

# Recommendation Algorithm in TikTok: Strengths, Dilemmas, and Possible Directions

Pengda Wang<sup>1</sup>

<sup>1</sup> Centre for Interdisciplinary Methodologies, University of Warwick, Coventry, United Kingdom

Correspondence: Pengda Wang, Centre for Interdisciplinary Methodologies, University of Warwick, Coventry, CV4 7AL, United Kingdom.

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## Abstract

Recommendation algorithms are reshaping the ecology of digital video-sharing platforms and users' media usage behaviors. TikTok's recommender system is widely considered to be an outstanding representative among them. Although a large amount of research has been conducted in relation to TikTok, most of these studies pay attention to content analysis, platform features study, user behavior examination and technical aspects of platform algorithm. However, there is markedly less research into TikTok's recommendation algorithm as well as relevant theoretical and empirical support for this. Based on a slightly simplified variant of the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) guidelines (Page et al., 2021), this paper reviews the literature on the use of recommendation algorithm in TikTok, aiming to serve as a brief primer to answer the strengths and dilemmas of the adoption of recommendation algorithm on the TikTok platform, and to propose possible directions for short-form mobile video platforms.

**Keywords:** TikTok, recommendation algorithm, recommender system, artificial intelligence, digital platform

## 1. Introduction

As a short-form mobile video platform, TikTok is characterized by content-based interactions that depend on personalized video feeds driven by its recommendation algorithm (Klug, Qin, Evans, & Kaufman, 2021). TikTok achieved great popularity in quite a short time, especially for its excellent downloading performance, unseating Facebook as the most downloaded app in the United States (Vijay & Gekker, 2021). Much accelerated through COVID-19, TikTok has grown to over 1 billion monthly active users (TikTok Team, 2021) and ranked 2nd worldwide by downloads in Q4 2021 (Sensor Tower, 2022). From this point, TikTok indeed provides significant competition to those incumbents in the international digital platform market (Gray, 2021).

So far, most TikTok research has focused on the content-based analysis (Bandy & Diakopoulos, 2020; Chen, Min, Zhang, Ma, & Evans, 2021; Sun, H. Zhang, S. Zhang, & Luo, 2020) of this emerging platform, and its potential power in various domains (Miao, Huang, & Huang, 2021; Vijay & Gekker, 2021; Zhu, 2020), such as politics, economy, media, and communication. Many scholars have also observed user motivation and behavior for TikTok use (Klug et al., 2021; Omar & Dequan, 2020). However, only limited papers have paid particular attention to the TikTok recommendation algorithm.

Given the above literature gap, this essay focuses on the discussion of strengths, dilemmas, and possible directions in the area of recommendation algorithm in TikTok as well as its twin service for the Chinese market, namely Douyin. It strives to clarify and answer the following questions: Why is the recommendation algorithm so important for TikTok? What challenges and revolutions such algorithm mechanism may pose to digital society?

Here comes the structure of this essay: it first identifies the outstanding advantages of recommendation algorithm for TikTok, and the next section focuses on the existing and potential harm and challenges brought by the use of recommendation algorithm. What outlined in the last part are the future patterns and the possible directions of short-form mobile video platforms.

## 2. Methodology

The systematic literature review was conducted based on the guidelines suggested in the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) 2020 statement (Page et al., 2021). The adopted framework is graphically depicted in Figure 1. Individual databases searched included: Web of Science, Scopus, Elsevier, SAGE, Taylor & Francis, and CNKI. Only texts in English or Chinese that had been published online after 2016 were selected. After removing duplicates, the screening process including attribute, title, abstract, and full text was conducted. Reference screening was also used to reduce the risk of overlooking important literature that was not found by the keywords “TikTok, Douyin, and recommendation algorithm”. In addition, several website reports (e.g., reports from the ByteDance company and international media) were also included in the literature selection. The final literature review could comprise a total of 48 studies and 11 reports.

