Leveraging AI for Enhanced Customer Analytics in Retail

Seminar Presentation

Guided by: Dr. Deepa V.

Presented by: Aleena Roy (SJC20AD010)

Outline

- Introduction
- Key Aspects of Customer Analytics
- AI Revolution in Retail
- AI Technologies in Retail
- AI Powered Customer Segmentation
- Literature Survey
- Research Methodology
- Analysis of Application types
- Correlation matrices
- Conclusion
- Reference

INTRODUCTION

- In the rapidly evolving retail landscape, understanding and engaging customers on a profound level is pivotal to success.
- With the advent of Artificial Intelligence (AI) and data analytics, retailers now have powerful tools at their disposal to gain deeper insights into customer behavior, preferences, and trends.
- This seminar, delves into the transformative power of Artificial Intelligence (AI) in deciphering the intricate patterns of consumer engagement.

WHAT???

Customer analytics refers to the process of collecting, analyzing, and interpreting customer data to gain insights into customer behavior, preferences, and trends. This data-driven approach allows businesses to better understand their customers and make informed decisions to improve products, services, marketing strategies, and overall customer experiences.

KEY ASPECTS OF CUSTOMER ANALYTICS

- Data Collection
- Data Integration
- Data Cleansing and Preprocessing
- Descriptive Analytics
- Segmentation
- Predictive Analytics
- Prescriptive Analytics
- Ethical Considerations
- Customer Lifetime Value (CLV) Analysis
- Churn Analysis
- Market Basket Analysis
- A/B Testing
- Feedback and Sentiment Analysis
- Data Visualization
- Real-Time Analytics

The role of customer analytics in the retail.....

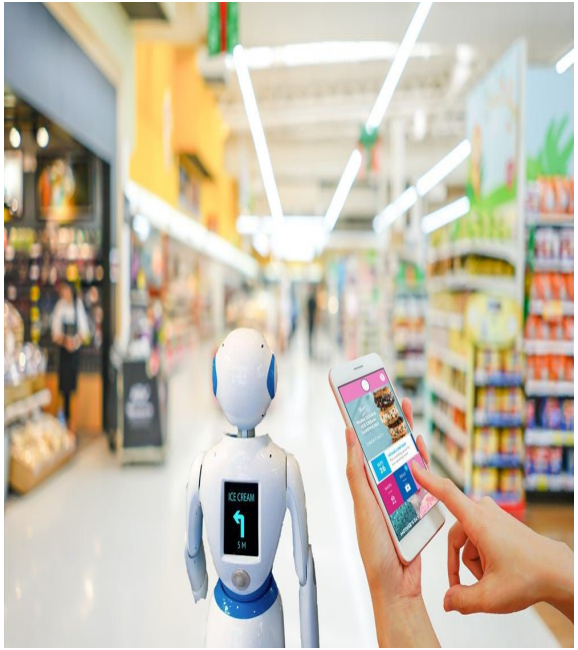
- Customer analytics is not just a tool; it's a strategic imperative for retailers.
- It empowers them to make data-driven decisions, adapt to changing customer behaviors, and thrive in an environment where customer expectations are constantly evolving.

Customer Analytics

- Enhanced Customer Understanding: Customer analytics provides in-depth insights into customer behavior, preferences, and demographics, allowing retailers to understand their audience on a granular level.
- Effective Segmentation: It enables retailers to segment their customer base into distinct groups, facilitating targeted marketing efforts and personalized experiences for different customer segments.
- Personalization and Customer Engagement: Customer analytics empowers retailers to offer personalized recommendations, promotions, and experiences, fostering stronger customer engagement and loyalty.
- Inventory Optimization: By analyzing customer demand patterns, retailers can optimize inventory levels, reducing carrying costs and ensuring products are available when and where customers want them.
- Marketing ROI and Decision-Making: Retailers can measure the effectiveness of marketing campaigns, allocate budgets efficiently, and make data-driven decisions to maximize return on investment in marketing efforts.

The AI Revolution in Retail

- The retail industry is experiencing a transformative revolution driven by **Artificial Intelligence** (AI) technologies.
- AI is reshaping how retailers operate, interact with customers, and make data-driven decisions. In this section, we will provide an overview of the AI technologies that are fundamentally changing the retail sector and present real-world examples of AI-driven success stories in retail.



