

The Use of Artificial Intelligence in Enhancing Customer Relationship Management (CRM): A Systematic Literature Review

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Abstract— Customer Relationship Management (CRM) has become a key business strategy for retaining customers. As data continues to grow in variety and volume, more advanced solutions are needed. The integration of Artificial Intelligence (AI), CRM, and Big Data offers promising support in addressing modern business challenges in the era of digitalization. This study explores the application of Artificial Intelligence in Customer Relationship Management (AI-CRM) through a literature review. We adopted the Kitchenham and Charters method for conducting the review and initially identified 356 studies. Data were collected from 33 studies published in the Scopus, ScienceDirect, and IEEE databases between 2020 and 2025. The results show that supervised learning remains the most widely used AI technique, while deep learning has grown significantly in recent years, indicating a shift toward more sophisticated CRM solutions. Most applications were found in Analytical CRM, particularly for churn prediction, customer segmentation, and personalization. However, challenges related to data quality, bias, privacy, and transparency remain prevalent. Additionally, areas such as B2B and Strategic CRM remain underexplored. This review emphasizes the need for organizational readiness before adopting AI-CRM and highlights AI's transformative potential to enhance CRM strategies and gain a competitive advantage. The findings deliver useful insights into the application of AI in data-driven CRM.

Keywords— AI-CRM, Customer Relationship Management (CRM), Artificial Intelligence, Machine Learning, Big Data

I. INTRODUCTION (HEADING 1)

Customer Relationship Management (CRM) has emerged as a rapidly expanding technology-driven business solution, primarily due to its profound impact on corporate profitability. [1]. CRM extends beyond mere sales functions, focusing instead on a deep comprehension of customer needs, preferences, and behaviours. As elucidated in [2], CRM significantly contributes to enhanced customer loyalty and satisfaction. The implementation of CRM systems frequently

generates substantial data volumes. Consequently, managing and analysing this extensive data presents a considerable challenge for organizations. [3]. Big Data technology offers a robust solution for streamlining data management and analysis. [4].

Big Data technology is employed by organizations that contend with exceptionally large, diverse, and rapidly expanding data volumes. [2]. As detailed in [5] Numerous enterprises have integrated Big Data technologies into their CRM frameworks to address market demands, thereby ensuring business resilience and growth. This evolution further necessitates more sophisticated business solutions, including the deployment of Artificial Intelligence (AI) and Machine Learning (ML) for optimal Big Data processing and utilization. [3], [5]. The capacity of these technologies to analyse data, automate processes, and even facilitate decision-making positions them as transformative forces in the business realm [6]. Consequently, the integration of AI within CRM, termed AI-CRM, presents substantial opportunities for further scholarly investigation. [7]. This is also evidenced by the escalating corporate interest in implementing AI-CRM to bolster efficiency and competitive advantage. [8]. This trend is underscored by the increasing adoption of and investment in AI-powered CRM solutions across diverse industries. With projected market growth from \$19 million in 2022 to \$34.2 million by 2025, this trajectory signals expanding opportunities and demand for AI-enhanced CRM capabilities. [6].

Several preceding studies have conducted literature reviews within the domain of AI-CRM. For instance, the analysis in [9] identified seven principal themes reflecting the evolution and thematic landscape of AI-CRM research. Concurrently, the review in [10] provides a comprehensive overview of the historical development, current status, and burgeoning research domains within the AI-CRM literature. Other studies have concentrated on the application of Generative AI (GenAI) within CRM, examining various implementation examples such as Einstein GPT, SugarCRM, and Microsoft Dynamics 365 [11]. Conversely, the literature review in [7] categorizes AI-CRM research into three primary subfields: the utilization of Big Data as the foundation for CRM data, the application of

AI/ML techniques in CRM activities, and strategic management in AI integration into CRM. This study also offers directives for future research, including the imperative to explore further the application of AI and ML techniques in CRM activities [7].

Although several studies have investigated AI-CRM, there is still room for further exploration, especially regarding its potential and various applications. However, existing studies have not covered everything in detail, leaving opportunities for future investigation.

Based on the foregoing discussion, this research seeks to address the existing research gap in the application of artificial intelligence models to support various CRM functions. This will be achieved through a systematic literature review approach. This study is anticipated to significantly enrich the body of knowledge of the future implementation of AI-CRM.

