

The Impact of Online Reviews Manipulation on Consumer Purchase Decision Based on The Perspective of Consumers' Perception

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Abstract

Consumers depend on online reviews to influence their purchase decisions. On account of that, many vendors and retailers try to manipulate online reviews to mislead potential consumers to take risky purchase decisions. Many scholars have conducted a lot of research on the impact of online product reviews on consumer behavior and sales. However, the existing work are mainly based on the premise of real product reviews, but few attentions have been paid of fake ones. Based on the recognition results of deceptive reviews, this article explores whether consumers be aware or perceive it when deceptive reviews are flooding the online review system, and further analyze what influence will be imposed on final purchase decision with different perception. The empirical analysis of the questionnaire survey show that in the context of two different perceptions of consumers, deceptive reviews have significant differences in the results of purchase decisions. In addition, research also shows that consumers' persuasive knowledge plays a moderating role between perceived deception and purchase decision.

Keywords: Review manipulation, Purchase decision, Deceptive reviews, Incentive reviews, Persuasive knowledge level

1 Introduction

The increasing popularity of e-commerce and rapid development of online shopping have resulted in large numbers of online reviews describing the perception of consumers on many goods and services. As a common form of online word-of-mouth, online product reviews contain users' evaluations of purchased products, reflecting their opinions on product quality, performance, price, and service. The powerful search and storage of the Internet make product reviews become an important source of information, and its credibility and influence are much higher than the information released by enterprises. In latest studies, 93% of consumers tend to rely on online product reviews to evaluate the quality of their products, and indicated that online reviews significantly influence their purchase decisions [1-5] and further affect product sales [6-8]. The report of 2013 China

online market shopping released by CNNIC draw a similar conclusion. While consumers shop online, product reviews are the most important factors considered in their purchase decision, followed by the website popularity and reputation, price, website brand and other factors.

As the important role of product reviews in purchase decision has received more and more attention, the authenticity of review information has encountered a crisis. Driven by competition and vested interests, many vendors and retailers try to manipulate online reviews. For example, they tend to post deceptive reviews in an attempt to mislead potential consumers and make them take risky purchase decisions. In the worst cases, they may employ many spammers to either post glamorized positive reviews with the aim to improve their product reputation or harmful negative reviews to suppress their competitors. Besides, they may also induce real consumers to post inaccurate reviews with material incentives, such as cash return or gift coupons, which could attract more potential consumers to purchase products through word-of-mouth. This type of deceptive review is called incentive reviews.

Numerous existing studies have confirmed the influence of online review attributes on purchase decision, such as number [6, 9-12], depth [13-15] and valence [16-17]. However, those works are mainly based on the premise of real product reviews, but few attentions have been paid of fake ones. As matter of fact, online review systems cannot effectively identify and eliminate all deceptive comments, and fake reviews are widespread in e-commerce websites, which results in the wording 'nine in ten Taobao shops fabricating review'. When deceptive reviews are flooding the online review system, can consumers be aware or perceive it? What influence will be imposed on final purchase decision with different perception? Therefore, based on customer perception of fake product reviews, this article discusses the influence of deceptive comments existed in online reviews on consumer purchase decision. Our study provide references for online retail merchants to conduct online marketing and e-commerce managers to formulate management specifications. Furthermore, it also throws a new light on consumer decision, and complements online review related fields.

The remainder of this paper is organized as follows. In section 2, we outline the past research relevant to this study

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and present the research hypotheses. Section 3 provide the data analysis and results. Section 4 provides the conclusion, limitations and future scope for research.

2 Literature Review and Research Hypotheses

2.1 Related Work

Increasing numbers of scholars have highlighted the impact of deceptive reviews on consumers' purchase decision and behavior.