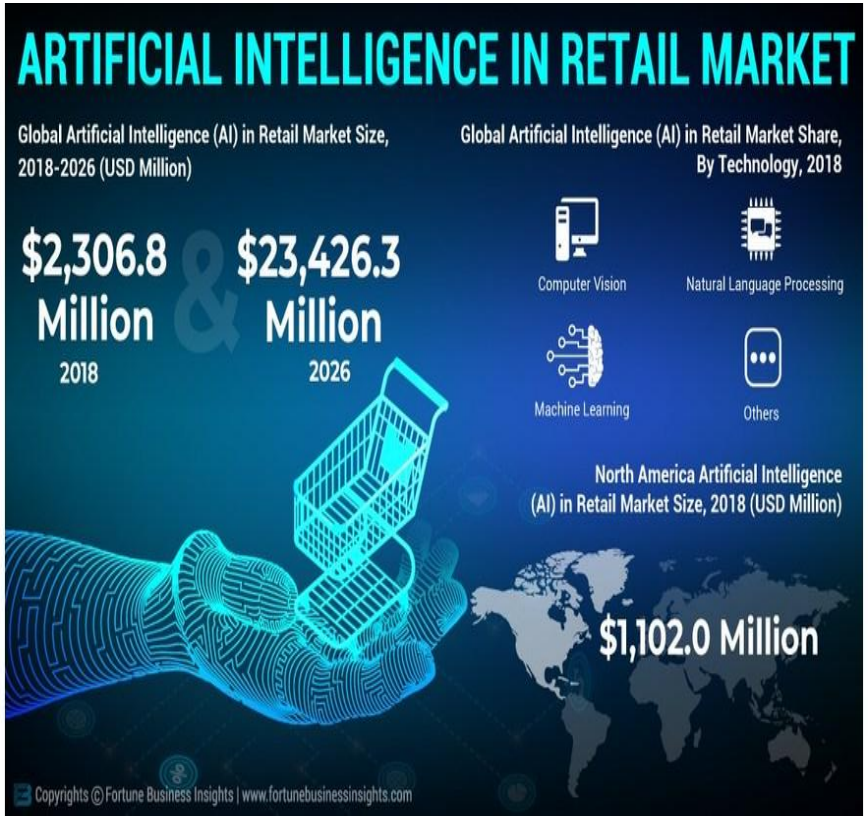
AI TECHNOLOGIES IN RETAIL

- ➔ Predictive Analytics: AI-driven predictive analytics enables retailers to forecast demand accurately. By analyzing historical data, market trends, and various external factors, such as weather and economic indicators, retailers can optimize inventory management, reduce stockouts, and enhance supply chain efficiency.
- ➔ Personalization: AI algorithms analyze vast amounts of customer data to create highly personalized shopping experiences. This includes product recommendations based on past purchases, customized marketing messages, and tailored website interfaces. Personalization increases customer engagement and loyalty.
- ➔ Chatbots and Virtual Assistants: AI-powered chatbots and virtual assistants provide round-the-clock customer support. They handle routine inquiries, assist with product recommendations, and improve overall customer service by reducing response times.

- Visual Search and Image Recognition: AI technologies enable visual search capabilities, allowing customers to search for products using images or photos. This feature simplifies the shopping process and helps customers find products more efficiently.
- Price Optimization: AI algorithms dynamically adjust prices based on real-time data, including competitor pricing, demand fluctuations, and market conditions. Retailers can optimize pricing strategies to maximize revenue while remaining competitive.
- Supply Chain Optimization: AI enhances supply chain management by optimizing routes, predicting maintenance needs, and minimizing waste. Retailers can reduce costs and improve delivery efficiency, ensuring timely product deliveries.

Real-World Examples of AI Success Stories in Retail

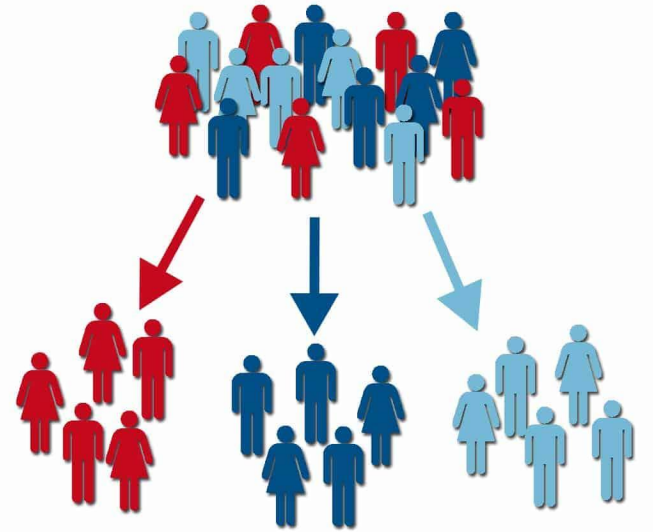
- Amazon and Recommendation Systems
- Walmart and Inventory Management
- Alibaba's Hema Supermarkets
- Sephora's Virtual Artist
- Nordstrom and Chatbots



AI-Powered Customer Segmentation

- Customer segmentation is a fundamental strategy for retailers to understand their diverse customer base and tailor marketing efforts to specific groups.
- AI-powered customer segmentation takes this practice to the next level by using advanced algorithms and machine learning to identify meaningful customer segments.

