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An Analysis on Online Shopping Based on Fuzzy Logic: A Review Perspective

Ravi Shankar Sharma[1]* Prof. (Dr.) Mahaveer K. Sain[2] Mr. Vipin Singh[3]

[1] Department of Computer Science and Informatics, MAU, Jaipur, India

[2] Department of Computer Science and Informatics, MAU, Jaipur, India

[3] Department of Computer Science and Applications, MAISM, Jaipur, India

Abstract – Online Shopping has become a more preferred option as the Internet is a daily requirement for people nowadays. Due to its convenience, handiness, and anytime and anywhere shopping, variety of products, and numerous discounts and deals on goods, online shopping is the most favored choice for customers. The focus of this new era of e-commerce is on understanding the perception of consumers towards online shopping. A lot of studies have been done to learn more knowledge about this ever-evolving sector. The goal of this paper is to get an idea of the attitudes of the customers towards shopping online about their growth regarding online shopping, artificial intelligence in E-commerce, and their technology. This paper outlines the numerous components that have a moderating effect on loyalty, e-marketing, customer satisfaction, and appreciated value. In view of the scope and diversity of the customers, e-marketing must continue to be crucial for the unique market.Online platforms continue to be important because of the reach and the diversity of the customers meaning e-marketing should target the unique market. Online customer reviews to test customer reviews performance. The technique pre-processes the text of the input using fuzzification and defuzzification and then uses the fuzzy logic of decision-making.

Keywords – Online Shopping, Consumer Behavior, Artificial Intelligence, Fuzzy Logic, E-Commerce

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1. INTRODUCTION

Online shopping is a popular way for customers to purchase. Demands for online shopping are frequently dynamic. As a result, inventory management is a challenge for many online business owners. Daily sales projections that are accurate help to sell & refill more efficiently [1]. In the e-commerce era, online shopping is a new model. Consumers who shop online or not are relevant to the credibility of businesses, electronic commerce & logistics, etc. With e-commerce promotion, consumer online shopping is progressively being understood and is being developed as a new way to shop, especially on a C2C market by the trend of specialization and broadcast. The unique advantages of online shopping include no time & space limits, convenient payment, comprehensive selection of goods, low prices, etc. But online shopping has disadvantages such as product quality problems, the credibility of businesses, and logistics, and many consumers like web browsers are just being watched.

There is no space-time boundary on online shopping which means you can shop on the store website anytime, anywhere, while you connect with the Internet. In physical shopping, customers have less time, and many bureau personnel has time for shopping just by night or weekend. The Traffic congestion and developing shop lengthen the time of shopping and consumer identification of various goods is challenging. A new quick, convenient purchasing and service paradigm is therefore badly needed. The network enables consumers to compare goods indoors that save time and cost and increase the efficiency of the purchase that is actually achieved in time. Online shopping was good for consumers, believe that online shopping can save time and have an opportunity for the purchase of goods that are not sold locally[2]. In the meantime, online shopping is a mode consuming for some white-collars & students that pursue personality.

Through the use of fuzzy logic methodologies, the marketing model must be adaptable, customizable, and completely demonstrate the relationship b/w consumer perception & buying behaviour. In this sense, we concentrate our research on one of the foundations on which the marketing model is based,

such as modelling estimation techniques, along with improvement as well as representation of the variables that estimation techniques dependent on Fuzzy Association Rules (FAS) theoretically & empirically represent. We may expect more variety, exhaustiveness & sophistication from these models, as well as considerably more qualitative data than prior estimation strategies. Vagueness or fuzzy is a phrase used to describe something that is ambiguous or unclear. In our daily lives, they frequently encounter conditions in which we are unable to determine whether the reality is entirely real or false.Several approaches, for example, artificial intelligence (AI) & fuzzy logic (FL) techniques, are being utilized to enhance the performance of Flexible Manufacturing Systems[3].These techniques are based on machine learning, deep learning, data mining, and so on. We believe the improvement of e-commerce legislation, e-commerce security technologies, specialized and systemic logistics will attract ever more customers.

2. E-COMMERCE

E-commerce usually referred to as Electronic Commerce, denotes the onlineselling & buying of goods, products, or services. These services are available online through the internet network. Funds, data, and Money transactions are also regarded as e-commerce. These business transactions may be performed in four different ways: Business to Business (B2B), Business to Customers (B2C), Customer to Customers (C2C)& Customer to Business(C2B). A commercial transaction occurring on the internet is the standard definition of e-commerce. The e-commerce websites are instances of online shops such as Flipkart, Amazon, Myntra, Shopify, Olx, eBay, and Quikr [4].