One approach is to explore the impact of online reviews on purchase decision from the perspective of their perceived usefulness and credibility. For example, J. Ahrens et al. [18] used empirical analysis to study the impact of deceptive reviews on businesses and consumers. The results showed that the number of deceptive reviews affected consumers' perceived credibility of online reviews. The more deceptive reviews, the lower their perceived credibility. Ketron [19] utilizes attribution theory to examine perceived deception as mediator between consumer cynicism and purchase decision. The results reveal that perceived deceptive sizing practices has an amplifying negative effect on the consumer purchase decision. On basis of hotel occupancy data analysis, Zhuang et al. [20] drew an interesting conclusion that the effect of manipulating online product reviews, such as adding positive reviews, deleting negative reviews, exhibits an inverted U-curve on sales. Filieri et al [21] investigated consumer perceptions and analyzed the influence of central (long, relevant, current and factual OCRs) and peripheral cues (source credibility, overall ranking scores) on perceived information diagnosticity. In China, Zheng et al. [22] explore the impact of spammers' comment attributes (such as the number of comments, quality, similarity, and so on) on consumers' purchase intentions. The empirical analysis results indicate that all attributes of spammers' reviews have significant effect on consumers' purchase decision by influencing their perceived usefulness. Song et al. [23] focused on incentive reviews, combined with the usefulness of online reviews, to explore the impact on consumer purchase behavior. The experimental results show that positive incentive reviews significantly affects the credibility of online reviews and the authenticity score of product, and further reduces purchase intention.

Other research analyzed the impact of review manipulation on purchase decisions based on some theory, such as persuasive knowledge models, consumer defense, and customer loyalty. For example, Riquelme et al. [24] used customer loyalty theory to compare the impact of perceived deception on consumer satisfaction (including product satisfaction and retailer satisfaction) and word of mouth under online and offline different shopping scenarios. The results have shown that perceived deception in online shopping has a negative impact on product satisfaction, and meanwhile its negative impact is stronger than offline shopping. Ma et al. [25] introduced the persuasion coping theory and used the structural equation model to explore how online manipulation review infect consumers' persuasion coping and further affect

their product evaluation and purchase intention. Cui et al. [26] used the persuasion knowledge model to distinguish consumers' moral and deceptive evaluations based on different online review manipulations (such as adding positive reviews, deleting negative reviews, and posting incentive reviews). They discussed different influences of consumers' product purchase intention and the moderating effect of persuasion knowledge. The results show that the perceived deception of online review manipulation has a greater negative impact on consumers with low persuading knowledge.

In summary, there is still limited knowledge related to the impact of deceptive reviews on consumer purchase decisions currently. Moreover, little attention has been put on consumers' awareness of deceptive reviews and whether their different perceptions have different effects on consumers' purchase intention or decision-making.

2.2 Hypotheses Formulation

Persuasion is defined as "the change of attitude through receiving and absorbing other people's information". Friestad and Wright [27] proposed the most representative Persuasion Knowledge Model (PKM). The model assumes that the consumer can continue to enrich and use this knowledge to deal with the persuasive segment, and identify the intention that the sales agent is trying to influence him and achieve his own goals through the persuasion. Kirmani and Campbell [28] studied the consumers' response to salespeople's sales behavior, and revealed 15 response strategies reflecting targets who are both goal seekers and persuasion sentries. Seeker strategies reflect the consumer's knowledge of the agent's role as helper, whereas sentry strategies reflect knowledge of the agent as persuader.

As mentioned above, deceptive reviews were manipulated by many vendors and retailers. They employed many spammers or collective spammers to post deceptive reviews in an attempt to mislead potential consumers and make them take risky purchasing decisions. In essence, this behavior is also an act of persuasion. Consumers' persuasive response to the deceptive persuasive behavior depends on the persuasion strategy whether fake reviews are identified.

In reality, we believe that consumers are smart enough that even if they cannot directly or completely distinguish fake reviews from real ones, they can perceive whether review manipulation has occurred, thereby adjusting their interpretation and reliance on reviews. We speculate that the increase in perceived deception has an overall negative impact on consumer purchase behavior. When consumers perceive that a product review may be manipulated, they will take different responses, such as no longer fully trusting the content of the review, resolutely refraining from purchase behavior, or decreasing willingness to purchase, or although the willingness to buy has declined, it is still persuaded in the end and so on. On the other hand, to confuse many consumers, spammers are more careful about the manipulation of their reviews. They usually try to imitate true reviews so that consumers do not perceive the review manipulation. So, consumers mistake these reviews for real ones, regard reviewers as helpers, and positively influence

their purchase decisions based on the overall valence of the reviews. Specifically, if the review valence is positive, the purchase intention is significantly increased, and if the review valence is negative, the willingness to buy is significantly reduced. Therefore, we propose the following hypotheses:

H1: Under the two different perceptions, deceptive reviews have significant differences in the impact of consumers' purchase decisions.