  - Demographics
  - Geographic
  - Behavior
  - Psychographics



Market Segmentation

Geographics

- Country
- City
- Density
- Language
- Climate
- Area
- Population

Demographics

- Age
- Gender
- Income
- Education
- Social Status
- Family
- Life Stage
- Occupation

Psychographics

- Lifestyle
- AIO: Activity, Interest, Opinion
- Concerns
- Personality
- Values
- Attitudes

Behavioral

- Benefits Sought
- Purchase
- Usage
- Intent
- Occasion
- Buyer Stage
- User Status
- Life Cycle Stage
- Engagement

How AI Can Help Retailers Segment Their Customer Base Effectively?????????

Artificial Intelligence (AI) can significantly assist retailers in effectively segmenting their customer base by leveraging advanced data analysis techniques and automation.

- Data Processing
- Advanced Analytics
- Real-Time Segmentation
- Dynamic Segmentation
- Predictive Segmentation
- Granular Segmentation

Data Processing

- Data processing using Artificial Intelligence (AI) refers to the application of AI techniques and algorithms to manage, manipulate, and extract insights from data.
- AI can process and analyze vast volumes of customer data from various sources, including transaction histories, online interactions, demographics, and social media behavior. This analysis uncovers valuable insights into customer behavior and preferences.
- AI can efficiently process and analyze vast amounts of customer data from multiple sources, including transaction history, online interactions, social media activity, and demographic information. It handles both structured and unstructured data, providing a holistic view of customer behavior.

Advanced Analytics

- Advanced analytics using AI refers to the utilization of Artificial Intelligence techniques and technologies to perform sophisticated and data-intensive analyses, uncover complex patterns and insights, and make data-driven decisions.
- AI employs complex algorithms to identify patterns, correlations, and trends within the customer data. It can uncover subtle relationships and nuances that human analysts might overlook, leading to more accurate segmentation.
- Advanced analytics using AI often involves the use of large datasets, powerful computing resources, and sophisticated algorithms. It enables organizations to gain deeper insights, automate complex decision-making processes, and uncover hidden opportunities or risks in their data.

Real-Time Segmentation

- Real-time segmentation using AI refers to the process of dynamically categorizing data or individuals into distinct groups or segments in real-time as new data becomes available.
- This approach allows organizations to respond quickly to changing conditions, personalize interactions, and make informed decisions based on up-to-the-minute insights.
- AI enables real-time customer segmentation, allowing retailers to adapt their strategies as customer behaviors evolve. This flexibility ensures that marketing efforts remain relevant and effective.

Dynamic Segmentation

- Dynamic segmentation using AI refers to the process of continuously and automatically categorizing data or individuals into distinct groups or segments in a way that adapts to changing conditions and behaviors over time.
- This approach enables organizations to respond dynamically to evolving patterns, preferences, or needs.
- AI can create dynamic customer segments that adapt to changing customer preferences and behaviors. This agility is invaluable in industries where trends shift rapidly.

Predictive Segmentation

- Predictive segmentation using AI involves the use of artificial intelligence techniques and predictive analytics to categorize data or individuals into segments based on anticipated future behaviors, preferences, or actions.
- It enables organizations to be proactive in their decision-making and customer engagement strategies. By anticipating future behaviors and preferences, businesses can optimize resource allocation, improve customer satisfaction, and enhance overall operational efficiency.
- AI can predict future customer behavior based on historical data. For example, it can forecast which segments are likely to make a purchase or which might churn, enabling proactive marketing strategies.

Granular Segmentation

- Granular segmentation using AI involves categorizing data or individuals into highly specific and detailed segments based on various attributes, behaviors, or characteristics. This level of segmentation goes beyond broad categories and allows organizations to target very niche or specialized groups.
- AI allows for granular customer segmentation by considering a wide array of factors, including browsing habits, purchase frequency, product preferences, geographic location, and more. This precision facilitates highly targeted marketing efforts.
- Granular segmentation using AI empowers organizations to target and serve highly specialized customer groups, optimize resource allocation, and deliver tailored experiences that resonate with individual preferences and needs.