Electronic commerce (often known as e-Commerce) is a commercial concept whichpermitsbusinesses models & individuals to sell&buying goods through the internet. E-commerce is available in each of the following four key market segments listed below:

- Business to consumer
- Consumer to business
- Business to business
- Consumer to consumer

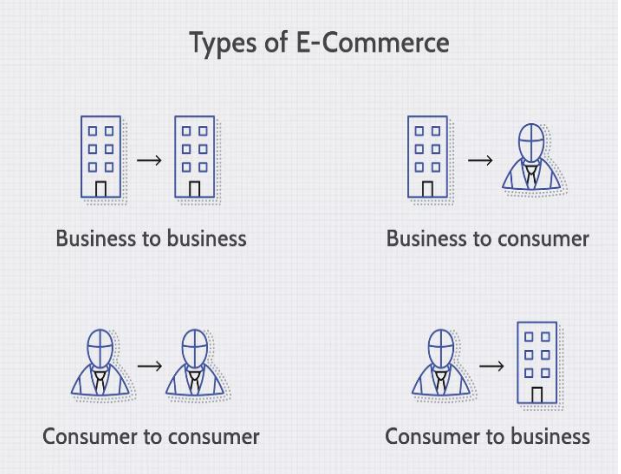

Figure 1 E-commerce types

2.1 Most common uses of Ecommerce:

- **Online marketing**

It refers to the data collection about consumer behavior, preferences, requirements, buying patterns, etc. It promotes marketing activities including negotiation, price-fixing, improved product features, and strong relationships with customers since such data is presented to enhance the customer's buying experience.

- **Online Booking**

Almost everyone has done it at some time - booked hotels, vacations, travel insurance, airline tickets, travel insurance, and so on. IRE (Internet Reservation Engine) is used to make these reservations and bookings feasible. Tour operations, Aviation, and hotels are all used to their full potential.

- **Digital Advertising**

Online advertising consists of both an advertiser and a publisher who use the Internet to provide consumer advertising material. The publisher incorporates the publicity provider's adverts & advertisements into online content.

- **Online publishing**

This study focuses on the digital publication of catalogs, books, magazines & digital libraries.

2.2 Technologies used in online shopping:

There is rarely a facet of an industry that has not been impacted by technology. Big data and machine learning, in particular, pave the way for robotics automation, immediate data transfer, and a variety of intriguing devices. The retail sector is no exception when it comes to embracing technology [5].

I. Personalized user experience

Sales & conversions are considered critical user experiences by 74% of businesses. 59 percent of consumers' decisions influence AI's ability to create a personalized user experience. Artificial intelligence can assist you in making purchases that are reinforced by your customers' specific preferences.

II. Recommendations to customers

As AI can predict client behavior patterns, it may advise customers on services and products, as well as other relevant & useful information. Using search history and other 3rd-party data from a customer, AI and machine learning algorithms may effectively forecast this information. It may be able to successfully provide consumers with appropriate information and solutions that match their needs.

III. The Cloud

In the cloud, you'll find a successful business with at least one business component under strain. Data management & processing in the cloud is critical for anyone on any device to have fast access to data. Cloud ERP may help e-commerce businesses improve delivery times, make store adjustments easier, and provide business stability and growth.

IV. Chatbots

Recognized for their pleasure with their customers, chatbots swing from limited use in call centers to extensive e-commerce applications. Websites adopting chatbots can provide a broad range of solutions & services instead of asking for questions and providing telephone information.

3. ARTIFICIAL INTELLIGENCE

AI is a branch of computer science focused on the design and reaction of machines that imitate human intelligence. This covers things like learning, planning, and problem-solving. Expert systems - the framework that demonstrates behavior, learns, explains, clarifies, & counsels its users – are the primary goal of artificial intelligence. The second goal is to incorporate human intelligence into robots by providing frameworks for comprehending, reasoning, learning, & reacting in the same way that humans activity. Artificial intelligence is now seen as a critical component in the technology industry [6]. Artificial intelligence has 2 types:

- Weak Artificial intelligence
- Strong Artificial intelligence

3.1 AI in E-commerce:

AI aids the E-commerce business to become more accessible to its customers. E-commerce enterprises can now employ AI to analyze large data sets on usage patterns & customer behavior. Auto-learningartificial intelligence algorithms that learn on their own can give personalized shopping experiences to internet buyers. Highlights of e-commerce powered by AI follow [7]

1) Real-time product targeting

E-Commerce firms'purposeis to give their customers the greatest purchasing online experience, by providing them with easy and easy access to their goods. Machine learning can help to deliver custom product recommendations, reductions, and offers to shoppers online.

