with LLM adoption trends. With sentence-level analysis, we also reveal that AIGTs tend to be more objective and standardized, whereas HWTs are more flexible and informal; (3) **Technology-related topics drive higher AARs on Medium**. Topics like "Technology" and "Software Development" show the highest AARs, indicating that users with a strong technical background are more likely to adopt LLMs; (4) **Predicted HWTs receive more engagement than AIGTs.** On Medium, the content predicted by our **OSM-Det** as HWTs receives more average "Likes" and "Comments" than AIGTs. This suggests that users are more inclined to engage with HWTs; and (5) **Authors with fewer followers are more likely to produce AIGTs.** On Medium, users with no more than one thousand followers tend to produce content that has the highest mean AAR at 54.02%. In contrast, as the follower count increases, the AAR gradually shifts toward the lower range ($\leq$ 25.00%).

Our contributions are summarized as follows:

- We are the first to conduct a systematic study to quantify, monitor, and analyze AIGTs on social media. To achieve this, we collect a large-scale dataset *SM-D*, which includes around 2.4*M* posts from three platforms, spanning from January 2022 to October 2024.
- We construct *AIGTBench*, a dataset for benchmarking AIGT detectors. *AIGTBench* can be divided into two parts: one derived from open-source datasets and the other generated by 12 LLMs based on platform-specific characteristics. Leveraging *AIGTBench*, we identify the most effective AIGT detector, **OSM-Det**.
- Our research reveals a remarkable increase in AAR on social media after the widespread adoption of LLMs. Moreover, this trend varies markedly across different platforms.
- We conduct an in-depth analysis of the characteristics of AIGTs and HWTs through *linguistic analysis* and *multidimensional analysis of posts*, revealing differences in lexical patterns, topic distributions, engagement levels, and the follower distributions of authors. These analyses provide valuable insights for future research.

2 Related Work

The growth in model parameters and training data has recently empowered LLMs to demonstrate exceptional language processing capabilities and few-shot learning abilities [51]. Since then, LLMs have gradually gained popularity, like GPT-4 [31] and Llama [44], enabling users to generate high-quality texts effortlessly. Yet, LLMs have raised concerns about potential misuse, such as fake news generation [50], academic misconduct [47], and performance degradation of training LLMs using AI content [5], making the detection of AI-Generated texts (AIGTs, also known as machine-generated texts) increasingly important [8]. He *et al.*[14] introduce the first benchmark, MGTBench, for standardizing the evaluation of different LLMs and experimental setups within the AIGT detectors. They broadly categorize the detectors into two main types: metric-based and model-based detectors. Metric-based detectors use pre-defined metrics, such as log-likelihood values and rankings, to capture the characteristics of texts and identify AIGTs [9, 28, 41]. In contrast, model-based detectors rely on trained models to distinguish between AIGTs and HWTs [4, 10, 12, 16, 20, 24, 39]. For more introduction, refer to Appendix B.

Based on these AIGT detectors, some researchers have applied them to text detection in real-world scenarios. Hanley *et al.*[13] train a detector using data generated by the ChatGPT and Turing benchmark model and conduct detection tests on multiple news websites. Their study reveals that, from January 1, 2022, to May 1, 2023, the proportion of synthetic articles increased on news sites. Liu *et al.*[24] also conduct detection tests on arXiv and find a significant rise in the proportion of papers using ChatGPT-generated content, reaching 26.1% by December 2023. In contrast to their detection targets, we focus on detecting AIGTs on social media platforms and covering a broader range of LLMs.

Macko *et al.*[25] construct a multilingual dataset based on instant messaging and social interaction platforms such as Telegram, Discord, and WhatsApp, using it to compare the performance of existing detectors. In contrast, our research focuses on providing an in-depth temporal analysis of AIGTs on content-driven social platforms like Medium, Quora, and Reddit.

3 Data Collection

In this section, we elaborate on the data collection process, which primarily includes two datasets: the social media dataset (*SM-D*) and the detector training dataset (*AIGTBench*).

3.1 *SM-D* (Social Media Dataset)

Dataset	# Posts	# Filtered Posts	Time Range
Medium	1,416,208	1,170,821	January 1, 2022-October 31, 2024
Quora	445,864	245,131	January 1, 2022-October 31, 2024
Reddit	1,019,261	982,440	January 1, 2022-July 31, 2024

Table 1: Overview of the Medium, Quora, and Rediit datasets.

Unlike previous research, we focus on social media platforms, including Medium, Quora, and Reddit, emphasizing content creation, sharing, and discussion. The introduction of platforms is in Appendix C. These platforms stand out for hosting longer, more detailed posts where users emphasize the depth and quality of the information they share. As shown in Table 1, we collect data from these social media platforms from January 1, 2022 to October 31, 2024. We consider this part as our social media dataset for analysis.

For each platform, the detection targets are determined based on their distinct characteristics. On Medium, a blog hosting platform, we extract both the titles and contents of articles, treating the entire article as the detection target. On Quora, a question-and-answer platform, we select the corresponding answers to questions as the detection target. Similarly, on Reddit, which is known for its user-driven discussions, we also choose the response content as the detection target. Furthermore, we apply data filtering with the rules described in Appendix E.

3.2 *AIGTBench* (Detector Training Dataset)

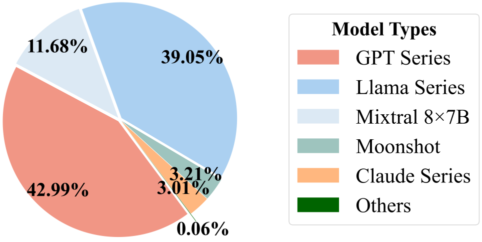


Figure 1: Proportion of total sentences various LLMs, with "Others" including Alpaca 7B and Vicuna 13B.

To train the AIGT detectors, we consider two parts of the data. First, we consider 6 publicly available AIGT datasets and 5 common SFT datasets to form the training dataset (see Tables A1 and A2 for dataset statistics and Appendix D for more details). Second, to increase the detector's generalization capabilities on social media, we additionally collect data from the 3 social media platforms ranging from January 1, 2018, to December 31, 2021. We classify this data as HWTs, given that most LLMs had not been published during this period. We also design different LLMs writing tasks to generate AIGTs that align with the characteristics of platforms (Table A3 describes the statistics details).

For Medium, which is primarily used for sharing articles and blogs, the core tasks are centered on writing. We design two LLM writing tasks: (1) polish articles to create polished versions; (2) based on the article's title and summary, directing the LLM to generate complete article content, thereby simulating a writing scenario. For Quora and Reddit, which mainly focus on question answering and user interaction, we design two tasks: (1) polish texts like Medium and (2) query LLM directly answer questions, simulating a user interaction scenario. Detailed prompts are provided in Appendix F.

Overall, the datasets used for training our detector and the distribution of LLM series are shown in Figure 1. This dataset includes 12 different LLMs, with a detailed introduction provided in Appendix A. Within these datasets, the two most prevalent model series are the GPT Series, which accounts for 42.99%, and the Llama series, which represents 39.05%. GPT Series is the most widely used proprietary model and has played a pivotal role in the evolution of generative AI. As of January 2023, approximately 13M users interact daily with GPT-3.5 [49]. The Llama series models also have significant influences, as the report indicates that downloads of Llama models on the Hugging Face platform have nearly reached around 350M [27]. Therefore, these two model series are the primary focus of our dataset. During the data generation process, we notice that certain samples contain textual noise, like irrelevant or redundant information. To maintain data quality, we implement some data processing strategies (see Appendix E for details).

4 Experimental Settings

4.1 Datasets

As mentioned in Section 3, we collect the social media dataset (*SM-D*) and the detector training dataset (*AIGTBench*). *SM-D* refers to the social media dataset that we conduct the quantification, with more details provided in Section 3.1. *AIGTBench* is the benchmark dataset for AIGT detectors, which includes samples generated by 12 different LLMs, as described in Section 3.2. We randomly divide *AIGTBench* into training, validation, and test sets in a 7 : 1 : 2 ratio. Specifically, the distribution of tokens across the texts in the training set is shown in Figure A1, and the validation and test sets maintain a consistent token distribution with the training set.

4.2 AIGT Detectors

Following the experimental setup of MGTBench [14], we evaluate 14 detectors. For metric-based detectors, we consider LogLikelihood, Rank, LogRank, Entropy, GLTR, LRR, DetectGPT, and NPR [9, 28, 39]. We choose the GPT-2 medium [34] as the base model, given its good detection performance at limited computational costs.

During the detection process, we initially use the GPT-2 medium to extract multiple metrics, including log-likelihood and log-rank. Based on these extracted metrics, we train logistic regression models to enhance the accuracy of predictions.

For the model-based detectors, we consider both pre-trained detectors and fine-tuned models with the *AIGTBench*, that is, OpenAI Detector [39], ChatGPT Detector [12], ConDA [4], GPTZero [10], CheckGPT [24], and LM-D [16]. Specifically, for the OpenAI Detector and ChatGPT Detector, we consider their pre-trained version and select the RoBERTa-base model as it demonstrates stable performance across multiple detection tasks and typically provides better detection results. For ConDA and LM-D, we choose the Longformer-base-4096 model as the base model and fine-tune it with the *AIGTBench*. For GPTZero, we directly use its commercial API. For CheckGPT, we retrain the original training framework [24].

4.3 Evaluation Metrics

To evaluate the performance of different detectors, we use accuracy and F1-score as the evaluation metrics, which are common standards in AIGT detection tasks. Besides, we introduce two new metrics **AI Attribution Rate** (AAR) and **False Positive Rate** (FPR) for social media text detection. The AAR indicates the proportion of texts that the model predicts as AI-generated, while the FPR measures the proportion of HWTs that are mistakenly identified as AIGTs.

To evaluate word usage, we calculate the term frequency and divide it by the total number of documents, obtaining the **normalized term frequency** (NTF), which represents the relative occurrence of the word in the document d, as follows:

$$\mathrm{NTF}(t,d) = \frac{f_{t,d}}{N \cdot \sum_{t' \in d} f_{t',d}}, \qquad (1)$$

where $f_{t,d}$ denotes the frequency of word t in document d. The $\sum_{t' \in d} f_{t',d}$ accounts for all words present in d. The N represents the total number of occurrences of the word across all documents.

5 Evaluation

5.1 Benchmarking Detectors

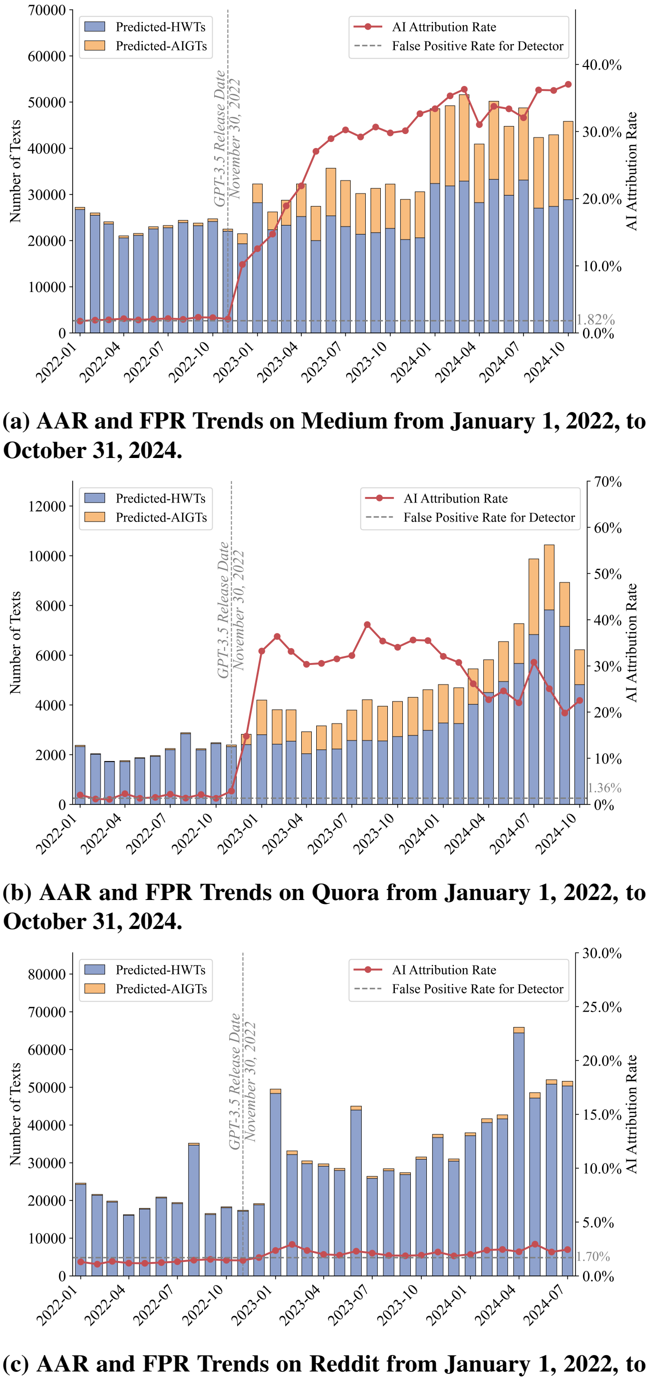
This section compares different AIGT detectors on the test set of the *AIGTBench*. Illustrated in Table 2, the metric-based detectors perform poorly. The F1-scores for Log-Likelihood, Rank, Log-Rank, and Entropy are 0.754, 0.730, 0.741, and 0.697, respectively. These low scores indicate that metric-based detectors face limitations in handling complex, multi-source datasets and struggle to capture subtle textual features effectively.

