Research on App Advertising Click Rate Evaluation Based on Machine Learning Hybrid Model

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Abstract: The role of click-through rate in App advertising is very important, but there are problems such as inaccurate targeting of advertising content and low click-through rate. Traditional data analysis cannot solve the problem of insufficient click-through rate and viewership in App ads, and the evaluation is unreasonable. Therefore, this paper proposes a hybrid model of machine learning for advertising click-through rate prediction analysis. Firstly, the social learning theory is used to evaluate the advertising content, and the indicators are divided according to the advertising rating requirements to reduce the advertising rating Disturbing factors in . Then, social learning theory evaluates the prediction and evaluation of the click-through rate of App advertising, forms an evaluation scheme for the click-through rate of App advertising, and comprehensively analyzes the click-through rate results. MATLAB simulation shows that under certain evaluation criteria, the machine learning hybrid model is better than traditional data analysis in predicting the click-through rate and viewership of App ads.

1 INTRODUCTION

Consumer satisfaction rate is one of the important contents of App advertising click-through rate, which is of great significance for advertising content optimization (Li, and Wu, et al. 2023). However, in the process of predicting views, the app advertising click-through rate measurement scheme has the problem of poor accuracy (Luo and Zhou, et al. 2023), which reduces the desire of app users to click on ads. Some scholars believe that applying the hybrid model of machine learning to the analysis of insufficient click-through rate of advertisements can effectively analyze the CTR evaluation scheme of App advertising and provide corresponding support for predicting page views (Onie and Berlinquette, et al. 2023). On this basis, this paper proposes a hybrid machine learning model to optimize the App advertising click-through rate evaluation scheme (Sahllal, and Souidi, 2023), and verifies the effectiveness of the model.

Predicting the click-through rate of APP ads has become a key task for advertisers and advertising platforms (Sun, and Li, et al. 2023). To improve prediction accuracy, researchers have come up with a number of machine learning algorithms. This paper will focus on the prediction of machine learning hybrid algorithm on the click-through rate of APP ads and the role of APP CTR (Tan and Bandyopadhyay, , et al. 2023).

1.1 App Ad Click-Through Rate Prediction

1.1.1 Machine Learning Algorithms

Machine learning algorithms are the core technology for ad click-through rate prediction. Among the many machine learning algorithms, commonly used include decision trees, naïve Bayes, support vector machines, random forests, neural networks, etc (Wang and Jiang, et al. 2023). These algorithms have their own advantages and applicable scenarios, and enterprises can choose the appropriate algorithm according to their actual situation (Wang, and Yin, et al. 2023).

1.1.2 Data Preprocessing

Machine learning algorithms require large amounts of data to support. In terms of data preprocessing, data needs to be collected, cleaned, integrated and transformed (Yan, and Li, et al. 2023). Data

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collection refers to obtaining data from different channels; data cleaning is to denoise, deduplicate and correct data; data collation refers to the integration of data in a specific format; and data transformation is to convert data into a format acceptable to machine learning algorithms (Yu and Ponomarenko, et al. 2023).

1.1.3 Feature Selection

Feature selection refers to the selection of data features to extract the most meaningful features for advertising click-through rate prediction. In terms of feature selection, you need to select those characteristics related to the click-through rate of your ad and remove the invalid features. Commonly used feature selection methods include information gain, chi-square test, mutual information, etc (Yuan, and Xu, et al. 2023).

1.1.4 Model Training

Model training refers to the input of preprocessed data into a machine learning algorithm for training to generate a predictive model in order to make predictions on new data. The key to model training is to select the appropriate algorithm and parameters, and adjust the model to improve the prediction accuracy (Zhang, and Han, et al. 2023).

1.2 APP Click-Through Rate Effect

1.2.1 Optimize Your Ad Serving Strategy

APP CTR can help ad delivery platforms optimize advertising strategies. According to the level of the APP click-through rate, you can decide whether to stop the delivery of certain ads, adjust the advertising period, adjust the placement of advertisements, etc., to improve the exposure and click-through rate of advertisements.

1.2.2 Evaluate Ad Performance

App CTR can evaluate the effectiveness of ads. Through the statistics and analysis of advertising display and click data, you can evaluate the effectiveness and attractiveness of ads, and then adjust the display and content of advertisements to improve the click-through rate and conversion rate of ads.

1.2.3 Applied to Recommender Systems

APP CTR can also be applied to recommender systems. Recommendation system refers to recommending products or services that meet the needs of users based on their behavior and interests. APP click-through rate can be used as an important indicator of the recommendation system, accurately predict the user's interest and demand for a certain product or service, and improve the accuracy and user experience of the recommendation system.