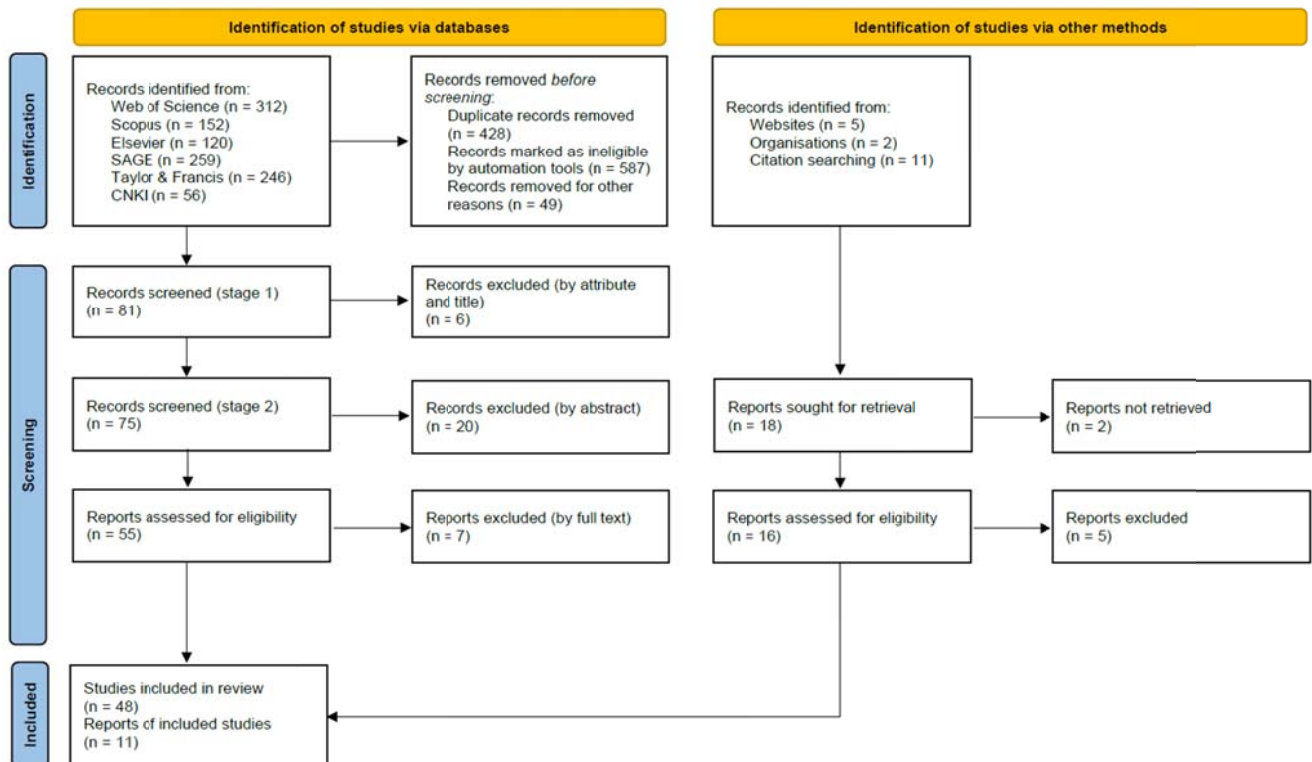


Figure 1. Literature selection working flow based on the PRISMA method

## 3. Significance of the Use of Recommendation Algorithm for TikTok

The analysis of a platform case starts with determining the platform characteristics (Nooren, van Gorp, & van Eijk, 2016). With direct networks effects, TikTok is an algorithm-driven, content-oriented product (Zhao, 2021), where recommended videos that are 15 seconds or less in duration. The potential of recommendation algorithm is grounded in massive user data availability, making TikTok eligible to enhance the effectiveness of content distribution and adaptability of the tailored video feed.

### 3.1 Content Distribution

From the perspective of communication theory, the AI recommendation algorithm is of crucial significance for TikTok's effective content distribution strategies. Video sharing platforms have transformed the way that users consume online content drastically (X. Lu, Z. Lu, & Liu, 2020). As a new interface culture, also a new digital medium (Han, 2017), TikTok is reprogramming us with the algorithm technology. It is a further benefit that TikTok can make users accept personalized video feed without initiative, reducing the time cost for information searching to a large extent.

