Analyzing the Use of Artificial Intelligence and Machine Learning in Customer Support Systems

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Abstract: *In order to identify areas that need further research, this study will analyze how machine learning (ML) and artificial intelligence (AI) technologies are applied in various customer services. This is done by using a systematic review of literature procedure to examine publications on the application of AI and ML in customer service that have been posted on various academic websites. Numerous AI and ML approaches may be applied by businesses to improve customer support and assistance. The use of self-service technologies, integrated product-service offers, service excellence, and word-of-mouth marketing are some of these techniques. The study's conclusion addresses the customer service knowledge gaps that it identified when reviewing the literature. The information provided by the current study on how Artificial Intelligence (AI) and Machine Learning (ML) technologies may be applied or properly used to improve customer service or may be fruitful to businesses. The findings of the study will provide theoretical and practical implication of AI and ML in customer support system to develop more effective and efficient strategies to the users and policy makers. Ultimately the findings of the study will help increase the degree of satisfaction of customer. Longitudinal studies should assess AI and ML's long-term impact on customer support systems, balancing human-AI collaboration, developing transparent models, considering cross-cultural factors, and adopting a human-centric design approach.*

Keywords: *Machine learning, Artificial intelligence, Customer support system.*

Introduction

A subfield of computer science called artificial intelligence (AI) seeks to build intelligent robots that are capable of doing activities that would typically need human intellect, such as recognition of speech, visual perception, decision-making, and language translation. The creation of algorithms and machine learning models, which allow computers to learn from data and make proper predictions or judgments based on that provided data, is how artificial intelligence (AI) is created. Norvig and Russell (2010). Machine learning (ML), a subtype of artificial intelligence, enables computers to automatically learn from experience and develop without explicit programming. It focuses on developing statistical models and algorithms that enable machines to do tasks without requiring human input. Emin Alpaydin. Martn et al. (2022) claim that in the modern digital age, information is continually acquired and processed from a variety of sources, for a variety of applications, and across a number of organizations.

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Artificial intelligence (AI) and machine learning (ML) are crucial for transforming unstructured data into predictions and suggestions that can be used to enhance daily routines and company operations. Analytics, AI, and ML may be applied or used by businesses to increase their customer services.

Computers can now infer conclusions from data patterns thanks to machine learning (ML), which enables them to process massive volumes of data (Hossain & Rahman, 2022). In turn, ML uses self-defining algorithms to provide computers the ability to adjust to human needs and learn on their own. These innovations have changed modern life and sped up commercial decision-making. Haleem et al. (2022) claim that the goal of artificial intelligence (AI) is to create intelligent computers that think and behave like people. Since they enable computers to address complex problems and imitate human talents without explicit programming, AI and ML are viewed as the "next step" in the industrial revolution (Hossain et al., 2022). Employees now have more time to focus on critical tasks, which may increase services, client loyalty, and brand reputation. A few examples of how AI and ML applications are developing and changing life include self-driving vehicles, machine translation, smartphones, and virtual assistants (Syed et al., 2020). AI are frequently employed throughout sectors due to their versatility and capacity for solving complex challenges.

AI can take on many various shapes, including helping human support staff with straightforward tasks so they can concentrate on more challenging ones (Hossain & Rahman, 2022). AI-powered chatbots that can recognize speech triggers swiftly give relevant information. Data collection and analysis are further uses of AI in customer service (Hossain et al., 2022). Intelligent AI aids firms in directing customers in the right way by utilizing interactive website design and intelligent email marketing. ML, a subfield of AI, allows computers to learn from collected data (Haleem et al., 2022). AI creates content that is tailored to the audience using data from websites, reviews, and social media. By exploiting recent data, AI helps businesses to target potential customers with attractive advertising at the appropriate moments.

2. Review of Relevant Literature

2.1 AI and Machine language for Customer Support

Big data management, improving customer service, and creating chatbots all require machine learning. In order to enable clients to autonomously handle issues, predictive analytics predicts typical problems and machine learning (ML) gathers chat details overlooked by agents. Brands can enhance customer service and create emotional bonds by integrating data, AI, and ML at every touchpoint. Dey and Lee (2021) assert that ML has significantly contributed to this transformation by refocusing attention from intensive coding to the development and upkeep of learning models. But there are still issues to be resolved about the security, transparency, and fidelity of AI systems. Using labeled data to forecast machine output, supervised learning has applications in a variety of fields, including risk assessment,

image categorization, fraud detection, and more. Based on prior knowledge, it provides precise item class identification.

ML models are trained using unlabeled datasets through unsupervised learning so they can run autonomously. Since it does not have labeled input data, it is employed for more complicated issues. Since unlabeled data is more accessible than labeled data, unsupervised learning is preferable.

