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Research on Public Perception of Autonomous Driving Taxis Based on Web Text Analysis: A Case Study of Apollo Go in Wuhan

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Abstract. In the context of rapid artificial intelligence advancement, this study explores public perception of autonomous driving technology, exemplified by Baidu's " Apollo Go " autonomous driving taxis in Wuhan. Given the discrepancy between governmental/enterprise optimism and public skepticism, this research aims to analyze public sentiment and concerns towards autonomous vehicles to mitigate risks associated with AI adoption in intelligent driving. Utilizing web text analysis, 2,181 valid Weibo comments were collected and analyzed using ROST CM6 software. Results reveal that while 81.50% of the public expresses positive emotions, primarily driven by technological progress and service experience, significant concerns persist regarding safety (15.38% negative sentiment) and socio-economic impacts, such as potential job displacement. The study innovatively employs social media data for a nuanced understanding of public perception, providing valuable insights for policymakers and industry stakeholders to enhance autonomous vehicles social compatibility and facilitate its safe, orderly, and extensive deployment.

Keywords: Public Perception; Apollo Go; Autonomous Taxi.

1. Introduction

With the rapid advancement of artificial intelligence, Baidu's "Apollo Go" driverless vehicles took the lead in achieving commercial operation of autonomous driving in Wuhan in August 2023, achieving remarkable success. The Chinese government strongly supports the development of automated driving technology and has proposed a development strategy that deeply integrates technologies such as artificial intelligence and big data with the transportation and logistics industry [1]. In contrast to the optimistic and proactive attitudes of the government and enterprises, the domestic public currently holds skeptical and cautious views on driverless cars [2]. For instance, controversial topics such as "Apollo Go driverless taxi knocks down pedestrians," "Apollo Go accused of disrupting the market with ultra-low prices," and "Is Apollo Go going to take away drivers' livelihoods?" quickly dominated the trending topics on Weibo [2]. Faced with this public sentiment, the research motivation of this paper lies in: how to fully explore and analyze the public's attitude perception towards driverless technology in this public sentiment, thereby further preventing the risks brought by artificial intelligence technology and helping China gain the initiative in the intelligent driving industry.

Among the current research findings on the acceptance and public perception of driverless technology, most studies primarily analyze survey data through carefully designed questionnaires. For example, Zefreh et al. explored the influencing factors of public acceptance of driverless public transportation based on a questionnaire survey in Budapest [3], but these studies often suffer from issues such as insufficient sample size and subjective biases of respondents. In today's increasingly popular social media landscape, the public has become accustomed to obtaining information and expressing opinions through online social platforms. Sina Weibo, one of China's largest public social media websites, provides an important window for presenting the public's interest, attention, and attitudes towards various hot events [4]. In recent years, scholars have begun to fully utilize social media data and emerging online text analysis methods to study public perception values and influencing factors in areas such as consumer decision-making and satisfaction [5-6], tourism experiences [7-8], etc.

Based on the above research background, this paper innovatively applies online text analysis methods, taking Weibo text data related to "Apollo Go" as the research object, to help capture the public's perception attitudes towards topics related to rapid driverless technology. This approach provides a more comprehensive and diversified perspective for government policy formulation and corporate business operations to understand the public's cognitive responses to the practical application of artificial intelligence technology.

2. Materials and methods

2.1. Overview of the case

Apollo Go is an autonomous driving mobility service platform under Baidu, which has opened up test operation services for passenger transport in 11 cities and is conducting tests for fully driverless autonomous driving mobility services in Beijing, Wuhan, Chongqing, Shenzhen, and Shanghai. As of July 28, 2024, Apollo Go has provided over 7 million autonomous driving mobility services to the public. In May 2024, Baidu launched the sixth-generation Apollo Go driverless vehicle in Wuhan, equipped with the world's first large-scale autonomous driving model supporting L4-level driverless applications [9]. The platform is expected to achieve break-even in Wuhan by the end of 2024 and enter a full-scale profit-making phase in 2025.

2.2. Data collection

We collected perception-related comments about Wuhan Apollo Go from Weibo between July 1, 2024, and June 30, 2025. A total of 2,473 comments were obtained. After manually screening and removing duplicate, irrelevant, promotional, and other invalid comments, we ended up with 2,181 valid comments.

2.3. Research methods

The network text analysis method, also known as content analysis, encompasses techniques for transforming unstructured, qualitative symbolic content derived from online consumer reviews into structured, quantitative data for in-depth research [10]. In this study, we employ the network text analysis method to mine public comments on the Apollo Go autonomous driving mobility service from original Weibo posts. We utilize the ROST CM6 software to analyze the online review data, dissecting the public's sentiment towards the Apollo Go autonomous driving mobility service, and subsequently propose relevant policy recommendations.

