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Data Driven Approach to Public Opinion Mining on Autonomous Vehicles: Sentiment Analysis of Social Media Comments Using Large Language Models

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INTRODUCTION & MOTIVATION

- As autonomous vehicles roll out on public roads, tracking public sentiment helps address safety and ethical concerns that could shape adoption and regulation.
- Traditional survey-based sentiment analysis is time and resource intensive, relies on small samples, and is vulnerable to biases.
- In this study, we utilize large language models to perform context aware sentiment analysis on raw social media posts about autonomous vehicles across multiple years and platforms in the US, capturing nuanced attitudes and their evolution to inform major Autonomous Vehicle (AV) stakeholders.

METHODS

Platform and source selection
Built a new dataset from YouTube and Reddit using public APIs, collecting comments on six AV brands (Argo AI, May Mobility, Nuro, Tesla, Waymo, Zoox) from early 2018 to mid-2025.

Filtering
Developed a cleaning pipeline to remove bots, spam, and off-topic comments from AV-related posts and videos.

Sentiment labeling and temporal aggregation:
Used Llama-3.1-8B to evaluate posts and assign sentiment scores on a 5-point scale from very negative to very positive

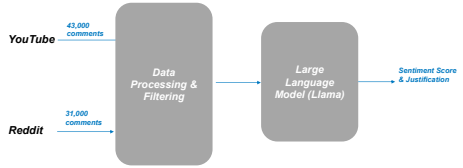

Figure 1. Sentiment Analysis Flowchart utilizing social medial posts

RESULTS AND DISCUSSION

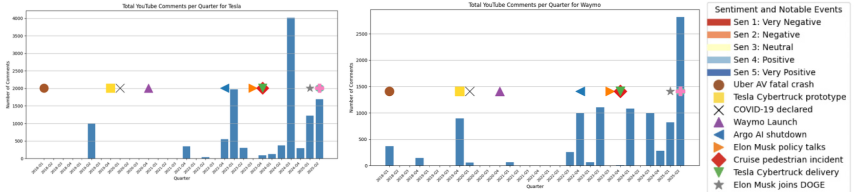

Figure 2. Distribution of comments from Youtube for Tesla and Waymo along with major news events

Positive	Negative
Excitement about the future: Users are thrilled about the potential of autonomous driving.	**Safety concerns:** Fear of sudden failures or malfunctions during busy road conditions.
Improved safety: Many believe that self-driving cars will significantly reduce accidents and make roads safer.	**Lack of human judgment:** Doubts about self-driving cars handling unexpected situations like humans.
Convenience: Eliminating the need to drive, providing ease and comfort during travel.	**Job displacement:** Concerns over employment loss in driving-related industries.
Increased accessibility: Avs may enable people with disabilities to maintain their independence	**Reliability issues:** Skepticism about technology breakdowns or malfunctions.
Reduced traffic congestion: Users hope that traffic will become more efficient and reduce travel times	**Network connectivity risks:** Anxiety over network loss while driving, especially on highways or tunnels.
Affordability: Could be a cheaper alternative to ride-hailing services or owning a car.	**Loss of control:** Unease about relying solely on software without human intervention.
Potential for social good: Seen as a tool for addressing transportation inequality and poverty.	**Disconnection from human experience:** Fear of losing the personal aspect of driving, replaced by dependency on technology.

RQ1: How has public sentiment toward autonomous vehicles evolved over time?

- Early views on autonomous vehicles were mostly neutral to positive, driven by optimism about the technology's potential.
- Over time, sentiment became more volatile and event driven rising around major breakthroughs and product launches, but dropping sharply after high-profile crashes, startup failures, and regulatory conflicts

RQ2: Does this evolution differ across various brands within the autonomous vehicle industry?

- Sentiment trends are clearly brand-specific: Tesla and Waymo draw high engagement but are seeing more negative reactions over time, driven by safety issues, and broader sociopolitical debates.
- Other AV brands show sharper, short-lived swings in sentiment that closely follow specific company events or announcements.
- Overall, public attitudes toward autonomous vehicles are dynamic, event-driven, and highly dependent on each brand's progress and reputation.

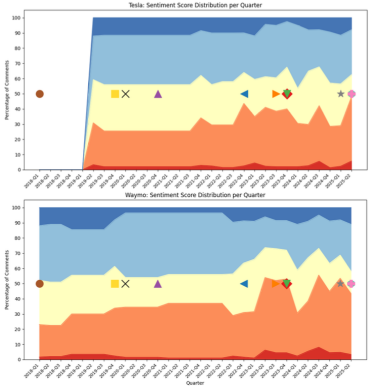

Figure 3. Distribution of Sentiment score for Tesla and Waymo

CONCLUSIONS & FUTURE WORK

- Comments for AVs come in pulses based on the news event.
- A negative new article about a specific AV company generates more social media discussion and creates a negative sentiment towards all in general.
- Safety is the key theme that most people are excited about and also have more concerns for.

REFRENCES

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[2] Wankhade, M., A. C. S. Rao, and C. Kulkarni, A survey on sentiment analysis methods, applications, and challenges. Artificial Intelligence Review, Vol. 55, No. 7, 2022, pp. 5731–5780

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