As per Wang and Biljecki (2022), unsupervised learning has a history of conquering the challenges of urban situations. While reinforcement learning enables agents to learn from both positive and negative information, unsupervised learning identifies patterns without identifying them. One of the most useful ML features is reinforcement learning, which is used as the main learning technique in AI when agents freely explore their surroundings.

RL should be avoided when there is adequate data or when more effective ML algorithms are available. Learning new knowledge might be challenging in RL due to the delayed input, which is a significant issue. Delgado and Oyedele (2022) draw attention to the fact that RL, as an ML paradigm, has the potential to expand robotics' applicability outside of more traditional sectors like advanced manufacturing and the car industry. Since RL enables autonomous robot behavior learning as opposed to manually coding complex movements, it is particularly nicely-suited for robotic work planning, development and control. Studies have shown that RL adoption in robotics may be attained by modifying RL methods from other domains.

ML and predictive analytics aid in identifying common customer questions and responses while also detecting chat details missed by agents. As analytics become more accessible, AI and ML will become industry standards, allowing for better problem-solving and customized customer experiences.

2.2 Current Challenges in Customer Support

2.2.1 Integrated product service offering (IPSO)

A product service system (PSS), also known as an integrated product service offering (IPSO), is made up of physical goods, services, and strategies and delivers value to clients throughout their life cycles (Nilsson & Lindahl, 2016). This method enables providers to efficiently and affordably satisfy consumer demands while maximizing resource use (Lindahl et al., 2014). In addition to actual items, services are essential for increasing profitability. Manufacturers are concentrating on "servitizing" their products as a result of the growing importance of services in the global economy. Product service systems (PSS), which mix products and services to provide clients with value, become crucial in this environment (Tenucci & Supino, 2020). The challenges of implementing IPSO include enhancing customer satisfaction, increasing ROI, comprehending customer needs and expectations, providing informed

product and service recommendations, addressing customer complaints, and promoting customer loyalty.

2.2.2 Word-of-mouth (WoM)

Consumer behavior is significantly influenced by positive word-of-mouth (WOM) (Iyer & Griffin, 2021). Negative WOM is challenging for organizations to manage, but it may harm a company's brand when irate consumers vent to prospective clients. Customers may voice their ideas and distribute WOM in the modern digital era on a variety of venues, including social media (Hossain & Rahman, 2022). Enterprises now find it difficult to understand client sentiment and the speed at which good or negative sentiments propagate in the age of big data. It is more complex for businesses to monitor and manage internet evaluations because of their capacity to quickly spread negative opinions and supportive responses from potential customers.

2.2.3 Service excellence (SE)

According to Wirtz (2019; Zhan et al., 2020), service excellence is the ability of service providers to continuously meet or surpass client expectations. It requires sustaining strict standards for the caliber of services while ensuring consumer satisfaction. Delivering on promises, personalizing, going above and above, and expertly addressing issues and questions are the four crucial elements of exceptional customer service, according to Johnston (2004). According to Padma and Wagenseil (2018), the retail brand image has a big impact on how customers perceive value, satisfaction, and loyalty. A few of the hurdles that must be addressed to attain service excellence include managing complicated client experiences, dealing with unhappy customers, building live chat systems, lowering customer turnover, integrating data sources, and optimizing logistics.

2.2.4 Self-service technology (SST)

Self-service technologies (SSTs) including ATMs, internet banking, and ticketing machines enable the practice of clients serving themselves during transactions, which is known as self-service (Vakulenko et al., 2019). SSTs are now an important topic of study and give service providers a competitive edge. They are become an essential component of consumers' daily life. SSTs benefit customers and service providers alike. SSTs can be utilized effectively, but there are challenges to be solved before they can automate complaint detection, enhance relationships, meet expectations, regulate industrial processes, solve problems, and provide expert advice.

2.3 Customer Support AI and ML Applications

For firms, managing customer service issues effectively is essential. Client satisfaction and service alignment with client needs are paramount. AI in particular has transformed management approaches, allowing for effective decision-making and tackling complicated problems (Wang, 2022). AI opens up possibilities for data analytics and labor analytics, boosting operational efficiency and competitiveness. Organizations are utilizing AI in customer assistance, which is still in its early stages, to raise the caliber of their services. Diverse commercial AI and ML applications offer businesses insightful information and prospects for use.

