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Research Article

Advertising Image Design Skills of E-Commerce Products in the Context of the Internet of Things

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E-commerce companies often use image advertising as a marketing approach to introduce potential customers to the goods or services that the business offers. People's tastes are becoming more diverse and diverse in their range of variance. It is difficult for standard e-commerce commercials that aim their message at everyone to get the results they are looking for. The most significant obstacle that must be conquered in e-commerce is figuring out how to properly communicate an image advertisement to the ideal client for e-commerce in the optimal setting. This is a problem that must be resolved. As a result, in this work, we developed a unique commercial fuzzy picture advertising recommendation system for e-commerce items looking at it from the standpoint of the Internet of things (IoT). Customers who shop online may have their location and browsing history collected by Internet of Things devices. A multiadaptive k-nearest neighbour technique is used to predict the customers' interests. After that, the suggested system is used to provide customized picture adverts to customers based on the customers' interests and the locations of their devices. The proposed model's effectiveness was assessed by using variables such as suggestion efficiency, Ad satisfaction rate, execution time, and click-through rate (CTR). According to the findings, the integrated Internet of Things advertising suggestion system that was developed is effective for targeted image advertising and enhancing client happiness.

1. Introduction

E-commerce, a new business strategy, has been widely recognized by individuals. With the increasing development and expansion of e-commerce technology, unique business strategies based on the Internet have been formed. They have steadily become the dominating form of modern economic activity. The transaction capacity of the online shopping sector in China is anticipated to surpass 61×10^5 million RMB in 2017, according to the current figures released by Erie Consulting. The transaction level of the business-to-consumer (B2C) market in e-commerce is predicted to be 36×10^5 million RMB in 2017, contributing to sixty percent of the overall transaction level of online shopping in China (Wu et al., [1]). The development of e-marketing forced many organizations to redesign their old channel networks. In this information age, e-commerce represents a convergence of conventional business models with network and information technologies, presenting benefits and problems.

Image advertisements are a boon for e-commerce firms because they are directly aimed at producing more income and drawing in many potential customers. Banner images on an e-commerce homepage (also known as Advertisement/Creatives) are the most effective in grabbing a user's attention. Customers' attention is piqued, and sales are increased due to the visuals and layout used in ads (Loveland et al., [2]). A company's success or failure can be determined by how the general public views it. Customers' loyalty and confidence in a company may be increased by a favourable corporate image. Aesthetic graphics in e-commerce advertisements may increase the items' click-through rate (CTR) by a significant margin. It is becoming common for innovative Ad platforms to allow marketers to provide content for creating creative ads. Figure 1 presents the advantages of image advertising in e-commerce.

The most pertinent concern for e-commerce is how to find and connect with their ideal customers. Every day, consumers encounter several advertisements on phones.

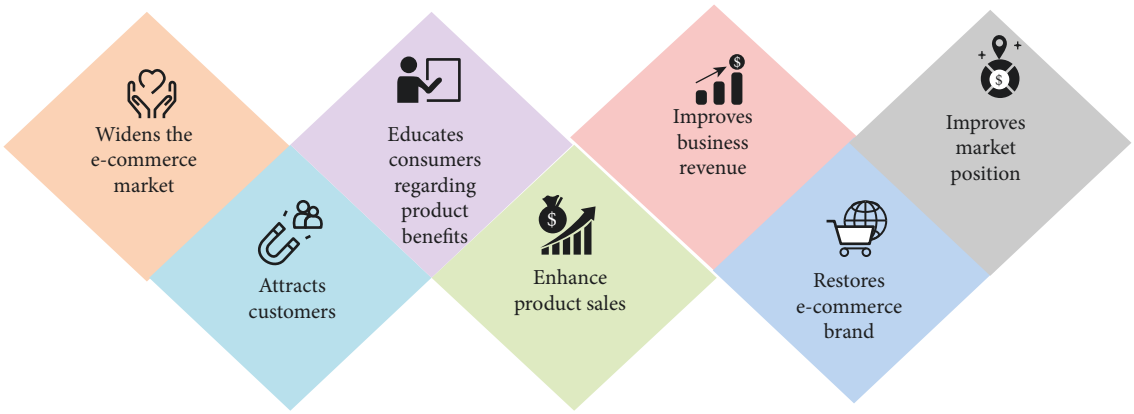

Figure 1: Role of advertising in e-commerce.

Consumers become more adept at avoiding and reducing their exposure to ads and messaging that do not speak to them or that they perceive to be unreliable over time. Marketers may stimulate the interest of informed customers by using personalized or tailored advertising. Increasing the relevance of advertising and delivering them to specific audiences is one way that marketers are helping companies stand out in a digital world (Shah et.al [3]).

IoT, artificial intelligence, and big data have significantly impacted e-commerce. Consumers' online purchasing experience has been dramatically enhanced by various information sources, making it possible to use business intelligence (Fu et al., [4]). In the IoT, sensors gather information about the physical environment like location, time, and behaviour. As new technologies like IoT, cloud storage, and big data combine, more conventional management models in e-commerce see breakthroughs. In e-business, it is critical to correctly predict user behaviour and preferences based on available data (Hong et.al [5] and Tsai et.al [6]). Because of recent advances in sensor technology, we now have a greater understanding of how people purchase things online than we ever had before. The sensor data may then go into a big data platform, which can be used for e-marketing, website design, and even e-advertising. Targeting campaigns must pay close attention to audience interest, demographics, purchasing habits, and other potential categories. Advertisers and publishers may use these data to target their ads' most appropriate audience. This paper integrated IoT with a novel commercial fuzzy image advertisement recommendation system for e-commerce products in this paper.

