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Title: Sentiment analysis of public reactions to Tesla's Optimus Robots on Reddit before and after the 'We, Robot' event. (1450 words)

Introduction :

With Tesla's release of 4 unique technologies, exploring consumer sentiment about Optimus Robots on Reddit feels timely. The AI-driven futuristic world that we dreamt of is coming to life and I wanted to see if my emotion of excitement is shared with others. Previous studies, like Saldaña, M., & Wong, K. (2021) on AI technologies and Zhang, J., & Wang, J. (2021) on electric vehicles, showed that people were skeptical about the same. So, I want to see if something similar is going to be observed for Tesla's Optimus.

Research Question: How did the 'We, Robot' event affect public emotions on Reddit towards Tesla's Optimus robot?

Method:

Data:

Data is collected from the following subreddits: r/Tesla, r/technology, r/robotics, and r/teslamotors. These subreddits are selected because of the frequent discussions surrounding Tesla's technological advancements, including the Optimus Robot. To find posts and comments about the robot, I used keywords such as 'Optimus robot', 'Tesla Optimus', and 'Tesla robot'. To target relevant posts and comments. Since, the 'We, Robot' event took place on 11th Oct 2024, data will be gathered from Sept 30th, 2023 (the last time The robot was presented) until the present. This period will help capture both the pre-release hype and post-release reactions, providing insights into any possible sentiment shifts. This time-range is further divided into Section A - Posts and comments from **September 30, 2023,** to **October 10, 2024** (before the 'We, Robot' event) and Section B - Data from **October 11, 2024,** to **November 6, 2024** (after the event). This helps us to exactly determine how the reddit users were impacted by the event. For eg: Did it live up to the hype? A total of 1762 data points was collected where section A contained 864 data points and Section B contained 898 points. For every post the code tried to extract a maximum of 35 comments which amounted to 1700 comments and 62 posts. After collecting the data, I obtained a summary of posts and comments within each section.(Table 1)

Section	comment	post
Section_A	836	28
Section_B	864	34

Table 1: Post and Comment Counts by Section

Each data point contains the content of the comment or post, its timestamp (to analyse sentiment changes over time), the number of upvotes received (to gauge popularity), its type (post or comment) and Section (data collected before or after event). The entire data collection was automated using PRAW (Python Reddit Wrapper Api) to help streamline data collection in a structured manner. The max and minimum upvote comment/post was also found. (Table2)

Section	Content	Type	Upvotes
Section_B	The Optimus robots at Tesla's Cybercab event w..	post	30923
Section_A	BD are physical bots designed for mobility, li...	comment	-163

Table 2: Top Upvoted Post /Comment and Least Upvoted Post/Comment

Analysis

Firstly, data cleaning was performed to remove any irrelevant posts or comments not related to the Robot along with any special characters and HTML tags. Next, the text was broken down into tokens using the NLTK (Natural Language Toolkit) package. This process of creating tokens is called tokenization and is crucial for any natural language processing task. I then removed all stop words like "the", "is", because they won't contribute to identifying the sentiment of the statement. One more crucial preprocessing step, which is conducted, is lemmatization. Here we reduce the words to their base word to boost data consistency. Finally, I implemented sentiment analysis using a pre-trained model called VADER (Valence Aware Dictionary and sEntiment Reasoner) because of its ability to detect sentiments through context and informal language. A previous study by Youvan, Douglas (2024) on VADER also talked about how the model assigns sentiment scores (positive, negative, neutral) based on the language used, thereby providing insights to the public perception. This score ranges from -1 to +1, where anything above 0.05 will be considered positive and anything below -0.05 will be negative. The range between 0.05 to -0.05 is neutral. An aggregate from the 2 sides (before and after the event) has been taken to understand the overall mood of the public. Additionally, all the findings are displayed using visualizations on Matplotlib and Seaborn, allowing clear interpretation of the sentiment analysis results. Sentiment and emotion trends were compared between Section A (before launch) and Section B (after launch) to observe any shifts in public perception. The analysis focused on identifying changes in positive, neutral, and negative emotions post-event.

Results:

The average sentiment scores observed for Section A (before the event) and Section B (after the event) are 0.186 and 0.156 respectively. Both scores show positive scores but it is clear that Section A had an overall higher score. This implies that people were more "positive" about the release of the robot before the annual Tesla event took place. One might also say that the Reddit users felt like their expectations weren't fully met, leading to a subtle shift towards a more "cautious" sentiment.