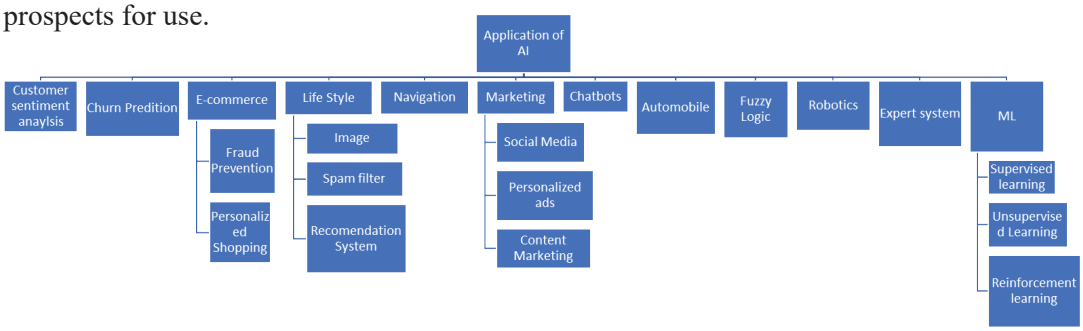

Figure 1 : Applications of AI and ML (Wang, 2022)

2.3.1 Customer sentiment analysis

To learn how consumers feel about things, ML can examine online reviews (Park et al., 2021). Customer sentiment analysis aids in understanding appreciated and criticized elements by identifying positive and negative attitudes stated in reviews. Social media user-generated material has a big impact on how consumers judge products and make decisions. Different emotions, including joy, surprise, sadness, and rage are categorized by AI and ML-based sentiment analysis models (Balli et al., 2022). Generally speaking, there are four categories:

(i) Intent analysis: Businesses must take into account consumer intent as a crucial factor in order to focus efforts, save money and time, Intent analysis assists in reaching this goal by identifying user intent, such as whether the user is interested in making a purchase or is only browsing the website without making a decision. The intended clients of a product may be located and helped by using ads that are well targeted. It will be less expensive, labor- and resource-intensive to ignore consumers who have no intention of buying the products.

(ii) Aspect-based: Aspect-based sentiment analysis, according to Gu et al. (2022), aims to ascertain the polarity of the sentiment connected to a specific aspect. Aspect-based sentiment analysis also looks at specific characteristics that customers discuss in regard to a product, service, or idea. Suppose a customer reviews a laptop and

remarks, "The webcam seems to switch on and off sporadically." Aspect-based analysis in this case enables the laptop manufacturer to understand the customer's "negative" feedback regarding the laptop's "webcam" component.

(iii) Emotion detection: Classifiers and lexicons are used in ML-based emotion identification algorithms to recognize a variety of emotions, including joy, sadness, fear, and concern (Pashchenko et al., 2022). Since ML can capture the subtle manifestations of emotions and prevent probable inaccuracies in sentiment analysis, it is recommended over lexicons. For instance, a review like "This phone is really nuts" may elicit several feelings that could be misunderstood based only on lexicons. This danger is reduced by ML-based detection because it produces more precise results.

(iv) Fine-grained: Fine-grained sentiment analysis includes sentiment element extraction, AOP identification, and the sentiment orientation analysis (Bian et al., 2022). It allows for a more accurate determination of polarity; it can be extremely positive, extremely negative, positive, negative, or neutral. In this analysis, client evaluations and ratings are examined. These might be positive (5–10) or negative (1-4) on a scale of 1–10, respectively.

2.3.2 Marketing with Artificial Intelligence:

To enable tailored messaging without relying on marketing staff, AI in marketing automates decision-making based on data analysis and audience patterns (Haleem et al., 2022). By adjusting strategies to specific demands and equipping marketers to comprehend and address client wants using data-driven algorithms, it revolutionizes the interaction between customers and businesses.

Marketing operations entail commercial sales efforts and are a response to market demands. The ability of ML to collect and analyze data makes it useful for improving marketing strategy. According to Nan et al. (2022) ML aids companies in understanding consumer preferences, enhancing goods and services, and luring and keeping customers.

Examples of Artificial Intelligence in Marketing:

(i) Data Analysis: massive marketing data that would otherwise need to be managed, collated, and processed manually from a range of campaigns and projects.

(ii) Natural Language Processing (NLP): Human-like language is being created for a variety of applications, such as content development and creation, customer support bots, experience customization, and others.

(iii) Making Decisions Automatically: Based on previous data or external data inputs, AI marketing solutions assist firms in selecting the most effective marketing or company growth strategy.

(iv) Content Creation: According to Sharma et al. (2021), AI is always learning from the data it analyses, unlike traditional data analytics tools. This makes it possible for companies to provide highly relevant material that improves the customer experience.

(v) Media Buying: In order to reach its target market and increase the return on investment from its marketing plan, a corporation must select the best media and advertising placements.

(vi) Personalization in real-time: modifying a user's encounter with a marketing resource, such a website, social media post, or email, to correspond with the user's prior preferences in an effort to encourage a certain action, like signing up for something, clicking a link, seeing, or making a purchase.

