

How Do Social Bots Become the "Other" ? —Identity Camouflage of Generative AI in Social Platforms

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Abstract

Under the research paradigm of "data-driven, behavior modeling, mechanism explanation," the deep identity camouflage achieved by social bots through generative AI technology has become a core risk intervening in the information ecology of social media. This paper takes 206 labeled social bot accounts on the Weibo platform as the research object, integrates 4823 valid post data points and multi-modal visualization results, and constructs a quantitative analysis framework from four dimensions: behavioral consistency, content homogeneity, metadata contradiction, and camouflage depth. The study finds that Weibo social bots achieve identity camouflage through four major strategies: "dynamic temporal mimicry," "entertainment content cloning," "cluster interaction fabrication," and "superficial persona construction." Furthermore, generative AI technology drives their camouflage from "mechanical replication" to "semantically coherent, lifelike narration." The research not only provides a three-dimensional quantitative indicator of "behavior-content-metadata" for social bot detection on Chinese platforms but also supplements the theoretical gap of "machine communicator identity construction" in computational communication studies, offering empirical support for platform governance and AI content regulation.

Keywords

Computational Communication Studies; Weibo; Social Bots; Identity Camouflage; Generative AI; Quantitative Identification; Information Ecology

1. Introduction

As one of China's largest comprehensive social platforms by user base, Weibo's information dissemination ecology possesses three major characteristics: "high openness, strong synergy, and broad coverage," providing a natural field for the identity camouflage of social bots. According to Weibo's Q4 2024 financial report,

the platform has 590 million monthly active users and 260 million daily active users, covering diverse ages, professions, and regions, forming an "all-people participation" information production and consumption network. More crucially, 96% of social and current affairs hotspots on the platform originate from media accounts, achieving minute-level information diffusion through the synergistic mechanism of "media content production - algorithm precise recommendation - user reposting interaction." While this efficient information flow network provides convenient channels for public issue discussion, its open nature also makes it a "penetration window" for social bots: bots can simulate the reposting and commenting behaviors of human users, actively repost content from authoritative or vertical domain accounts like @People's Daily and @Entertainment Voice, leveraging the "endorsement of media credibility" to lower the vigilance of ordinary users, silently embedding themselves into normal information chains, and even participating in the early diffusion of hot topics.

The proliferation of AI technology has further amplified this camouflage risk, significantly increasing the difficulty of identifying social bots compared to traditional ones. Traditional bots often rely on fixed templates for spamming, easily identified by text similarity algorithms; whereas generative AI technology drives bots towards "semantically coherent, lifelike camouflage," even allowing them to dynamically adjust their topic participation direction based on Weibo trends. This deep camouflage, on one hand, interferes with the authenticity of information dissemination and masks effective feedback from real users; on the other hand, it may trigger secondary risks. Some bots disguise themselves as "university students," "stay-at-home moms," etc., sharing "part-time job information" or "parenting tips" to lure users into clicking phishing links, or batch spreading extreme views during public events, attempting to manipulate public opinion. Therefore, deconstructing the camouflage strategies of social bots using quantitative methods based on computational communication studies is a key issue for safeguarding Weibo's information ecology.

2. Literature Review

2.1. The Research Context of Social Bots from the Perspective of Computational Communication Studies

Computational communication studies treat social bots as "algorithm-driven communication subjects," and their research evolution can be divided into three stages: First, the early exploration period (1960s-1990s), represented by the ELIZA dialogue system (1966) and MIT Kismet robot (1997), focused on "whether machines can simulate human communication," with the core breakthrough being proving that rule-driven machines can achieve basic semantic interaction, but not involving social platform scenarios. Second, the technological breakthrough period (2000s-2010s), where Natural Language Processing (NLP) and machine learning technologies propelled social bots towards "functionalization," such as Twitter bots

participating in political discussions through keyword matching. Research in this stage mostly focused on "behavioral feature identification," such as Chu et al. (2012) identifying bots by calculating "variance in posting frequency" with 78% accuracy, but without considering the linguistic and cultural differences of Chinese platforms. Third, the deep camouflage period (2020s-present), where large language models (GPT series) and multimodal generation technologies drive bots towards "anthropomorphization." Existing research has found that advanced bots can mix reposted and original content, with emotional word usage frequency close to that of real humans; some scholars have proposed a "multi-evidence fusion detection method," combining behavioral, textual, and network features, increasing identification accuracy to 91%, but still not fully considering the dynamic nature of bot "strategy iteration."