H1a: When consumers do not perceive the manipulation of reviews, deceptive product reviews significantly positively influence purchase decisions;

H1b: When consumers perceive reviews to be manipulated, deceptive product reviews negatively affect purchase decisions;

H1c: Concerning the role of deceptive product reviews on purchase decision, the extent of its negative impact is less than that of its positive one.

When consumers fail to perceive the manipulation of reviews, they will actively refer to the content of the reviews. As a kind of special deceptive reviews, incentive reviews are written by real consumers, and hence are more concealed and harder to be identified. Consumers are more likely to be influenced by the review content. For this reason, the following hypotheses are proposed:

H2: Under no perception of review manipulation by customers, "incentive reviews" play a greater role on purchase decision than deceptive positive ones.

When consumers perceive manipulation behavior in reviews, they will have a negative impact on their purchase behavior. However, different consumers have different levels of persuasion knowledge, their attitudes towards review manipulation behaviors show different tolerances and subjectivity, resulting in purchase behaviors being affected to a lesser extent by perceived deceptiveness. Meanwhile, consumers' ability to accurately identify spam reviews is very limited, and they do not have full confidence in their own judgments. Therefore, as moderating variable, persuasion knowledge, is introduced, and the following hypothesis is proposed:

H3: Persuasive knowledge of consumers plays a moderating role in the relationship between perceived deception and purchase decision. In other words, when consumers perceive review manipulation, consumers with lower persuasive knowledge about negative influence on their purchase decisions is significantly higher than consumers with higher persuasive knowledge.

3 Empirical Analysis

3.1 Data Collection and Labeling

This experiment adopts a questionnaire survey, and the dataset of our work is based on the publicly collected Taobao review. We select some online reviews about rice cookers (brand: Midea, model: MB-WFS3018Q). The purpose of this experiment is to study the influence on purchasing decisions after consumers reading product reviews with manipulation reviews. Therefore, it is necessary to detect deceptive reviews

and incentive reviews in advance. At present, the detection method of deceptive reviews mainly focus on review text content analysis and reviewer behavior feature mining [29]. Review content involves review length, extreme sentiment tendencies, text duplication, ratio of opinion words, and personal expression. Reviewer behavior features is reviewer activity, review posting, appending review time, appending pictures, super users, and so on. Regarding incentive reviews, some stores implement a praise cashback strategy to entice consumers to post positive reviews, such as writing more than 15-words and rebate 3 yuan for positive reviews. Based on these clues and the method in the report "30 Ways You Can Spot Fake Online Reviews", we invited 2 undergraduates and 1 postgraduate with rich experience in online shopping to mark the reviews in the dataset as true or deceptive. The final labeling result was performed using the Simple MAJORITY Voting Ensemble. MAJORITY is a voting method based on the principle of the subordination of the minority to the majority. That is, at least two people in the manual annotation results unanimously judged the review as a fake review. Then, the review was eventually determined to be a fake review. In addition, in the marked deceptive reviews, we use the same MAJORITY meta-judgment method to mark the "Praise Reward" reviews based on the prompt information that appears in the positive feedback.

3.2 Questionnaire Design

The questionnaire contains three parts. The first part is statistical information of participants, consisted of gender, age, educational background, age of online shopping, and frequency of online shopping. The second part is three groups of product reviews, namely fake reviews, true reviews and incentive reviews. The third part is the respondents' final purchase decision (buy or not).

In the second part, in order to reduce the burden of reading we selected four sampling comments with the highest probability from each group based on the aforementioned labeling results. The first group is real reviews, including two positive reviews and two negative reviews. The second group is deceptive reviews and we take 3 deceptive positive reviews and 1 negative reviews because of fewer negative fake reviews than positive reviews in practice. The last group is incentive reviews. For example, in following Table 1, the participants were asked to read the four reviews, and respondents rated each review on a 5-point Likert scale ranging from 5(Strongly buy), 4(may buy), 3(not sure, Neutral), 2(may not buy), and 1(Strongly not buy).

Furthermore, to clarify and quantify the two different perceptions of consumers on review manipulation, that is, perceived or unperceived the manipulation of comments, we have prepared a question below each group of reviews (real reviews, deceptive reviews and incentive reviews). For example, the specific question of second group of reviews is shown in the Figure 1. The participants answered them respectively, and only when the three questions raised by the three groups were answered correctly could the respondent perceive the existence of comment manipulation.