II. METHODOLOGY

In this study, the literature review was conducted using the Systematic Literature Review (SLR) method proposed by Kitchenham and Charters. This approach was selected for its comprehensive process of identifying, evaluating, and interpreting research evidence, thereby enabling concise and accurate answers to the research questions. [12]. The literature review process in this study consists of three main stages: planning, implementation, and reporting. [12].

A. Planning

The planning stage initiates the research process by identifying the need for and urgency of a literature review, and its relevance to the research topic. In this stage, existing studies were evaluated, and research gaps were identified. Subsequently, a review protocol was developed, which includes background study, predefined research questions, search strategy, inclusion and exclusion criteria, article selection standards, data extraction strategy, data synthesis methods, and the research timeline. Table 1 presents the research questions that were formulated and mutually agreed upon.

TABLE I. RESEARCH QUESTIONS

No.	Research Question
1	What are the trends in AI approaches used in CRM implementation over the past five years?
2	How has AI modeling been implemented in CRM across different industries over the past five years?
3	What are the challenges in implementing AI in CRM?

B. Implementation

Once all researchers agreed on the established protocol, the next step was to conduct the review. This step involved executing a comprehensive search strategy to identify relevant primary studies. In this case, the search strategy was developed using the keywords “Customer Relationship Management (CRM) AND Artificial Intelligence,” “Customer Relationship Management (CRM) AND Machine Learning,” “Customer Relationship Management (CRM) AND Big Data,” and “Customer Relationship Management (CRM) AND Deep Learning.” The initial search was carried out using the Scopus,

IEEE, and Science Direct database, covering the period from 2020 to 2025.

The search yielded 356 studies, which were then filtered based on the inclusion and exclusion criteria presented in Table 2. Studies that did not meet the criteria were excluded, leaving 65 for evaluation using a quality assessment checklist, as shown in Table 3. The quality assessment was conducted to evaluate the methodological rigor of each primary study.

Out of the 65 studies, only 33 met the quality assessment checklist. From these, 33 studies were selected for data extraction. The extracted data were then categorized based on the models, algorithms, and techniques used.

TABLE II. INCLUSIONS AND EXCLUSIONS CRITERIA

Inclusion Criteria	Exclusion Criteria
Studies written in English	Studies written in English
Studies published within the last five years (2020–2025)	Studies published over the previous five years (2020–2025)
Studies discussing the application of AI in CRM	Studies discussing the application of AI in CRM

TABLE III. QUALITY ASSESSMENT CHECKLIST

ID	QA Checklist
QA1	Is the objective of the study clearly and specifically stated?
QA2	Does the study include the AI models/frameworks/methods/techniques applied in CRM?

C. Reporting

The reporting stage aims to present and summarize the findings from the data extraction and synthesis process systematically. The results are organized to address all research questions, with narrative explanations supported by visualizations such as tables, diagrams, and charts. Each reported finding covers key aspects, including trends in AI-CRM research, techniques employed, areas of implementation, and the objectives of AI applications. This stage concludes with the preparation of a scientific manuscript that outlines the research process, key findings, and provides recommendations for future research or practical applications based on the literature review results.

III. RESULTS AND ANALYSIS

Among the 33 selected studies, the authors classified the literature by year of publication. The classification results are presented in Figure 1, which illustrates the distribution trend of the related literature. The findings indicate a significant increase in the adoption of AI approaches in CRM in 2024, with the highest number of publications—12 studies. However, as of the time of writing this article, only one relevant study published in 2025 was identified that aligns with the focus of this literature review.