Regarding model-based detectors, we observe that both OpenAI Detector and ChatGPT Detector perform worse than some metric-based detectors. Specifically, OpenAI Detector has an F1-score of only 0.484, with relatively low accuracy. This underperformance may be due to the detector being fine-tuned using GPT-2 output, which struggles to adapt to more complex data generated by modern LLMs, such as the Llama and Claude Series.

Notably, LM-D and ConDA outperform the others in both accuracy and F1-score. ConDA achieves an accuracy of 0.972, while the LM-D performs even better, with an accuracy of 0.979 and an F1-score of 0.980, making it the most effective detector. Based on these benchmark results, we consider LM-D as the most effective detection method and name LM-D fine-tuned on *AIGTBench* as **OSM-Det**, which is subsequently used to quantify and monitor the AAR in social media dataset (*SM-D*).

5.2 Evaluation on Social Media Platforms

As shown in Table 3, **OSM-Det** achieves False Positive Rates (FPR) of 1.82%, 1.36%, and 1.70% on Medium, Quora, and Reddit, respectively, while achieving a benchmark F1-score of 0.980 (see Table 2). These results highlight **OSM-Det**'s low misclassification rate and high overall accuracy, making it a reliable choice for quantifying and monitoring AIGTs on social media.



(a) AAR and FPR Trends on Medium from January 1, 2022, to October 31, 2024.

(b) AAR and FPR Trends on Quora from January 1, 2022, to October 31, 2024.

(c) AAR and FPR Trends on Reddit from January 1, 2022, to July 31, 2024.

Figure 2: Comparison of AAR and FPR across Medium, Quora, and Reddit over different time periods.

Evaluation on Medium. Figure 2a illustrates the trend of

	Metric-based								Model-based					
	Log-Likelihood	Rank	Log-Rank	Entropy	GLTR	LRR	DetectGPT	NPR	OpenAI Detector	ChatGPT Detector	ConDA	GPTZero	CheckGPT	LM-D
Accuracy	0.730	0.618	0.713	0.650	0.704	0.680	0.686	0.658	0.615	0.686	0.972	0.933	0.966	**0.979**
F1-score	0.754	0.730	0.741	0.697	0.733	0.660	0.659	0.639	0.484	0.602	0.973	0.930	0.966	**0.980**

Table 2: Performance of detectors on *AIGTBench*.

Platform	# text (Human)	FPR
Medium	116,303	1.82%
Quora	101,145	1.36%
Reddit	53,321	1.70%

Table 3: FPR of OSM-Det on social media platforms.

AAR on Medium from January 2022 to October 2024. From January 2022 to November 2022, the AAR remains stable, fluctuating around 1.82%. This suggests that, before the widespread adoption of GPT-3.5, creators mainly rely on original content with minimal dependency on LLM-generated content. However, starting in December 2022, coinciding with the launch of GPT-3.5, the AAR begin to rise rapidly. Between December 2022 and July 2023, the AAR surges from 10.20% to 30.24%, reflecting how the popularization of LLM technology significantly lowers the barriers of content generation, prompting Medium's creator community to widely adopt LLM-assisted content creation. From August 2023 to July 2024, the AAR experiences slower growth, ranging between 29.20% and 36.29%, with fluctuations stabilizing between 30.12% and 33.75%. This indicates that AIGTs have gradually become an integral part of the platform's creative ecosystem, serving as a critical component of content production. From August 2024 to October 2024, the AAR further increased to 37.03%, reaching a new peak. This likely reflects the growing acceptance and reliance on LLM-assisted creation among content creators to enhance writing efficiency and quality.

Overall, from December 2022 to October 2024, the AAR on Medium has shown a continuous upward trend, underscoring the significant impact of LLM technology on content creation.

Evaluation on Quora. Figure 2b displays the trend of AAR on Quora. We observe that from January 2022 to October 2022, the AAR fluctuates but remains relatively low. After the release of GPT-3.5 in November 2022, the AAR slightly increases to 2.87%. Subsequently, starting in December 2022, the AAR markedly rises to 15.12% and shows a clear upward trend in AIGTs, reaching a peak of 38.95% in August 2023. From September 2023 to the first half of 2024, although the AAR remains high, it declines from the peak in early 2023 and gradually stabilizes between 22.03% – 30.79% throughout 2024. This indicates that the behavior of Quora users in generating AI content is becoming more stable. From June 2024, the AAR gradually decreases and reaches a low near 19.79% between September and October 2024. The increase in AAR may be attributed to Quora's launch of its LLM platform, Poe, in 2023 [1], which initially led to a rise in AI-generated content. However, as many Quora users found Poe's capabilities insufficient to meet their daily needs, the AAR likely declined following this initial surge, eventually stabilizing.

Evaluation on Reddit. Figure 2c shows the quantification analysis on Reddit from January 2022 to July 2024. From January to November 2022, we observe that the AAR remains below the FPR, fluctuating around 1.30%, indicating that there is almost no AI-generated content on Reddit during this period. Following the release of GPT-3.5, the AAR begins to rise slightly, reaching 2.36% in January 2023 and further increases to 2.93% in February 2023. From March 2023 to July 2024, the AAR stabilizes at a low level, within the range of 1.86% – 2.95%.

Briefly, similar to Medium and Quora, AAR on Reddit shows an upward trend following the release of GPT-3.5, but it consistently maintains a lower level, indicating a lower dependency on LLMs among Reddit users.

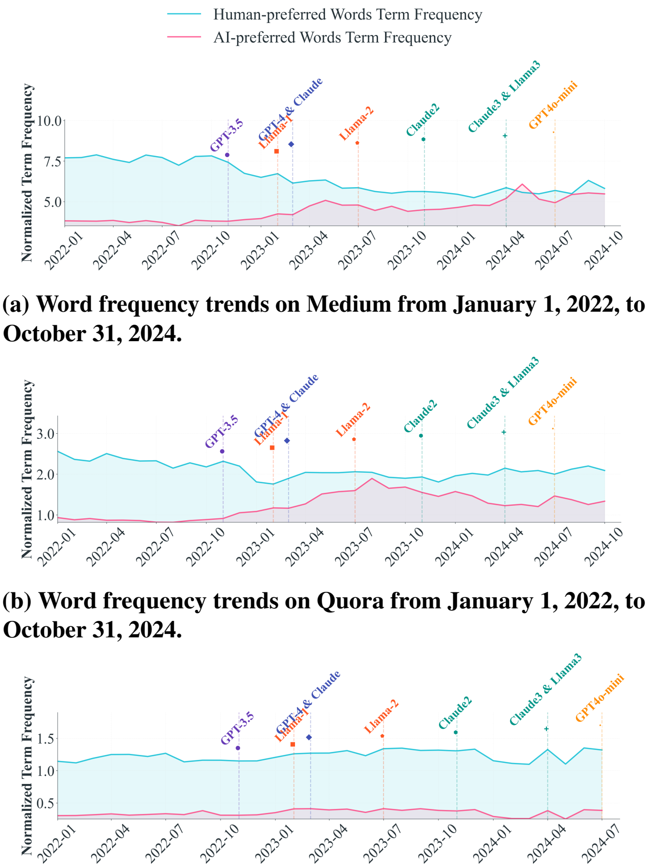
5.3 Linguistic Analysis at Different Levels

We explore the interpretability of the **OSM-Det** model in the case study using two methods: Integrated Gradients [42], representing a model-dependent perspective, and Shapley Value [36], offering a model-independent perspective. Details of the two methods can be found in Appendix G.2.

Word-Level Analysis. In the case study of Reddit (refer to Figures A4 and A6), words like "and", "think" and "I" have the highest Integrated Gradients and Shapley Value scores, which lead model to classify texts as human-written. Meanwhile, model-specific analysis shows the words "think", "can", and "Online" have the lowest scores, leading to AI-generated prediction. From these observations, we note that specifying clear word-level patterns between HWTs and AIGTs is challenging because certain words, like "think", contribute significantly to both classifications. This overlap suggests that word importance is highly context-dependent, complicating the task of isolating patterns that consistently distinguish the two text types. Similar challenges are also observed on Medium and Quora (refer to Figures A7, A9, A10 and A12).

Given this difficulty, we then turn to a different approach: a statistical analysis of high-frequency adjectives, conjunctions, and adverbs (details provided in Appendix G.1). These high-frequency terms are then classified into human-preferred and AI-preferred vocabularies. We then track the trends of these lexical items on *SM-D*.

As shown in Figures 3a and 3b, the NTF of AI-preferred vocabulary on the Medium and Quora is closely aligned with the development of LLMs. Following the release of LLMs such as GPT, Llama, and the Claude series, the NTF of human-



(a) Word frequency trends on Medium from January 1, 2022, to October 31, 2024.

(b) Word frequency trends on Quora from January 1, 2022, to October 31, 2024.

(c) Word frequency trends on Reddit from January 1, 2022, to July 31, 2024.

Figure 3: Comparison of Medium, Quora, and Reddit word frequency trends: human vs. AI preferences.

preferred vocabulary has gradually declined. Meanwhile, AI-preferred vocabulary shows an increase. These results reflect an increasing usage of LLMs for content generation by Medium and Quora platform users. In contrast, the trends on Reddit show some differences (see Figure 3c). From 2022 to 2024, the NTF of human-preferred vocabulary always remains high, while the AI-preferred vocabulary consistently remains low. This indicates that Reddit users rely less on LLMs to produce content.

From above, word frequency changes closely align with the AAR trends shown in Section 5.2.

Sentence-Level Analysis. We also conduct a sentence-level analysis using Shapley values, as Integrated Gradients are only suitable for word-level. From the case studies of Medium, Quora, and Reddit (shown in Figures A5, A8 and A11), we observe that AIGTs are characterized by their objective and standardized structures, typically beginning with a noun or pronoun and following a verb-object pattern, like “Online bullying...contributes...feelings...” . In contrast, HWTs often contain flexible sentence structures and informal expressions, as illustrated by “That being said, why not both?” and “Why can’t we restore...” . In summary, the results suggest that sentence-level patterns provide more distinctive characteristics for distinguishing AIGTs and HWTs, as LLMs may usually follow a standardized pattern to generate texts.

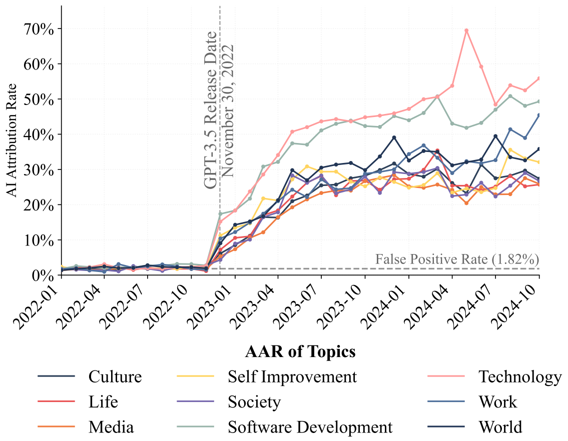


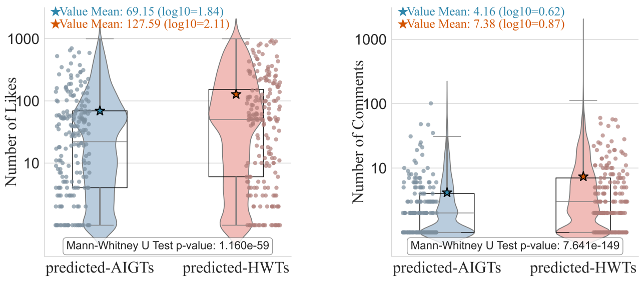
Figure 4: AAR trends across different topics.