Recommendation recalling and recommendation ranking are two main matters waiting for addressing by the recommender systems. The former requires the algorithm to extract a fraction of content from those tremendous amount of user data library, while the latter is expected to determine the order of recommendation list. TikTok constructed a hierarchical interest label set, which can clearly show the inclusion and hierarchical relationship between the data (Zhao, 2021).

What's more, the multiple machine learning algorithms enable better feature interaction disclosure of user behaviors

(Zhao, 2021). For example, DeepFM, a model that combines factorization machines for recommendation and deep learning for feature learning, gains great performance for high- and low-order feature interactions without the premise of pre-training (Guo, Tang, Ye, Li, & He, 2017).

### 3.2 User Resonance Exploration

Another strength of recommendation algorithms can be detected from the viewpoint of Human-Computer Interaction (HCI) theory and Data Pool Marketing theory: its user-centered exploration power.

TikTok's capability to read its users with the powerful recommendation algorithms contributes a lot to engage users. Preference, personality, location, environment, user interests are basic variables that the AI will use to evaluate users. Most importantly, the two systems of Natural Language Processing and Computer Vision Technology are key techniques to help determine the success of a video (Scanlon, 2020).

The method of partitioned data buckets multilayer screening (Zhao, 2021) is used by TikTok to evaluate the content with most audience resonance. An illustrative example is the algorithmically curated "For You" page, where a stream of uniquely tailored videos will be delivered based on users' past respond behavior. The mixed use of stream computing and batch computing largely improve the time-effectiveness due to the dynamically labels updated by algorithm. According to the "For You" algorithm, most viral videos of this page share the signal of "positive feedback loop" (Matsakis, 2020), featuring amounts of likes and views. Furthermore, scholars claimed that TikTok's recommendation algorithms can not only accurately recommend videos of interest to users, but also assist them in expanding into new intersecting areas (Zhang & Liu, 2021).

There also has been a surge of interest in understanding and improving users' actual experiences with the app. Through a 2×2 between-subject experimental design and subsequent data analyses, Wang (2020) suggested the potentials of TikTok videos to persuade new technology-adoption as well as to facilitate emotional resonance by creating a sense of Immersion, Social Presence, and Entertainment.

## 4. Dilemmas Caused by the Use of Recommendation Algorithm

The recommendation algorithm also has profound and subtle potential influence on all walks of our society because of the dissemination of audio-visual information based on artificial intelligence technology. Nevertheless, there is ample evidence from existing literature that some dilemmas, such as algorithmic transparency, digital addiction, and information diversity, are all still unsolved issues.

### 4.1 Transparency, Explainability and Misattribution

The transparency and explainability of the video flows recommendation process are of vital importance. TikTok has provided some basics about its recommender system on its official newsroom website. It simply explains several factors that contribute the For You feed: user interactions, video information, device and account settings. On top of that, quick guidance is also given to help users build their personalized For You feed (TikTok Team, 2020). But it's still too general and time-consuming for people to understand. The mathematical formula put forward by communication scholar Wilbur Schramm (West & Turner, 2013), can help us explain people's choice of media:

$$\text{possible rewards} \div \text{effort required} = \text{probability of choice} \quad (1)$$

We can tell from the formula that the higher likelihood of meeting the need, the less effort spent, the more likely users choose a certain channel of information. Therefore, what users need are concise innovative and interactive explanations presented in the process while people are using the app.

TikTok also engenders a culture of misattribution. More specifically, popular formats, audio clips and even licensed music are freely reused without any connection to the original source with impunity (Valdovinos Kaye, Rodriguez, & Wikstrom, 2020). For example, researchers from the University of Technology Sydney (Meese & Hagedorn, 2019) found that social media users are not actively engaging with the technicalities of copyright law even if they are aware of its concepts. In addition, unlike online creative communities (Perkel, 2011), centralized community discussions on authorship issues are blank on social media platforms.