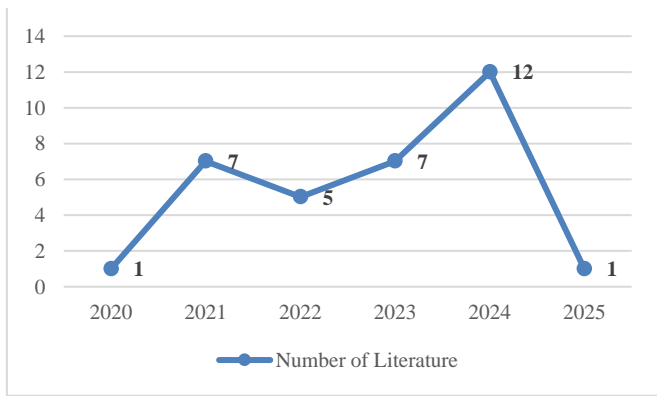


Fig. 1. Distribution of Selected Literature by Year of Publication

A. RQ1. What Are the Trends in AI Approaches Used in CRM Implementation Over the Past Five Years?

Based on the analysis of publications and applications of AI in Customer Relationship Management (CRM) over the past five years (2020–2025), as shown in Figure 2, the supervised learning approach has been the most widely used. Although there was a slight decline in 2024, it consistently remained the primary choice for AI-CRM development. Figure 3 presents the distribution of supervised learning algorithms used in AI applications for CRM, with decision trees and random forests being the most commonly used techniques in this category, often applied to predict customer behavior, such as the likelihood of repeat purchases or the risk of churn. [13], [14], [15], [16].

The deep learning approach, although only beginning to gain wider adoption in 2022, has seen a sharp increase through 2024. This trend reflects the growing exploration of more complex and advanced AI-CRM approaches. Such developments open new opportunities for implementing AI to support more sophisticated CRM tasks, thereby helping companies enhance the effectiveness of their customer relationship management.

In the deep learning category, shown in Figure 4, the most widely used technique is the Recurrent Neural Network (RNN), followed by BERT, Neural Networks, and Transformer-based models. Most deep learning techniques in the reviewed literature were applied to support Natural Language Processing (NLP) tasks. One example is presented in [17], where an LSTM-RNN architecture was used for its ability to handle linguistic complexity. The study showed that this method effectively classified customer records from the CRM text corpus into high- and low-priority lead categories.

Figure 5 illustrates the percentage of papers using Natural Language Processing (NLP) approaches in the literature, which has fluctuated over the past five years. Basic techniques such as TF-IDF and Word2Vec are frequently used. However, in practice, NLP techniques are often combined with deep learning approaches such as BERT, RNNs, LSTMs, and Transformers, especially to handle more complex NLP tasks, such as understanding word meaning in sentence context and capturing relationships between words within sentences or paragraphs. [17], [18], [19]. NLP is often used for sentiment

analysis of customer feedback from various sources, such as emails, product reviews, and social media [17], [18], [19].

On the other hand, unsupervised learning, while less popular than other methods, has maintained a consistent level of use each year. This approach is commonly applied to customer segmentation, with K-Means among the most widely implemented techniques, as depicted in Figure 6. Several studies demonstrate the integration of K-Means with other machine learning techniques for purposes such as segmenting customers based on the estimated customer lifetime value [20], [21]. Additionally, K-Means has been used to identify customer clusters based on their demographic characteristics and shopping behavior. [20], [21]. Through such segmentation, companies can develop more targeted and effective marketing strategies. [21].

Statistical approaches began appearing in the literature in 2022, with usage rising through 2024. Figure 7 shows the statistical methods used in the study, with Bayesian being one of the most commonly used techniques, following Gamma-Gamma and BG/NBD. Some studies adopted Bayesian methods for real-time prediction, which have proven effective in boosting company sales. [22]. Meanwhile, models such as BG/NBD and Gamma-Gamma are widely used to estimate CLV and customer purchase probabilities, ultimately supporting more effective customer retention strategies. [13], [18].