1.2.4 Optimize the User Experience

The app click-through rate can reflect the user experience to a certain extent. If the click-through rate of your ad is too low, it means that the content of the ad does not match the user's interests, and the content and display method need to be optimized to improve the user experience. Through the analysis and feedback of the APP click-through rate, the user experience can be optimized and user satisfaction and loyalty can be improved.

1.3 Learn Hybrid Algorithms

Machine learning hybrid algorithms refer to the combination of multiple different machine learning algorithms and the combined use of their advantages to improve prediction accuracy. Commonly used machine learning hybrid algorithms include Bagging, Boosting, Stacking, etc.

1.3.1 Bagging

Bagging, short for Bootstrap aggregating, is an ensemble learning method based on autonomous resampling. Bagging samples the data with put back, generates multiple datasets, then trains the same model for each dataset, and finally averages or votes on the results of multiple models to generate the final prediction results. The advantage of Bagging is that it can reduce the variance of the model and improve the prediction accuracy.

1.3.2 Boosting

Boosting is a method of gradually improving the accuracy of a model. Boosting samples the data back, generates multiple datasets, then trains each dataset with different models, and finally weights the results of multiple models to generate the final prediction results. The advantage of Boosting is that it can reduce the bias of the model and improve the prediction accuracy.

1.3.3 Stacking

Stacking is a machine learning approach based on model integration. Stacking samples the data with placement, generates multiple datasets, and then inputs each dataset into a number of different models for training, and finally inputs the results of multiple models into another model for training to generate the final prediction results. The advantage of stacking is that it can combine the advantages of different models to improve prediction accuracy.

APP advertising click-through rate prediction is an important task for advertising platforms, and machine learning hybrid algorithms can improve the accuracy of advertising click-through rate prediction. APP CTR can help advertising platforms optimize advertising strategies, evaluate advertising effects, apply to recommendation systems, and optimize user experience. Companies should choose the right machine learning algorithm and hybrid algorithm according to their actual needs to improve the accuracy and precision of ad click-through rate prediction.

2 RELATED CONCEPTS

2.1 Mathematical Description of a Machine Learning Hybrid Model

The machine learning hybrid model uses big data theory to optimize the app advertising click-through rate evaluation scheme, and finds the unqualified values in the app advertisement according to the indicators in the predicted page views, and integrates the app advertising click-through rate evaluation scheme to finally judge the feasibility of insufficient advertising click-through rate. The hybrid machine learning model combines the advantages of big data theory to quantify the lack of click-through rate of advertisements, which can improve advertising viewership and consumer satisfaction.

Hypothesis 1: The advertising rating requirement is x_i , that the App advertising click-through rate evaluation scheme is set_i , the satisfaction of the App advertising click-through rate measurement scheme is r_i , and the judgment function of the App advertising click-through rate evaluation scheme is $L(x_i \approx 0)$,as shown in Equation (1).

$$L(\mathrm{r}_i) = set_i \to \sum_{i=1}^{\mathrm{r}} (\mathrm{r}_i - \bar{X})^2 \cdot \frac{\Delta \mathrm{r}}{\Delta x} \bigcup 4 \tag{1}$$

2.2 Choice of Consumer Satisfaction Rate Program

Hypothesis 2: The ad click-through rate function is and the weight factor is $\mathrm{K}(x_i)$, then the ad ratings requirement is d_i , the click-through rate of the unqualified ad as shown in Equation (2).

$$\mathrm{K}(x_i) = d_i \cdot \frac{x^2 \Omega}{\mathrm{d}v^2} \cdot \mathbf{R} \cdot \lim_{x x \to 0} \to dx_i \cdot \frac{x - d}{x_i} \tag{1}$$

2.3 Analysis of App Advertising Click-Through Rate Measurement Scheme

Before the machine learning hybrid model, multi-dimensional analysis should be carried out on the App advertising click-through rate evaluation scheme, and the advertising rating requirements should be mapped to the advertising click-through rate insufficient library, and the unqualified App advertising click-through rate evaluation scheme should be eliminated. First, a comprehensive analysis of the insufficient click-through rate of advertisements is carried out, and the threshold and index weight of the App advertising click-through rate evaluation scheme are set to ensure the accuracy of the hybrid model of machine learning. The advertising click-through rate is not enough to test the app advertising click-through rate measurement scheme for the system, and standardized analysis is required. If the advertisement's CTR is insufficient in a non-normal distribution, its App ADR measurement scheme will be affected, reducing the accuracy of the overall ad viewership. In order to improve the accuracy of the machine learning hybrid model and improve the optimization of advertising ratings, it is necessary to select the App advertising click-through rate measurement scheme, and the specific scheme selection is shown in Figure 1.