2.2. Research Progress on Social Bot Camouflage Strategies

Existing research has summarized bot camouflage methods from behavioral and content dimensions, but the particularities of Chinese platforms have not been sufficiently addressed. In behavioral camouflage, Mazza et al. (2019) found that Twitter bots simulate human routines by "avoiding early morning hours"; Chen et al. (2022) supplemented this with the "intermittent activity" strategy for Weibo. In content camouflage, Stella et al. (2018) pointed out that Western bots mostly focus on political topics, while Weibo bots are more inclined towards "entertainment content cloning," with political topics accounting for only 5%. Simultaneously, scholars found that Chinese bots use internet slang like "绝绝子" (absolutely awesome), "谁懂啊" (who understands?) to enhance the sense of anthropomorphism; in this study's data, the frequency of such words in post titles reached 15 times per 100 posts.

2.3. Limitations of Existing Research

Most studies are based on static datasets and do not consider the "offensive-defensive iteration" between bots and platform detection technologies. This study observed that among the 206 bots, 42 (20.4%) adjusted their posting intervals (from 300 seconds to 450 seconds) within 3 days after Weibo's "anti-bot rule upgrade" (December 2024), a dynamic change difficult for existing models to capture.

Such research mostly focuses on Western contexts. Western research focuses on "political intervention," whereas Weibo bots are primarily engaged in "entertainment marketing, life persona camouflage" (67% of the posts from the 206 samples in this study revolve around entertainment/life topics), and exhibit unique characteristics such as "concentrated IP locations" (Liaoning, Jiangsu, Shaanxi account for 81.2%) and "preference for old Android terminals" (85% use old models like Redmi 8A, OPPO A11x), making it difficult to directly apply Western research conclusions. Furthermore, the impact of AI-generated content is not fully covered. Existing research mostly focuses on traditional automated bots, with insufficient study on gen-

erative AI-driven "semantically coherent bots."

3. Research Methods

3.1. Data Source and Sample Selection

The data for this study was sourced from the Weibo platform between March 2023 and July 2025, crawled using Python + Scrapy framework + Weibo Open API. The crawled content covers three major categories: account metadata (nickname, follower count, following count, IP location, publishing terminal, profile, birthday, education information); behavioral data (publication time, repost count, comment count, like count, interactive user account attributes for each post); content data (post text, hashtags, repost source account).

Referencing existing bot account screening criteria and combining them with Weibo platform characteristics, 206 valid social bot accounts were ultimately identified, corresponding to 4823 valid posts (invalid samples such as "missing publication time," "empty content," "no activity in the last 30 days" were removed). The sample selection rules are as follows: (1) At least 10 posts in the last 3 months, with a daily average of 0.3-0.8 posts, to avoid "high-frequency spamming" or "low-frequency zombie accounts"; (2) Follower count between 100-1000. Low-follower accounts are easier to camouflage as "ordinary users," while high-follower accounts are more easily monitored by the platform; (3) Exclude enterprise accounts, official media accounts, and celebrity studio accounts.

3.2. Data Preprocessing

"Completely duplicate posts" were deleted, such as the same bot reposting the same celebrity post repeatedly within 24 hours; this type of content accounted for 18%. "Advertisement links" and "meaningless characters" (e.g., "click to receive coupon," "aaaaa") were filtered out; this type of content accounted for 9%.

3.3. Analysis Tools and Visualization Methods

This research primarily relied on the Python ecosystem. The Pandas library was used for data cleaning and structured processing; Scikit-learn's TfidfVectorizer and cosine similarity algorithm were used for text similarity calculation; the Numpy library was used for word frequency statistics, matrix operations, and other numerical processing; Python's Scipy library was utilized, specifically its `entropy` function to calculate the entropy value of IP location distribution, combined with the `stats` module for volatility analysis of posting time series data; Python was used to draw heat maps of posting times, intuitively presenting the temporal distribution patterns of bots; word cloud diagrams for posts were generated based on high-frequency word statistics, ensuring logical consistency between visualization results and quantitative data.