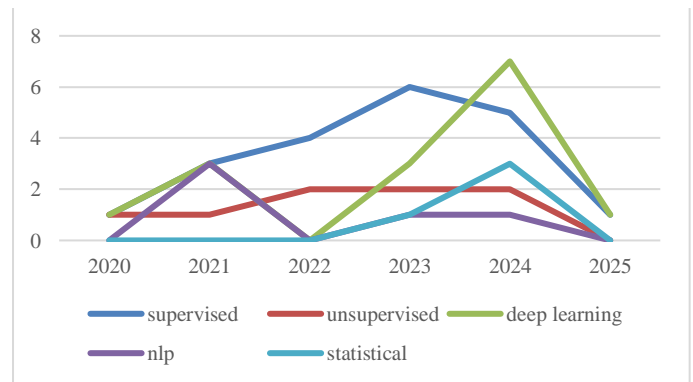


Fig. 2. Trends in the Use of AI Approaches in CRM Over the Past Five Years

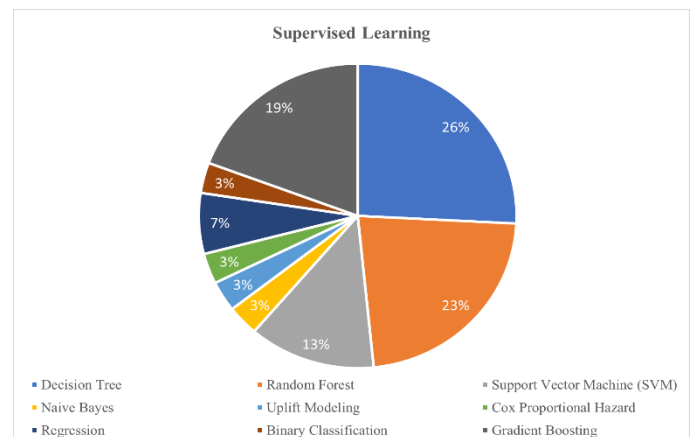


Fig. 3. Distribution of AI Techniques Applied in Supervised Learning

Approaches for CRM

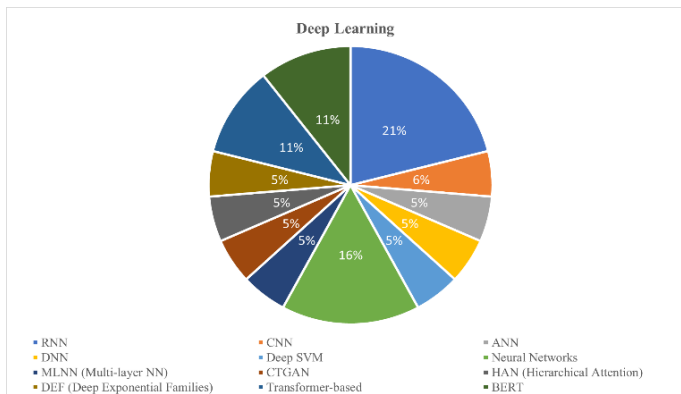


Fig. 4. Distribution of AI Techniques Applied in Deep Learning Approaches for CRM

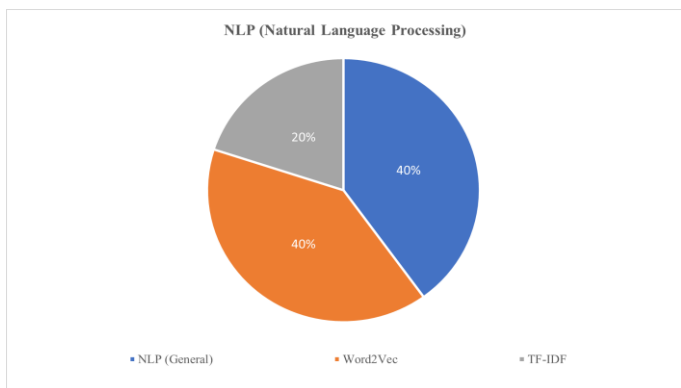


Fig. 5. Distribution of AI Techniques Applied in NLP Approaches for CRM

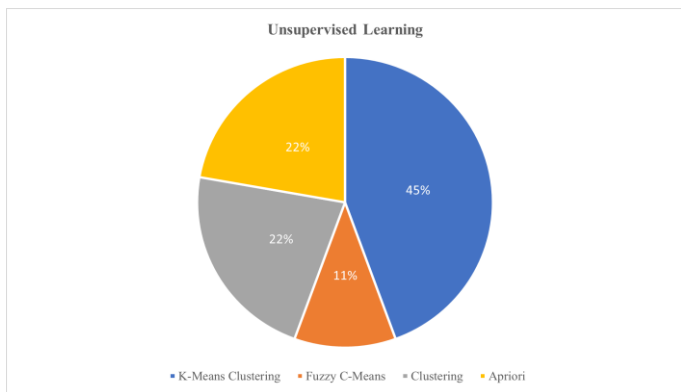


Fig. 6. Distribution of AI Techniques Applied in Unsupervised Learning Approaches for CRM

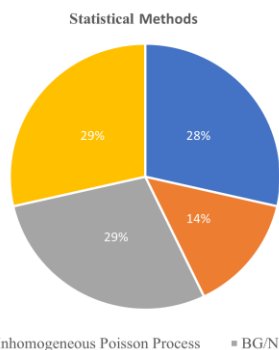


Fig. 7. Distribution of AI Techniques Applied in Statistical-based Approaches for CRM

B. RQ2. How Is AI Modeling Implemented in CRM Across Different Industries Over the Past Five Years?

Based on a review of the selected literature, the implementation of Artificial Intelligence (AI) models in Customer Relationship Management (CRM) shows considerable variation, depending on the characteristics of each industry and its specific objectives. In this review, AI-CRM implementations are classified into 13 major sectors: telecommunications and communication, e-commerce, retail, credit and insurance, banking, research, online transportation services (ridesharing), advertising and consultancy, information technology, academic administration, hospitality, business-to-business (B2B), and manufacturing. Table 4 provides the applications of AI Models in CRM and their functional tasks.