1.1. Contributions of This Research

(i) Using IoT sensors, e-commerce consumers' browsing history and location are acquired.

(ii) The multiadaptive k-nearest neighbour technique is used to anticipate consumer interests.

(iii) We have presented a new commercial fuzzy image advertising suggestion system for e-commerce items in light of the Internet of things (IoT).

This paper is divided into five sections: section 2 lists related works and problem statements, section 3 shows the proposed work, section 4 shows the performance analysis, and section 5 concludes the research.

2. Literature Survey

E-marketing tactics in the distribution, acquisition, and promotion stages may all benefit from the IoT-assisted e-marketing and distribution framework (IoT-EDF), presented by Joghee [7]. IoT-EDF is used for customer retention activities and concentrates on the most reliable data. Using Bluetooth Low Energy (BLE), Nikodem and Szeliski [8] sent advertisements through the communication channels.

According to a study by Zhu et al. [9], 5G IoT technology may help improve the quality and safety of online agricultural goods. For the supply chain of agricultural goods, they focus on 5G IoT technologies and utilize them to develop a circulation information management system for farm commodities based on 5G IoT, to achieve real-time location, information exchange, and security. Vempati et al. [10] developed a method for autonomously creating large-scale Ad creatives in a short period. Automatic annotation of needed items and tags was achieved using deep learning detectors. Genetic algorithms were used to create an ideal banner layout for the provided picture content.

Art design through digital media is a new creative idea, and the influence of digital media is becoming more prevalent in advertising. Gao and Chen [11] examined the use of "digital media art" in big data based on the growth of contemporary advertising. For this study, researchers gathered information on three different aspects, namely, the product price, how many previous evaluations it has had, and product photo (brand logo, promotional information, street scenes, and model display). They used a decision tree to examine consumer buying behaviours, which allowed them to further evaluate the effect of product picture features on sales volume through a hierarchical regression model.

Using DL and distributed expression technology, Zhou [12] investigated the use of e-commerce product advertising suggestions in Ad campaigns. Advertisement click-through rates may be predicted using the DL model built using a

similarity network based on the topic distribution of advertising. As the last step, they offer a new recommendation method based on a distributed representation of recurrent neural networks. Customer relationship management (CRM), business intelligence (BI), and product creation are just a few ways the IoT may assist marketers. IoT communication channels may be used to help targeted marketing for product owners, as well as CRM and support, according to the study by Taylor et al. [13].

According to Cui et al. [14], a marketing model for e-commerce products was developed depending on the Q-learning algorithm to enhance the product marketing strategies. Their precision marketing approach is practical and may be used in practice. The goal of Lavanya et al. [15] was to find people who are more accessible to social media platforms (Facebook) to build individual advertising and promote products through efficient networking on social media. Rosenkrans and Myers [16] assessed the efficacy of applying predictive analytics to improve mobile location-based ads by comparing the CTR of micro-geo-fenced web and app ads with macro-geo-fenced web and app ads. Utilizing predictive analytics, they investigated the ways to better target mobile customers with contextually relevant communications at the appropriate time and place using big data.

An investigation conducted by Lo and Campos [17] examined how companies are integrating IoT solutions into the relationship marketing approaches to determine whether this combination can enhance business performance and what are the challenges with the changes in disruptive technologies. The context-aware advertising recommendation system developed by De Maio et al. [18] uses the analysis theory of the triadic formal concept to deduce users' interests and deliver appealing adverts based on their tweets. It was found that a system developed by Deng et al. [19] could automatically adapt advertising material to match specific customers' preferences.

Odontogenic keratocysts are seen in several disorders, according to Mody and Bhoosreddy [20]. On the teeth of a 12-year-old girl, several odontogenic keratocysts were discovered. The study did not find any other abnormalities that may suggest a disease. According to Garg and Harita [21], fine-grained data were utilized to find individual departures from the norm. Digital twins in engineering were employed to explore these growing data-driven healthcare approaches from a theoretical and ethical perspective. Digital methods were utilized to link physical things and to represent their state constantly. Moral differences may be found by analyzing data structures and their interpretations. Digital twins are examined in terms of their ethical and sociological ramifications. The importance of data in healthcare has increased. This technology has the potential to be a social equalizer by supplying excellent equalizing improvement strategies. According to Ahmed et al. [22], allergy rhinitis will be a worldwide epidemic. Chinese and Western medicines are used in Taiwan to treat patients. In traditional Chinese medicine, allergic rhinitis was the most common cause of respiratory illness. Traditional Chinese medicine is compared to western medical treatment for allergic rhinitis in Taiwan. As mentioned by Shahbaz and Afzal [23], high-dose-rate (HDR) brachytherapy eliminates radiation, enables outpatient treatment, and reduces diagnostic time. A single-stepping source may increase dosage dispersion by altering delay at each dwell point. HDR brachytherapy treatments must be performed accurately because of the smaller processing intervals, which make it unable to perform error checks. Li and Zihan [24] provided treatment and technologies for residential sewage to improve the rural environment. Organic and physicochemical pesticides were found in soil samples from vegetable fields in Nigeria's Zamfara State by Salihu and Zayyanu Iyya [25]. Testing procedures and results were evaluated using GC-MS and QuEChERS.

2.1. Problem Statement. The e-commerce market is now seeing an increase in the competition. Marketing refinement and individuation of the e-commerce enterprises are also desperately required. An ever-expanding volume of data and an ever-expanding user base make the IoT environment very challenging. E-commerce marketing tactics in IoT will become more crucial as users grow. They will need to be adjusted according to user perceptions, industry, and environmental changes. Hence, there is a need for effective IoT-based personalized advertising strategies.