Table 1. Example reviews of second group

(1) “The rice cooker was received. The appearance is very beautiful and the cooking is fragrant. It’s very good. It is worth buying.”; Which of following options is your purchase decision: (Strongly buy, may buy, not sure (Neutral), may not buy, and Strongly not buy)
(2) “Very good, the rice is fragrant and the price is too affordable!”; Which of following options is your purchase decision: (Strongly buy, may buy, not sure (Neutral), may not buy, and Strongly not buy)
(3) “I was surprised when I received it. The quality is unexpectedly good, beautiful, and easy to use. It’s really good quality and cheap. Five-star praise”; Which of following options is your purchase decision: (Strongly buy, may buy, not sure (Neutral), may not buy, and Strongly not buy)
(4) “As many people say, the smell is very heavy, but the rubber ring inside is very smelly. I don’t know if it will affect your health. If it affects your health, it will kill Suning. This is because consumers are not so easy to fool and outnumbered. Will continue to pay attention to this issue later.” Which of following options is your purchase decision: (Strongly buy, may buy, not sure (Neutral), may not buy, and Strongly not buy)

The second comment group you just saw belongs to one of the following types.
Which type do you think it is? [multiple choice] *

(1) True reviews;
(2) Deceptive reviews;
(3) incentive reviews

Figure 1. Question settings whether perceive comments manipulative existence

3.3 Examples Characteristic

In our study, questionnaires were distributed through the questionnaire star platform. We have received out of 200 questionnaires, in which 40 were dropped due to inconsistency of information. Therefore, the final analysis was based on the responses of 160 respondents. The majority of the respondents, 42 percent were male, and 58 percent were women; 84 percent of sample were in the age group between 18 and 35; 74 percent of respondents had

undergraduate degree. The sample was represented by the following number of online purchase categories at least once every half week (12%), at least once every week (21%), at least once every half month (37%) and at least once every month (31%), indicating that the samples all have online shopping experience, and hence could better reflect the influence of online reviews on purchasing decisions. Table 2 summarizes the demographic data.

Table 2. Demographic details

Variable	Percentage	Variable	Percentage		
Sex	Male	42%	Age	18~35years old	83.75%
	Female	58%		36~50years old	14.40%
Online shopping age	1~3years	23%		50~60years old	1.90%
	3~5years	43%	Online shopping frequency	Buy often	56%
	5~8years	21%		Buy occasionally	44%
	More than 8 years	13%	Number of online purchases	At least once every half week	12%
Education	Undergraduate	7.50%		At least once every week	21%
	Undergraduate	73.75%		At least once every half month	37%
	Post-graduate	18.75%		At least once every month	31%

The experiment sets a total of 17 variables, namely the purchase decision score of 11 reviews, the purchase decision value of the true review group (the average purchase decision score of the four reviews in the review group 2), the purchase decision value of the fake review group (the average purchase decision score of the four reviews in the review group 2), the purchase decision value of the incentive review group (the average purchase decision score of the three reviews in the review group 3), the purchase decision value of the fake positive review (the average of purchase decision score of the three positive reviews in the fake review group), perceive

the manipulation of reviews for consumers, and the final purchase decision value.

In order to ensure the reliability of the scale, the reliability and validity of the scale should be examined first. Reliability analysis is divided into total reliability analysis and relevant dimensions analysis (fake reviews, real reviews and incentive reviews). The results are shown in Table 3.

Through the index of Cronbach’s Alpha testing, it is found that all the scale and each variable have Cronbach’s Alpha>0.7, indicating that the scale has good internal consistency and attain high level of reliability.

Meanwhile, structural validity analysis is performed. The principal component analysis method is used for exploratory factor analysis (the characteristic value is greater than 1), and the maximum variance method is used for rotation. The results are shown in Table 4. The scale fits the actual data satisfactorily, which indicates that the validity of the model variable is good.

Table 3. The results of reliability analysis

	Cronbach's Alpha
Total reliability	0.938
Fake reviews	0.895
Incentive reviews	0.829
Real reviews	0.783

Table 4. The results of structural validity analysis

KMO		0.939
	Approximate chi-square	3693.808
Bartley sphericity test	df	190
	Sig.	0.000

3.4 Hypotheses Testing

Study 1: The influence of fake reviews on consumers' purchasing decisions

Based on whether consumers perceived manipulation of reviews, we used software IBM SPSS version 22 to conduct T-test of two independent samples. The T statistic is 2.143, and the corresponding two-sided probability P is 0.037, which is less than the significance level of 0.05. Therefore, the mean of the two populations is significant difference, that is, under the two different perception judgments of consumers, there are significant differences in the impact of fake product reviews on the results of purchase decision, so we accept H1.