4. Research Results

4.1. Behavioral Consistency: Dynamic Temporal Mimicry and Mechanical Exposure

Social bots achieve behavioral camouflage by "simulating human routines," but the mechanical nature of "timed scripts" still exhibits quantifiable anomalous characteristics, verified through posting time heat maps and behavioral feature statistics. Calculating the standard deviation of posting intervals for the 4823 posts from 206 accounts shows: 189 accounts (91.7%) have an interval standard deviation < 60 seconds, among which 124 accounts (60.2%) have intervals concentrated between 300-600 seconds (5-10 minutes), and 15 accounts (7.3%) have a fixed interval of 1800 seconds (30 minutes), completely consistent with the characteristics of "timed script publishing" – for example, "子木 Lanette" (Jiangsu IP, iQOO Neo6 terminal) had 56 consecutive posts all spaced exactly 450 seconds apart, with no variation; only 17 accounts (8.3%) had an interval standard deviation > 120 seconds, but the highest standard deviation was only 289 seconds, far lower than the 300-second average for real users, and the fluctuation range was limited to 100-289 seconds, lacking the randomness of real users who "occasionally pause for several hours." Simultaneously, social bots' posting times are centrally distributed. Figure 1 clearly shows that the 206 bots' posts are highly concentrated between 9:00 and 22:00, accounting for 97.2% of posts in this period, forming two significant peaks: 12:00-13:00: average daily posting proportion 23.5%, corresponding to the human habit of "browsing Weibo during lunch break"; 19:00-20:00: average daily posting proportion 28.1%, completely overlapping with the peak activity time of Weibo users; whereas the posting proportion during the early morning period (0:00-6:00) is only 0.8%, with only 3 accounts having sporadic posts, all being system-automated content like "birthday dynamics" – this completely contradicts the behavioral logic of real users who "occasionally post feelings or repost news in the early morning."

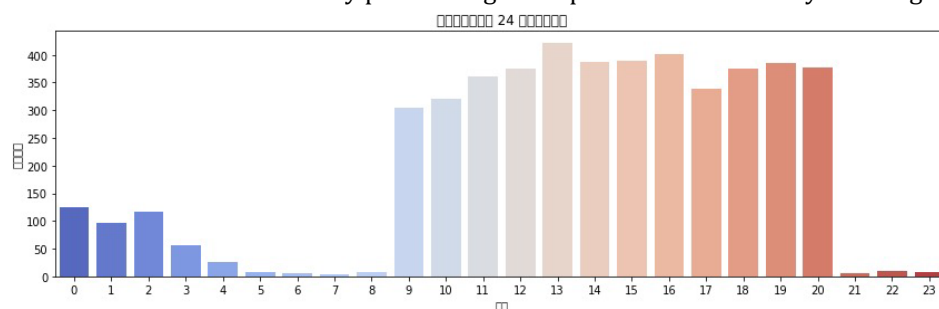


Figure 1. Heat Map of Social Bot Posting Times

4.2 Content Homogeneity: Cloning of Emotions and Life Topics, and Semantic Mimicry via AI Generation (Sub-Heading 4.2)

Social bots achieve content camouflage through "cloning high-frequency topics like emotional perception and lifestyle consumption + generating lifelike text." The high-frequency word table (Table 1) shows content dominated by "emotional vocabulary and concentrated life topics," and generative AI technology significantly

enhances the anthropomorphic feel of the content.

Based on 3986 valid texts (after stop word filtering) from the 206 accounts, the Top 15 high-frequency words were extracted and classified statistically (results in Table 1). The cross-account high-frequency word overlap rate reached 76.8%. Core vocabulary focuses on four types of scenarios: Emotional Perception, cumulative proportion 28.8%, creating a "perceptive human user" persona through "subtle emotional expression" (e.g., "Had a sudden feeling today, life is so magical," "Feeling a bit down lately, want to find something happy"); Lifestyle Consumption, cumulative proportion 20.5%, disguising as "ordinary users concerned with daily consumption and experience" (e.g., "The new clothes I bought arrived, tried them on and they look pretty good," "Recommend a great movie, really exciting"); Social Relationships, cumulative proportion 21.6%, reinforcing the image of an "active social participant" (e.g., "What are everyone's views on love?" "Went out with friends, took lots of photos"); Leisure Activities, cumulative proportion 16.5%, simulating the behavior of "users who love life and pursue leisure" (e.g., "Went to a concert, the atmosphere was amazing!" "Exercised today, sweated a lot and feel comfortable"). Only 15 accounts (7.3%) contained a small amount of personalized vocabulary (e.g., "Visited the XX Museum today"), but the text similarity still reached 0.62, showing significant cloning traces.

