

A Review on the Role of Machine Learning in Enhancing User Experience in E-commerce Applications

Tanvi Chadaga¹, Mahantesh Shivagunde², Jyothi Shetty³, Sharvani G S⁴

¹Dept. Of Computer Science and Engineering, RV College of Engineering, Bengaluru, Karnataka, India,

²Dept. Of Computer Science and Engineering, RV College of Engineering, Bengaluru, Karnataka, India,

³Assistant Professor, Dept. Of Computer Science and Engineering, RV College of Engineering, Bengaluru, Karnataka, India

⁴Associate Professor, Dept. Of Computer Science and Engineering, RV College of Engineering, Bengaluru, Karnataka, India

Abstract - Machine Learning is now becoming one of the leading topics in the technology world. So it comes to no one's surprise that leading e-commerce companies would look into machine learning to incorporate into their commerce application. User Experience is an important aspect for smooth business operation since customer satisfaction is the key to greater productivity. To automate several operations within the e-commerce application has proven advantageous and profitable for most business operators. This paper explores and reviews the various applications of machine learning in e-commerce as a tool to enhance the user experience.

Key Words: Machine Learning, User Experience, E-commerce

1. INTRODUCTION

E-commerce stands for Electronic Commerce. It implies buying and selling goods and services through Electronic media and the Internet. A more complete definition of E-commerce is given in [1] : E-commerce is the use of electronic communications and digital information processing technology in business transactions to create, transform, and redefine relationships for value creation between or among organizations, and between organizations and individuals.

E-commerce has transformed the way in which organizations interact with their consumers and partners. With rapid development in Information and Communication Technology (ICT), there has been an unprecedented growth in the E-commerce industry all over the world. According to studies, global E-commerce sales are expected to reach \$4.2 trillion in 2020 and \$6.5 trillion by 2023. With increased number of transactions happening on E-commerce platforms, organizations have a large corpus of data about these transactions. This data is being leveraged to improve the customer satisfaction and User Experience. Artificial Intelligence (AI), Big Data Analytics (BDA), Data Mining and Machine Learning (ML) are the tools being used to extract knowledge from the data which can be used to improve the

User Experience by means of recommendations, dynamic pricing, optimized search results etc.

1.1 Machine Learning

Propelled by an increase in computational power, memory, storage and the generation of huge amounts of data, computers are being employed to perform a wide-range of complex-tasks with commendable accuracy. Machine Learning comprises elements of mathematics, statistics and computer science. It is being leveraged in both industry and academia to develop intelligent products with the ability to make accurate predictions using diverse sources of data[2]. The key beneficiaries of the Machine Learning and Artificial Intelligence technologies have been the industries which are able to collect large amounts of data from their business. The large corpus of data being collected in E-commerce industries offer tremendous potential to enhance business opportunities and to improve customer experience.

Machine learning techniques employ algorithms - a set of mathematical procedures which describe the relationships between variables. The primary concern in any Machine Learning application is an accurate prediction. Given a set of input features representing the input data, Machine Learning algorithms try to predict some kind of unknown characteristic about the input features or find some pattern from the input data.

The majority of Machine Learning algorithms can be categorized into two types of learning techniques: Supervised learning and Unsupervised learning. Supervised learning refers to a set of Machine Learning algorithms in which a model is trained on a range of input features which are associated with a known outcome. In E-commerce this might represent training a model to relate a customer's characteristics (e.g., age, location, purchase history) to certain outcome (product recommendation). There are two main types of supervised learning algorithms: Classification and Regression. Regression is a type of supervised learning which predicts an output value based on the input features

and is used when the output is real and continuous values. Classification is a type of supervised learning that specifies the class to which data elements belong to and is used when the output has finite and discrete values. In contrast to supervised learning, unsupervised learning algorithms do not involve predefined outcomes. In unsupervised learning, patterns are sought by algorithms without any input from the user. Thus, unsupervised algorithms are exploratory and used to find undefined patterns or clusters which occur within the dataset.

1.2 E-commerce websites and its UX

Currently, businesses use eCommerce applications on both desktop computers and smartphones as digital marketing instruments, and these solutions have brought much awareness from both users and academicians regarding technological novelty[2]. User Experience, often confused with UI which is 'User interface, deals with the overall feel of a particular application from a user standpoint, while the latter encompasses the interface of the application the user is exposed to. UI along with usability is an important subset of UX. Products that provide great user experience are thus designed with not only the product's consumption or use in mind but also the entire process of acquiring, owning and even troubleshooting it. Similarly, UX designers not only focus on creating products that are usable, but also go far beyond what the user wants and needs, in order to provide a high quality experience. This ultimately determines whether the product sells well or if the user is willing to come back for more.