Furthermore, we conduct group inspections of split files based on whether consumers perceive the manipulation of

reviews. One group uses the purchase decision value of fake positive reviews as the test variable, and the other group uses the purchase decision value of fake reviews as the test variable. The test value is set 3 corresponding to the middle option of the purchase decision, "not sure (Neutral)", and the one-sample T test is performed respectively. The experimental results are shown on Table 5.

It can be seen from the data in the Table 5 that when consumers do not perceive the manipulation of comments, the probability P value corresponding to fake positive review is 0.025, and the difference between the average value of "fake positive" and the test value 3 is 0.17725, The difference is positive, indicating that when consumers do not perceive the manipulation of reviews, fake reviews significantly positively affect purchase decisions. Hypothesis H1a is valid. Similarly, when consumers can perceive manipulation of comments, the probability P value is 0.005, which is less than the significance level of 0.05. The difference between the average value of "fake reviews" and 3 is -0.375. The negative value indicate that when consumers can perceive the manipulation of reviews, fake reviews have a significant overall and negative impact on purchasing decisions, H1b is valid.

Furthermore, based on purchase decision value of the true review group, correlation analysis is taken between the purchase decision value of the fake review group and the purchase decision value of the true review group. The results are shown in Table 6.

As shown in Table 6, the correlation coefficient between the purchase decision value of the fake review group and the true review group was 0.340, which was greater than the correlation coefficient between the two in the case of "perceive review manipulation" 0.277. Based on the aforementioned two hypotheses verification, it reveal that the positive influence of the fake review group (in the context of being unable to perceive review manipulation) on the purchase decision of consumers is greater than the negative influence of the fake product reviews (in the context of being able to perceive review manipulation) on the purchase decision, meaning H1c is supported.

Table 5. One-sample T test results

Variable	Group	T Value	Sig. (Two-tailed)	Mean difference
Purchase decision value of fake positive reviews	Perceived	2.269	0.025	0.17725
Purchase decision value of fake reviews	Unperceived	-2.979	0.005	-0.3750

Table 6. Correlation analysis results

		Purchase decision value of the true review group	Purchase decision value of the fake review group
Purchase decision value of the true review group (unperceived the manipulation of reviews)	Pearson correlation	1.0	0.340
	Sig. (two-tailed)		0.000
Purchase decision value of the fake review group (perceived the manipulation of reviews)	Pearson correlation	0.277	1.0
	Sig. (two-tailed)	0.113	

Study 2: The impact of incentive reviews on consumer purchasing decisions

In order to examine the influence of incentive reviews and fake positive reviews on consumers’ purchase decisions, we have adopted the means comparison method and the results are shown on Table 7.

Table 7. Means comparison results

	Average decision value
Incentive reviews	3.2169
Fake positive review	3.1772

a. unperceived review manipulation

In the context of unperceived review manipulation, the purchase decision value of the incentive reviews group is 3.2169, and the purchase decision value of the fake positive review is 3.1772. Obviously, the average value of the incentive review is higher than the average value of the fake positive review, indicating that the effect of incentive reviews on the purchase decision is significantly higher than fake positive review in the context of unperceived review manipulation. Therefore, hypothesis 2 is accepted.

Study 3: The role of consumers’ persuasive knowledge in the relationship between perceived deceptiveness and purchase decision

In the process of purchasing decision-making, consumers’ persuasion knowledge level will be affected by three factors: “online shopping age”, “online shopping frequency” and “number of online purchases”. To this end, age, frequency and the number of online shopping are divided into three levels, “high”, “medium”, and “low”, and consumer’s persuasion knowledge level is determined accordingly. We believe that if two of the three factors are both at a high level, the final persuasion knowledge level is high, and two factors are both at a low level, the final persuasion knowledge level is low, and the rest are set to medium. Based on this, a regression model with dummy variables is constructed, in which the final purchase decision value is the dependent variable, and the persuasive knowledge level is the explanatory variable. The results are shown in Table 8 and Table 9.