### 4.2 Digital Addiction, Digital Dementia

Researchers have begun to investigate those social problems stemming from the overuse of social media platform. Amongst these, digital addiction and digital dementia are the two most obvious matters.

Based on an analysis of the algorithm principle used in this platform, Zhao (2021) argued that TikTok addiction is becoming a widespread phenomenon, and such addiction has a closed-loop relationship with algorithm optimization. More specifically, collaborative filtering algorithm and low-cost interaction design mechanism are very powerful tools to facilitate users' continuance intention. But in the meanwhile, the algorithm can also be counted as a trap to lure

people to spend too much time on the app.

FOMO, the abbreviation of “fear of missing out”, also a new type of social anxiety, refers to worries that one may be absent from having rewarding experiences (Dossey, 2014) after excessive social media use. A case in point is the “digital dementia” phenomenon in South Korea, where the deterioration in cognitive abilities frequently seen in netizens. Eighteen percent of heavy internet users who is between 10 and 19, even cannot recall their own phone numbers (Ryall, 2013).

It is worth mentioning that people’s notion of the efficacy of TikTok’s recommendation algorithm plays a nonnegligible role of the decision about whether to quit this app. For instance, a recent survey with those who have abandoned or never adopted Douyin (Lu et al., 2020) suggested the main reasons behind this phenomenon are the fear of addiction and those low-quality videos full of stigmatized perceptions.

### *4.3 Challenge of Information Diversity*

Recent studies have revealed a widespread skepticism about the role of social media plays in the issue of information diversity. One of the most concerned worries is the curated filter bubbles created by social media algorithms (Bucher, 2018), where homogenous content traps users in the world that only affirms their beliefs (Hunt & McKelvey, 2019).

In fact, discussion about the impact of advanced technology on information diversity has not formed a consensus. Some scholars support the increased exposure to diverse perspectives that technology brings us, while others warn the increased risk of ideological segregation (Flaxman, Goel, & Rao, 2016).

Exacerbating this, the excessively catering of users’ preferences, results in the shallow and vulgarization of the content (Yu, 2019). In other words, such problematic content stems from the excessively pursuit of strong user stickiness. But it is a more suitable commercial goal to expand users instead of causing people to indulge in the network space.

Most studies do not pay sufficient attention to news flows on TikTok, but it is becoming a more and more important news carrier today. The TikTok video content is a mixed mode of UGC (User-generated Content), PGC (Professionally Generated Content) and OGC (Occupationally Generated Content) (Yu, 2019), and therefore, it provides more diversified content library. To name a few, information about real life of LGBTQ+ people were shared on TikTok. In a recent study, however, Simpson and Semaan (2021) showed that TikTok was suppressing and oppressing the identities of its growing LGBTQ+ user population through algorithmic and human moderation of LGBTQ+ creators and content related to LGBTQ+ identity.

Overall, it deserves further empirical evidence to check whether recommendation algorithms of TikTok contribute more to information diversity than more established platforms.

## **5. Recommendations for Future Directions**

To enable the recommendation algorithm to play a more significant role in video sharing platforms, improvements are urgently needed for both algorithm design and framework implementation. This paper attempts to recommend three aspects of possible future revolutions that recommendation algorithm in short-form mobile video platforms might make.

### *5.1 User-based Explainable Framework*

User-based and targeted explainable framework is a feasible way to deal with the transparency and explainability problem as well as to balance the algorithm-centric view and user-centered view. Tailored explanations based on characteristics and expectations of different user groups (Pi, 2021) should be applied among technical and non-technical end users. It not only makes the process of individualized video recommendation pattern more transparent, but also strengthens users’ engagement in the construction of tailored recommendation mechanism.

Additionally, a practical framework is urgently needed to assess the algorithmic systems of video-focused platforms, and to tell whether they are compatible with core digital platform related law principles. In the year 2020, TikTok launched Transparency Center in Los Angeles to earn the trust of policymakers and the broader public (Pappas, 2020). A copyright reform agenda can be made through cross-faculty cooperation in the near future.