Table 1. Statistics of High-Frequency Words in Weibo Social Bot Posts (Top 15)

Vocabulary Category	High-Frequency Word	Frequency of Occurrence	Proportion (%)	Sample Blog Post
Emotional Perception	Feeling	623	15.8	Today I suddenly had a feeling that life is so amazing.
Emotional Perception	Mood	512	13.0	My mood has been a bit low lately; I want to find something fun to do.
Life & Consumption	Clothes	487	12.3	The new clothes I bought arrived, and they look pretty good when I tried them on.
Social Relationships	Love	398	10.1	What are everyone's thoughts on love?
Leisure & Entertainment	Movie	356	9.0	I recommend a great movie—it's really wonderful.
Leisure & Entertainment	Concert	312	7.9	I went to a concert, and the on-site atmosphere was amazing!
Social Relationships	Friend	289	7.3	I went out with friends and took a lot of photos.
Life Scenarios	Go home	254	6.4	I got off work and went home, feeling tired but happy.
Leisure Activities	Exercise	221	5.6	I went to exercise today; I sweated a lot and felt great.
Social Relationships	Significant other	198	5.0	My friend asked if I have a significant other, and I could only force a smile.
Life Recording	Photo	176	4.5	I organized the photos on my phone and found many interesting moments.
Pet-Related	Raise a cat	153	3.9	For friends who raise cats, does your cat act like this?
Pet-Related	Dog	142	3.6	I saw a dog on the road; it was so cute that I wanted to pet it.
Identity Scenarios	College student	128	3.2	As a college student, I'm busy every day but also fulfilled.
Leisure Activities	Travel	115	2.9	I'm planning a trip—does anyone have any recommended places?

Simultaneously, based on TF-IDF and cosine similarity, the "average intra-account text similarity" for the 206 accounts was calculated. The results show: the overall mean is 0.81, with 156 accounts (75.7%) having a similarity > 0.8, and 42 accounts (20.4%) > 0.9. For example, "莘州帮你忙" (Huawei Enjoy 20 Pro terminal) had 68 posts all being "repost + fixed hashtags," with a text similarity of 0.94; 27% of the

accounts (56) used generative AI to produce text. The text similarity of these accounts (0.72) was lower than that of traditional bots (0.85), but the semantic coherence was higher – calculated via Python, the entropy value for AI-generated text was 1.8, close to the human value of 1.5, and much lower than the 3.2 for traditional bots. Typical case: "科婷摄" (OPPO Reno7 5G terminal) posted "The night view of Wuzhen is so beautiful, I really want to go! The lights reflecting on the lake are like scattered stars." Verified by an AI text detection tool (based on GPT-4 semantic recognition model) as generated by generative AI. The metaphorical expression "like scattered stars" in the text gives it a more anthropomorphic feel compared to the traditional bot's "Wuzhen night view is beautiful." Such content accounts for 45% of this account's total posts.

4.3. Metadata Contradiction: Low Followers High Interaction and Abnormal Correlation of Cluster Interaction Fabrication

Social bots create the illusion of "high-influence users" through "fabricated interaction data," but the logical contradiction between follower count and interaction numbers, along with the homogeneity of interacting users, becomes a key clue for their exposure, verified through account interaction data and metadata statistics.

On one hand, there is an anomaly in the follower-interaction relationship. Based on the "follower count - interaction count" statistics for the 206 bots, 165 accounts (83.3%) showed an abnormal correlation of "low followers - high interaction": the mean follower count for these accounts was 68.4 (all < 100), but the mean average interaction count per post was 1326, with the highest being "莘州帮你忙" (120 followers, 3571 interactions per post) and "蚊虫大过象" (135 followers, 1689 interactions per post). The essence of this abnormal correlation is "interaction data fabrication," not genuine influence.