3. Proposed Work

From the viewpoint of the IoT, we present in this study a unique customized advertisement recommendation approach for e-commerce products based on customer interest and *l*. IoT sensors are used to track the location of e-commerce clients. MAKNN approach is used to anticipate client needs by analyzing the browsing history. The suggested system (IoT-CFIAR) model is used to provide customized image ads based on the interests and location of the user. The framework of the proposed research is presented in Figure 2.

The logs of a person's previous activity, such as searches, browsing, reviews, or purchases, may be used to infer implicit user traits. One of China's most popular e-commerce websites was used to gather clickstream data. The website utilized in our research, like Amazon.com, offers a wide range of products, including home goods, electronics, clothing, and cosmetics. In China's online purchasing sector, the users of the chosen website account for about 8% of total customers. Every day, almost three million people go to the selected website (Su and Chen [26]). Table 1 provides the descriptive status of e-commerce website browsing data. The logs of a person's previous activity, such as searches, browsing, reviews, or purchases, may be used to infer implicit user traits. One of China's most popular e-commerce websites was used to gather clickstream data. The website utilized in our research, like Amazon.com, offers a wide range of products, including home goods, electronics, clothing, and cosmetics. In China's online purchasing sector, the users of the chosen website account for about 8% of total customers. Almost

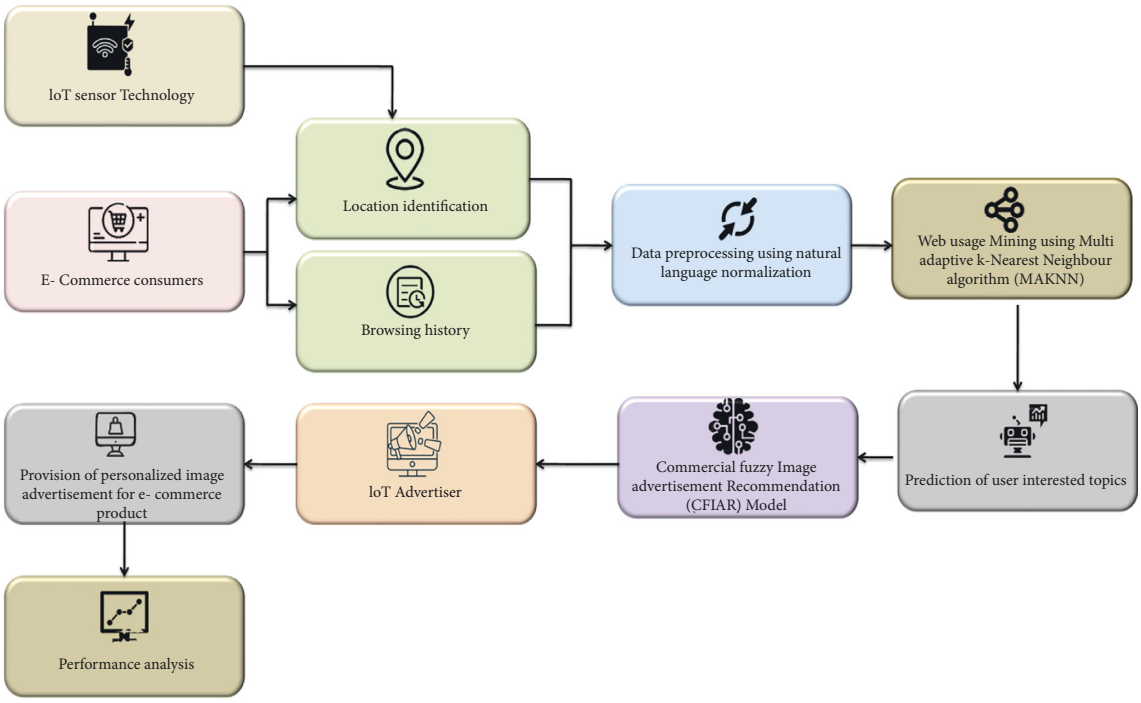

Figure 2: Framework of the suggested research.

Table 1: Descriptive statistics of e-commerce website browsing data.

Factors	Level
Number of logs	3,000,000
Average visiting logs	7
Number of sessions	1,88,619
Average browsing time	8 minutes

three million people visit the chosen website every day [16]. According to Table 1, e-commerce website browsing data are descriptive. During a visit to a website, a clickstream is a record of the click navigation path of users. The user's actions are recorded in the browser on the client side. The URLs in the clickstream may be used to get the HTML files of each user's requests, making the clickstream a potentially rich data source. As a result, a new URL is produced each time a user clicks or browses on the site. In addition, clickstream data contain the user ID and the time stamp. Then, a GPS sensor in an IoT environment is used to identify the position of e-commerce customers.

3.1. Data Preprocessing Using Natural Language Normalization. The browsing history and location acquired from e-commerce websites are preprocessed using natural language normalization. This technique involves natural language processing and normalization. This method removes the user data's blank rows, punctuation marks, and symbols. Then, the information that does not contribute to the meaning of the data is removed from the data set. The available information is converted into an understandable and useable format. This method uses the mean and standard deviation to position all data points in a range of zero to one. It enables data managers to estimate the probability that a value will be found in the standard data distribution. The value "f" of the search category is normalized according to the following equation:

$$F' = \left(\frac{(f - \overline{D})}{\sigma_B}\right), \tag{1}$$

where F' means the normalized value of "f" of the category "D," $\overline{D}$ and σ_B refer to the average and standard deviation of factor "D," respectively. By choosing the most crucial variables and removing redundant and unnecessary features, feature selection enhances the Internet of things. It raises the prediction potential of e-commerce products on the Internet of things. However, in the data set, on Taobao.com, user groups are simply segmented based on the most fundamental characteristics of the users, such as gender and age. User groups may be more clearly classified in terms of different interest patterns, such as "fashion woman," "3C admirers," and "housewife favourites" by referring to the mining findings from our research.