3. Results

3.1. Word frequency and high-frequency words

This paper employs the ROST CM6 software for word segmentation and statistical analysis of the collected data, extracting the top 80 high-frequency words and translating them to capture the public's initial emotional perception of "Apollo Go" (as shown in Table 1). From a part-of-speech perspective, these high-frequency words are primarily nouns, verbs, and adjectives.

Nouns mainly reflect the public's focus on objects and related contexts concerning "Apollo Go" autonomous driving taxis. Such terms include "Apollo Go," "Autonomous Driving," "Driver," "Driverless," and "Safety Officer," which embody core concerns in terms of technology, personnel, and functionality. For instance, "Apollo Go" (8,112 occurrences), as the brand name, appears most frequently, indicating the public's high level of attention to this brand. "Autonomous Driving" (3,293 occurrences) and "Driverless" (2,564 occurrences), as core technical terms, indicate the public's strong interest in this technology itself. Meanwhile, the frequent appearance of "Safety Officer" (2,528 occurrences) and "Safety" (1,188 occurrences) highlights the public's concerns about safety assurance in autonomous driving.

Verbs reflect the actions and experiences involved in public discussions, indicating the public's attention to practical operations and experiences during the use of autonomous driving taxis. For example, "Experience" (921 occurrences), as a high-frequency verb, shows that the public is particularly concerned about the experience during the use of autonomous driving taxis. Additionally, the emergence of verbs such as "Recruitment" (698 occurrences) and "Travel" (645 occurrences) indicates the public's interest in employment opportunities and changes in travel modes brought about by autonomous driving technology.

Adjectives reflect the public's subjective evaluations and emotional attitudes toward autonomous driving taxis. For instance, the frequent appearance of words like "Intelligent" (769 occurrences) and "Priority" (656 occurrences) reflects the public's recognition of the intelligence level of autonomous driving technology and their expectations for its priority development.

In summary, the public has expressed high attention and expectations regarding the emergence of autonomous driving taxis. However, the appearance of words such as "Safety" and "Employment" in high-frequency terms also reveals the public's concerns about potential social risks brought by autonomous vehicles.

Table 1. Top 80 high frequency words

No.	Words	Frequency	No.	Words	Frequency	No.	Words	Frequency	No.	Words	Frequency
1	Apollo Go	8112	21	Travel	645	41	Opportunity	296	61	Platform	224
2	Autonomous Driving	3293	22	System	636	42	Civilization	285	62	Second	220
3	Driver	3165	23	Order	617	43	Traffic	283	63	Ability	219
4	Driverless	2564	24	Automobile	577	44	Protection	281	64	Time	216
5	Safety Officer	2528	25	Market	534	45	Society	279	65	Rent	215
6	Wuhan	1709	26	Apply	532	46	Operation	279	66	Test	212
7	Position	1685	27	Google	509	47	Interview	271	67	Beijing	209
8	Safety	1188	28	Employment	433	48	Year-on-Year	269	68	Abundant	209
9	Taxi	1187	29	China	379	49	Placement	254	69	Capital	203
10	Driving	1185	30	Career	378	50	Capable	250	70	Attract	202
11	Technology	1134	31	Bus	375	51	Passenger	249	71	San Francisco	201
12	Baidu	1131	32	Era	372	52	Application	244	72	Worry	201
13	Experience	921	33	Ten Thousand Orders	371	53	Bring	241	73	United States	201
14	Ride-hailing	872	34	Growth	357	54	Popular	240	74	Size	194

15	Future	771	35	Competition	334	55	Enterprise	232	75	Break	193
16	Intelligent	769	36	Artificial Intelligence	332	56	Friends	230	76	Road	193
17	Development	704	37	Issues	324	57	Expectation	228	77	Prospect	190
18	Recruitment	698	38	Vehicle	323	58	Popularization	228	78	Cumulative	187
19	Service	696	39	Minutes	314	59	Order Volume	227	79	Business	185
20	Priority	656	40	Field	302	60	Shenzhen	224	80	Demand	183

3.2. Sentiment analysis

Sentiment analysis aims to systematically organize reviews with emotional undertones to intuitively and effectively reveal consumers' emotional experiences and perceptions of Apollo Go. Sentiment analysis reflects consumers' direct feelings toward Apollo Go, categorizing emotions into positive, neutral, and negative types. It quantitatively scores and evaluates emotional expressions in customers' text information to analyze the distribution of customers' emotions. This paper utilizes the sentiment analysis tool in ROST CM6 software to conduct a detailed analysis of customers' comments.