In general, AI models are applied to support three main CRM types: Analytical CRM, Operational CRM, and Strategic CRM. Analytical CRM focuses on understanding customer needs and behavior by analyzing historical data and big data. [23]. Operational CRM aims to automate business processes that directly interact with customers. [23]. Meanwhile, Strategic CRM emphasizes the formulation of customer-oriented business strategies to gain a competitive edge and build long-term relationships. [23].

The classification results show that most of the AI models analyzed are implemented in the context of Analytical CRM, with the retail and e-commerce sectors as the primary adopters. One example of AI implementation in Analytical CRM within the e-commerce sector is presented in [16], which developed models based on Decision Tree and Multi-Layer Neural Network (MLNN), namely the Enhanced Model for Customer Behavior and Purchase Analysis and Mouse Movement Pattern-Based Analysis of Customer Behavior (CBA-MMP). These models used demographic and behavioral attributes, including mouse movement patterns, to analyze and predict customer behavior. The findings demonstrated that the models were effective in predicting behavior and capable of handling large-scale data. [16].

Another example is found in [24], which showed that a personalized recommendation system based on collaborative filtering and machine learning on an e-commerce platform increased upselling, as indicated by a 20% increase in Average

Order Value (AOV). This system utilized real-time customer data, including purchase history, browsing behavior, and individual preferences.

In the retail sector, study [19] Proposed a First-Impression Model (FIM) based on probabilistic machine learning, capable of identifying high-value customers and those sensitive to marketing actions at the early stages of acquisition, even when historical data was limited. Additionally, study [25] Developed a deep learning-based system to detect customers' age and gender through facial images captured by in-store cameras. This system supported CRM by enabling personalized product shelf layouts, ultimately enhancing shopping experiences and increasing store sales.

One of the most common tasks in Analytical CRM is churn prediction, particularly in sectors heavily reliant on long-term customer retention, such as telecommunications, e-commerce, banking, and credit and insurance. In this context, AI is used to identify customers at high risk of churn, enabling companies to design retention strategies and improve customer satisfaction. [14], [26], [27]. The most frequently used techniques for churn prediction are supervised learning approaches, particularly decision tree and random forest models.

On the other hand, AI implementation in Operational CRM was found in sectors such as advertising consulting and academic administration, where AI models are used to improve operational efficiency. For instance, study [17] Explored how deep learning-based AI enhanced CRM operations in an advertising consulting firm. The system utilized agent log data to replicate managerial behavior in classifying high- and low-priority leads. Moreover, it could automatically identify the agent writing the log and predict the next word to be typed, supporting efficient documentation.

Another example is shown in study. [28], which demonstrated that a WhatsApp-based chatbot for academic services improved service efficiency and positively impacted user satisfaction and loyalty.

The application of AI models in supporting Strategic CRM can be seen in study. [29], which proposed an Improved LSTM-based CRM system to support automated decision-making processes in business relationship management. This system was shown to enhance inter-organizational relationship satisfaction and contribute to improved business performance in a B2B context.

In some cases, AI applications have been mentioned in the context of Strategic CRM, particularly in scenarios where organizations seek to maintain competitive advantage and build long-term relationships with customers. These applications may involve decision-support systems, predictive analytics, and other AI-driven tools that contribute to strategic planning. While these examples illustrate that AI can be linked to Strategic CRM, the reviewed studies generally do not go into detail about how these systems are specifically designed or implemented in a strategic context. Instead, they mostly describe general potential benefits, such as improved decision-making or enhanced relationship management, without discussing the underlying processes. Therefore, while Strategic

CRM remains an essential aspect of CRM as a whole, its AI-driven implementation continues to be acknowledged in the literature mainly at a conceptual level.