2.3.3 Artificial intelligence in auto mobile industry

AI is used in almost every step of the manufacturing of autos. Industrial robots that build automobiles and autonomous vehicles that employ ML and vision are two instances of AI in the automotive sector. The auto sector is utilizing AI to give customers virtual assistants for greater performance. For example, Tesla just launched the capable virtual assistant Tesla Bot. Self-driving car technology is now being developed by several companies to enhance the safety, security and protect of your ride.

Automotive navigation systems are being improved through driver assistance and the inclusion of technologies such as IoT and autonomous driving. Tech behemoths like Apple and Google are making investments in future vehicle technologies, which will change the transportation sector. Important firms like Neusoft and Huawei are fostering the expansion of IoT and the Internet of Vehicles as the automotive and IT sectors merge. Customizing automobile models, enhancing resource efficiency, and optimizing manufacturing with robotics that are powered by AI are just a few examples of how AI and ML are altering the industry. This technology, according to Kun et al. (2013), provides increased value and unique driving experiences.

2.3.4 Artificial intelligence in commerce

E-commerce is the term used to describe the electronic exchange of products, services, and money through the internet. AI and ML are essential to e-commerce marketing because they provide customized offerings and user insights. AI is utilized for fraud detection, personalization, customer review analysis, and chatbot services. It improves supply chain management, operational efficiency, and customer experience (Pallathadka et al., 2021). Deep learning and machine learning support customer outreach and product quality management. Better predictions and insights from data are made possible by these technologies across many industries.

(i) Personalized Shopping: E-commerce users have different needs for personalized information and services, and businesses can suggest products based on consumer preferences and purchasing behavior. In order to deliver individualized product recommendations based on user behavior, AI and ML are utilized to personalize the purchasing experience. This aids internet retailers in luring and keeping hold of devoted customers (Liu, 2022).

(ii) Fraud Recantation: Common types of e-commerce fraud include credit card testing, phishing, and friendly fraud. Attacks on online merchants can account for up to 40% of incidents. Phishing efforts come in second. AI-based fraud detection systems are necessary for efficient fraud detection and prevention due to the complexity and diversity of fraud situations that are on the rise.

AI technologies have significantly improved the e-commerce industry and have great promise going forward. Face-to-face interactions and lie detectors are examples of traditional fraud detection techniques that have drawbacks. However, new AI-based fraud detection algorithms, like the one created by international scientists, make it possible to quickly identify online scammers. The e-commerce experience is constantly being improved by AI, which offers tailored shopping through virtual buying assistants.

2.3.5 Artificial intelligence in robotics

Robotics uses computer science, electrical engineering, and mechanical engineering to build intelligent machines. Although robotics and AI have distinct objectives, robotics is frequently seen as a subclass of AI. Robots are currently utilized in a variety of industries, including hospitality and tourism, for duties like check-ins, cleaning, and deliveries, thanks to developments in mechanical engineering and AI technology. Robots are now able to discern between things, behaviors, and maintain social distance thanks to AI and ML.

According to Luo et al. (2021), ICT has recently become increasingly significant in determining customer experiences and supplying items that are tied to services. As more hospitality service providers combine human and robotic capabilities, practitioners and academics have become more interested in how robots and AI could improve service delivery or client experiences. Because they can learn by themselves and recognize new objects, AI-powered robots are more valuable than traditional robots. They are used by many industries, including warehousing, to conduct operations more accurately and successfully. Numerous training data types are used to build these robots.

2.3.6 Artificial intelligence in chatbots

Software called a Chabot replicates text-based chat exchanges between people that seem to be human. Conversational technologies are transforming how people and machines communicate, claim Bilquise et al. in 2022. In place of human agents, chatbots are being used more often to do jobs, respond to queries, give instructions, and offer social and emotional support. As per Janssen et al. (2022), significant advancements in machine learning (ML) and natural language processing (NLP) have recently enhanced the appeal of chatbots. Due to the hype, a number of businesses from many industries have adopted chatbots, either to demonstrate their technological expertise or to simply provide customers another way to reach them.

Despite the fact that chatbots are becoming more and more popular across businesses, research shows that people still value human engagement. For chatbot integration to be successful, natural communication and user happiness are essential. Chatbots now have more advanced conversational capabilities because to AI and NLP technologies. Despite chatbots' advancements, clients still favor human engagement due to their conversational limitations. However, chatbots provide cost-saving advantages, and it's crucial to close the technological and customer expectations gaps.

2.3.7 Artificial intelligence in navigation

AI navigation systems can effectively predict traffic changes thanks to dynamic routing, ensuring both safe and effective travel for human drivers and autonomous vehicles. By analyzing conditions and suggesting the best courses of action, AI can increase productivity while avoiding traffic and dangers. High-definition maps can be produced by gathering a lot of visual data and including community participation. Consumer distrust of data privacy and advertisements is still a problem, thus ad-free navigation systems are necessary to win over users.