From the data in the table, it can be concluded that positive emotions dominate consumers' sentiments toward Apollo Go, accounting for a high proportion of 81.50%, indicating consumers' high recognition and satisfaction with Apollo Go's services. In the breakdown of positive emotions, the proportions of "general," "moderate," and "high" positive emotions are relatively balanced, with general positive emotions accounting for 31.60%, moderate positive emotions for 30.56%, and high positive emotions for 19.33%. Notably, the proportions of moderate and general positive emotions are similar, suggesting that these consumers' emotional tendencies are relatively fragile and prone to fluctuation influenced by external factors. Therefore, for Apollo Go, it is crucial to continuously optimize services, consolidate and enhance consumers' positive emotions, particularly transforming general positive emotions into moderate or even high positive emotions.

Meanwhile, observing the specific numbers of positive emotions, there are 304 instances of general positive emotions. This requires Apollo Go to pay particular attention to effectively improving the satisfaction of this group of consumers when promoting service upgrades, encouraging their emotional tendencies to shift towards more positive levels, and preventing them from slipping into neutral or negative emotions.

Additionally, although negative emotions account for a relatively low proportion, 15.38% of consumers still expressed dissatisfaction, including 102 instances of general negative emotions (10.60%), 28 instances of moderate negative emotions (2.91%), and 8 instances of high negative emotions (0.83%). These data indicate that while most consumers hold a positive attitude toward Apollo Go, a small portion of consumers still exhibit varying degrees of dissatisfaction, particularly the presence of high negative emotions, which cannot be overlooked. Therefore, Apollo Go needs to promptly take measures to address service issues based on specific consumer feedback, improving overall consumer satisfaction and promoting the brand's long-term development.

3.3. Semantic network analysis

To gain a deeper understanding of the factors influencing consumers' positive and negative perceptions, we conducted positive and negative semantic network analyses. Based on the extracted high-frequency words and the correlations among them, we constructed semantic network diagrams.

The connections between nodes in these diagrams illustrate the associative relationships among words, enabling the analysis of their underlying logic. A greater number of arrows indicates a higher frequency of co-occurrence and closer relationships among the words.

3.3.1. Sources of positive perceptions

By extracting and analyzing texts expressing "positive" emotions, as illustrated in Figure 1, we summarized the primary sources of consumers' positive perceptions as follows:

Technological advancement stands as the core reason for consumers' high praise of the self-driving taxi service Apollo Go. Numerous consumers have mentioned that "the autonomous driving technology demonstrated by Apollo Go is astonishing, truly making me feel the power of technology transforming our lives" and "the precision and safety of self-driving have filled me with anticipation for future travel." These evaluations highlight and discuss the transformative impact of self-driving technology as an emerging technological innovation on the automotive industry and even the structure of human society. They also reflect the widespread belief among the Chinese public that this trend is "inevitable".

Service experience serves as a bridge connecting technology with users, and high-quality service experience further solidifies consumers' positive perceptions. For instance, feedback such as "the entire process from booking to riding was seamless, with prompt customer service responses that made me feel very at ease" and "the interior of the Apollo Go self-driving taxi is clean, and the ride is comfortable, giving one a sense of being at home" indicates that Apollo Go's meticulous attention to service details has effectively enhanced consumer satisfaction and loyalty, enabling the convenience brought by technological advancements to be better delivered to every consumer.