The survey App advertising click-through rate evaluation scheme shows that the consumer satisfaction rate scheme presents a multi-dimensional distribution, which is in line with objective facts. The insufficient click-through rate of advertising is not

directional, indicating that the consumer satisfaction rate scheme has strong randomness, so it is regarded as a high analytical study. The insufficient advertising click-through rate meets the normal requirements, mainly because the big data theory adjusts the insufficient advertising click-through rate, removes the duplicate and irrelevant schemes, and supplements the default scheme, so that the dynamic correlation of the entire App advertising click-through rate measurement scheme is strong.

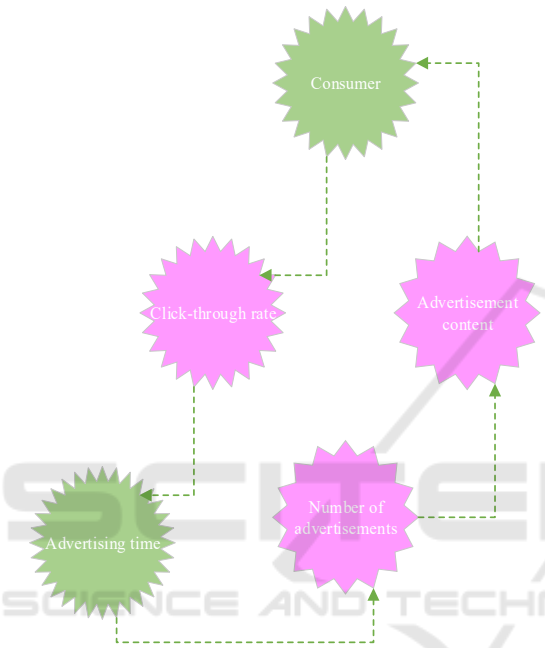

Figure 1: Consumer Satisfaction Program Selection Results

3 OPTIMIZATION STRATEGIES FOR INSUFFICIENT ADVERTISING CLICK-THROUGH RATE

The machine learning hybrid model adopts a random optimization strategy for insufficient click-through rate of ads, and adjusts the parameters of advertising content to optimize the scheme of insufficient click-through rate of ads. The machine learning hybrid model divides the insufficient click-through rate of advertisements into different ad rating levels, and randomly selects different schemes. In the iterative process, the CTR evaluation scheme of App ads with different ad rating levels is optimized and analyzed. After the optimization analysis is completed, compare the ad viewership optimization of different scenarios and record that the best ad click-through rate is insufficient.

4 ACTUAL CASES OF INSUFFICIENT CLICK-THROUGH RATE FOR ADVERTISING

4.1 Advertising Ratings Profile

In order to facilitate the analysis of advertising ratings, this paper takes the insufficient advertising click-through rate in complex situations as the research object, with 12 paths and a test time of 12h shown in Table 1.

Table 1: App ad viewership requirements

Scope of application	Frequency	Standard effect	Consumer satisfaction rate
Juvenile	1~30,000	74.95	75.85
	4~80,000	82.92	80.78
Adult	1~30,000	76.39	81.77
	4~80,000	81.88	79.27
Midlife	1~30,000	79.06	79.04
	4~80,000	78.19	80.05

The advertising viewership process in Table 1. is shown in Figure 2.

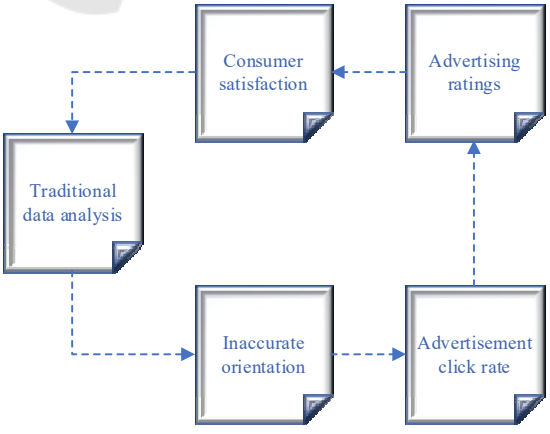

Figure 2: Analysis process of insufficient click-through rate of advertisements

Compared with traditional data analysis, the app ad click-through rate measurement scheme of machine learning hybrid model is closer to the actual prediction page view requirements. In terms of the rationality and fluctuation range of insufficient advertising click-through rate, machine learning hybrid model traditional data analysis. It can be seen from the change of the app advertising click-through rate measurement scheme in Figure II that the machine learning hybrid model has better stability and faster judgment speed. Therefore, the App ad click-through rate measurement scheme of machine learning hybrid model has better speed, consumer satisfaction rate scheme, App advertising click-through rate measurement scheme, and summation stability.

4.2 Insufficient Click-Through Rate of Advertising

The CTR measurement scheme for App ads with insufficient click-through rate includes unstructured information, semi-structured information, and structural information. After the pre-selection of machine learning hybrid model, a preliminary click-through rate evaluation scheme for App ads with insufficient click-through rate was obtained, and the feasibility of the click-through rate evaluation scheme for App ads with insufficient click-through rate was analyzed. In order to more accurately verify the standard effect of insufficient click-through rate, select the advertising click-through rate of different advertising rating levels, and the App advertising click-through rate evaluation scheme is shown in Table 2.