Since transportation network grows, AI guiding systems are in charge and provide improved responsiveness and precision. But first, producers need to make sure a strong framework is in place. Digital maps that are the most accurate depends on precise information from numerous reliable sources. By using crowdsourced maps and AI modeling, the processing load on systems will be reduced while still maintaining the efficacy and security of AI-assisted navigation.

2.3.8 Artificial intelligence in life style

AI is already pervasive and will keep having a big impact on how we live and work. From voice assistants to smart gadgets, AI encompasses everything. Numerous jobs are already being automated at a dizzying rate in our homes and places of employment by AI technology.

Image identification in computer vision, a branch of artificial intelligence, objects, places, and people are recognized and analyzed in images. It attempts to imitate perception in people. Systems for recognizing medical images have showed promise in enhancing treatment results and enabling sensitive and accurate diagnosis. In order to extract important information from visual input, image recognition is a critical part of computer vision.

Spam Filter: AI is essential for spotting spam and possible virus dangers in emails. AI-driven spam filters can identify and flag offensive content, including viruses, by analyzing incoming messages. AI can detect warning indications and rapidly advise people to avoid opening phishing emails using cognitive learning. Spam filtering research is still ongoing in order to shield internet users from the broad spreading of false information. Tools that classify text using machine learning are among the best ways to stop spam.

Recommendation System: Based on previous user data, a recommendation engine driven by AI generates choices for services, products, and related information. The user's experiences, the behaviors of other users who are similar or close to them, their interests, hobbies, and prior purchases are all collected by the recommendation system. Recommender systems powered by AI are widely used and have a big impact on the current digital environment. AI-powered instant suggestions are becoming more commonplace, supporting customers in making informed decisions and fostering brand loyalty. These technologies enhance efficiency and user experience, making them essential for maintaining market dominance and meeting customer needs.

Recommender systems that employ AI to generate personalized suggestions based on user preferences and past behavior. These systems use ML and computational intelligence techniques to increase accuracy and handle problems like data sparsity and cold start challenges. The techniques and processes employed in recommender systems are examined in this paper, along with the potential impacts of AI on their development and use.

2.3.9 Artificial intelligence in fuzzy logic

Fuzzy logic is used in a variety of contexts, including data processing, decision-making systems, and industrial operations. It has the ability to handle challenging real-world circumstances. Binary logic is not used in the computation; instead, "degrees of truth" are applied. Process modeling, Computer vision, autonomous control, data mining, and data categorization all use fuzzy logic. In order to improve usability and privacy, it provides exact multidimensional data segmentation and categorization. It is utilized in social media engagement and client sentiment research for successful marketing efforts. Automated decision-making benefits from the encoding of cultural, social, and medical knowledge using fuzzy logic and inference systems. It is used in investment software to decode trading signals and excels at addressing situations with ambiguous or inaccurate data.

2.3.10 Artificial intelligence in churn prediction

Churn prediction aids companies in identifying clients who may leave, especially in industries like telecommunications. Because customer attrition has an impact on revenue creation, it's critical to examine behavior and forecast churn. Accurate churn prediction relies heavily on AI classification techniques, yet high-dimensional and unbalanced datasets present difficulties. The adoption of AI and ML technology has enhanced business performance, with telecommunications companies successfully utilizing these technologies to forecast and lower customer attrition. In sectors including telecoms, banking, insurance, and online gambling, ML and deep analysis help with customer retention, cost cutting, and revenue protection.

2.3.11 Neural networks

Neural networks mimic the human brain and seek out hidden relationships in data. Interest in AI components is growing, necessitating adaptability to environmental features and constraints. The specialization of network subtasks is investigated for pruning techniques. Customer service is rapidly utilizing AI and neural networks, particularly in light of the COVID-19 epidemic. Various uses such as Image recognition, Natural language processing, Fraud detection etc. of neural networks are possible, depending on the needs of the business. Utilizing transfer learning and pre-trained models are key components of neural network specialization. In the literature, research has been done on pruning-based transfer learning.

2.3.12 Natural language processing

Artificial intelligence enables robots to comprehend and interpret human language as opposed to merely reading it (Hossain & Rahman, 2022). NLP may be used by machines to understand spoken or written language as well as to identify speech, assess sentiment, and automatically summarize content. The goal of NLP, a branch of computer science, is to make computers better at understanding what people say and write. This is a difficult undertaking since there is a large amount of unstructured data involved. As per Thessen et al. (2012), a computer can read (and presumably "understand") text from literature written in natural language, such as novels, using NLP. An overview of the Unstructured Information Management Architecture of the Apache Foundation, as defined by Nadkarni et al. (2011), as well as machine-learning techniques that are being employed for various NLP sub-problems are included in this exposition of how modern NLP architectures are constructed.