2. MACHINE LEARNING IN ECOMMERCE APPLICATION

Machine learning helps e-commerce companies in the process of creating a better UX. Both Machine Learning and Ecommerce focus on the same goal, to interpret human behaviour. These smart systems can process information on the customers and users, then apply changes to optimize the model for future use. By continuously learning and applying these changes, the model can improve user experience by offering a more engaging experience.

Some Applications include:

1. Product Recommendations
2. Efficient Search Results
3. Dynamic Pricing
4. Customer Support and chatbots
5. Fraud Prevention
6. Error Corrections

2.1 Product Recommendations

Product Recommendation systems try to predict the products in which a consumer might be interested, by using the data about the products and the consumer's profiles [3]. There are two main methods for recommendation systems: collaborative filtering methods and content-based methods. In collaborative filtering methods, recommendations made to a given customer is based on what the similar customers have selected in the past. In simple terms, if customer A has bought products x and y, and customer B has bought only product y, then x can be recommended to customer B. Techniques like Apriori algorithm for Association Rule Mining [4] are used in this method. In content-based methods, recommendation systems try to match the content of the customer profiles (eg. gender, age, location) to the properties of the products (eg. category, price, brand). Algorithms like Term Frequency and Inverse Document Frequency (TF-IDF) [6] are used in this approach. There are also hybrid approaches which try to combine the results from both collaborative and content-based methods.

2.2. Efficient Search Results

Modern E-commerce applications are huge, comprising millions of different products and services. Because of this huge size and scale of the data to be searched, the task of indexing the products and services relevantly becomes challenging. Users want to quickly find what they need. From the user's perspective, they need the assurance that the search results provided are relevant and exhaustive. The search results are based on ranking algorithms which decide the result relevance and the order in which they will be displayed. Machine Learning based on neural networks and deep learning [9] is helping to improve the ranking algorithms based on short term and long term user preferences. Such personalized search engines are able to increase the user's conversion better than traditional non-personalized search engines.

2.3. Dynamic Pricing

Dynamic pricing also known as price optimization refers to offering goods and services at different prices which vary according to consumer demands. The pricing is decided based on various factors like competitor's pricing, supply, demand, conversion rates, sales goals etc. Machine learning algorithms help to automate the pricing decisions efficiently to maximize profits. All the different factors affecting the pricing decision act as input to the ML algorithm which can use intelligent calculations and predictions to change the pricing strategy to best adapt to the dynamic environment. A very common example for the use of machine learning in dynamic pricing in E-commerce is in the Airline industries. Wherein the pricing of the tickets is highly dynamic and strongly varies according to consumer

demands. Another common use case is the online taxi services, which make use of machine learning for dynamically pricing their rides. Algorithms like Deep reinforcement learning [8] are very popular for this application.

2.4. Customer Support and Chatbots

ML and AI based chatbots are increasingly becoming a common trend in many ecommerce giants. The chatbot mainly understands the user's search buying patterns and provides the necessary support to the customers. It can answer upto 80% of the customer's queries, and quickly transfers it to a live chat agent in case it fails to address the issue. Hence the requirement for staff required on duty to fulfill a customer's needs is reduced drastically. This automated support is available 24x7 and is able to keep up with the growing needs of the customer. Moreover, the bot also takes the input of the customer and presents the required information within seconds so the customers do not have to wait for technical support to be provided. They also provide a near perfect personalized tour to a customer on any query regarding the wide variety of products that are available on the ecommerce website. A compelling pitch on a product drives the marketing campaign. This is incorporated into the algorithm of the chatbot enhances the sale of the product. Chatbots are also incorporated to collect feedback, which is later used to drive product analytics and customer satisfaction.