Table 8. Moderate role test results of persuasive knowledge level

	Coefficient	Standard error	T Value	Significance
Persuasive knowledge	-0.189	0.080	-2.357	0.020

Table 9. Means comparison results

	Average decision value
Low persuasive knowledge	27.64
High persuasive knowledge	29.92

a. perceived review manipulation

Table 8 illustrates that the consumer’s persuasive knowledge plays a moderating role in the purchase decision, and the coefficient value is $-0.189 < 0$, indicating a significant negative influence on the purchase decision.

In Table 9, it can be seen that the average decision score of consumers with low persuasion knowledge is lower than those with high persuasion knowledge in the context of perceived review manipulation.

This means that users with low persuasion knowledge are tend to more susceptible to fake reviews. When they perceive reviews manipulation, they often choose not to buy in their purchase decisions. On the contrary, users with high persuasion knowledge have different purchase attitude toward manipulation of reviews, showing some tolerance and subjectivity. For example, they will not blindly choose not to buy. Therefore, the average score of decision-making is relatively higher, and hence hypothesis 3 is accepted.

4 Conclusion

Based on the Persuasion Knowledge Model, this research explores how reviews manipulation influence consumers’ purchase decisions through empirical analysis of questionnaire surveys. In the online review system flooded deceptive reviews, whether consumers are aware of the manipulation of reviews and the impact of different perception on consumers’ final purchase decision are studied. When consumers do not perceive review manipulation, fake product reviews positively affect purchase decisions, among which incentive reviews play a more important role than fake positive ones. Conversely, when consumers perceive review manipulation, fake product reviews negatively affect purchase decisions. In addition, we also explore the role of persuasive knowledge, and the findings show that consumers with low persuasive knowledge have a significantly higher degree of negative influence on their purchase decisions than those with high level of persuasive knowledge. Consumer’ persuasive knowledge plays a moderating role in the relationship between perceived deceptiveness and purchase decision.

The research has made significant contributions to the theory and practice. The findings of this study extends and supplements the current online review related fields. Although there have been many studies that investigate the impact of online reviews on consumer purchase decisions, there are few attention to the role of spam opinion in online review systems. The research on online reviews manipulation is still in an immature stage and is still uncertain to what extent consumers can correct the cognitive biases caused by manipulative comments. So, we throw a new light on consumer decision-making.

The study has key implications on both consumers and E-commerce platforms. Firstly, as consumers, product reviews are one of the important sources to obtain product information. Faced with such a complex review environment, consumers should prejudge the product quality before reading reviews. When the product quality is low, consumers should appropriately reduce their trust in the evaluation system, but when the product quality is high, consumers should trust the

evaluation system. Secondly, deceptive reviews and incentive reviews are both behaviors that distort market information and harm the utility of consumers. E-commerce platforms should effectively supervise manipulation behaviors, and focus on supervising store sellers with medium product quality to improve the overall e-commerce platform's credibility.

However, this research still has the following deficiencies, which need to be further improved in future research. First of all, the survey sample has certain limitations. The sample size is not large, and most of the participants are university students. Future research could verify the universality of the research results by expanding the sample size and representativeness. Second, this article mainly qualitatively analyzes the influence of consumers on purchasing decisions under different perceptions. The subsequent quantitative analysis can be further carried out, for example, which factors of fake product reviews will affect consumers' different coping strategies, such as deceptive emotional expression of reviews, number of fake reviews, posting frequency of fake reviews, and so on, how much of these factors are affected, and to what extent the threshold value of these fake factors in the review system will have a significant impact on consumers' purchasing decisions. In addition, the data collected in this study is from Taobao. If the review data of other shopping platforms such as JD.com, Dangdang, and Yihaodian can be comprehensively analyzed, it will be able to more comprehensively and objectively measure the effect of fake reviews on purchase decisions under customer perception.

Acknowledgments

The work presented in this article is supported by the National Science Foundation of China under Grant Numbers 71762017, 71861013, 71861014; Key Science and Technology Project of Hunan Provincial Department of Education under Grant Numbers 20A081 and 19A077; Hunan Natural Science Foundation under Grant Numbers 2023JJ30101.

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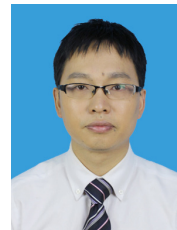
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