5.4 Multidimensional Analysis of Posts

We analyze posts on social media from multi-dimensions to find the characteristics between posts predicted as AIGTs and those classified as HWTs, including topic, engagement, and author analysis.

Topic Analysis. Classifying topics on platforms like Quora and Reddit is challenging due to their wide range. Therefore, we focus our analysis on 9 major topics listed on the Medium platform,[1] examining them from a temporal perspective. The proportion of topics is shown in Figure A2.

Figure 4 shows the trends of AAR across different topics. We observe a rapid increase in AAR for all topics following the release of GPT-3.5 in December 2022, indicating that the popularity of LLMs has impacted all topics on Medium. Besides, the AAR for “Technology” and “Software Development” remains consistently higher than other topics from December 2022 to October 2024, ranking respectively first and second. One possible reason is that people in the technology field are more likely to know about LLMs and frequently interact with them, leading to a higher AAR.



(a) Number of Likes.

(b) Number of Comments.

Figure 5: Differences between predicted AIGTs and predicted HWTs compressed using a log10 transformation.

[1] https://medium.com/explore-topics.

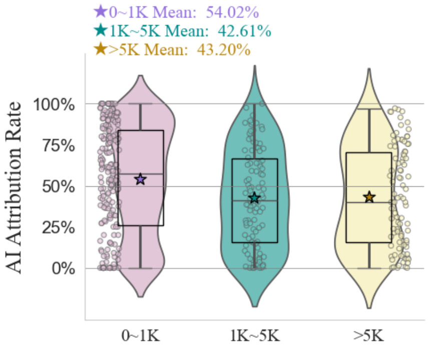


Figure 6: AAR distribution among follower groups.

Engagement Analysis. To understand how user engagement differs between articles predicted to be AIGTs or HWTs, we analyze the number of "Likes" (known as "Claps" on Medium) and "Comments" in Medium blogs. To ensure balanced comparisons, we randomly select 16,600 blogs with a 1:1 class ratio. Mann-Whitney U tests reveal statistically significant differences in the number of "Likes" and "Comments" between the two classes ($p < 0.05$).

As shown in Figure 5a, the predicted-AIGTs receive fewer "Likes" on average than predicted-HWTs, with mean values of 69.15 and 127.59, respectively. And predicted-AIGTs exhibit a higher frequency of low "Likes" counts. Figure 5b shows that predicted-AIGTs receive fewer "Comments" on average compared to predicted-HWTs, with mean values of 4.16 and 7.38, respectively.

To summarize, predicted-HWTs obtain more "Likes" and "Comments", which indicates that users in Medium are generally more willing to engage with human-written content. However, the relatively small gap between the two suggests that AI-generated content appeals to users.

Author Analysis. On Medium, we randomly select 1,000 authors from the predicted-AIGTs group who have published at least ten articles. We collect and detect all of their published articles to determine if they are AI-generated, aiming to explore the potential relationship between an author's follower count and their usage of AI-generated content.

As shown in Figure 6, we divide these authors into three groups based on their follower count. Among the groups, those with 1,000 or fewer followers exhibit a stronger concentration in the high AAR range ($\geq 75.00\%$). This group also achieves the highest mean AAR at 54.02%. From the overall distribution, as the follower number increases, the AAR gradually shifts toward the lower range ($\leq 25.00\%$). This trend may stem from more popular authors prioritizing content quality, while less-followed authors rely on LLMs to boost efficiency.

Furthermore, Figure A3 illustrates the publication timeline of the first articles detected as AIGTs from these authors. It can be observed that there is a significant increase in such publications during the month GPT-3.5 is released, followed by a relatively stable trend in subsequent months.

6 Conclusion

In this paper, we collect a large-scale dataset, *SM-D*, encompassing multiple platforms and diverse time periods, providing the first comprehensive quantification and analysis of AIGTs on online social media. We construct *AIGTBench*, an AIGT detection benchmark integrating diverse LLMs, to identify the most effective detector,**OSM-Det**. We then perform temporal tracking analyses, highlighting distinct trends in AAR that are shaped by platform-specific characteristics and the increasing adoption of LLMs. Finally, our analysis uncovers critical differences between AIGTs and HWTs across linguistic patterns, topical features, engagement levels, and the follower distribution of authors. Our findings offer valuable perspectives into the evolving dynamics of AIGTs on social media.

7 Ethical Statement

We emphasize that the purpose of this research is not to expose or criticize specific platforms or users for employing AIGTs nor to interfere with legitimate content-creation activities. Instead, our goal is to provide valuable insights through scientific analysis to aid the research community and the public to better understand the current state and trends of generative AI usage on social media. All data used in our paper is publicly available, and we do not collect and monitor any private information.

8 Limitations

In this paper, we conduct long-term quantification of AIGTs on 3 commonly used social media platforms, but there are still some limitations:

1. **Limited coverage of LLMs:** *AIGTBench* includes only 12 LLMs and does not cover all LLMs released across different time periods. Although the current AIGT detectors can generalize to LLMs that are not involved in training to a certain extent [20], there may still be slight errors, which poses a potential impact on the accuracy of some results. We also note that *AIGTBench* exhibits a distributional bias in the number of LLM-generated texts, favoring the GPT series and Llama series models, which dominate its composition at 42.9% and 39.05%, respectively. However, this bias is unlikely to significantly impact the analysis results, as these models are also the most widely used in real-world applications.
2. **Lack of analysis on multilingual platforms:** Our research focuses on English-dominated social media platforms. Therefore, the applicability of our findings is restricted to these specific platforms and language contexts. Since data collection is a long-term process, we plan to gradually expand to multilingual environments and more platforms in future research to improve the universality of the conclusions.
3. **Insufficient dimensions of analysis across platforms:** We conduct an in-depth analysis of the three dimensions of topic, engagement, and author on the Medium platform, but we are unable to conduct similar multi-dimensional research on Quora and Reddit. This is mainly due to the

differences in data collection methods and the difficulty of different platforms. If richer data from these platforms becomes available in the future, we will supplement and enhance the analysis.

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A Introduction of LLMs in Detector Training Dataset

In this paper, we have selected the most representative LLMs as our detection targets:

- **Llama-1 (Feb. 2023)** [44], **Llama-2 (Jul. 2023)**[45], and **Llama-3 (Apr. 2024)** [7]: The Llama series (from Llama-1 to Llama-3) launched by Meta are powerful and extremely popular open source models. This series of models enables researchers to fine-tune diverse datasets, is highly scalable, and is suitable for various research and development environments. The latest version, Llama-3, is equipped with a larger parameter size and optimized training architecture, making it perform better in text generation, context understanding, and complex task processing.
- **ChatGPT/GPT-3.5 Turbo (Nov. 2022)** [30]: GPT-3.5, an optimized version of GPT-3 by OpenAI, was released in 2022. By incorporating a Reinforcement Learning from Human Feedback (RLHF) reward mechanism and human feedback data, GPT-3.5 achieves significant improvements in accuracy and coherence in text generation. This version includes the Text-DaVinci-003 and GPT-3.5 (or GPT-3.5 Turbo), which focuses on fluent and natural multi-turn conversations and serves as the core model for systems like ChatGPT website.
- **GPT4o-mini (Jul. 2024)** [32]: Developed by OpenAI, GPT4o-mini is a lightweight language model optimized from GPT-4o technology. This model is designed to deliver efficient language processing capabilities that are suitable for applications with lower resource requirements. It supports both text and visual input, with future plans to expand into audio and video input and output. Since its release, the GPT4o-mini has progressively replaced the GPT-3.5 Turbo as the core model on the ChatGPT website.
- **Claude (Mar. 2023)** [2], : Claude is an advanced AI assistant developed by Anthropic. It is a closed-source model designed to communicate efficiently and intuitively with users through NLP technology. Claude can understand and generate human language to assist users in completing a variety of tasks, including answering questions, writing content, and programming assistance.
- **Alpaca 7B (Mar. 2023)** [43]: Alpaca 7B is a lightweight instruction-following model released by Stanford University, based on Meta's Llama-7B model and fine-tuned on the dataset of $52,000$ instruction-following examples. This fine-tuning markedly enhances the model's performance in understanding and executing task instructions. In evaluations of single-turn instruction-following tasks, Alpaca demonstrates performance comparable to OpenAI's Text-DaVinci-003, exhibiting high-quality responses to instructions.
- **Vicuna 13B (Mar. 2023)** [6]: Released by the LMSYS team, Vicuna 13B is based on Meta's Llama-13B model and trained on a large dataset of conversation data aggregated from high-quality models like GPT-3.5. The goal is to develop an open-source conversational model that approaches the quality of GPT-3.5.
- **Moonshot-v1 (Oct. 2023)** [29]: Developed by Moonshot AI, Moonshot-v1 is an advanced large language model for text generation. This model can understand and generate natural language text, manage everyday conversational exchanges, and produce structured content in various forms, such as articles, code, and summaries, across specialized domains.
- **Mixtral** 8×7**B (Dec. 2023)** [17]: Developed by Mistral AI, this LLM employs a Sparse Mixture of Experts (SMoE) architecture. It has demonstrated exceptional performance across multiple benchmarks, surpassing models like Llama-2 70B and GPT-3.5, especially excelling in tasks involving mathematics, code generation, and multilingual understanding.

B Introduction of Detectors

In this work, we adopt metric-based detectors from the MGT-Bench framework to detect AIGTs, including:

- **Log-Likelihood** [39]: We evaluate the likelihood of text generation by computing its log-likelihood score under a specific language model. The model constructs a reference distribution based on HWTs and AIGTs to calculate the log-likelihood score of the input text. A higher score suggests a greater likelihood of the text being LLM-generated.
- **Rank** [9] and **Log-Rank** [28]: The Rank method identifies the source of generation by analyzing the ranking of each word in the text. The model calculates the absolute ranking of each word based on context and averages all word rankings to derive an overall score. Generally, a lower score indicates that the text is more likely to be LLM-generated. Log-Rank, a variant of Rank, employs a logarithmic function when calculating each word's ranking, enhancing the detection of AIGTs.
- **Entropy** [9]: The Entropy method calculates the average entropy value of each word in the text under context conditions. Studies show that AIGTs tend to have lower entropy values.
- **GLTR** [9]: GLTR is a supportive tool for detecting AIGTs that use the ranking of words generated by a language model to sort the vocabulary of the text by predicted probability. Following Guo *et al.* [12], we employ the Test-2 feature to analyze the proportion of words in the top 10, 100, and 1000 ranks to assess the generative nature of the text.
- **DetectGPT** [28], **NPR**, and **LRR** [41]: The DetectGPT method introduces minor perturbations into the original text and observes changes in the model's log probability to detect its source. AIGTs typically reside at the local optima of the model's log probability function, whereas HWTs show greater changes in log probability after perturbation. The NPR method, similar to DetectGPT, focuses on observing significant increases in log-rank following perturbations to differentiate between AIGTs and HWTs. By combining log-likelihood and log-rank information, the LRR method captures the adaptiveness of generated texts in probability distributions while reflecting the text's ordinal preference relative to HWTs. This dual metric markedly enhances the detection accuracy.

We also consider model-based detectors, including:

- **OpenAI Detector** [39]: This detector fine-tunes a RoBERTa [22] model using output data generated by the

GPT-2 large, which has 1.5 billion parameters, to predict whether texts are LLM-generated.

- **ChatGPT Detector** [12]: Trained using the HC3 dataset, this approach employs a RoBERTa model and various training methods to distinguish between human and AIGTs. We select one that uses only the response texts to align with other detectors, following instructions described by He [14].
- **ConDA** [4]: This method enhances model discrimination of text sources in the feature space by maximizing the feature differences between generated samples and real samples. It also introduces a contrastive learning loss to improve detection accuracy.
- **GPTZero** [10]: A tool aimed at AIGT detection that analyses the perplexity and burstiness of texts to determine their generative nature. GPTZero provides a public API interface capable of returning a confidence score indicating whether a text is LLM-generated.
- **CheckGPT** [24]: The CheckGPT uses the pre-trained Roberta model to extract text features. Then, it uses LSTM to classify the text features and determine whether the text is LLM-generated or human-generated.
- **LM-D Detector** [16]: This approach adds an additional classification layer to a pre-trained language model (like RoBERTa) and fine-tunes it to differentiate between human-made and AIGTs. Inspired by the research of Li *et al.*[20], which shows that Longformer [3] has robust performance in detecting AIGT in out-of-domain texts, we also use the Longformer-base-4096 model to assess its performance in AIGT detection.