TABLE IV. AI TECHNIQUES, CRM IMPLEMENTATION AREAS, AND SUPPORTED TASKS

No.	Implementa-tion Area	Task	AI Model	Refer-ences
1	Telecommu-nication	Churn prediction	Uplift Modeling	[30]
			Random Forest + Cox Proportional Hazard Model	[14]
			Random Forest + Gradient Boosting + Support Vector Machine	[31]
		Recommendation system	Apriori Algorithm + The Depth-First Search Strategy + Bayesian Algorithm	[22]
2	E-commerce	Customer behaviour prediction	Decision tree + Multi-Layer Neural Networks (MLNN)	[16]
			Gradient Boosting Machines + Logistic Regression	[24]
		Personalization	Collaborative Filtering + Deep Learning Models	[24]
		Customer segmentation	Artificial Neural Network (ANN), Deep Neural Network (DNN)	[32]
		Churn prediction	Artificial Neural Network (ANN), Deep Neural Network (DNN)	[32]
		Recommendation system	Artificial Neural Network (ANN), Deep Neural Network (DNN)	[32]
		Sentiment Analysis	BERT	[24]
3	Retail	CLV prediction	Deep Exponential Families (DEF) + Bayesian Regression Framework + Word2Vec	[19]
		CLV estimation	BG/NBD + Gamma-Gamma Model	[18]
		Customer value segmentation	Probabilistic Model	[19]
		Customer behaviour prediction	Deep Support Vector Machines (Deep SVM)	[33]
		Customer profiling	K-Means + RFM (Recency, Frequency, Monetary) Model	[21]

		Age and Gender Estimation	CNN (VGG-16) + Fungsi Softmax + MTCNN (Multi-task Cascaded Convolutional Networks)	[25]
		Customer segmentation	K-Means + RFM Model	[18]
		Customer propensity	Gaussian Naive Bayes	[18]
		Sentiment analysis	TF-IDF + Neural Network	[18]
		Recommendation system	Affinity calculation	[18]
4	Credit and insurance	Customer behavior prediction	Binary Classification Algorithms + Variable Weighting	[34]
		Churn prediction	Binary Classification Algorithms + Variable Weighting	[34]
			Decision Tree + Forward Selection	[15]
		Customer risk prediction	Binary Classification Algorithms + Variable Weighting	[34]
5	Banking	Customer risk prediction	Random Forest	[35]
		Churn prediction	CTGAN + Ensemble-based Model	[36]
		Insurance fraud detection	CTGAN + Ensemble-based Model	[36]
		Loan default prediction	CTGAN + Xgboost	[36]
6	Research	Lead conversion prediction	Random Forest, Deep Neural Networks	[37]
7	Ridesharing	Customer behavior prediction	Bayesian nonparametric Gaussian process (GP) + Inhomogeneous Poisson Process	[38]
8	Advertisement consulting	Sentiment analysis	Word2Vec + Gensim	[17]
		Lead labelling	Word2Vec + LSTM-RNN	[17]
		Agent identification	Word2Vec + LSTM-RNN	[17]
9	IT	Lead win prediction	Decision Tree	[39]
10	Academic administration	Virtual assistant	LSTM +Transformer	[28]
11	Hotel	Customer behaviour prediction	Decision Tree (J48 Algorithms)	[20]
		Customer retention pattern	Apriori	[20]

		discovery		
		Customer segmentation	K-Means	[20]
12	B2B	Relationship decision making	Improved Long Short-Term Memory (LSTM) Model	[29]
13	Manufacturer	Customer behavior analysis	K-Means + Decision Tree	[40]

C. RQ3. What Are the Challenges in Implementing AI in CRM?

The implementation of Artificial Intelligence (AI) in Customer Relationship Management (CRM) systems presents various challenges that organizations must carefully consider. One of the most widely discussed issues in the literature relates to data-related concerns. AI deployment is highly dependent on the availability of customer data, including sensitive personal information. Therefore, data ownership, privacy protection, and ethical use of technology are critical considerations [27], [31]. Companies must ensure that all processes of data collection and processing comply with global regulations and obtain customer consent to avoid legal penalties and reputational damage. This necessitates the application of data protection mechanisms such as encryption, anonymization, and strict access control [27].

Another major challenge concerns the condition and quality of CRM data itself. In practice, customer data is often spread across multiple, unintegrated sources, and is typically unstructured and noisy [17], [18]. This complicates the preprocessing phase and requires complex data cleaning and transformation steps to generate valid outputs. [13], [17], [18].