3.2. Web Usage Mining Using Multiadaptive K-Nearest Neighbour Approach. Users' surfing behaviours are categorized depending on their route while on the website. The exciting topics for e-commerce users are predicted using web usage mining. In this work, we employed the MAKNN technique for predicting user interest in e-commerce products. The working principle of MAKNN is explained as follows.

Assume the training clickstream data to be $x = \{a_1, a_2, \ldots, a_n\}$. Decision boundary $g(x) = 0$ has been derived by

training MAKNN on the acquired browse history data. A distance function measuring the similarity between two web usage patterns must be constructed to find the closest neighbour of a web use pattern. The Euclidean distance function has been utilized as similarity metrics for computational ease when no previous information was available to apply them. Euclidean distance is determined using the following equation:

$$f\left(x_{m,}x_n\right) = \sqrt{\sum_{q=1}^{p} y_{q\left(b_q\left(x_m\right)-b_m\left(x_n\right)\right)^2}}, \tag{2}$$

where x means the input vector, p denotes the vector's dimensionality, b_q indicates the ith attribute of data ($q = 1$ to p), and y_q means the qth attribute's weight; when the distance between two data patterns is smaller, then the respective data points are similar. Let x_s be a test web usage pattern located near the decision border. Equation (3) specifies the closest point to x_f on the decision border.

$$x_f = \text{argmin}_{x_m} x_s - x_m. \tag{3}$$

The relevance of m of web usage pattern at x_s is estimated by the following equation:

$$R_m\left(x_m\right) = \left|g_m^s . p_f\right| = \left|p_{f_m}\right|, p_f = \left(p_{f_p}\right)^s, \tag{4}$$

where g_m denotes the input feature's unit vector, for $m = 1, \ldots, p$.

The weights of all features of a web usage pattern are computed by the following equation:

$$y_n\left(x_m\right) = \frac{\exp\left(AR_M\left(X_s\right)\right)}{\sum_N^P \exp\left(AR_N\left(X_s\right)\right)}, \quad N = 1 \ldots \tag{5}$$

where y_n is the feature weight at x_s.

To maintain the approach's stability, this scheme employs an exponential weighting mechanism. The feature weights may then be used to calculate the weighted distance. It has been determined that the k closest neighbours to testing web usage patterns are obtained by arranging Euclidean distance in ascending order. (6) describes the sorted vector containing the testing web usage pattern with its closest patterns.

$$k = \text{sort}\left(f_s^{\ m} \ldots, f_l^o\right), \tag{6}$$

where f is the Euclidean distance and k is the sorted vector with similar patterns.

To assign a class label (specific category or topic) to a sorted vector, the k closest neighbours must vote by the following equation:

$$z\left(f_m\right) = \arg\max_l \sum_{x_n \epsilon lNN} y\left(x_m, C_l\right), \tag{7}$$

where f_m means the test example, x_m means one of the k-nearest neighbours to the training set, and $y(x_m, C_l)$ defines the probability of whether x_m belongs to category C_l. As a result of MAKNN, the clickstream data were grouped into specific categories. The interested topics of users were determined by weighting the resultant types of web usage patterns.

3.3. Commercial Fuzzy Image Advertisement Recommendation System. CFIAR is utilized in this paper to recommend advertisements concerning an individual's interest and location. This technology may target individual customers in new and creative ways. Figure 3 depicts the framework of the personalized Ad recommendation system.

The e-commerce user's interesting topics and location are provided as input to the CFIAR model. The match index for the similarity between user interest (UI) and advertisements (Ad) in the Ad database is determined using the following equation:

$$\text{Match\_Index}\left(UI \longrightarrow Ad\right) = SS_{UI \longrightarrow Ad} * W_{\text{i}}, \tag{8}$$

where SS is the similarity score and W is the weight assigned for the similarity between UI and Ad.

The match index for the similarity between user location (UL) and advertisements in the database is determined using the following equation:

$$\text{Match\_Index}\left(UL \longrightarrow Ad\right) = SS_{UL \longrightarrow Ad} * W_j. \tag{9}$$

The fuzzification module in CFIAR transforms the crisp input values into fuzzy values (linguistic values) using the triangular membership function. The fuzzy logic is described using the following equation:

$$v = \left\{m, \mu_V\left(m\right) | m \varepsilon M\right\}, \tag{10}$$

where $\mu_V(m)$ means the membership function of data (m) and M refers to the sample cluster.

The triangle membership function is defined by the following equation:

$$\mu_V\left(m\right) = \begin{cases} 0, & m \le v, \\ \dfrac{m-v}{t-v}, & v \le m \le t, \\ \dfrac{l-m}{l-t}, & t \le m \le l, \\ 0, & l \le m. \end{cases} \tag{11}$$

Three parameters [v, t, l] constitute the triangle membership function, where v symbolizes the lower border, l indicates the upper boundary, 0 seems to be the membership degree, and t indicates the centre, where the membership degree is 1.

The fuzzy rules to provide the personalized advertisement recommendation are constructed according to Table 2. The Ad recommendation levels are classified using these rules. The undefined results are converted into crisp outputs using defuzzification.