C Social Media Platforms

To select suitable social media platforms for testing AIGT detection, we particularly consider the platform's mainstream status, the diversity of content, and their unique characteristics. Ultimately, we choose Reddit, Medium, and Quora as representative platforms.

- Reddit [35] is a social discussion platform where users autonomously create and manage "subreddit" sections featuring diverse and rich content themes. All content on the site is categorized into different "subreddits" according to user interests, covering a wide range of topics from technology to social issues. We choose Reddit not only for its active user base—with around 330M monthly active users—but also for its vast content diversity, including millions of subreddit topics, allowing it to cover a variety of discussion scenarios.
- Medium [26] is an American online publishing platform developed by Evan Williams and launched in August 2012. It centers on high-quality original articles and blog content and exemplifies social journalism, known for its content's depth, length, and professionalism.
- Quora [33] is a platform to gain and share knowledge. It enables users to ask questions and connect with people who provide unique insights or quality answers. Users can pose questions and receive answers from other users on topics ranging from daily life to highly specialized academic, technical, and professional queries.

We have selected these 3 platforms because their main functionalities closely align with common use cases for LLMs, such as writing and question-answering. Based on this, we hypothesize that there may be instances where users utilize LLMs to generate content on these platforms.

D Introduction of Open Source Datasets for Training Detectors

We consider 6 publicly available AIGT datasets and 5 common supervised finetuning datasets as one part of *AIGTBench*.

- The **MGT-Academic** dataset [23], assembled from textual sources such as Wikipedia, arXiv, and Project Gutenberg, covers STEM, Social Sciences, and Humanities. It is generated by various LLMs, including Llama3, GPT-3.5 Turbo, Moonshot, and Mixtral $8 \times 7B$, forming a comprehensive AIGT dataset.
- The **Coco-GPT3.5** dataset [21], produced using OpenAI's text-davinci-0035 model, incorporates entire newspaper articles from December 2022 to February 2023, reflecting the latest content of that period.
- The **GPABench2** dataset [24], based on the GPT-3.5 Turbo model, focuses on 3 LLM-generated tasks: GPT-written, GPT-completed, and GPT-polished, all based on academic abstracts. Due to the extensive amount of text generated by GPT-3.5 Turbo, we sampled around 100M tokens from this dataset for compilation.
- The **LWD** dataset [40] involves texts generated by Llama-2, GPT-4, and ChatGPT. Researchers designed specific prompts to "write an Amazon review in the style of the author of the following review: <human review>", where each prompt incorporates a real human-written Amazon review as a stylistic reference.
- The **HC3** dataset [12], collected by researchers, comprises nearly 40,000 questions and their answers from human experts and ChatGPT, covering a broad range of fields including open-domain, computer science, finance, medicine, law, and psychology.
- The **AIGT** dataset [38] samples human-generated content and content from seven popular open-source or API-driven LLMs, applied in real-world scenarios such as low-quality content generation, news fabrication, and student cheating. Due to the markedly lesser capabilities of GPT-2 XL and GPT-J compared to GPT-3.5, these models were not included.
- Given that high-quality Supervised Finetuning (SFT) datasets are frequently used for finetuning LLMs, and considering the lack of Claude and GPT-4 model-related content in the AIGT detection datasets, we also incorporate four SFT datasets with instruction-following features: **Claude2-Alpaca**[2], **Claude-3-Opus-Claude-3.5-Sonnet-9k**[3], **GPTeacher/GPT-4 General-Instruct**[4], and **Instruction in the Wild**[5].

[2] https://github.com/Lichang-Chen/claude2-alpaca

[3] https://huggingface.co/datasets/QuietImpostor/Claude-3-Opus-Claude-3.5-Sonnet-9k

[4] https://github.com/teknium1/GPTeacher/tree/main/Instruct

[5] https://github.com/XueFuzhao/InstructionWild

E Data Preprocessing for the *SM-D* and *AIGT-Bench* Datasets

***SM-D* Dataset.** For the *SM-D* dataset, we exclude texts with fewer than 150 characters (including spaces) and texts where the proportion of English content is below 90%. Plus, we observe that LLMs' responses often contain redundant or irrelevant content. For example, many LLMs' generated texts include irrelevant phrases at the beginning, such as "Of course..." or "Hey there...". Additionally, we find that responses generated by the Llama model often repetitively display strings of numbers or specific symbols, hitting the generation length limit instead of providing a complete answer. like "....throwaway11111...". We filter and remove these anomalous generated contents to enhance the accuracy of our dataset.

***AIGTBench* Dataset.** For the *AIGTBench* dataset, we exclude texts with fewer than 150 characters (including spaces) and texts where the proportion of English content is below 90%.

F Task Prompts for Generated AIGTs from Social Media

Inspired by [24], below are designed task prompts for polishing texts on Medium, Quora, and Reddit.

> Please act as a social media platform Medium/Quora/Reddit content creator.
>
> Your task is to polish the following content. Follow these guidelines:
>
> 1. Ensure the content flows naturally and is enjoyable to read.
>
> 2. Use simple and relatable language to connect with a broad audience.
>
> 3. Highlight key points in a concise and impactful way.
>
> 4. Make the content feel more conversational and friendly.
>
> 5. Where appropriate, add an engaging tone to draw the reader in.
>
> 6. Respond with the revised content only and nothing else:
>
> Here is the original content: "{content}"

Below are designed task prompts for answering the questions on Quora and Reddit.

> You are a content creator on Quora/Reddit.
>
> Your task is to generate a thoughtful and insightful answer to the following question. Follow these guidelines:
>
> 1. Provide a clear and comprehensive explanation that addresses the question thoroughly.
>
> 2. Use simple, relatable language to connect with a broad audience, making the content easy to understand.
>
> 3. Highlight key points with examples or anecdotes where applicable, to make the answer more engaging.
>
> 4. Add a conversational and friendly tone to make the answer feel more approachable.
>
> 5. Ensure the answer is well-structured, with an introduction, body, and conclusion, for better readability.
>
> 6. Where relevant, include unique insights or perspectives to make the answer stand out.
>
> 7. Respond with the generated answer only and nothing else.
>
> Here is the question: "{question}"

Below are two task prompts designed for summarizing Medium articles and writing detailed articles based on those summaries for Medium articles.

> You are a helpful, respectful, and honest assistant.
>
> Summarize the following content succinctly:
>
> "{content}"
>
> Summary:

> You are a helpful, respectful and honest assistant. Always answer as helpfully as possible, while being safe.
>
> Write a detailed article based on the summary below, following these guidelines:
>
> 1. Ensure it flows naturally and is enjoyable to read.
>
> 2. Use simple and relatable language for a broad audience.
>
> 3. Highlight key points in a concise, impactful way.
>
> 4. Make it conversational and friendly.
>
> 5. Add an engaging tone where appropriate.
>
> Summary:
>
> "{summary content}"
>
> Article:

G Details About the Collection of High-Frequency Words and Model Interpretation Analysis Methods

G.1 Collection of High-Frequency Words

We use the Spacy library [15] to classify the part-of-speech of words in the *SM-D*, specifically dividing them into adjectives, adverbs, and connectives. We then select around the top 20 words for human-preferred and AI-preferred categories, respectively. For detailed results, refer to Table A4.

G.2 Model Interpretation Analyze Methods

Here are the details and how we implement the two different methods:

- **Integrated Gradients** give an importance score to each input value by calculating the gradient of the detector. We follow [19] for implementation.
- **Shapley Value** is originally introduced in [37] and recently apply to machine learning interpretation. It quantifies the impact of each feature by perturbing the input value and observing the contributions in the prediction. We follow [36] for implementation.

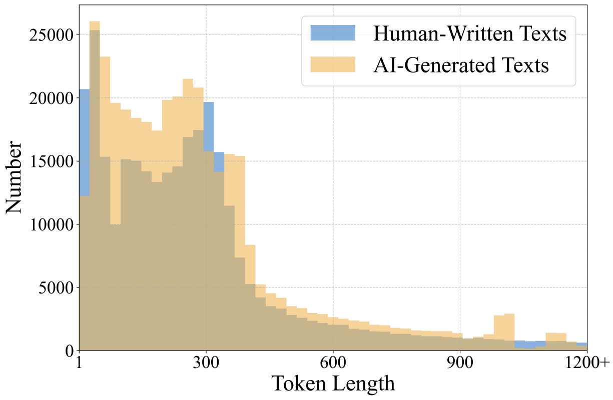


Figure A1: Token length distribution in the training set, calculated by the Llama-2 tokenizer [45].

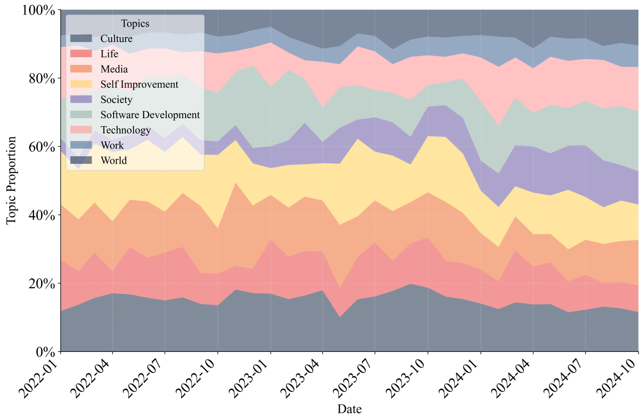


Figure A2: Stacked area chart shows the monthly proportions of 9 topics.

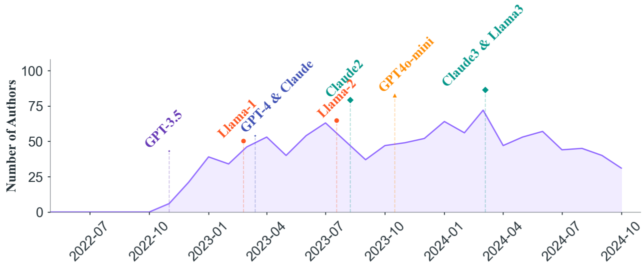


Figure A3: Timeline of authors' earliest adoption of AIGTs.

Dataset	Type	Sentence Number
MGT-Academic [23]	Llama3	1,478,485
	Mixtral 8×7B	2,639,498
	Moonshot	726,357
	GPT-3.5	1,611,244
	Human	6,007,476
Coco-GPT3.5 [21]	GPT-3.5	79,647
	Human	55,565
GPABench2 [24]	GPT-3.5	12,648,338 (Sample)
	Human	1,065,860
LWD [40]	Llama2	94,732
	GPT-3.5	95,443
	GPT-4	62,632
	Human	106,952
AIGT [38]	Llama2	6,967
	Alpaca 7B	6,083
	Vicuna 13B	7,028
	GPT-3.5	8,022
	GPT-4	7,156
	Human	12,228
HC3 [12]	GPT-3.5	184,692
	Human	347,423

Table A1: Statistics of open-source datasets (Part 1).