2.3.13 Expert systems

Expert systems imitate the choices and activities of real-world subject-matter experts. They complement professionals rather than replacing them. Management of customer relationships is essential for a successful organization, including greater competitiveness. To ensure

customer happiness and loyalty, businesses must comprehend and communicate effectively with their customers. It is crucial to analyze client demographics and satisfaction levels utilizing categorization techniques and structural models. A study in the white goods industry showed how conceptual knowledge could be translated into practical research, which helped to create strategies for client classification. The results guide the development of tools to improve customer strategies.

An e-commerce recommender system creates product recommendations based on customer preferences and online shop activity using a fuzzy expert system. The system considers elements such as item likeness, previous purchases, and average ratings. Evaluations of accuracy, recall, and F1-measure yielded positive results. The hybrid approach outperformed them and achieved over 90% accuracy when compared to conventional methods, actual consumers, and the suggestion module of another retailer.

Organizations frequently employ self-service contact channels to expedite interactions and lower expenses. Good customer service is essential for client retention and acquisition. Customers may find it frustrating to deal with self-service customer care solutions, though. Research emphasizes the significance of geography by highlighting regional variations in crucial aspects of customer contact experiences. The research offers suggestions for enhancing client interactions, such as choosing features to build specialized interactive voice response systems. Planning and hiring for the workforce might be aided by identifying calls that will likely be transferred. Another important factor for call center management decision-making is transfer rate.

In this research, Mahmoum Gonbadi and Colleagues (2019) describe a fuzzy expert system for identifying the most important clients among diverse groups with various demands. Because customer happiness is the cornerstone of all businesses, it is therefore possible to reduce the normal queuing system wait time while also raising it. Every customer wants the system to respect them and provide them with the best service because they all have different traits and expectations. A two-stage Mamdani fuzzy inference approach (FIS) was used in this study to score consumers for Service Length, Service Value, Customer Loyalty, Maximum Tolerance, and Waiting Time. To prioritize customers, an expert system was created and compared to other methods. The outcomes demonstrated that the suggested strategy worked better than the alternatives.

3. Research Gap and Objective of the Study

This work offers fresh conceptual understandings and useful applications in the area of consumer interaction with AI technology. In order to create new hypotheses and comprehend how businesses might use AI and ML for customer service, it uses the abductive research technique, integrating theoretical and empirical study. There is a lack of comprehensive understanding and analysis of the specific benefits, limitations, and challenges associated with the implementation of artificial intelligence and machine learning techniques in customer

support systems, particularly in relation to improving customer satisfaction, reducing response time, and enhancing overall service quality. By emphasizing the role of trust and perceived sacrifice in AI-enabled customer service, the study increases our understanding in this area. The results provide crucial direction for businesses looking to employ ML and AI to improve various customer services.

3.1 Objective of the Study

Nowadays, ML and AI have gained much attention in attracting, retaining, and better serving customers. Thus, the fourth industrial revolution has been heavily dependent on the emerging technologies. Realizing the needs of the age, we attempt the current study. Therefore, this study's objectives are to evaluate how ML and AI techniques are used in customer support, as well as to offer suggestions for future research topics.

RQ1: What are the key benefits, limitations, and challenges of implementing Artificial Intelligence and Machine Learning techniques in customer support systems, and how do they impact customer satisfaction?

Research Objectives:

RO1: To examine the benefits of integrating Artificial Intelligence and Machine Learning in customer support systems and their impact on improving service quality and customer satisfaction.

RO2: To identify the limitations and challenges in implementing AI and ML techniques in customer support systems and assess their potential impact on customer satisfaction.

4. Methodology of the Study

The methodology of this study is evaluated and explored using the abductive research technique, a methodical approach for building new theories based on a combination of several phases of the data-gathering process, encompassing both theoretical and empirical research. The abductive technique was used to discover basic notions and principles before performing information on the topic's present situation in order to avoid making assumptions about where the article should begin.

Data collection: Collect relevant research articles, books, industry reports, whitepapers, and other credible sources that provide information on the application of AI and ML in customer support systems. Ensure that the selected literature is recent and aligns with the research objectives.

Data analysis: Thoroughly analyze the collected literature by extracting key findings, methodologies employed, and outcomes of previous studies. Identify common trends, patterns, gaps, and limitations in the existing research to establish the basis for further investigation.

Framework development: Based on the analysis of the literature, develop a conceptual framework that outlines the key dimensions, variables, and relationships relevant to the use of AI and ML in customer support systems. This framework will guide the subsequent analysis and interpretation of the research findings.

Data synthesis: Synthesize the information obtained from the literature review to gain a comprehensive understanding of the current state of AI and ML implementation in customer support systems. Identify the benefits, challenges, and potential implications of these technologies on customer satisfaction and service quality.