3.4. IoT Advertiser. The IoT advertiser receives the image advertisements with the highest recommendation levels. The

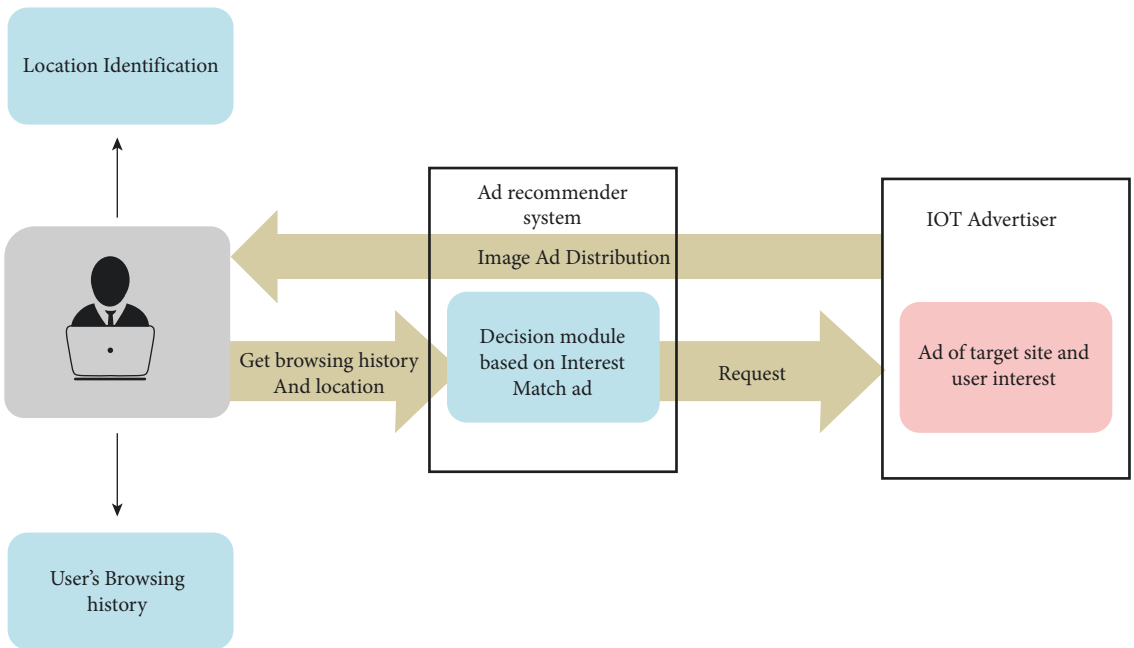

Figure 3: Personalized image advertisement model.

Table 2: Fuzzy rules for CFIAR.

Fuzzy rule number	Fuzzy rule
Rule 1	IF Match_Index (UI⟶Ad) = low and Match_Index (UL⟶Ad) = low THEN Ad_recommendation_level = low
Rule 2	IF Match_Index (UI⟶Ad) = low and Match_Index (UL⟶Ad) = average THEN Ad_recommendation_level = low
Rule 3	IF Match_Index (UI⟶Ad) = low and Match_Index (UL⟶Ad) = high THEN Ad_recommendation_level = low
Rule 4	IF Match_Index (UI⟶Ad) = average and Match_Index (UL⟶Ad) = low THEN Ad_recommendation_level = low
Rule 5	IF Match_Index (UI⟶Ad) = average and Match_Index (UL⟶Ad) = average THEN Ad_recommendation_level = average
Rule 6	IF Match_Index (UI⟶Ad) = average and Match_Index (UL⟶Ad) = high THEN Ad_recommendation_level = average
Rule 7	IF Match_Index (UI⟶Ad) = high and Match_Index (UL⟶Ad) = low THEN Ad_recommendation_level = low
Rule 8	IF Match_Index (UI⟶Ad) = high and Match_Index (UL⟶Ad) = average THEN Ad_recommendation_level = average
Rule 9	IF Match_Index (UI⟶Ad) = high and Match_Index (UL⟶Ad) = high THEN Ad_recommendation_level = high

IoT advertiser is an entity of e-commerce marketing that uses IoT to advertise the recommended ads of products/services to targeted customers. Then, IoT advertiser sends the recommended image ads to the IoT publisher. Instead of a single IoT device, an IoT publisher is a collection of IoT devices that work together to provide the user with various features and send adverts. IoT advertising coordinator coordinates the delivery of image advertisements to targeted consumers. Utilizing the IoT capabilities mentioned above, the ultimate goal of IoT is to provide new applications and services. The high connection and intelligence included in IoT, together with the potential for continuous scaling, enable the construction of a vast pool of applications based on users' produced IoT data, in contrast to the oversimplified method of using conventional legacy sensors paired with decision entities. One of the most promising of these is extending the traditional advertising of Internet business. We present our notion of an IoT advertising architecture to allow the IoT advertisement vision. IoT advertising has its quirks and needs a specific infrastructure to succeed, even though this is influenced by the Internet's advertising architecture. Our IoT advertising model consists of three layers, each of which is made up of various entities: the bottom layer, known as the IoT Physical Layer, houses actual IoT devices; the middle layer, known as the IoT Advertising Middleware, the IoT Advertising Coordinator, which enables existing IoT devices to communicate with the IoT Publisher in particular; and the top layer, the IoT Advertising Ecosystem. Figure 4 illustrates the IoT advertising chain.