2) Visual search

Image recognition technologies can allow websites users to look up images instead of texts for certain images in the field of e-commerce and match suitable products. A visual search example is the Pinterest visual search, where users can select the item online in an image and request that Pinterest display related products utilizing ID algorithms.

3) AI-based hiring processes

In various ways, HR (Human Resource) departments may leverage AI technology. E.g., Restless Bandit, software as a service product, automates the task of assessing applicants, reaching out, planning face-to-face interviewing, and discovering matches. This decreases HR's labor by delivering the possible job applicant.

4) AI fake reviews detection

For consumers' trust in online shopping, customer reviews have become vital. 90% of respondents reported that favorable internet reviews affected their buying decisions, according to a recent study by Dimensional research. But the buying choice could be affected by fake reviews. This problem can be managed using AI. Amazon also employs AI to combat fake product reviews. The artificial intelligence machine learning technology of amazon solely boosts verified buying reviews for customers. It also provides preferences for reviews that other users consider helpful.

5) AI-based sales process

The integration of artificial intelligence with customer interactions offers an effective solution for sales management. This Artificial intelligencepermits a CRM system to respond to customer demands, solve issues & even discover new options for sales personnel. Products and services that are no longer suitable for internet shopping are now no longer offered.

3.2 Application fields of AI and its technology

AI has been observed in a number of domains. Gaming, healthcare, banking, music & movie recommendation services, handwriting recognition, and intelligent robots are just a few applications of artificial intelligence [8].

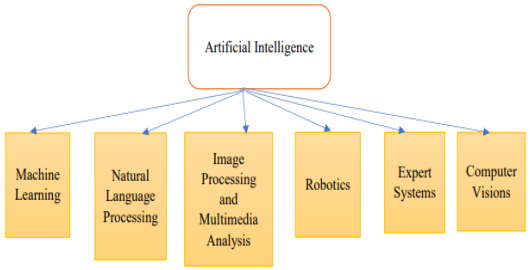

Fig. 2. Main fields of artificial intelligence

The technology of Artificial Intelligence is.

- **Expert systems**

Expert systems are computer programs using artificial intelligence to mimic a person or group of people that have experience and involvement in a specific subject a person or an organization.

- **Computer vision**

It is a software engineering field that takes shot on computers to look at, differentiate & process images in a similar way to that of human vision. It seems like providing a computer with human understanding and drives. It is, nevertheless, a troubling task to enable computers to perceive images of different products

- **NLP (Natural language processing)**

NLP is part of artificial intelligence which allows the machine to understand & translate human interactions and to govern them. NLP pulls its efforts to fill the hole b/w human correspondence and compute comprehension from several controls, involving software engineering and computer phonetics

- **Robotics**

The field of the use of equipment and program segments involving the participation of both equipment and programming as well as the framework that allows the customer to fulfill their responsibilities. These days, robotics are used for assembly companies that accomplish the work quickly, with great precision and productive efficiencies.

- **Machine Learning (ML)**

Machine learning has used algorithmic tools that enable the application of software to forecast results more accurately without being explicitly coded. The aim of machine learning is to design algorithms to accept input data and apply analytical techniques for predicting output data.

- **Image processing & multimedia analysis**

These include a rise in the quantity of information, an improvement in content data user experience as well as multimedia information like recordings, photos, sound, videos, etc., and more image processing & analytic data. To understand this mixed media knowledge, users must use photos to prepare and examine interactive media. The image processing computations process the information therein & attempt to interpret thedata& information it transmits.

4. FUZZY LOGIC

Fuzzy logic is commonly used in machine control. The term 'fuzzy logic' refers to a logic that may deal with ideas that are neither 'true' nor 'false,' but are "partly true" and cannot be expressed. While competing approaches such as neural networks and genetic algorithms are as effective as FL in many cases, FL has the advantage of addressing a problem in such a way that human operators can understand it and use their knowledge to controller design. This makes it easier to automate tasks that people are currently doing [9]. Fuzzy denotes uncertain information and the mathematical logic that is used to interpret that fuzzy logic (FL). The term "fuzzy logic" refers to "computation with fuzzy sets.

4.1 Use of Fuzzy Logic to analyze preference of Online Shopping

- Fuzzy Logic describes systems in numerical & linguistic ways (symbolic). This has benefits over mathematical (numerical) or purely symbolic techniques, as system knowledge in such a mix is very commonly available.
- The fuzzy logic assesses the certainty or uncertainty of the element's membership in the collection. The solution of some issues is based on the idea of rules defined in similar cases by fuzzy logic.
- The fugitive algorithms are frequently solid, in that they are not susceptible to shifting settings and to erroneous or forgotten rules.
- The reasoning process, as contrasted to computer-precise systems, is typically simple, saving computer power. This is particularly interesting in real-time systems.
- Fuzzy techniques are frequently shorter than conventional approaches.