Dataset	Type	Sentence Number
Claude2-Alpaca	Claude-2	404,051
Claude-3-Opus-Claude-3.5-Sonnet-9k	Claude-3	276,246
	Human	37,785
GPTeacher/GPT-4 General-Instruct	GPT-4	74,160
	Human	24,465
Alpaca_GPT4	GPT-4	354,801
	Human	22,253
Instruction in the Wild	GPT-3.5	300,424

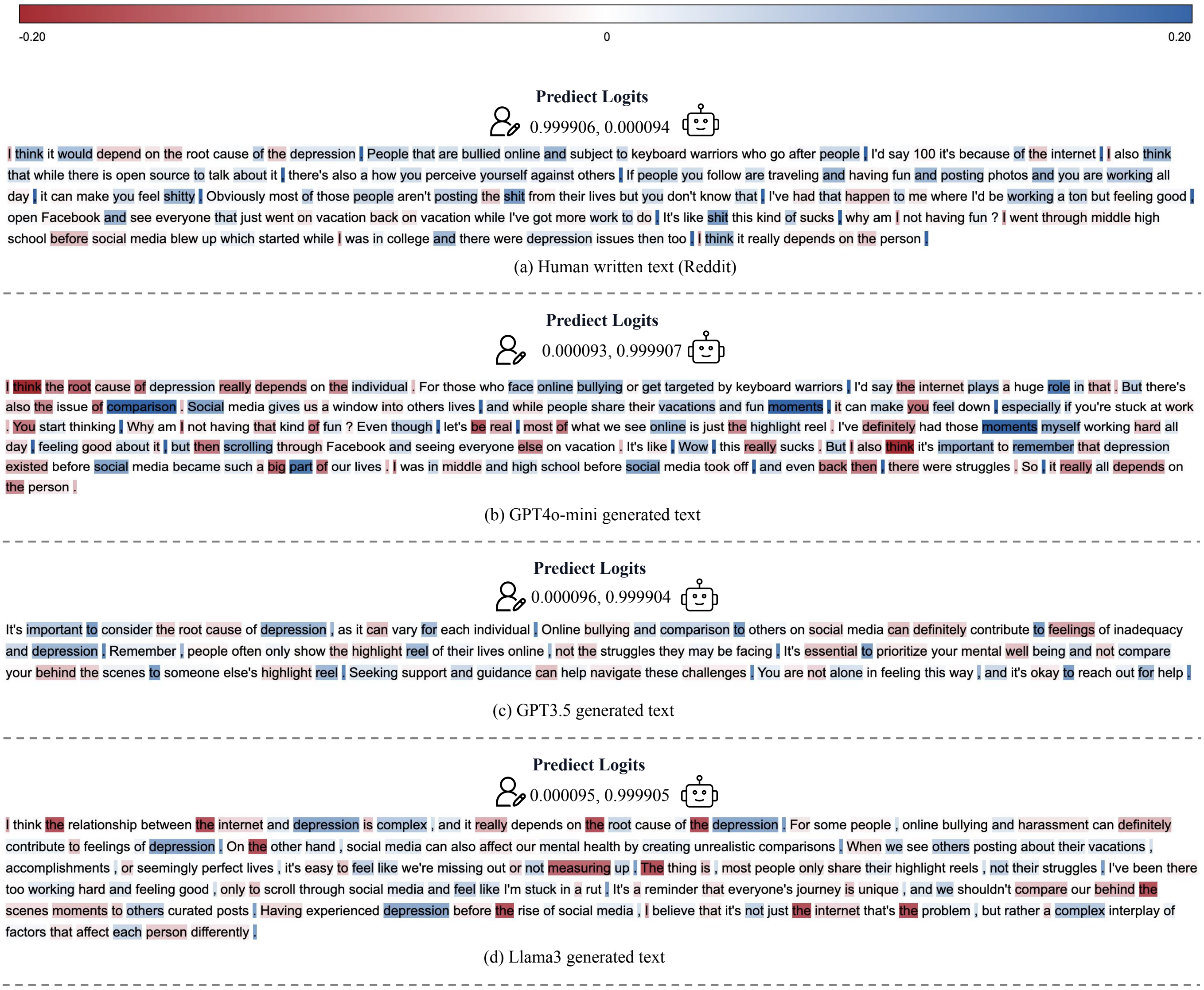
Table A2: Statistics of open-source datasets (Part 2).

Dataset	Type	Sentence Number
Medium	Llama Series	1,881,733
	GPT Series	681,480
	Human	2,033,105
Quora	Llama Series	1,974,368
	GPT Series	721,878
	Human	569,749
Reddit	Llama Series	2,892,584
	GPT Series	1,391,054
	Human	2,695,271
Total	AIGTs	9,543,097
	HWTs	5,298,125

Table A3: Sentence number statistics of our generated datasets (Llama Series include Llama-1, 2, 3; GPT Series include GPT-3.5, GPT-4o-mini).

Category	Words
Human top frequency words	‘little’, ‘small’, ‘last’, ‘able’, ‘bad’, ‘next’, ‘right’, ‘most’, ‘long’, ‘old’, ‘much’, ‘sure’, ‘great’, ‘actually’, ‘again’, ‘probably’, ‘much’, ‘very’, ‘pretty’, ‘already’, ‘since’, ‘against’, ‘yet’
AI top frequency words	‘various’, ‘significant’, ‘positive’, ‘complex’, ‘original’, ‘free’, ‘specific’, ‘unique’, ‘crucial’, ‘clear’, ‘human’, ‘personal’, ‘essential’, ‘particularly’, ‘especially’, ‘truly’, ‘instead’, ‘here’, ‘rather’, ‘additionally’, ‘despite’, ‘due to’, ‘following’

Table A4: Categorization of words into human and AI characteristics.



Predict Logits

0.999906, 0.000094

I think it would depend on the root cause of the depression . People that are bullied online and subject to keyboard warriors who go after people . I'd say 100 it's because of the internet . I also think that while there is open source to talk about it , there's also a how you perceive yourself against others . If people you follow are traveling and having fun and posting photos and you are working all day , it can make you feel shitty . Obviously most of those people aren't posting the shit from their lives but you don't know that . I've had that happen to me where I'd be working a ton but feeling good , open Facebook and see everyone that just went on vacation back on vacation while I've got more work to do . It's like shit this kind of sucks , why am I not having fun ? I went through middle high school before social media blew up which started while I was in college and there were depression issues then too . I think it really depends on the person .

(a) Human written text (Reddit)

Predict Logits

0.000093, 0.999907

I think the root cause of depression really depends on the individual . For those who face online bullying or get targeted by keyboard warriors , I'd say the internet plays a huge role in that . But there's also the issue of comparison . Social media gives us a window into others lives , and while people share their vacations and fun moments , it can make you feel down , especially if you're stuck at work . You start thinking , Why am I not having that kind of fun ? Even though , let's be real , most of what we see online is just the highlight reel . I've definitely had those moments myself working hard all day , feeling good about it , but then scrolling through Facebook and seeing everyone else on vacation . It's like , Wow , this really sucks . But I also think it's important to remember that depression existed before social media became such a big part of our lives . I was in middle and high school before social media took off , and even back then , there were struggles . So , it really all depends on the person .

(b) GPT4o-mini generated text

Predict Logits

0.000096, 0.999904

It's important to consider the root cause of depression , as it can vary for each individual . Online bullying and comparison to others on social media can definitely contribute to feelings of inadequacy and depression . Remember , people often only show the highlight reel of their lives online , not the struggles they may be facing . It's essential to prioritize your mental well being and not compare your behind the scenes to someone else's highlight reel . Seeking support and guidance can help navigate these challenges . You are not alone in feeling this way , and it's okay to reach out for help .

(c) GPT3.5 generated text

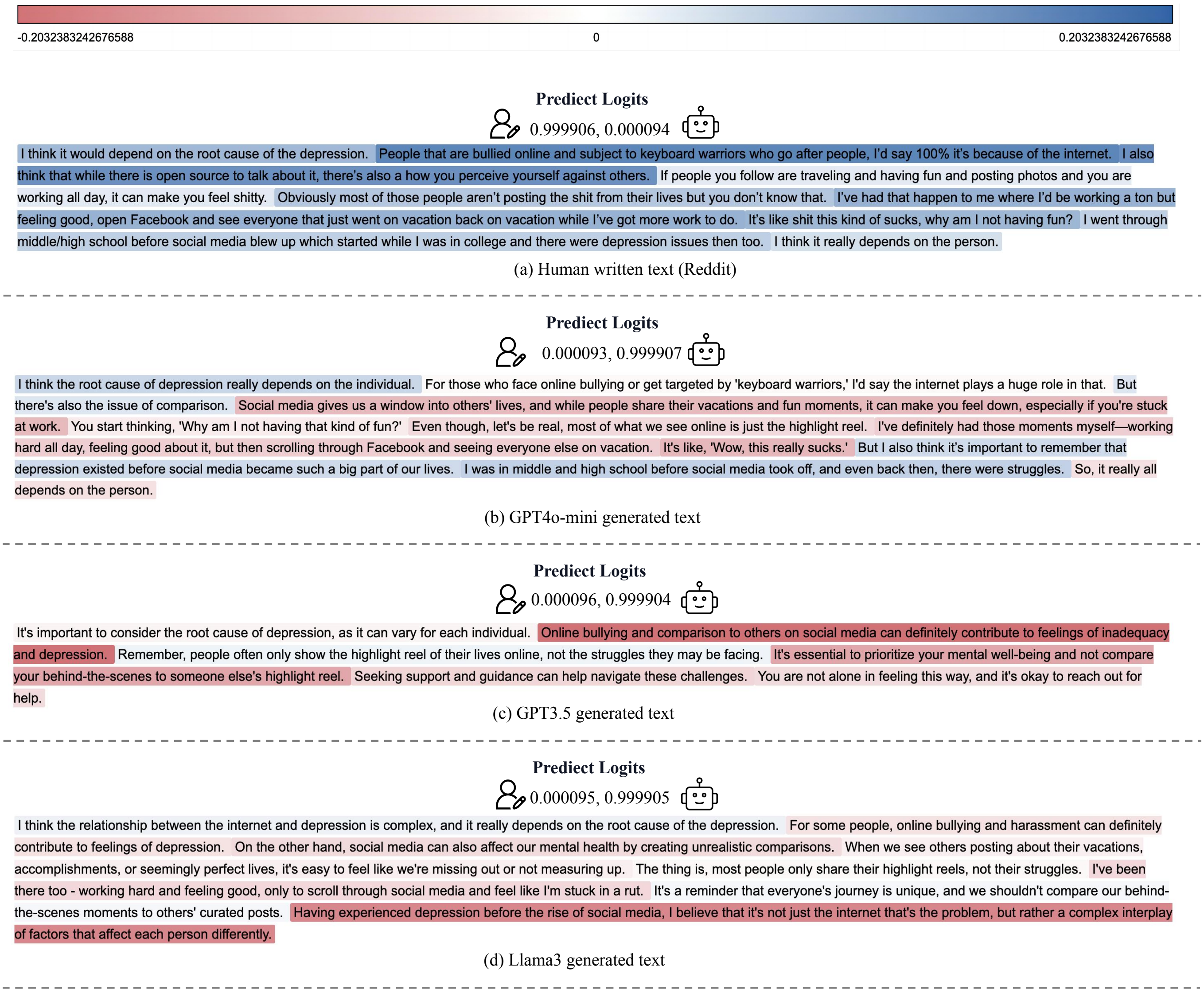
Predict Logits

0.000095, 0.999905

I think the relationship between the internet and depression is complex , and it really depends on the root cause of the depression . For some people , online bullying and harassment can definitely contribute to feelings of depression . On the other hand , social media can also affect our mental health by creating unrealistic comparisons . When we see others posting about their vacations , accomplishments , or seemingly perfect lives , it's easy to feel like we're missing out or not measuring up . The thing is , most people only share their highlight reels , not their struggles . I've been there too working hard and feeling good , only to scroll through social media and feel like I'm stuck in a rut . It's a reminder that everyone's journey is unique , and we shouldn't compare our behind the scenes moments to others curated posts . Having experienced depression before the rise of social media , I believe that it's not just the internet that's the problem , but rather a complex interplay of factors that affect each person differently .

(d) Llama3 generated text

Figure A4: Case study of word-level analysis through Integrated Gradients on Reddit.



Prediect Logits

0.999906, 0.000094

I think it would depend on the root cause of the depression. People that are bullied online and subject to keyboard warriors who go after people, I'd say 100% it's because of the internet. I also think that while there is open source to talk about it, there's also a how you perceive yourself against others. If people you follow are traveling and having fun and posting photos and you are working all day, it can make you feel shitty. Obviously most of those people aren't posting the shit from their lives but you don't know that. I've had that happen to me where I'd be working a ton but feeling good, open Facebook and see everyone that just went on vacation back on vacation while I've got more work to do. It's like shit this kind of sucks, why am I not having fun? I went through middle/high school before social media blew up which started while I was in college and there were depression issues then too. I think it really depends on the person.

(a) Human written text (Reddit)

Prediect Logits

0.000093, 0.999907

I think the root cause of depression really depends on the individual. For those who face online bullying or get targeted by 'keyboard warriors,' I'd say the internet plays a huge role in that. But there's also the issue of comparison. Social media gives us a window into others' lives, and while people share their vacations and fun moments, it can make you feel down, especially if you're stuck at work. You start thinking, 'Why am I not having that kind of fun?' Even though, let's be real, most of what we see online is just the highlight reel. I've definitely had those moments myself—working hard all day, feeling good about it, but then scrolling through Facebook and seeing everyone else on vacation. It's like, 'Wow, this really sucks.' But I also think it's important to remember that depression existed before social media became such a big part of our lives. I was in middle and high school before social media took off, and even back then, there were struggles. So, it really all depends on the person.

(b) GPT4o-mini generated text

Prediect Logits

0.000096, 0.999904

It's important to consider the root cause of depression, as it can vary for each individual. Online bullying and comparison to others on social media can definitely contribute to feelings of inadequacy and depression. Remember, people often only show the highlight reel of their lives online, not the struggles they may be facing. It's essential to prioritize your mental well-being and not compare your behind-the-scenes to someone else's highlight reel. Seeking support and guidance can help navigate these challenges. You are not alone in feeling this way, and it's okay to reach out for help.