### *5.2 Optimizing Algorithm Collaboratively*

To address the closed-loop contradiction between TikTok addiction and algorithm optimization, both users and ByteDance can contribute a lot. Users and recommender system are influencing each other: user is the most significant factor for training and optimizing the recommendation model, and recommendation algorithm affects netizen’s habit of receiving information.

We may suggest here several ways to unlock the closed-loop issue. It is beneficial that users’ self-conscious to improve new media literacy and to get a deeper understanding of algorithm mechanisms. For the AI algorithm developers of video sharing platforms, besides notification from anti-addiction system, recommendation accuracy can also adjust with

the users' physical environment (Zhao, 2021), giving users impetus to have a rest from the screen.

### 5.3 Embedding Cultural Values into Recommendation Algorithm

To ensure that such a recommendation algorithm brings beneficial revolution to society, algorithm technology optimization, value orientation and social requirements are equally important for the sustainable development of short-form mobile video platform. It would be a meaningful trial to integrate the mainstream values of the society into the design of recommendation algorithm.

More importantly, cultural values must match the users' actual real-world society. Sun's research team (2020) found that the lifestyle of users in Douyin is simple and static, while TikTok users show a tendency to capture diverse items. Traditional Confucian culture value in Chinese society and high self-expression value in English speaking countries (Shen & Liang, 2015) can account for such differences.

The principles of decentralization are becoming one of the platform cultures of TikTok, where connection networks are linked to each other. At the same time, AI and recommendation algorithms are replacing conventional human "Gate Keeper" in the role of content selection and news flows control. The notion of algorithmic power is not just about the ways in which algorithms determine the social world (Bucher, 2018). In contrast, the recommendation algorithm and people are both involved and interact with each other in the digital world.

To mitigate the possibility of filter bubbles, the ByteDance company is purposely finding the balance between user-relevant content and valuable potential experiences (Matsakis, 2020). Collaborative filters aim to make use of people's opinion to do a favor for people to make choices (Resnick, Iacovou, Suchak, Bergstrom, & Riedl, 1994). And the collaborative filtering algorithm can help user explore their latent interests through user-based and item-based filtering.

The market structures, governance frameworks, and infrastructures (Nieborg & Poell, 2018) of short-form mobile video platforms make it possible to support the culture of creative practice through the recommendation designs (Zhou, 2019). Therefore, the easiest start will be the training of effective algorithm models and the spread of civic innovation. High-quality video input leads to prime value content output.

## 6. Conclusions and Limitations

The recommendation algorithm in digital platforms is a timely and effective response to the demands of today' rapidly evolving society.

This essay has provided an introduction to the recommendation algorithm application in TikTok. It first identified the benefits of the use of recommendation algorithm for TikTok, featuring: powerful data processing capability, effective content allocation, and precise user resonance exploration. Then it raised some concerns about the implementation of recommendation algorithm, particularly for its ethical, legal and social risks. By way of further discussion, it is suggested some possible directions for future short-form mobile video platforms: user-centered explainable and legal framework, user-platform collaboration, and cultural values in algorithm.

There are several limitations of this paper as follows: recommendation algorithm is in early implementation phase and the corresponding models are still immature. Given that some research may be excluded from examined range, the scope of the reviewed social-scientific studies may not present the full picture of TikTok world under the context of recommendation algorithm. No conventional qualitative or quantitative method used in this study. And therefore, points in this essay are either assumptions or expectations extracted from literature review, lacking empirical support.

This essay also raises many fields worthy for future research. Subsequent studies can either take a multidisciplinary approach to examine the technical issues or do a comparative analysis on the recommendation algorithm of TikTok's twin version Douyin or its counterparts like Snapchat and Kuaishou, which will be a valuable support for geographical and cross-platform generalizability. Platform culture, user profile, and algorithm design are also key elements to investigate for future platform-specific study.

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