5. LITERATURE SURVEY

5.1 Overview

This section introduces the review related to the various study, which shows any kind of impact on the user's shopping preferences. The detailed study of the selected literature and articles has given a positive direction for the progression of the work.The decision to use fuzzy logic is based on the underlying reasoning process that underpins online transactions. We describe state of art methods regarding online shopping dependent on fuzzy logic in this section of the literature survey.

5.2 Related work

J. Lu, (2020)used literature analysis as well as practice, and drawing on the views of Osterwalder Alexander, the authors propose nine AI innovation paths for promoting business innovation, namely: customer-based segment innovation, key partnerships, customer relations and value positions, channels, key activities, key resources, income streams in businesses, and cost structures[10]

H. Lv, (2020) gave information on the completion of the customer order or the negotiation of the sales contract among customers (buyers) & software agents. Agents inform their creators of their progress by e-mails and accounts during agent-based business processes & may be configured anytime & anyplace. Their e-commerce solution automates the placement & sales process of many people, hence reducing the workload of everyone. They act as an agent for the entire life cycle, including before and after negotiations, therefore allowing both sellers and buyers to respond dynamically to the changing scenario of the product and can negotiate the terms and conditions for a letter from both sides[11].

Kachamas et al (2019) provided an analytical approach that may help Online sellers to predict Dentsu's behavior. The outcomes of 75 specialists that assessed the behavior that is likely after the remarks were published have produced an artificial intelligence model. The outcomes were therefore collected and processed for data modeling methodsby the use of the Naif Bayes probability concept and then by 10-fold cross-validation method for verifying the model's accuracy. Naïve Bayes' approach, as the previous study demonstrated, delivers the best results for the conducted analysis, as this study also does. This trial can provide an average of 86 percent accuracy with a prediction model for AISAS. With the AISAS model test with 30 online users, we can infer that the model's overall results are highly recognized and successfully satisfied. Most vendors also agreed on easy usage, which offers great prospects for the business[12].

Duncan et al (2019) generated a large amount of data, referred to as big data. Big data processing is a broad field now referred to as data science. There is fierce rivalry in e-commerce to entice customers by providing them with ever more buying options. This necessitates recognizing and offering regular clients on shopping websites, which increases e-Commerce revenue by mining purchasing data. This study offers a technique that uses centrality measures to identify the principal customer from transaction data in a dataset [13].

Albayrak, et al (2018) laid out the key operating principles & fundamental ideas of AI-based chatbots & related concepts, as well as their usage in a variety of industries, such as customer service, healthcare, telecommunications, banking, and e-commerce. In addition, the proposed architecture is accompanied by the findings of the example Chabot for a telecoms service provider [14].

Wangmo et al (2018) studied the development feasibility of the e-commerce platform for the college store. It solely examines how the frantic labor of man with the approaching internet service might be decreased and eased. It underlines the importance of popular electronic commerce technologies in minimizing human effort in shopping malls. The online inquiry is conducted through the college email service for determining its feasibility. A survey questionnaire was completed by 107 persons, the majority of students, and a few college personnel. The data are evaluated and the conclusion indicates an online shopping website for the store. This paper clearly explains how a website for the e-commerce industry can be useful to all students [15].

Kulkami et al (2017) suggested an algorithm that would give the prospective customer the best pricing. E-Negotiation will be dependent on the activity pattern of the buyer and the behavior of the surfer. This study presents a system for negotiation by watching the pattern of the customer's surfing alone, without depending upon his input, unlike the e-negotiation models that are already being presented for B2C, B2B & C2C e-commerce applications with buyer interaction. Surf patterns like visited sites and surfed products will inform the customer of the intention to acquire the product. The system is employed to produce the amount of negotiation discount. The purchase is motivated by the supply of such custom discounted pricing [16].

Dheeraj Kapoor, R. K. Gupta (2016) estimated the cost of software based on artificial neural networks. Using ANFIS improves the accuracy of software costing. The data used comes from the PROMISE software engineering repository's DESHARNAIS dataset. The suggested model performance was evaluated using MAE, Correlation Coefficient, and RMSE. With an RMSE of 780.97, the ANFIS model has outperformed the model regression by 3007.05 [17].

Unnati Dhavare & Umesh Kulkarni (2015) was investigated the natural language processingconcept. NLP is one of the AI applications. Natural language processing is used to examine how well a computer understands human language. Morphological analysis, discourse integration, syntactic analyses, semantic analyses, & pragmatic analysis are among the NLP steps [18].