(c) GPT3.5 generated text

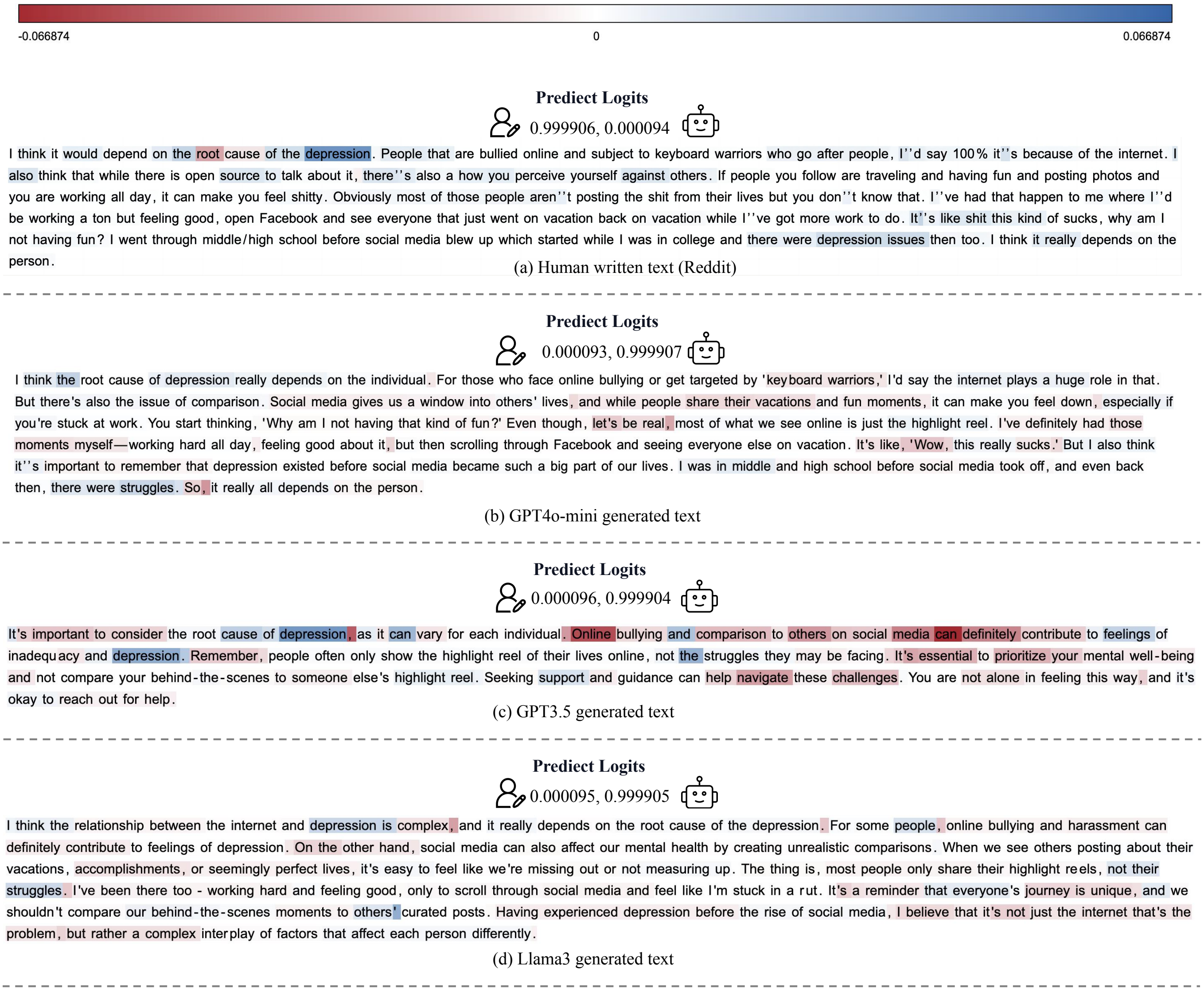
Prediect Logits

0.000095, 0.999905

I think the relationship between the internet and depression is complex, and it really depends on the root cause of the depression. For some people, online bullying and harassment can definitely contribute to feelings of depression. On the other hand, social media can also affect our mental health by creating unrealistic comparisons. When we see others posting about their vacations, accomplishments, or seemingly perfect lives, it's easy to feel like we're missing out or not measuring up. The thing is, most people only share their highlight reels, not their struggles. I've been there too - working hard and feeling good, only to scroll through social media and feel like I'm stuck in a rut. It's a reminder that everyone's journey is unique, and we shouldn't compare our behind-the-scenes moments to others' curated posts. Having experienced depression before the rise of social media, I believe that it's not just the internet that's the problem, but rather a complex interplay of factors that affect each person differently.

(d) Llama3 generated text

Figure A5: Case study of sentence-level analysis through Shaplay Value on Reddit.



Prediect Logits

0.999906, 0.000094

I think it would depend on the root cause of the depression. People that are bullied online and subject to keyboard warriors who go after people, I’’d say 100% it’’s because of the internet. I also think that while there is open source to talk about it, there’’s also a how you perceive yourself against others. If people you follow are traveling and having fun and posting photos and you are working all day, it can make you feel shitty. Obviously most of those people aren’’t posting the shit from their lives but you don’’t know that. I’’ve had that happen to me where I’’d be working a ton but feeling good, open Facebook and see everyone that just went on vacation back on vacation while I’’ve got more work to do. It’’s like shit this kind of sucks, why am I not having fun? I went through middle/high school before social media blew up which started while I was in college and there were depression issues then too. I think it really depends on the person.

(a) Human written text (Reddit)

Prediect Logits

0.000093, 0.999907

I think the root cause of depression really depends on the individual. For those who face online bullying or get targeted by 'key board warriors,' I'd say the internet plays a huge role in that. But there's also the issue of comparison. Social media gives us a window into others' lives, and while people share their vacations and fun moments, it can make you feel down, especially if you're stuck at work. You start thinking, 'Why am I not having that kind of fun?' Even though, let's be real, most of what we see online is just the highlight reel. I've definitely had those moments myself—working hard all day, feeling good about it, but then scrolling through Facebook and seeing everyone else on vacation. It's like, 'Wow, this really sucks.' But I also think it’’s important to remember that depression existed before social media became such a big part of our lives. I was in middle and high school before social media took off, and even back then, there were struggles. So, it really all depends on the person.

(b) GPT4o-mini generated text

Prediect Logits

0.000096, 0.999904

It's important to consider the root cause of depression, as it can vary for each individual. Online bullying and comparison to others on social media can definitely contribute to feelings of inadequ acy and depression. Remember, people often only show the highlight reel of their lives online, not the struggles they may be facing. It's essential to prioritize your mental well-being and not compare your behind-the-scenes to someone else's highlight reel. Seeking support and guidance can help navigate these challenges. You are not alone in feeling this way, and it's okay to reach out for help.

(c) GPT3.5 generated text

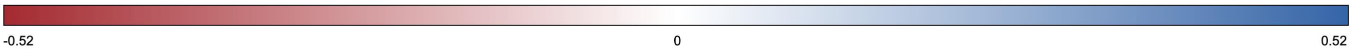
Prediect Logits

0.000095, 0.999905

I think the relationship between the internet and depression is complex, and it really depends on the root cause of the depression. For some people, online bullying and harassment can definitely contribute to feelings of depression. On the other hand, social media can also affect our mental health by creating unrealistic comparisons. When we see others posting about their vacations, accomplishments, or seemingly perfect lives, it's easy to feel like we're missing out or not measuring up. The thing is, most people only share their highlight re els, not their struggles. I've been there too - working hard and feeling good, only to scroll through social media and feel like I'm stuck in a rut. It's a reminder that everyone's journey is unique, and we shouldn't compare our behind-the-scenes moments to others' curated posts. Having experienced depression before the rise of social media, I believe that it's not just the internet that's the problem, but rather a complex inter play of factors that affect each person differently.

(d) Llama3 generated text

Figure A6: Case study of word-level analysis through Shaplay Value on Reddit.



Predict Logits

0.999906, 0.000094

Physical education and athletics as a school subject is not generally emphasized in the Chinese state public school system . It is given less weight in the High school placement examination Zhongkao where other subjects such as Mathematics , Science , Chinese , and English are awarded more points and are given more consideration in classroom hours allotted to these subjects . China performs well in the Olympics because they have a very strong national sports program that is able to identify talent at an early age and provide these young athletes with the necessary resources and training at special athletics schools . They adopted a factory model of training athletes to represent the country at international sporting events . Chinese people as a whole are fairly fit and do like to partake in activities such as dancing , table tennis , running , and basketball as diversions . But professional sports is nowhere as emphasized , developed , or lucrative as in the west where millions of people tune in to watch multimillionaire athletes like Lebron James dunk a basketball or Messi perform a hat trick . I think the root cause of depression really depends on the individual . For those who face online bullying or get targeted by keyboard warriors , I'd say the internet plays a huge role in that . But there's also the issue of comparison . Social media gives us a window into others lives , and while people share their vacations and fun moments , it can make you feel down , especially if you're stuck at work . You start thinking , Why am I not having that kind of fun ? Even though , let's be real , most of what we see online is just the highlight reel . I've definitely had those moments myself working hard all day , feeling good about it , but then scrolling through Facebook and seeing everyone else on vacation . It's like , Wow , this really sucks . But I also think it's important to remember that depression existed before social media became such a big part of our lives . I was in middle and high school before social media took off , and even back then , there were struggles . So , it really all depends on the person .

(a) Human written text (Quora)

Predict Logits

0.000093, 0.999907

In China , physical education and athletics aren't usually a major focus in the school curriculum . While subjects like Mathematics , Science , Chinese , and English take center stage especially in the Zhongkao high school entrance exam sports are given much less attention . However , China shines on the Olympic stage , thanks to its strong national sports program . This program excels at spotting talent early , providing young athletes with specialized training and resources at dedicated sports schools . It's almost like a factory model for nurturing top tier athletes who represent the country at global competitions . While professional sports in China aren't as big or as financially rewarding as in the West where fans tune in to watch icons like LeBron James dunk or Messi score breathtaking goals sports are still very much a part of everyday life . Many Chinese people enjoy activities like dancing , table tennis , running , and basketball , which serve as fun and popular diversions .

(b) GPT4o-mini generated text

Predict Logits

0.000096, 0.999904

Physical education and athletics may not be as prioritized in the Chinese state public school system , especially in comparison to subjects like Mathematics , Science , Chinese , and English . However , China's strong national sports program does contribute to their success in the Olympics . Through specialized athletics schools and early talent identification , they have been able to nurture young athletes effectively . While professional sports may not be as emphasized or lucrative in China as it is in the West , the Chinese people enjoy activities such as dancing , table tennis , running , and basketball as part of their active lifestyle . The focus on developing athletes from a young age and the factory model approach to training has helped China excel in international sporting events . It's fascinating to see different approaches to sports development around the world , each with its unique strengths and strategies .