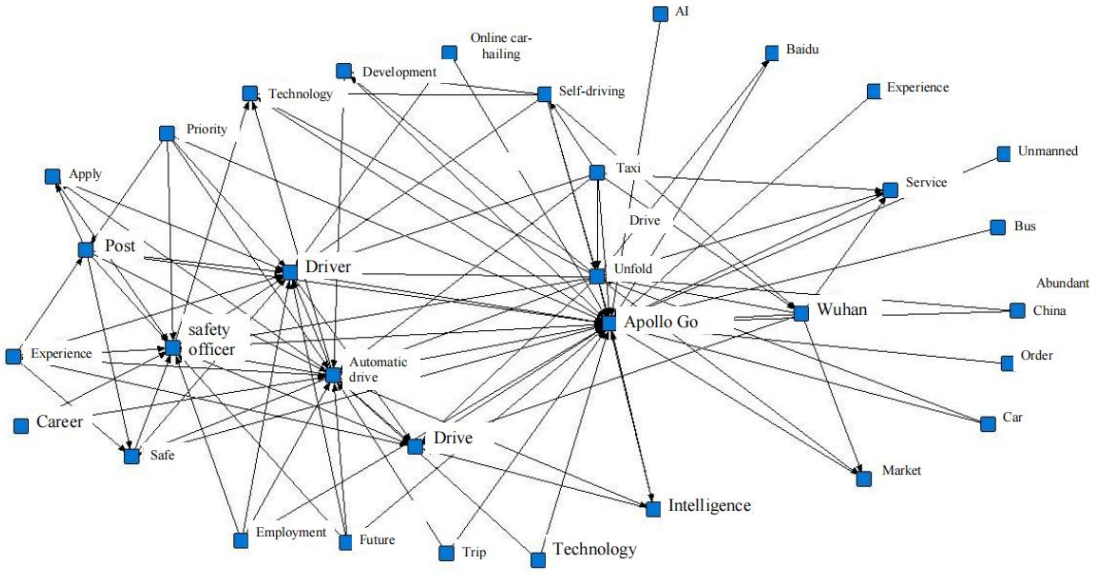

Figure 1. The positive semantic network diagram

3.3.2. Sources of negative perceptions

By extracting and analyzing texts expressing "negative" emotions, as illustrated in Figure 2, we have summarized the main sources of consumers' negative perceptions as follows:

Safety concerns constitute a significant factor contributing to consumers' negative attitudes towards the self-driving taxi service Apollo Go. In consumer feedback, concerns such as "doubts about the safety of self-driving technology, fearing risks of false advertising or technological fraud" and "whether self-driving vehicles have undergone legal certification and whether there are cases of illegal operation" frequently emerge. Keywords like "false", "fraud", "illegal", and "safety" reflect consumers' skepticism about the safety assurance mechanisms for new technological applications, as well as their worries about potential threats to personal and property safety.

Socioeconomic factors also play a crucial role in influencing consumers' negative perceptions. Consumers have expressed concerns about the potential socioeconomic impacts of self-driving taxis, such as "whether the widespread adoption of self-driving technology will replace a large number of traditional driver jobs, exacerbating employment issues" and "fears that the development of self-driving taxis will lead to driver unemployment and affect social stability." Keywords like "employment", "replacement", "drivers", and "unemployment" reveal consumers' unease about the socioeconomic structural changes that technological advancements may bring, particularly their sympathy and concern for the challenges that traditional industry workers may face.

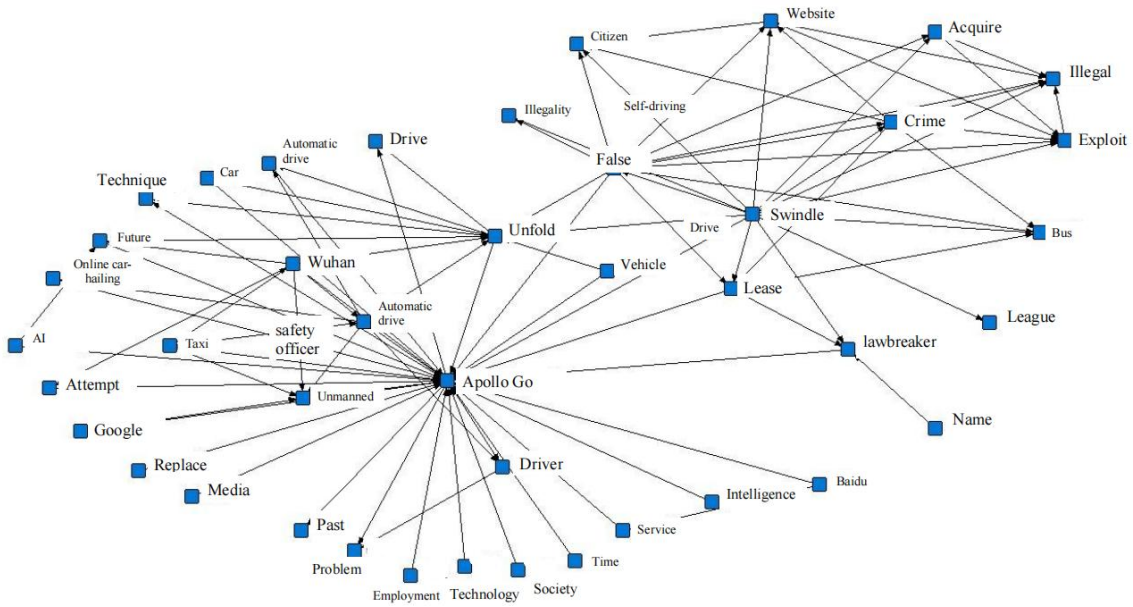

Figure 2. The negative semantic network diagram

4. Discussion

This paper focuses on the case of Apollo Go in Wuhan, which represents the world's largest-scale commercial operation of autonomous driving. By integrating social media data analysis with text mining techniques, this study aims to explore public attitudes toward autonomous driving technology, their key concerns, and potential directions for future research.