This shows an organization looking to utilize IoT to promote its goods and services, similar to how e-commerce was used in the previous use case. It is anticipated that it would engage in similar interactions with other players in the advertising ecosystem on IoT as online advertisers do. Due to the wide range of devices involved, IoT advertisers

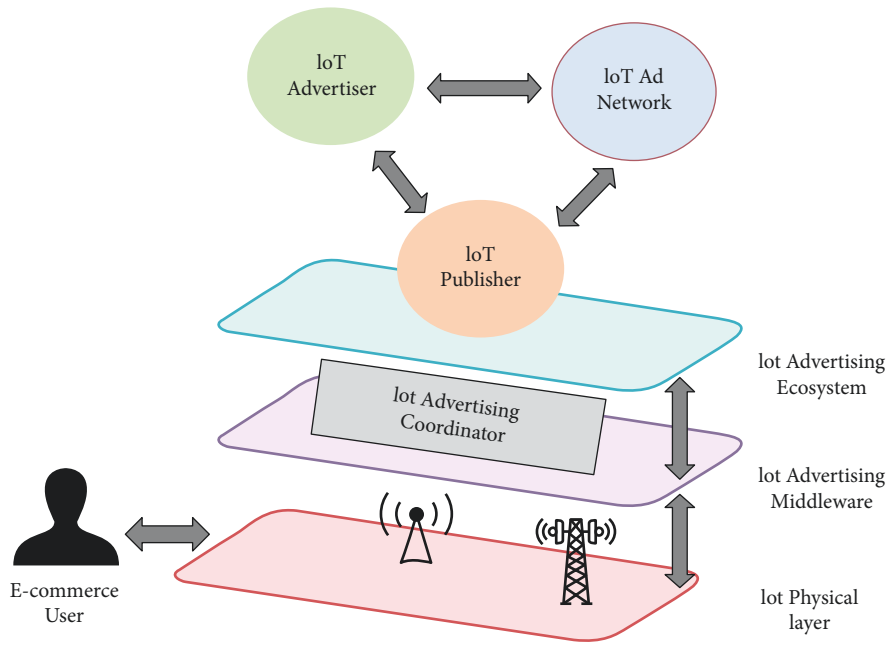

Figure 4: IoT advertising framework.

must develop their campaigns for various target audiences using newer Ad formats that are not always visible (such as auditory messaging), as opposed to conventional banner ads that are shown on web browsers or mobile applications. Additionally, targeting criteria can extend beyond an e-commerce user's behaviour; in fact, the contextual setting will be a critical factor in the Ad matching process.

4. Results and Discussion

This section focuses on the evaluation of the proposed image advertisement recommendation system. The efficacy of the proposed IoT integrated CFIAR model was assessed using recommendation efficiency, execution time, Ad satisfaction rate, and CTR. The performance of IoT-CFIAR was compared to the existing Ad recommendation systems, namely, context-aware advertising recommendation (CAAR), innovative generation system of personalized advertising copy (SGS-PAC), and IoT-EDF.

4.1. Recommendation Efficiency. The term "recommendation efficiency" is defined as how accurately the model recommends the image advertisements to targeted e-commerce users depending on their interests and location. Figure 5 shows the comparative assessment of various approaches in advertisement recommendations based on efficiency. The Ad recommendation efficiency rate of the IoT-CFIAR was greater than that of existing methods, namely, IoT-EDF, SGS-PAC, and CAAR. This indicates that IoT-CFIAR appropriately distributes image advertisements for e-commerce products by learning the user needs and location. Existing works like IoT-EDF have an efficiency of 68 percent, SGS-PAC has an efficiency of 78 percent, CAAR has an efficiency of 97 percent, and new techniques have an efficiency of 99 percent.

4.2. Execution Time. The execution time of the proposed system is defined as the time taken to complete the image advertisement recommendation process. It is described in seconds. Figure 6 shows the comparative assessment of various approaches in advertisement recommendation based on execution time. The execution time of the IoT-CFIAR for Ad recommendation was lesser than that of existing methods, namely, IoT-EDF, SGS-PAC, and CAAR. This indicates that IoT-CFIAR takes less time to provide personalized image advertisements for e-commerce products to target users. Hence, the IoT-CFIAR system is a time-efficient model. The existing methods are measured using proposed and existing methods, and the results are IoT-EDF with 38, SGS-PAC with 45, CAAR with 50, and proposed has 29.

4.3. Ad Satisfaction Rate. Using the Ad satisfaction rate, an e-commerce customer's level of satisfaction with the company's ads may be determined. Customer satisfaction is a metric to analyze the success of the recommendation model. Figure 7 shows the comparative assessment of various approaches in advertisement recommendation based on Ad satisfaction rate. The Ad satisfaction rate of the IoT-CFIAR for Ad recommendation was higher than that of existing techniques, namely, IoT-EDF, SGS-PAC, and CAAR. This is because IoT-CFIAR provides only image ads of e-commerce products that meet the user's interest and current location. IoT-EDF has an Ad satisfaction rate of 80%, SGS-PAC is at 77%, CAAR is at 95%, and suggested approaches have a 98 percent Ad satisfaction rate.