(c) GPT3.5 generated text

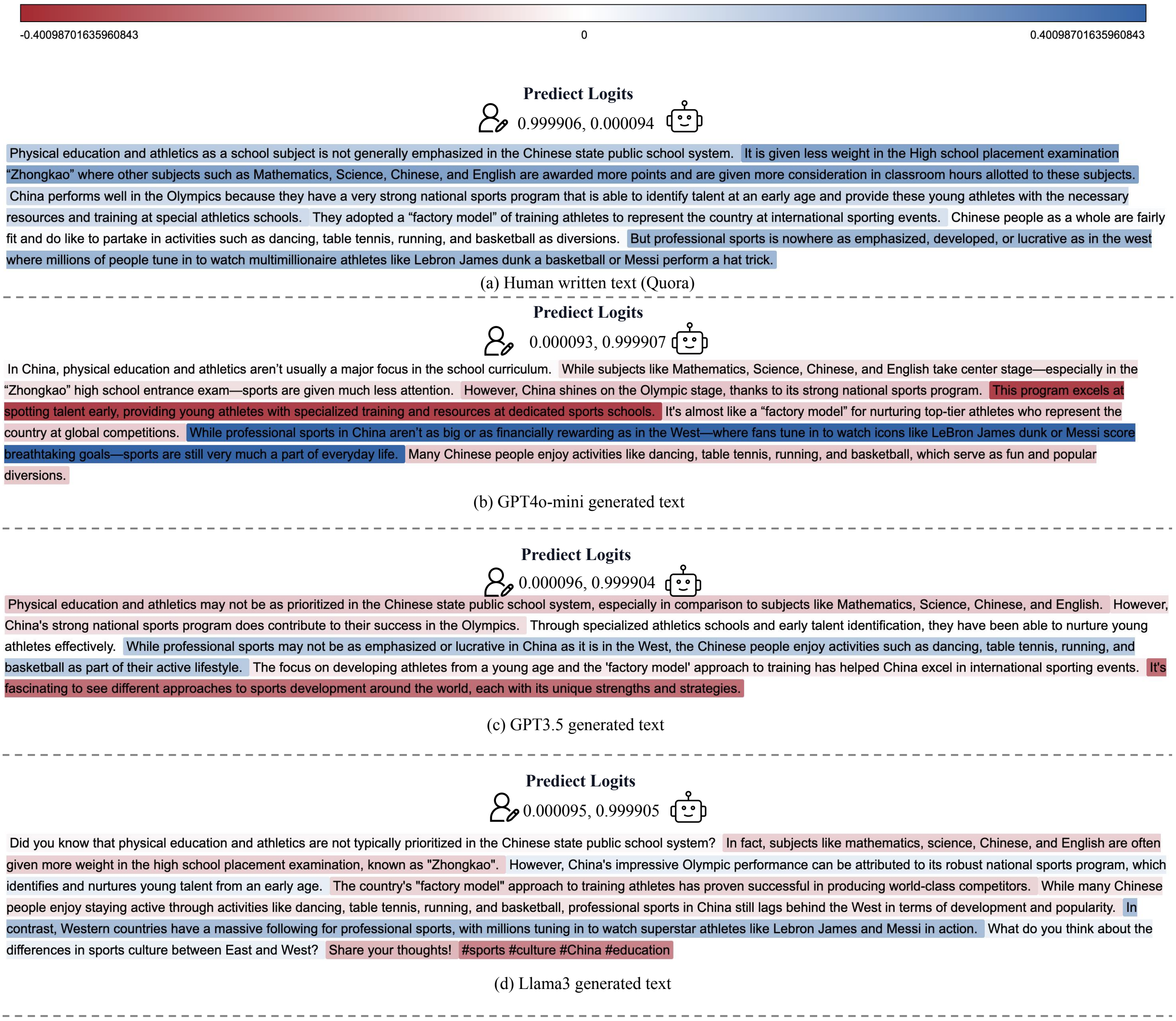
Predict Logits

0.000095, 0.999905

Did you know that physical education and athletics are not typically prioritized in the Chinese state public school system ? In fact , subjects like mathematics , science , Chinese , and English are often given more weight in the high school placement examination , known as Zhongkao . However , China's impressive Olympic performance can be attributed to its robust national sports program , which identifies and nurtures young talent from an early age . The country's factory model approach to training athletes has proven successful in producing world class competitors . While many Chinese people enjoy staying active through activities like dancing , table tennis , running , and basketball , professional sports in China still lags behind the West in terms of development and popularity . In contrast , Western countries have a massive following for professional sports , with millions tuning in to watch superstar athletes like Lebron James and Messi in action . What do you think about the differences in sports culture between East and West ? Share your thoughts ! sports culture China education

(d) Llama3 generated text

Figure A7: Case study of word-level analysis through Integrated Gradients on Quora.



Prediect Logits

0.999906, 0.000094

Physical education and athletics as a school subject is not generally emphasized in the Chinese state public school system. It is given less weight in the High school placement examination "Zhongkao" where other subjects such as Mathematics, Science, Chinese, and English are awarded more points and are given more consideration in classroom hours allotted to these subjects. China performs well in the Olympics because they have a very strong national sports program that is able to identify talent at an early age and provide these young athletes with the necessary resources and training at special athletics schools. They adopted a "factory model" of training athletes to represent the country at international sporting events. Chinese people as a whole are fairly fit and do like to partake in activities such as dancing, table tennis, running, and basketball as diversions. But professional sports is nowhere as emphasized, developed, or lucrative as in the west where millions of people tune in to watch multimillionaire athletes like Lebron James dunk a basketball or Messi perform a hat trick.

(a) Human written text (Quora)

Prediect Logits

0.000093, 0.999907

In China, physical education and athletics aren't usually a major focus in the school curriculum. While subjects like Mathematics, Science, Chinese, and English take center stage—especially in the "Zhongkao" high school entrance exam—sports are given much less attention. However, China shines on the Olympic stage, thanks to its strong national sports program. This program excels at spotting talent early, providing young athletes with specialized training and resources at dedicated sports schools. It's almost like a "factory model" for nurturing top-tier athletes who represent the country at global competitions. While professional sports in China aren't as big or as financially rewarding as in the West—where fans tune in to watch icons like LeBron James dunk or Messi score breathtaking goals—sports are still very much a part of everyday life. Many Chinese people enjoy activities like dancing, table tennis, running, and basketball, which serve as fun and popular diversions.

(b) GPT4o-mini generated text

Prediect Logits

0.000096, 0.999904

Physical education and athletics may not be as prioritized in the Chinese state public school system, especially in comparison to subjects like Mathematics, Science, Chinese, and English. However, China's strong national sports program does contribute to their success in the Olympics. Through specialized athletics schools and early talent identification, they have been able to nurture young athletes effectively. While professional sports may not be as emphasized or lucrative in China as it is in the West, the Chinese people enjoy activities such as dancing, table tennis, running, and basketball as part of their active lifestyle. The focus on developing athletes from a young age and the 'factory model' approach to training has helped China excel in international sporting events. It's fascinating to see different approaches to sports development around the world, each with its unique strengths and strategies.

(c) GPT3.5 generated text

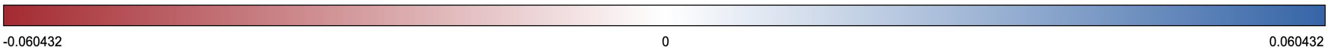
Prediect Logits

0.000095, 0.999905

Did you know that physical education and athletics are not typically prioritized in the Chinese state public school system? In fact, subjects like mathematics, science, Chinese, and English are often given more weight in the high school placement examination, known as "Zhongkao". However, China's impressive Olympic performance can be attributed to its robust national sports program, which identifies and nurtures young talent from an early age. The country's "factory model" approach to training athletes has proven successful in producing world-class competitors. While many Chinese people enjoy staying active through activities like dancing, table tennis, running, and basketball, professional sports in China still lags behind the West in terms of development and popularity. In contrast, Western countries have a massive following for professional sports, with millions tuning in to watch superstar athletes like Lebron James and Messi in action. What do you think about the differences in sports culture between East and West? Share your thoughts! #sports #culture #China #education

(d) Llama3 generated text

Figure A8: Case study of sentence-level analysis through Shaplay Value on Quora.



Prediect Logits

👤 0.999906, 0.000094 🤖

Physical education and athletics as a school subject is not generally emphasized in the Chinese state public school system. It is given less weight in the High school placement examination ““Zhongkao”” where other subjects such as Mathematics, Science, Chinese, and English are awarded more points and are given more consideration in classroom hours allotted to these subjects.China performs well in the Olympics because they have a very strong national sports program that is able to identify talent at an early age and provide these young athletes with the necessary resources and training at special athletics schools. They adopted a ““factory model”” of training athletes to represent the country at international sporting events.Chinese people as a whole are fairly fit and do like to partake in activities such as dancing, table tennis, running, and basketball as diversions. But professional sports is nowhere as emphasized, developed, or lucrative as in the west where millions of people tune in to watch multimillionaire athletes like Lebron James dunk a basketball or Messi perform a hat trick.

(a) Human written text (Quora)

Prediect Logits

👤 0.000094, 0.999906 🤖

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(b) GPT4o-mini generated text

Prediect Logits

👤 0.000096, 0.999904 🤖

Physical education and athletics may not be as prioritized in the Chinese state public school system, especially in comparison to subjects like Mathematics, Science, Chinese, and English. However, China's strong national sports program does contribute to their success in the Olympics. Through specialized athletics schools and early talent identification, they have been able to nurture young athletes effectively. While professional sports may not be as emphasized or lucrative in China as it is in the West, the Chinese people enjoy activities such as dancing, table tennis, running, and basketball as part of their active lifestyle. The focus on developing athletes from a young age and the 'factory model' approach to training has helped China excel in international sporting events. It's fascinating to see different approaches to sports development around the world, each with its unique strengths and strategies.

(c) GPT3.5 generated text

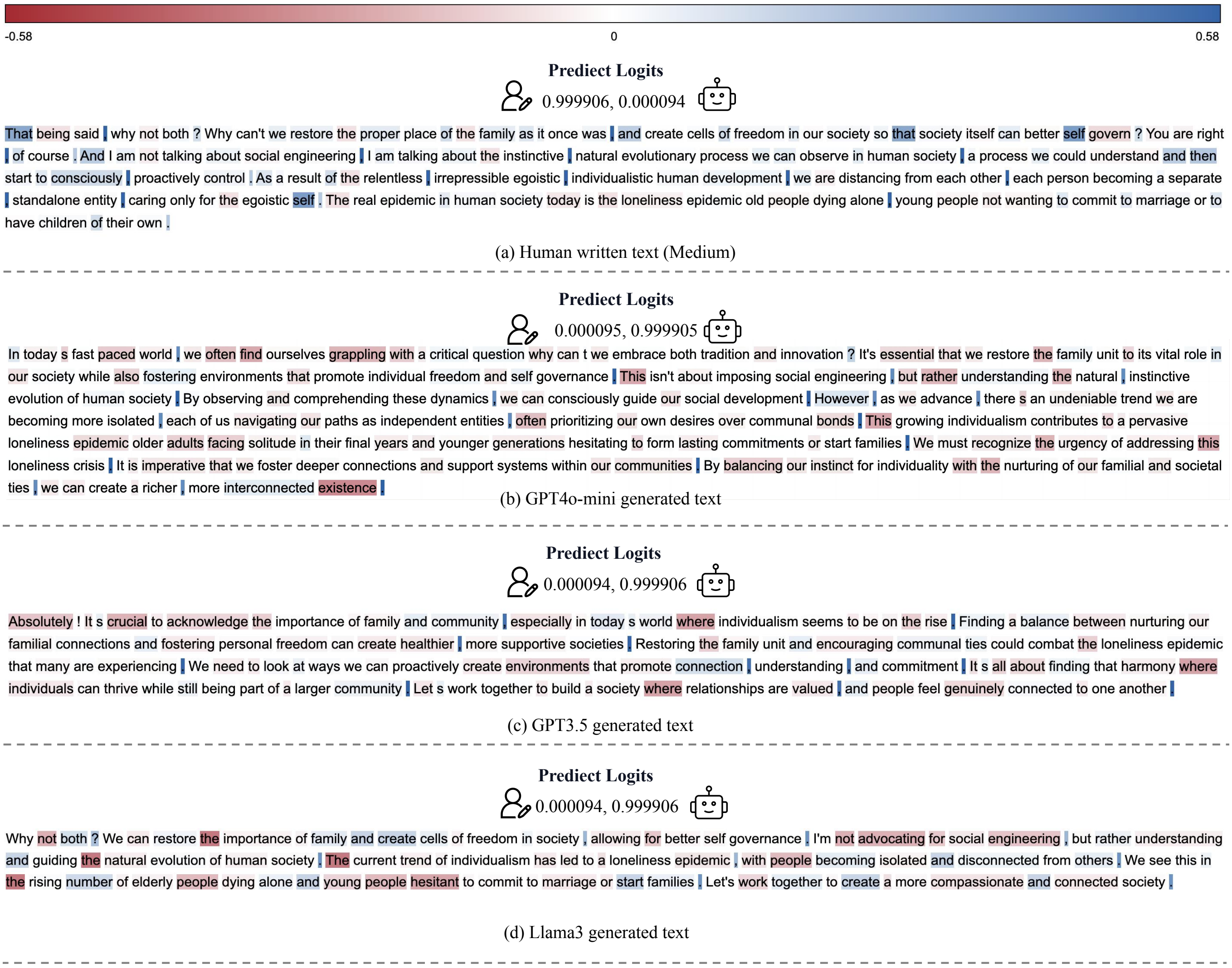
Prediect Logits

👤 0.000095, 0.999905 🤖

Did you know that physical education and athletics are not typically prioritized in the Chinese state public school system? In fact, subjects like mathematics, science, Chinese, and English are often given more weight in the high school placement examination, known as "Zhongkao". However, China's impressive Olympic performance can be attributed to its robust national sports program, which identifies and nurtures young talent from an early age. The country's "factory model" approach to training athletes has proven successful in producing world-class competitors. While many Chinese people enjoy staying active through activities like dancing, table tennis, running, and basketball, professional sports in China still lags behind the West in terms of development and popularity. In contrast, Western countries have a massive following for professional sports, with millions tuning in to watch superstar athletes like Lebron James and Messi in action. What do you think about the differences in sports culture between East and West? Share your thoughts! #sports #culture #China #education

(d) Llama3 generated text

Figure A9: Case study of word-level analysis through Shaplay Value on Quora.