Discussion and interpretation: Analyze and interpret the synthesized data, discussing the findings in relation to the research objectives. Evaluate the strengths and weaknesses of existing research, identify research gaps, and propose areas for further investigation or improvement.

The gathering and analysis of data are done carefully. The online platforms of Elsevier, IEEE Explorer, Sage, Springer, and Hindawi were used to collect the study's data, which covered customer support for AI and ML. This was done in order to comprehend how AI and ML are now used in customer service. articles that look at the use of AI and ML to customer assistance (SST), particularly in regard to integrated product service offers (IPSO), good word of mouth (WoM), service excellence (SE), and self-service technologies. Found 6188 articles; Figure 2 displays the quantity of research on the use of AI and ML for various customer support-related challenges that has been published by various publishers.

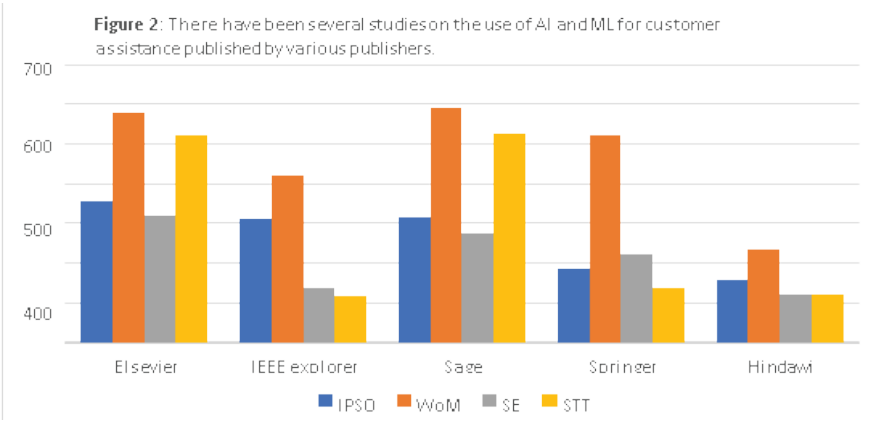

Figure 2: There have been several studies on the use of AI and ML for customer assistance published by various publishers**.**

5. Findings of the Study

Ways to improve customer support service sustainable development by using AI and ML

There are several ways for businesses to employ AI and ML to enhance customer service, according to study. Intent analysis, real-time personalization, client loyalty, and predictive models can all increase consumer satisfaction. Making exact product and service suggestions is made easier by the use of recommendation engines, decision trees, and content development. Predicting client complaints also helps in accurately identifying and resolving problems.

In addition to face-to-face encounters, customers today have various options to openly express themselves in any digital medium. Businesses may use a variety of AI and ML techniques to assess digital word-of-mouth. As an example, NLP and sentiment analysis may be used to ascertain the actual sentiment of customers, discover how they feel about businesses, comprehend the rates at which good and negative emotions propagate, and spot bad sentiment. Understanding the speeds at which good and negative emotions spread may also be done using NLP and emotion detection.

Businesses may employ AI and ML techniques to achieve their objective of offering excellent customer service. Customer feedback is improved by chatbots, logistical services are optimized by AI navigation systems, customer data integration is made easier by data scraping and analytics, and sentiment analysis and complaint management are supported by reinforcement learning. Decision-making tools like churn prediction and decision trees further enhance customer service.

Finally, companies may employ a range of AI and ML methodologies to assist clients in creating successful SSTs. Chatbots, neural networks, robots, vehicle navigation systems, customized shopping, expert systems, and customer complaint categorization, for instance, which automates the process of discovering client concerns about products and services, all increase customer engagement. Complex industrial processes and decision-making systems are controlled by neural networks, fuzzy logic, and decision trees. Fuzzy logic, robotics, and expert systems are also employed to deliver effective specialized support. In terms of specialized support, while fuzzy logic and expert systems play a significant role, the use of robotics is increasingly gaining prominence. Robotics enables automation and physical interaction in industrial processes, providing specialized support in areas such as manufacturing, logistics, and healthcare.

Table: 1.0: Difficulties with customer service today and potential AI and ML fixes

Support Services for Customers	Current problems	Approaches using AI and ML
Integrated product service offering (IPSO)	Increasing client satisfaction	(i) Intent analysis.
	Customers' genuine requirements and demands	(i) Personalization in real time. (ii) Intent evaluation.
	The proper product and service recommendations	(i) Predictive models. (ii) System of recommendations. (iii) Content Generation. (iv) Tree of decisions.
	Analysis of customer complaints	(i) Prediction of customer complaints
	Increasing ROI	(i) Media buying.
	Developing customer loyalty	(i) Intent analysis
Word-of-mouth (WoM)	Determining what customers really think	(i) Processing of natural language. (ii) Sentiment review
	Emotions of customers toward organizations	(i) Emotion detection
	The velocities of good and negative emotions	(i) Processing language naturally. (ii) Sentiment review.
	Avoid negative emotions since they are dangerous and contagious.	(i) Natural language processing. (ii) Emotion detection.
	Empathetic responses from prospective buyers to internet reviews	(i) Identifying customers' empathetic conduct.