Public attitudes toward autonomous driving technology exhibit a certain degree of complexity. On one hand, technological progress, as a high-frequency keyword, frequently appears in social media comments, reflecting public recognition and anticipation of autonomous driving technology as an emerging innovation. This positive attitude primarily stems from the convenience and transformative impact on future travel modes brought about by autonomous driving technology. On the other hand, despite the high level of acceptance of technological progress, safety remains one of the foremost concerns among the public. This is evidenced by high-frequency terms such as "Safety," indicating public worries about the safety and reliability of autonomous driving technology in practical applications.

In addition to technological progress, service experience is also a focal point of public attention. During the operation of Apollo Go, the public has extensively discussed the riding experience of autonomous taxis, covering aspects such as the in-car environment, driving routes, and comfort. Simultaneously, the socioeconomic impacts of autonomous driving technology are also a significant concern among the public. For instance, the potential job displacement caused by autonomous taxis has sparked widespread discussion, particularly resonating among ride-hailing drivers. Word frequency analysis reveals that the public has significant concerns about whether autonomous driving technology will lead to unemployment among traditional drivers.

Market competition and policy environment are also crucial factors influencing public attitudes. Through text analysis, this paper finds that the public pays close attention to the performance of autonomous taxis in market competition, including pricing strategies, service quality, and market share. Meanwhile, the policy environment plays a vital role in the promotion and application of autonomous driving technology. Relevant government policies not only provide a clear management framework and operational procedures for road testing and demonstration applications of autonomous driving technology but also promote the research and development, promotion, and industrialization of intelligent connected vehicle technology. These policies have a non-negligible impact on the formation and evolution of public attitudes.

Given the complex public attitudes toward autonomous driving technology, future research should focus on enhancing the social compatibility of autonomous driving. This includes improving the safety and reliability of autonomous driving technology through technological innovation to alleviate public safety concerns. Simultaneously, public education and promotion efforts should be strengthened to increase public awareness and acceptance of autonomous driving technology. Additionally, attention should be paid to the integration of autonomous driving technology with social culture to promote its widespread application across various sectors of society.

In response to potential market competition issues arising from autonomous taxis, future research should delve into the relationship between the market structure of travel services and government regulation. On one hand, a sound market competition mechanism should be established to encourage enterprises to enhance technological innovation and improve service quality. On the other hand, the government should formulate scientific and reasonable regulatory policies to ensure fair and orderly market competition. Simultaneously, attention should be paid to the impact and shock of autonomous taxis on the traditional taxi industry, and reasonable policy measures should be formulated to promote coordinated development between the two industries.

The widespread application of autonomous driving technology will inevitably lead to changes in the employment structure. Future research should focus on the impact of employment changes on social stability and development and propose corresponding improvement plans for the social security system. This includes establishing a sound unemployment insurance system, strengthening vocational skills training and reemployment services, among others. Simultaneously, attention should be paid to the emergence and development trends of new occupations to provide necessary support and guarantees for practitioners in emerging occupations.

Legal frameworks and local legislation are essential foundations for ensuring the safe and orderly development of autonomous driving technology. Future research should focus on the latest developments and trends in legal frameworks and local legislation in the field of autonomous driving both domestically and internationally. Based on China's actual situation, practical legal frameworks and local legislative recommendations should be proposed. This includes clarifying legal provisions and procedural requirements for road testing and demonstration applications, access registration, usage management, traffic violations, and accident handling of autonomous vehicles to provide a solid legal guarantee for the widespread application of autonomous driving technology.

5. Conclusions

Through an in-depth study of the commercial operation case of Apollo Go (Wuhan's autonomous driving project) and by integrating social media data analysis with text mining techniques, this paper explores public attitudes toward autonomous driving technology, their key concerns, and potential directions for future research. The research findings indicate that the public holds complex attitudes toward autonomous driving technology, characterized by both anticipation and apprehension. Future research should focus on enhancing the social compatibility of autonomous driving, improving the market structure of travel services and government regulation, addressing employment changes and social security systems, and exploring legal frameworks and local legislation, thereby promoting the safe, orderly, and widespread application of autonomous driving technology.

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