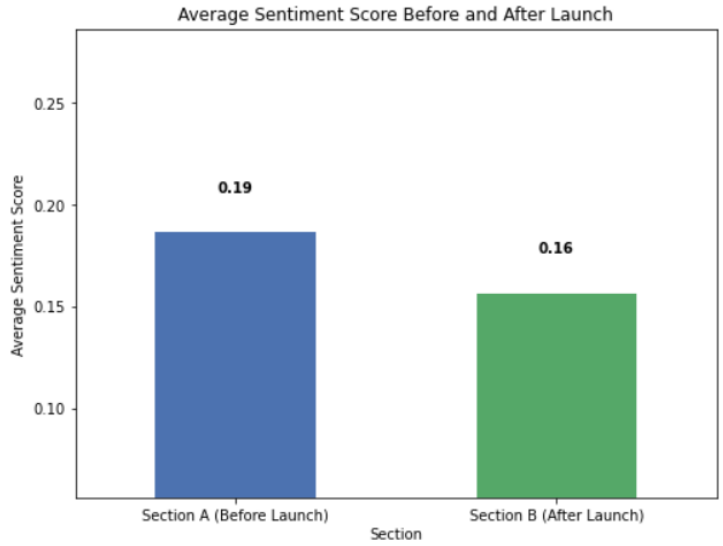

Figure 1: Avg Sentiment Score in Section A and B

The count of emotions based on the section gives us a better idea as to how the emotions of the reddit viewers were throughout this whole span of time(from the last event up until Nov 6th, 2024). For Section A (before the event), the Reddit content had a negative emotion in comparison to after the event. After the event quite a people had a neutral emotion as opposed to before the event. Finally, more positive content was found towards Tesla's Optimus Robot after the event took place.

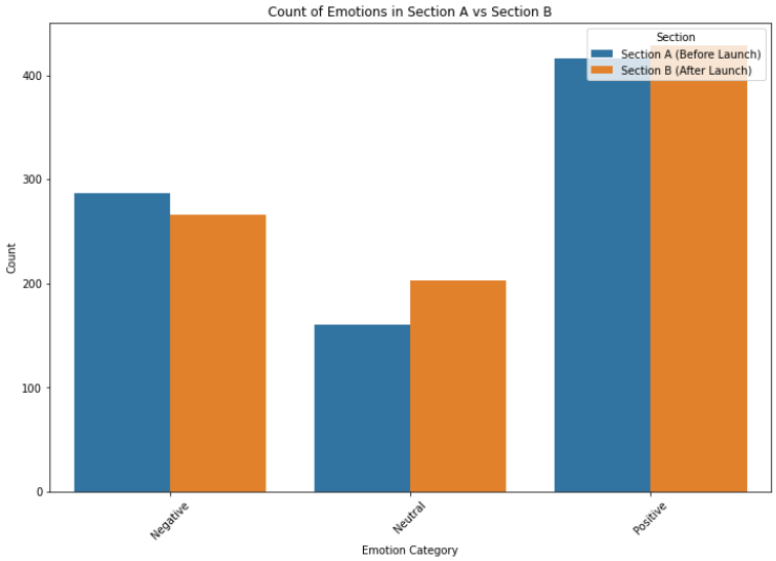

Figure 2: Count of Emotions in Section A and B

Limitations and Conclusions:

This study helps us understand how the 'We, Robot' event shaped sentiments of Reddit users on the Optimus robot. Even though the mean of the Section A seems higher, the count of positive emotions for section B is higher. This suggests that even though individual emotions were milder, the overall event broadened positive emotions.

However, there are a few limitations. The usage of VADER model might not have been the best decision, because the model might fail to capture subtle emotional nuances, especially

when talking about complex technologies like a robot (Xu et al., 2022). Moreover, restricting to Reddit data might have prevented the study to gain a generalised view on the topic. The analysis focused on only 2 major time points (pre and post-event). If the emotions were tracked over time we might have gotten a richer prespective. Simplifying emotions into categories may also overlook more complex reactions, which is common response to emerging technologies (Savela et al., 2024).

Despite the limitations, the study shows a majorly positive sentiment, indicating that the event possibly reduced negative perceptions on the Optimus robot.

References:

Saldaña, M., & Wong, K. (2021). The Role of Consumer Sentiment in the Adoption of AI Technologies: A Meta-Analysis. *Journal of Business Research*, 128, 213-226.

Zhang, J., & Wang, J. (2021). Understanding Consumer Sentiment Towards Electric Vehicles: A Text Mining Approach. *Transportation Research Part D: Transport and Environment*, 94, 102844.

Youvan, Douglas. (2024). Understanding Sentiment Analysis with VADER: A Comprehensive Overview and Application. 10.13140/RG.2.2.33567.98726.

Xu, Q. A., Chang, V., & Jayne, C. (2022). A systematic review of social media-based sentiment analysis: Emerging trends and challenges. *Decision Analytics Journal, 3*, 100073. https://doi.org/10.1016/j.dajour.2022.100073

Savela, N., Garcia, D., Pellert, M., & Oksanen, A. (2024). Emotional talk about robotic technologies on Reddit: Sentiment analysis of life domains, motives, and temporal themes. New Media & Society, 26(2), 757-781. https://doi.org/10.1177/14614448211067259