Service excellence (SE)	Enhancing logistical support services	(i) AI Navigation system
	Difficulty in combining data from several consumer sources	(i) Data mining. (ii) Extraction of Data.
	Optimizing logistic service	(i) Analytics of Data.
	Customer feedback methods that are simple	(i) Chatbot.
	Complexity of the customer experience	(i) Reinforcement Learning.
	Managing furious clients.	(i) Sentiment review. (ii) Managing complaints. (iii) Complaint prediction.
	Reduce cognitive load.	(i) Logical system. (ii) Tree of Decision.
	Developing live chat system.	(i) Chatbot.
	Customer churn prediction.	(i) Churn prediction.
Self Service Technology (SST)	identifying customer concerns automatically.	(i) Customer complain classification.
	24/7 Customer service or Support.	(i) Neural networks. (ii) Chatbot.
	Optimizing customer interactions.	(i) Strategies for intelligent optimization. (ii) Robotics.
	Meeting customer exactions.	(i) Systems for navigating vehicles. (ii) Chatbots. (iii) Expert system. (iv) Personalized Shopping.
	Regulating sophisticated industrial processes and decision-making frameworks.	(i) Expert system. (ii) Fuzzy logic.
	Capacity for problem-solving.	(i) Chatbot. (ii) Neural networks. (iii) Decision tree.
	Offering expert support.	(i) Expert system. (i) Robotics.

6. Conclusion

Currently, AI is popular with the general population and commonly used in customer service. Customers already embrace AI customer service because it can offer assistance whenever needed, has more impartial and objective viewpoints, and anticipates future development trends. Consumers dislike AI customer service because it is much less good than manual customer service, especially in targeted, efficient, and seamless areas. It is also challenging to seamlessly blend real-human customer service with AI if the latter cannot satisfy consumer demand.

The researcher in this study evaluated how machine learning and artificial intelligence are used in customer services and made recommendations for future research initiatives. It served as the foundation for this study's methodical approach to the literature review, which it used to evaluate publications concerning the application of AI and ML in customer service that were published on various academic websites. The findings of this study demonstrated how different AI and ML approaches could assist companies in offering better customer service and assistance for particular sub-issues across a number of customer care dimensions (integrated product and service offerings, word-of-mouth, service excellence, and self-service technologies). Our work will serve as a roadmap for further research to further our understanding of AI and ML in customer assistance. It also emphasizes cutting-edge ideas that might significantly impact customer service and other disciplines theoretically and practically.

6.1 Applications of the Study

There are several theoretical and real-world applications for this topic. First, the study's primary theoretical applications provided a theoretical description of the many facets of customer service in the modern day, when massive volumes of data were being produced at an astounding rate. The current study advances the theories of online marketing, AI, and ML-based business sectors, particularly marketing, by identifying specific qualities of the numerous customer support components. Finally, the study makes a substantial contribution to the literature on customer services, consumer behavior, and AI and ML by categorizing a number of components of various customer support dimensions and offering a range of AI and ML methodologies under unique circumstances. Because of our research, businesses may improve support and customer care by implementing the best AL and ML techniques.

6.2 Limitations and Directions for Future Research

This study has several restrictions that should be considered in future investigations. Only the use of AI and ML to customer service was the subject of this study. Therefore, adopting a wider perspective could aid the outcomes of the future investigation. AI is enhancing customer service in all conceivable ways. Although they are growing tolerant of the technology,

customers are cautious to employ AI for customer service since it currently performs at a lower level than traditional real-human customer care. Therefore, there is constant demand on the sector to fully develop relevant technologies and improve the caliber of its offerings. The limitations of analyzing the use of artificial intelligence (AI) and machine learning (ML) in customer support systems may include limited generalizability of findings to specific contexts or industries, reliance on theoretical frameworks without extensive real-world implementation data, inadequate consideration of ethical implications, and potential constraints due to data availability and quality. Future research in this area should focus on conducting longitudinal studies to assess the long-term impact of AI and ML on customer support systems, exploring the optimal balance between human-AI collaboration, developing explainable and transparent AI models, considering cross-cultural factors, integrating AI across multiple support channels, and adopting a human-centric design approach. These research directions will enhance understanding, improve practical applications, and address ethical concerns associated with the use of AI and ML in customer support systems.

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