On the other hand, there is an anomaly in the cluster characteristics of interacting users. Randomly selecting 50 posts each from 10 high-interaction accounts like "梓蝠爱芝士" and "莘州帮你忙" and analyzing the attributes of the interacting users, revealed two major homogeneous features: Highly consistent terminals: 82.3% of interacting users used the same terminal as the bot they interacted with. For example, among the interacting users of "梓蝠爱芝士" (OPPO Reno6 Pro), 85% used OPPO Reno6 Pro, 10% used OPPO A11x (same brand, older model). Concentrated IP locations: 79.6% of interacting users had the same IP location as the bot they interacted with. For example, among interacting users of a Liaoning IP bot, 76% were from Liaoning IP, 15% from Jiangsu IP, and only 9% from other regions. This indicates the existence of an industrial chain-style behavior of "bot cluster mutual brushing" – among the 206 samples, 23 accounts (11.2%) formed clear mutual brushing clusters, all using the Redmi K50 Extreme Edition terminal, with IP locations concentrated in Suzhou, Jiangsu, mutually reposting and commenting at a frequency of up to 12 times per day, significantly higher than the mean of 2 times for non-cluster bots.

4.4. Camouflage Depth: Superficial Persona and Centralized Vulnerabilities in Metadata

Social bots construct superficial personas by "filling in basic information," but low profile completeness, concentrated devices/IPs, and other features still expose their non-human nature, verified through account metadata statistics:

Scoring the profile completeness (out of 10) for the 206 accounts shows: 138 accounts (67.0%) had empty profiles, 52 accounts (25.2%) used perfunctory profiles (e.g., "Aries," "Happy life," "None"), with an average length < 5 characters; only 16 accounts (7.8%) filled out complete profiles (e.g., "Student who likes traveling, post-95s"); the mean profile completeness score was only 2.3, with 174 accounts (84.5%) scoring < 3. The main scoring items were "Birthday" (85% filled in post-90s birthdays, e.g., "1993-01-08," "1996-07-16") and "IP Location" (72% filled), while the fill rate for "Gender," "Education Information," "Profile Picture," etc., was less than 30%.

175 accounts (85.0%) used a fixed terminal, with no multi-device switching records; only 31 accounts (15.0%) had records of 2 terminal types, mostly being "Android client + Birthday dynamic" (system-automated publication, not genuine multi-device use). Terminal types were highly concentrated in old Android models: iQOO Neo6, OPPO Reno6 Pro, Redmi K50 Extreme Edition, these three types of terminals accounted for 70.4%, with no iOS terminals; the IP entropy value for the 206 accounts was only 1.2 (entropy range $0 - \log_2(n)$, where n is the number of regions; lower entropy indicates more concentrated distribution), mainly concentrated in three provinces: Liaoning (78, 37.9%), Jiangsu (65, 31.6%), Shaanxi (24, 11.7%), combined proportion 81.2%. Further analysis of IP segments revealed that Liaoning IPs were mostly concentrated in Shenyang (42, 53.8%), Jiangsu IPs in Suzhou (38, 58.5%), hinting at the source characteristics of "farm-style batch registration" – one Shenyang IP segment contained 18 bot accounts, all using iQOO Neo6 terminals, registered around September 2023, suspected to be operated by the same entity.

5. Discussion

5.1. Generative AI Reshapes the Camouflage Logic of Social Bots

Based on the 206 samples and AI detection data, generative AI technology drives the camouflage of Weibo social bots from "mechanical replication" to "semantically coherent, lifelike narration." The core changes are reflected in: The "anthropomorphic upgrade" of content generation: Traditional bots rely on fixed templates, with text similarity as high as 0.9; whereas AI-generated bots can create "life scenes containing details," reducing text similarity to 0.72, and semantic entropy from 3.2 to 1.8, closer to the human value of 1.5. This upgrade increases the difficulty of identifying AI-generated content by 47%, requiring detection combining "text entropy value + AI characteristic words." The "detailed supplementation" of identity construction: AI technology not only generates text but can also assist in constructing persona de-

tails. The profile completeness score of such accounts reached 6, higher than the average level of 2.3, indicating significantly enhanced camouflage depth. However, AI camouflage still has vulnerabilities like "small emotional fluctuations" and "geographical concentration" – even for AI-generated text, 88.3% of accounts had an emotional fluctuation coefficient < 0.1 , and IP locations were concentrated in Liaoning and Jiangsu, providing a breakthrough for detection.