Wang et al (2013) suggested the construction method of e-commerce ontology. The e-commerce ontology is a set of rules for finding and analyzing web entities that are interested in market intelligence. They consider dynamic relations of entities in addition to static relationships of entities in the construction of the ontology, making it more effective in shaping entities, events, & relations [19].

5.3 Research Gap

Here, the review of the literature concludes that the fuzzified approach to assist users to select the best website for online shopping, has not yet, been explored for its implementation in daily life. In this research study, the concept of fuzzy logic has been introduced to make decisions for the selection of websites, while performing online shopping activities. It is expected, that the proposed study will help both consumers as well as commercial organizations for more accurate decision-making.

Table 1: Comparative Table of Literature Review

Author name	Title	Method	Result/Future scope
Punhani et. al. (2021) [20]	Application of Clustering Algorithm for Effective Customer Segmentation in E-Commerce	K-mean technique	The results prove that customers need personalization, thus now experiences have become a priority, otherwise, you can't compete. In summary, it concentrates on introduce client segmentation, it is fundamental, explains why in the digital market it is required, efficiently filtering customer data & analysis.
Pekaslan et al (2020) [21]	Adaptive Online Nonsingleton Fuzzy Logic Systems,	Uncertainty detection technique	Results show that the suggested adaptive NSFLS frameworks offer significant benefits, especially in contexts where noise levels are highly variable, prevalent in real-world applications.
Karthika et al (2019)[22]	Sentiment Analysis of Social Media Network Using Random Forest Algorithm	Random Forest Machine Learning technique	The proposed project is assessed with the Random Forest Machine Learning technique and simulated with SPYDER. The customer feels tough to check a specific aspect of a product they intend to purchase precisely. The accuracy, f-measurement, and recall of the Support Vector Machine (SVM) & Random Forest algorithm is calculated in our system & then the two algorithms are compared with precision. In the random forest 97% of the vector, the supporting machine is given the best accuracy
S. Ahn *et al*., (2019) [23]	A Fuzzy Logic Based Machine Learning Tool for Supporting Big Data Business Analytics in Complex Artificial Intelligence Environments	Business analytics use techniques from data science, data mining, artificial intelligence (especially, machine learning)	Our findings demonstrate the relevance of our technology in the business environment, in which business analysis is supported in complicated artificial intelligence environments, for classification and wage levels projection.
Y. Liang et al., (2019) [24]	Online Shop Daily Sale Prediction Using Adaptive Network-Based Fuzzy Inference System,"	Kalman Filter Iterative Process, the technique for online shop daily sale forecasting.	The results were slightly better than the MAPE 4,9891 &ACC(±) 39,85 percent Back Propagation Neural Network. Based on the respective MAPE and ACC(±), 200 product groups were sorted into 6 categories. The results have shown that every daily sale of 22,86% of products is successfully forecasted, whereas 34,29% of products are mispronounced.

Ahmeda, et al (2015) [25]	Performance Study of Classification Algorithms for Consumer Online Shopping Attitudes and Behavior Using Data Mining,"	Data mining classification techniques	The results reveal that the classification of decision table & filtered classification delivers the maximum accuracy and that the lowest precision may be attained through clustering and basic cart classification.

6. CONCLUSION

Online shopping is a procedure in which customers buy goods or services directly from a seller simultaneously, without any mediatory services on the internet. Online shopping is a type of electronic commerce. This study tries to show how E-satisfaction, E-loyalty & E-trust are based on organizational, technological, and customer aspects. It was revealed that the majority of research considered in this literature analysis has focused in particular on elements that increase e-commerce acceptance from one perspective (at the adoption phase). This study studies and determines the effect of consumer pleasure and trust on e-commerce loyalty.

This paperdiscusses E-commerce, the use of E-commerce, the technology of online shopping, AI in e-commerce, and fuzzy logic approach based on online shoppingand comparative research of literature review in depth. The background of fuzzy logic is based on online shopping and presents the related works.The following advantages are presented in the fuzzy data algorithm: (1)Software may readily implement it, (2) Business logic may be included in the fugitive rules, (3)Automate the e-commerce application decision-making procedure. Some of the publicly available datasets for researchers are also covered.The aim of this study is to introduce the latest progress in online shopping. The research has examined specifics in the many facets of online shopping, then discusses the state-of-the-artmethods regarding online shopping.

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Corresponding Author

Ravi Shankar Sharma*

Department of Computer Science and Informatics, MAU, Jaipur, India

ravibhatra9@gmail.com