In addition, the vast volume of data, particularly when dealing with millions of customers, can significantly hinder analysis and constrain the system's ability to generate real-time insights, especially for new customer interactions. [19]. Consequently, implementing a more sophisticated and robust CRM system is essential to leverage the capabilities of Artificial Intelligence fully.

A related issue is the need for more diverse and representative data. For AI models to be effective, they must capture the complexity of real-world conditions, which requires rich, varied data. [13], [17], [19]. A lack of data diversity can lead to biased or suboptimal analytical outcomes.

Beyond data quality and diversity, significant challenges include algorithmic bias and the lack of transparency in AI decision-making processes. Most AI models are trained on historical data, which can unintentionally replicate past biases. [27], [31]. For example, systems may exhibit tendencies to treat customers differently based on age, gender, or past purchasing behavior. If left unaddressed, this can result in inappropriate recommendations or unfair decisions. [27]. To mitigate this risk, organizations must use balanced, inclusive datasets to ensure models are more representative and fair. [14], [17]

Customer segmentation also presents its own set of challenges. Complex segmentation (beyond binary classification) is feasible only when sufficient data are available

for each segment [17]. This becomes particularly problematic for small companies or minority segments with limited data [17]. Moreover, several significant variables that could enhance customer analysis are still underutilized in the literature, limiting the representativeness of segmentation results [13].

During implementation, organizations often struggle to adapt developed AI models to operational environments. The model's validity on real-world data is usually uncertain due to many variables that have not been empirically tested. [19]. To address these challenges, organizations require more adaptive and robust model structures, along with more efficient preprocessing strategies, such as precise clustering techniques and more meaningful feature extraction methods. [41].

Additional challenges arise in cross-domain applications of AI models. Model performance often deteriorates initially and requires adjustment to new data characteristics and contextual nuances. [42]. Furthermore, advanced tasks such as aspect-based sentiment analysis increase implementation complexity, as they demand a deep understanding of customer opinions regarding specific features of a product or service [42].

Overall, although AI offers significant potential to enhance CRM strategies through personalization, prediction, and automation, its implementation poses complex challenges. The success of AI deployment in CRM depends greatly on an organization's readiness to manage data responsibly, comply with ethical and legal standards, and build systems that are fair, transparent, and reliable.

In general, several broad approaches could be considered to address these challenges. Organizations may focus on improving data management practices, enhancing employee skills, and increasing investment in AI infrastructure. They might also explore partnerships with technology providers to gain access to more advanced tools and expertise. Furthermore, companies could adopt general ethical guidelines for AI use, along with basic monitoring mechanisms to ensure models remain aligned with business objectives. While these steps do not directly resolve all identified issues, they could contribute to a more supportive environment for AI-CRM adoption in the long term.

IV. CONCLUSIONS

This study provides an overview of AI-CRM literature from the last five years. Among the AI approaches identified, deep learning has shown substantial growth over the past four years, despite limited literature available in 2022, reflecting a shift toward more complex and advanced CRM applications that enable CRM systems to address more complicated tasks. Meanwhile, supervised learning remains the most widely adopted approach across the reviewed studies.

A range of AI models has been employed across various CRM contexts, including Analytical CRM, Operational CRM, and Strategic CRM. However, Analytical CRM emerges as the most predominant focus in the literature, with tasks such as churn prediction, customer behavior analysis, and personalization being the most frequently addressed.

These applications demonstrate the transformative potential of AI to enhance CRM strategies through automation,

prediction, and personalization, ultimately improving customer retention and overall business performance.

The review also identifies several key challenges, particularly related to data privacy, availability, quality, representativeness, algorithmic bias, and ethical considerations. These issues highlight the need for responsible data governance and the development of fair, transparent, and reliable AI systems. Organizational readiness, including technical infrastructure and ethical compliance, is critical for successful AI-CRM integration.

Future research should explore studies in a broader variety of industry sectors and include the evaluations of proposed AI techniques. Cross-domain AI models should be further investigated to enhance adaptability. More research is also needed in B2B contexts, which are currently underrepresented. Additionally, the role of AI in Strategic CRM should be examined in greater depth, as it remains a relatively underexplored area in current literature. Researchers could also test AI models across different environments to assess their performance.

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