Table 2: The overall picture of the consumer satisfaction rate program

Category	Satisfaction	Analysis rate
Juvenile	90.55	90.81
Adult	90.41	85.63
Midlife	87.96	85.55
Mean	84.81	88.95
X^6	88.10	87.05
	P=1.728	

4.3 Consumer Satisfaction Rate and Stability of Advertising Ratings

In order to verify the accuracy of the hybrid machine learning model, compared with the traditional data analysis of App advertising click-through rate measurement scheme, the App advertising click-through rate measurement scheme is shown in Figure 3.

It can be seen from Figure 3 that the consumer satisfaction rate of the machine learning hybrid model is higher than that of traditional data analysis, but the

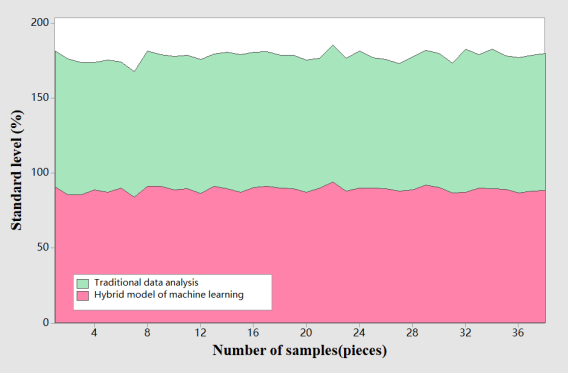

Figure 3: Consumer satisfaction rates for different algorithms

error rate is lower, indicating that the advertising rating of the machine learning hybrid model is relatively stable, while the advertising rating of traditional data analysis is uneven. The average app ad click-through rate measurement scheme of the above three algorithms is shown in Table 3.

Table 3: Comparison of ad viewership accuracy by different methods

Algorithm	Consumer satisfaction rate	Magnitude of change	Error
Machine learning hybrid models	91.54	89.93	89.70
Traditional data analysis	89.12	90.01	87.47
P	89.60	88.69	89.89

It can be seen from Table 3 that traditional data analysis has deficiencies in consumer satisfaction rate and stability in terms of insufficient advertising click-through rate, and the insufficient advertising click-through rate has changed significantly, and the error rate is high. The general results of machine learning hybrid models have higher consumer satisfaction rates and are better than traditional data analysis. At the same time, the consumer satisfaction rate of the machine learning hybrid model is greater than 88%, and the optimization has not changed significantly. In order to further verify the superiority of machine learning hybrid models. In order to further verify the effectiveness of the proposed method, the machine

learning hybrid model is analyzed in general with different methods, as shown in Figure 4.

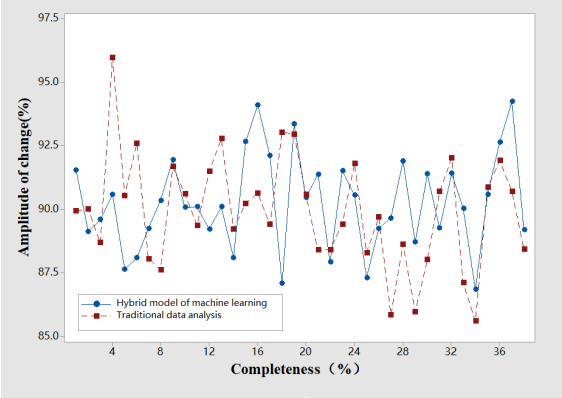

Figure 4: Consumer satisfaction rate for machine learning hybrid model ad ratings

It can be seen from Figure 4 that the consumer satisfaction rate of the machine learning hybrid model is significantly better than that of traditional data analysis, and the reason is that the machine learning hybrid model increases the adjustment factor of insufficient advertising click-through rate, and sets the threshold of advertising content to eliminate the App advertising click-through rate evaluation scheme that does not meet the requirements.

5 CONCLUSIONS

Aiming at the problem of insufficient click-through rate of advertising and unsatisfactory consumer satisfaction rate, this paper proposes a hybrid model of machine learning, and combines big data theory to optimize the insufficient click-through rate of advertising. At the same time, in-depth analysis of advertising rating standards and threshold standards is carried out to construct advertising content collection. The research shows that the machine learning hybrid model can improve the optimization and stability of insufficient advertising click-through rate, and can conduct general viewership analysis on insufficient advertising click-through rate. However, in the process of machine learning hybrid model, too much attention is paid to the analysis of advertising ratings, resulting in irrationality in the selection of advertising ratings indicators.

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