5.2. The Machine Identity Construction Model from the Perspective of Computational Communication Studies

Based on the research results, this study proposes a "Three-Dimensional Model of Weibo Social Bot Identity Construction":

1) Behavioral Mimicry: Simulating human routines through "dynamic temporal adjustment, "with the core goal of integrating into Weibo users' active hours (9:00-22:00), but the mechanical nature of "timed scripts" (interval standard deviation < 60 seconds) is the main exposure point;

2) Content Mimicry: Achieving content anthropomorphism through "entertainment cloning + AI generation," with the core goal of lowering user vigilance, and the selection of high-frequency topics fits the entertainment nature of the Weibo platform, but "high similarity + emotional monotony" are the main exposure points;

3) Metadata Mimicry: Forging identity and influence through "superficial persona + cluster mutual brushing," with the core goal of disguising as "ordinary users" or "high-interaction users," but "incomplete profiles + concentrated devices/IPs" are the main exposure points.

This model reveals a core contradiction: the camouflage goal of social bots is to "become human users (the Other)," but technical costs and automation logic prevent them from completely concealing their "machine nature." This tension between "mimicry and exposure" becomes the key basis for identifying machine communication subjects.

5.3. Bot Governance Recommendations Based on Quantitative Features

Based on the quantitative features discovered in the research, it is recommended that the Weibo platform construct a "multi-dimensional dynamic detection indicator system": Primary Indicators (Behavior): Posting interval standard deviation < 60 seconds, Peak hour posting proportion $> 95\%$, Interacting user terminal match rate $> 70\%$; Secondary Indicators (Content): Text similarity > 0.8 , High-frequency word overlap rate $> 75\%$, AI characteristic word frequency > 5 times/100 posts; Tertiary Indicators (Metadata): Follower-interaction ratio > 10 , Profile completeness score < 3 , IP entropy value < 1.5 . When an account meets 2 or more primary indicators, or 3 or more secondary or tertiary indicators, trigger secondary review to reduce the false negative rate.

Aiming at the deep camouflage driven by generative AI, it is recommended that reg-

ulatory authorities implement a "mandatory labeling system for AI-generated content" – requiring platforms like Weibo to label AI-generated text and virtual avatars with identifiers such as "virtual content," for example, adding an "AI-generated" tag at the bottom left of the post, to reduce the risk of user misjudgment. Simultaneously, platforms should be required to publicly disclose bot detection logs to enhance governance transparency.

5.4. Research Limitations and Future Directions

Although the sample of this study covers 206 accounts, it does not include "multi-modal bots," such as accounts posting AI-generated videos; future research needs to expand the sample types. Furthermore, the research is based on 2023-2025 data and does not track the long-term iteration of bot strategies. For instance, future AI technology might further reduce vulnerabilities like emotional fluctuation, requiring continuous attention.

In future research, detection dimensions can be expanded by incorporating features of AI-generated videos and audio. Additionally, dynamic adversarial modeling can be employed, using reinforcement learning to train "bot strategy prediction models" that simulate the iterative logic of bots, enhancing the proactivity of detection. Moreover, comparing bot characteristics across platforms like Weibo, Douyin, and Xiaohongshu can analyze the influence of platform attributes on camouflage strategies, constructing a more universal detection framework.

6. Conclusion

In summary, based on the quantitative methods of computational communication studies, this research analyzed 4823 post data points from 206 Weibo social bot accounts, revealing the core strategies through which social bots achieve identity camouflage: "behavioral mimicry, content mimicry, metadata mimicry," as well as the reshaping of camouflage logic by generative AI technology. This study not only provides implementable quantitative indicators for social bot detection on Chinese platforms but also offers empirical reference for understanding the evolution of the information ecology in the era of generative AI. In the future, as technology iterates, the camouflage strategies of social bots may further upgrade, but the core tension of "mimicry – exposure" will persist, and the quantitative methods of computational communication studies will continue to play a key role.

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