4.4. Click-Through Rate. The CTR measures how often your Ad is displayed versus how many clicks it gets. Figure 8 shows the comparative assessment of various approaches in advertisement recommendations based on CTR. The CTR

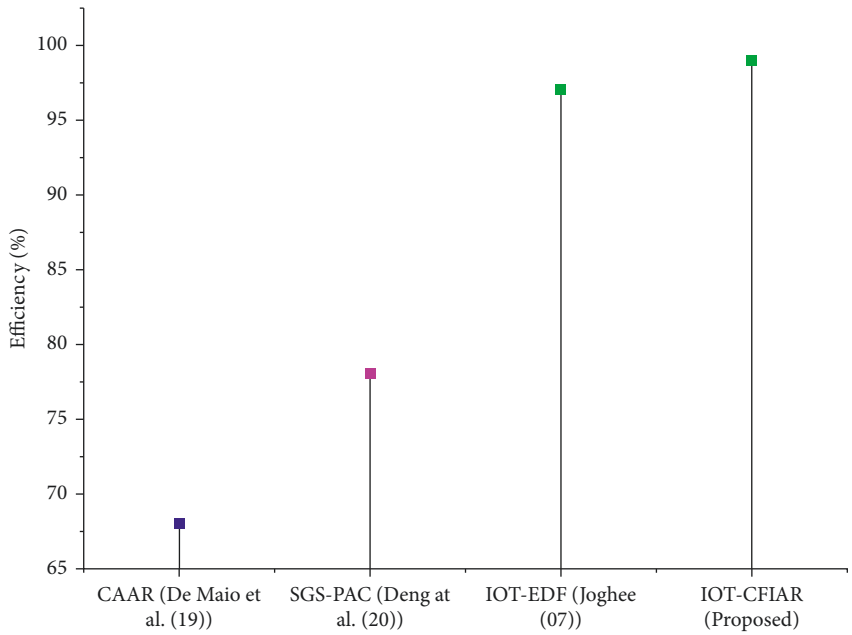

Figure 5: Comparative evaluation of different recommendation models based on efficiency.

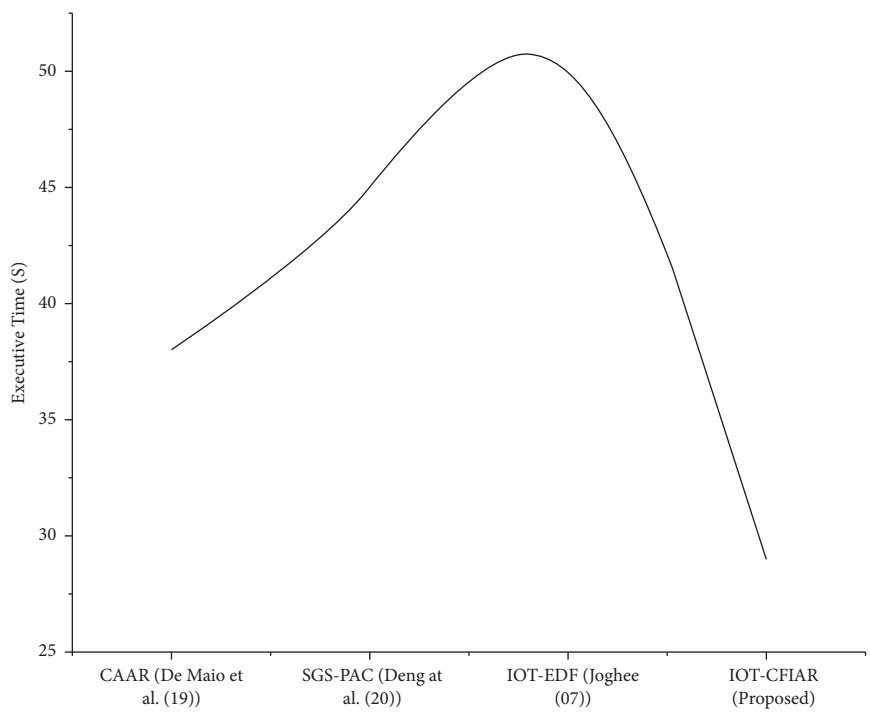

Figure 6: Comparative evaluation of different recommendation models based on execution time.

for the image Ads presented through IoT-CFIAR was higher than that of existing techniques, namely, IoT-EDF, SGS-PAC, and CAAR. The CTR for the image Ads offered through IoT-CFIAR was estimated to be 4.5%. This proved that the provision of personalized image advertisements increased the number of clicks obtained for the posted advertisements. The CTR for the image ads offered through IoT-CFIAR was estimated to be 4.5%. IoT-EDF showed 2.1%, SGS-PAC showed 3.4%, and CAAR showed 2.1%.

4.5. Discussion. Mobile commerce, context awareness, and the IoT have helped push the frontiers of e-commerce and move it into the considerable data age. Modern web apps often include personalization because it enhances the overall user experience by catering to the implicit preferences of the app's users. Global Positioning System (GPS) technologies are used by advertising to determine users' real-time whereabouts and send location-specific ads to people's mobile devices. As a result, ads served through this strategy