Prediect Logits

0.999906, 0.000094

That being said , why not both ? Why can't we restore the proper place of the family as it once was , and create cells of freedom in our society so that society itself can better self govern ? You are right , of course . And I am not talking about social engineering , I am talking about the instinctive , natural evolutionary process we can observe in human society , a process we could understand and then start to consciously , proactively control . As a result of the relentless , irrepressible egoistic , individualistic human development , we are distancing from each other , each person becoming a separate , standalone entity , caring only for the egoistic self . The real epidemic in human society today is the loneliness epidemic old people dying alone , young people not wanting to commit to marriage or to have children of their own .

(a) Human written text (Medium)

Prediect Logits

0.000095, 0.999905

In today s fast paced world , we often find ourselves grappling with a critical question why can t we embrace both tradition and innovation ? It's essential that we restore the family unit to its vital role in our society while also fostering environments that promote individual freedom and self governance . This isn't about imposing social engineering , but rather understanding the natural , instinctive evolution of human society . By observing and comprehending these dynamics , we can consciously guide our social development . However , as we advance , there s an undeniable trend we are becoming more isolated , each of us navigating our paths as independent entities , often prioritizing our own desires over communal bonds . This growing individualism contributes to a pervasive loneliness epidemic older adults facing solitude in their final years and younger generations hesitating to form lasting commitments or start families . We must recognize the urgency of addressing this loneliness crisis . It is imperative that we foster deeper connections and support systems within our communities . By balancing our instinct for individuality with the nurturing of our familial and societal ties , we can create a richer , more interconnected existence .

(b) GPT4o-mini generated text

Prediect Logits

0.000094, 0.999906

Absolutely ! It s crucial to acknowledge the importance of family and community , especially in today s world where individualism seems to be on the rise . Finding a balance between nurturing our familial connections and fostering personal freedom can create healthier , more supportive societies . Restoring the family unit and encouraging communal ties could combat the loneliness epidemic that many are experiencing . We need to look at ways we can proactively create environments that promote connection , understanding , and commitment . It s all about finding that harmony where individuals can thrive while still being part of a larger community . Let s work together to build a society where relationships are valued , and people feel genuinely connected to one another .

(c) GPT3.5 generated text

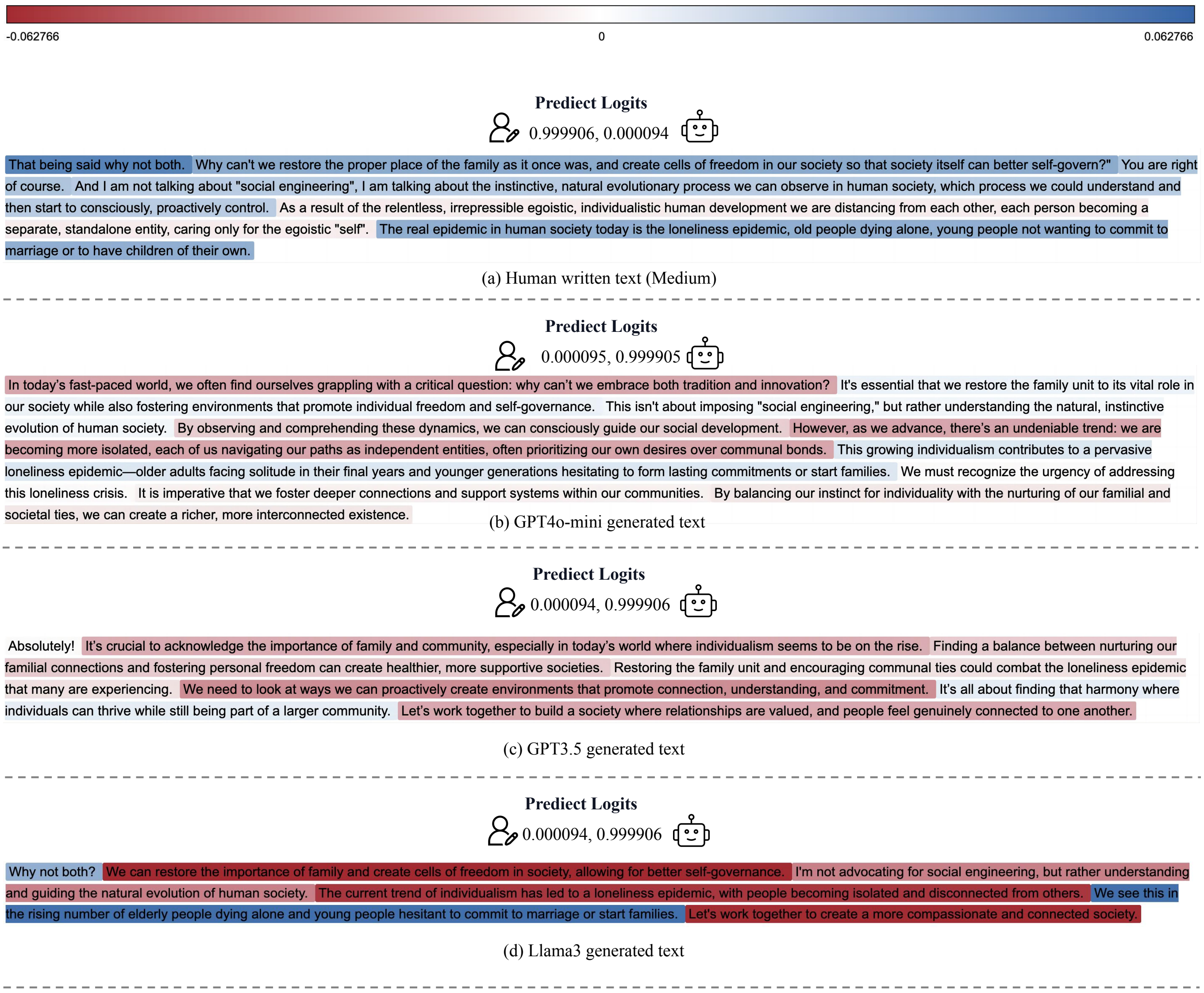
Prediect Logits

0.000094, 0.999906

Why not both ? We can restore the importance of family and create cells of freedom in society , allowing for better self governance . I'm not advocating for social engineering , but rather understanding and guiding the natural evolution of human society . The current trend of individualism has led to a loneliness epidemic , with people becoming isolated and disconnected from others . We see this in the rising number of elderly people dying alone and young people hesitant to commit to marriage or start families . Let's work together to create a more compassionate and connected society .

(d) Llama3 generated text

Figure A10: Case study of word-level analysis through Integrated Gradients on Medium.


-0.062766
0
0.062766
Predict Logits
0.999906, 0.000094

That being said why not both. Why can't we restore the proper place of the family as it once was, and create cells of freedom in our society so that society itself can better self-govern?" You are right of course. And I am not talking about "social engineering", I am talking about the instinctive, natural evolutionary process we can observe in human society, which process we could understand and then start to consciously, proactively control. As a result of the relentless, irrepressible egoistic, individualistic human development we are distancing from each other, each person becoming a separate, standalone entity, caring only for the egoistic "self". The real epidemic in human society today is the loneliness epidemic, old people dying alone, young people not wanting to commit to marriage or to have children of their own.

(a) Human written text (Medium)

In today's fast-paced world, we often find ourselves grappling with a critical question: why can't we embrace both tradition and innovation? It's essential that we restore the family unit to its vital role in our society while also fostering environments that promote individual freedom and self-governance. This isn't about imposing "social engineering," but rather understanding the natural, instinctive evolution of human society. By observing and comprehending these dynamics, we can consciously guide our social development. However, as we advance, there's an undeniable trend: we are becoming more isolated, each of us navigating our paths as independent entities, often prioritizing our own desires over communal bonds. This growing individualism contributes to a pervasive loneliness epidemic—older adults facing solitude in their final years and younger generations hesitating to form lasting commitments or start families. We must recognize the urgency of addressing this loneliness crisis. It is imperative that we foster deeper connections and support systems within our communities. By balancing our instinct for individuality with the nurturing of our familial and societal ties, we can create a richer, more interconnected existence.

(b) GPT4o-mini generated text

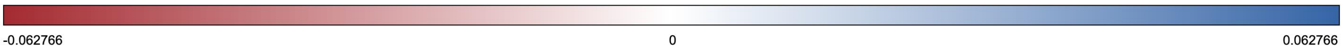
Absolutely! It's crucial to acknowledge the importance of family and community, especially in today's world where individualism seems to be on the rise. Finding a balance between nurturing our familial connections and fostering personal freedom can create healthier, more supportive societies. Restoring the family unit and encouraging communal ties could combat the loneliness epidemic that many are experiencing. We need to look at ways we can proactively create environments that promote connection, understanding, and commitment. It's all about finding that harmony where individuals can thrive while still being part of a larger community. Let's work together to build a society where relationships are valued, and people feel genuinely connected to one another.

(c) GPT3.5 generated text

Why not both? We can restore the importance of family and create cells of freedom in society, allowing for better self-governance. I'm not advocating for social engineering, but rather understanding and guiding the natural evolution of human society. The current trend of individualism has led to a loneliness epidemic, with people becoming isolated and disconnected from others. We see this in the rising number of elderly people dying alone and young people hesitant to commit to marriage or start families. Let's work together to create a more compassionate and connected society.

(d) Llama3 generated text

Figure A11: Case study of sentence-level analysis through Shaplay Value on Medium.



Predict Logits

0.999906, 0.000094

That being said why not both. Why can't we restore the proper place of the family as it once was, and create cells of freedom in our society so that society itself can better self-govern?" You are right of course. And I am not talking about "social engineering", I am talking about the instinctive, natural evolutionary process we can observe in human society, which process we could understand and then start to consciously, proactively control. As a result of the relentless, irrepressible egoistic, individualistic human development we are distancing from each other, each person becoming a separate, standalone entity, caring only for the egoistic "self". The real epidemic in human society today is the loneliness epidemic, old people dying alone, young people not wanting to commit to marriage or to have children of their own.

(a) Human written text (Medium)

Predict Logits

0.000095, 0.999905

In today''s fast-paced world, we often find ourselves grappling with a critical question: why can''t we embrace both tradition and innovation? It's essential that we restore the family unit to its vital role in our society while also fostering environments that promote individual freedom and self-governance. This isn't about imposing "social engineering," but rather understanding the natural, instinctive evolution of human society. By observing and comprehending these dynamics, we can consciously guide our social development.However, as we advance, there''s an undeniable trend: we are becoming more isolated, each of us navigating our paths as independent entities, often prioritizing our own desires over communal bonds. This growing individualism contributes to a pervasive loneliness epidemic—older adults facing solitude in their final years and younger generations hesitating to form lasting commitments or start families. We must recognize the urgency of addressing this loneliness crisis. It is imperative that we foster deeper connections and support systems within our communities. By balancing our instinct for individuality with the nurturing of our familial and societal ties, we can create a richer, more interconnected existence.

(b) GPT4o-mini generated text

Predict Logits

0.000094, 0.999906

Absolutely! It''s crucial to acknowledge the importance of family and community, especially in today''s world where individualism seems to be on the rise. Finding a balance between nurturing our familial connections and fostering personal freedom can create healthier, more supportive societies. Restoring the family unit and encouraging communal ties could combat the loneliness epidemic that many are experiencing. We need to look at ways we can proactively create environments that promote connection, understanding, and commitment. It''s all about finding that harmony where individuals can thrive while still being part of a larger community. Let''s work together to build a society where relationships are valued, and people feel genuinely connected to one another.

(c) GPT3.5 generated text

Predict Logits

0.000094, 0.999906

Why not both? We can restore the importance of family and create cells of freedom in society, allowing for better self-governance. I'm not advocating for social engineering, but rather understanding and guiding the natural evolution of human society. The current trend of individualism has led to a loneliness epidemic, with people becoming isolated and disconnected from others. We see this in the rising number of elderly people dying alone and young people hesitant to commit to marriage or start families. Let's work together to create a more compassionate and connected society.

(d) Llama3 generated text

Figure A12: Case study of word-level analysis through Shaplay Value on Medium.