2.5. Fraud Prevention

Consumers require immediacy in the fulfilment of demands when it comes to an ecommerce website. This creates a surplus of frauds taking place. One such fraud is Return to Origin, where the fraudster abuses e-commerce's refund policies by returning a different product instead of the original product bought. Payment frauds and Account Takeover are frauds where transactions are carried out using stolen credentials. To counter the fraudsters, Artificial Intelligent algorithms have an upperhand. These algorithms can analyse, learn and adapt a model that can determine and learn the actions of fraudsters. The model continuously adjusts itself to improve the performance on detecting these frauds and quickly preventing them. Pattern recognition, such as fingerprint detection is used mainly to verify the identification of the users and their accounts. Behaviour analysis is performed on these accounts using positive profiling of the consumer, to ensure that the consumer using the account is the rightful owner. Hence based on behavioural data, it is able to detect when the consumer is behaving 'differently', by mapping these to the saved data points of the consumer. Such are a few algorithms that are used[7]. Ultimately this model is deployed with a good performance for real time analysis.

2.6. Error Corrections

E-commerce is a vast software system, therefore for consumers that do not have the technical knowledge of the system, a large number of errors take place on a daily basis. This results in a delay in processing which can attribute to the delay in order placement of the product. An error correction system is deployed to help users make fewer errors, resulting in a better user experience as well as faster response to the customer's needs. By creating an engine that provides such fixes, processing time of these errors is reduced, leading to higher efficiency in the transaction processing time.

A machine learning model is trained and tested using the product's details. This model is then used to suggest a fix to any consumer who is making an error while selecting a product. Such models can be deployed for any of the fields in the product that usually result in a large amount of errors. Models such as Random Forest Classifier and Neural Networks prove to have a high accuracy in dealing with the big data present in these applications. Such models hosted on the ecommerce website provide fixes to the errors in real time.

3. CONCLUSIONS

With the advancement of digitization in marketing, the web applications are using more smarter techniques to improve customer experience. Machine Learning techniques have already proven to be an indispensable part in filling the gaps in this experience. It has been applied in various fields like product recommendation and fraud detection, thereby reducing the need for human intervention by substituting it with machine efficiency. But it has not yet completely been mastered for automation, since it stumbles when it comes to more complex queries, answering a variety of questions and detecting human emotion. In the future, these limitations might be attended to, bringing forth a better ecommerce experience.

REFERENCES

- [1] Chanana Nisha and Goele Sangeeta, "Future of e-commerce in India", International Journal of Computing & Business Research, ISSN (Online): 2229-6166M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.
- [2] Micu, Adrian & Geru, Marius & Capatina, Alex & Constantin, Avram & Rusu, Robert & Andrei Alexandru, Panait. (2019). Leveraging e-Commerce Performance through Machine Learning Algorithms. Annals of Dunarea de Jos University of Galati. Fascicle I. Economics and Applied Informatics. 25. 162-171. 10.35219/eai1584040947.

- [3] Jordan MI, Mitchell TM. Machine learning: Trends, perspectives, and prospects. *Sci (NY)*. 2015; 349(6245):255–60.
- [4] Sohail, Shahab & Siddiqui, Jamshed & Ali, Rashid. (2012). Product Recommendation Techniques for Ecommerce - past, present and future. *ijarcet*. 1. 219-225.
- [5] L. Wang, "Association rule mining algorithm study and improvement," 2010 2nd International Conference on Software Technology and Engineering, San Juan, PR, 2010, pp. V2-362-V2-364, doi: 10.1109/ICSTE.2010.5608787.
- [6] Li-Ping Ling, Hou-Kuan Huang and Hong-Bo Shi. "Improved feature selection approach TFIDF in text mining." Proceedings. International Conference on Machine Learning and Cybernetics, Beijing, China, 2002. pp. 944-946 vol.2, doi: 10.1109/ICMLC.2002.1174522.
- [7] Caldeira, Evandro & Brandao, Gabriel & Pereira, Adriano. (2014). Fraud Analysis and Prevention in e-Commerce Transactions. Proceedings - 9th Latin American Web Congress, LA-WEB 2014. 42-49. 10.1109/LAWeb.2014.23.
- [8] Jiayi Liu, Yidong Zhang, Xiaoqing Wang, Yuming Deng, Xingyu Wu, Dynamic Pricing on E-commerce Platform with Deep Reinforcement Learning, arXiv:1912.02572
- [9] Serrano, Will. (2018). Neural Networks in Big Data and Web Search. *Data*. 4. 7. 10.3390/data4010007.
- [10] Yang, Qian. (2018). Machine Learning as a UX Design Material: How Can We Imagine Beyond Automation, Recommenders, and Reminders?.