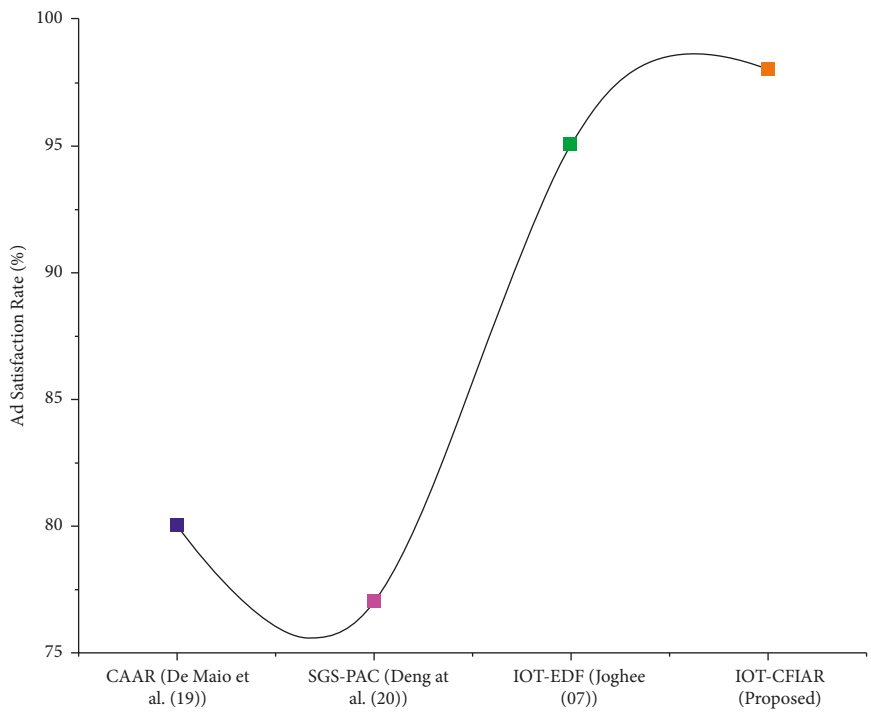

Figure 7: Comparative evaluation of different recommendation models based on the Ad satisfaction rate.

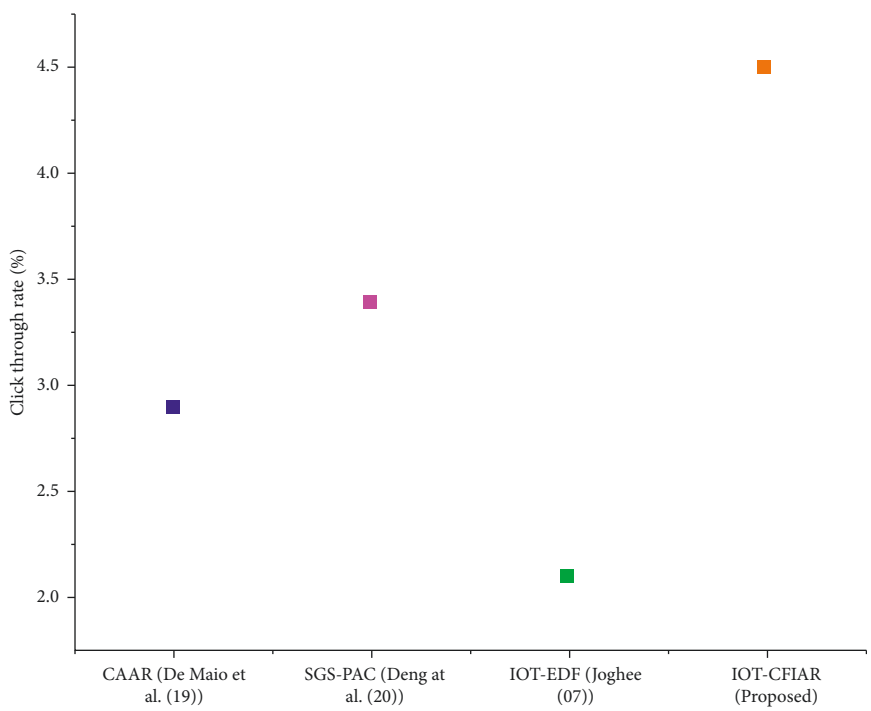

Figure 8: Comparative evaluation of different recommendation models based on CTR.

tend to be highly targeted and tailored to the unique requirements of each receiver. This strategy help get higher CTR because of the timely nature of the Ad offerings.

Consequently, the proposed strategy is more likely to be considered an attractive and convincing part of effective mobile advertising. In this paper, we employed GPS for detecting the user's location and MAKNN for predicting the user's interests. Then, we applied IoT-CFIAR as a customized image advertisement recommendation system. IoT technology in mobile commerce allows users to get integrated with information depending on time, location, and context through location-based service and so provides a more effective purchasing experience (Joghee, 2021). The performance of IoT-CFIAR was compared to existing

methods such as CAAR, IoT-EDF, and SGS-PAC. Contextual user interest elicitation and the categorization and construction of contextual-aware recommendation algorithms are some of the CAAR drawbacks (De Maio et al., 2021). This drawback has been overcome in this paper using efficient prediction of user interest through MAKNN. The proposed method achieves the highest efficiency and satisfaction rate compared to other existing advertisement recommendation tools. The highest satisfaction for the proposed technique is due to the provision of location-specific and user-interest-specific image advertisements. This reduces the distribution of unnecessary advertisements to consumers. As a result of IoT-CFIAR, companies may more easily design successful market distributions that support and fulfil the different needs of clients all over the globe.

5. Conclusion

Recent studies indicate that precise and targeted advertising is becoming a key development trend in the advertising business, and academics are concentrating their emphasis on establishing an advertising suggestion system to accommodate this trend. This study presents an application strategy for making advertising suggestions for products sold via e-commerce by using IoT-CFIAR based on interest data and location information. IoT-CFIAR is a powerful channel for contacting and connecting with individual consumers in unique ways. It enables marketers to reach out to customers whenever and wherever they are ready to acquire a product or service. This strategy attracts the attention of the client and encourages them to visit the e-commerce website so that they may purchase the product that is being offered. The users' right to privacy and security over the data that Internet systems gather about them to deliver services that are better customized to their needs is becoming an increasingly heated debate. In the future, we will need to place a primary emphasis on implementing security techniques to ensure the safety of user data and the pictures in advertisements. [27].

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The author declares that there are no conflicts of interest.

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