BASE PAPER - ” Technology roadmap of AI applications in the retail industry”

LITERATURE SURVEY

[1] Hsi-Peng Lu , Hsiang-Ling Cheng , Jen-Chuen Tzou , Chiao-Shan Chen (2023). ” Technology roadmap of AI applications in the retail industry”

- New retail, an online-merge-offline system with artificial intelligence (AI) applications, became popular after the COVID-19 pandemic. This research introduces a novel technology roadmap methodology for new retail after studying 41 smart retail cases.
- Based on the correlation analysis, it was found that new retail should: (1) aim towards the fourth stage of AI development, such as image generation technology; (2) develop a seamless shopping process; and (3) formulate cloud integration platforms integrating data on consumer shopping behavior. Overall, the findings obtained could be promising reference for future studies in the retail industry.

Research methodology

Research process:-

This study proposed three stages.A list of 41 real-world new retail cases incorporating AI technologies and services is selected for data collection and validation (first stage). Most cases were gathered from press releases and public statements by government agencies or prominent international exhibitions. Through the integration of online and offline services, each case focuses on improving the customer experience.

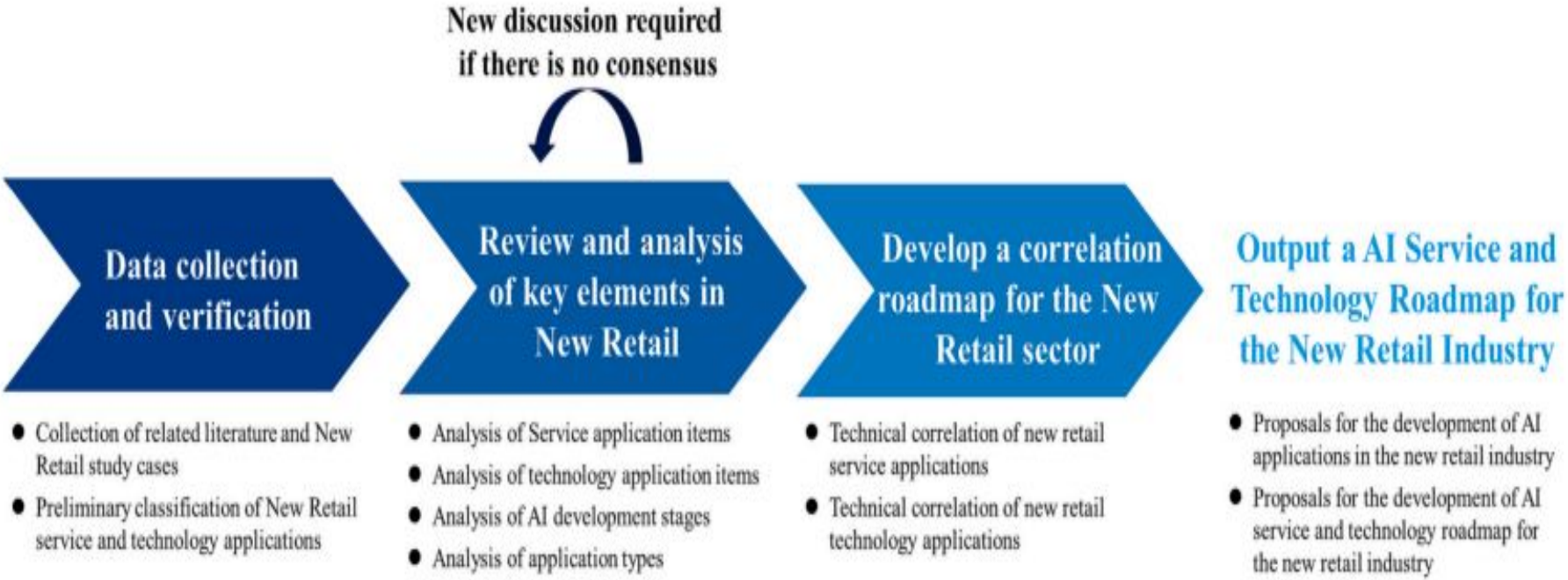
The cases were selected because of

- The involvement of AI applications in the real world
- Active in the market for at least one year during the COVID-19 epidemic, demonstrating consumer acceptance
- Gradually accepted by consumers, suggesting that the services and technology applications offered may change accordingly with technological advances and consumer demand.

This study also provides a preliminary classification and definition of the technology and service applications related to these cases.

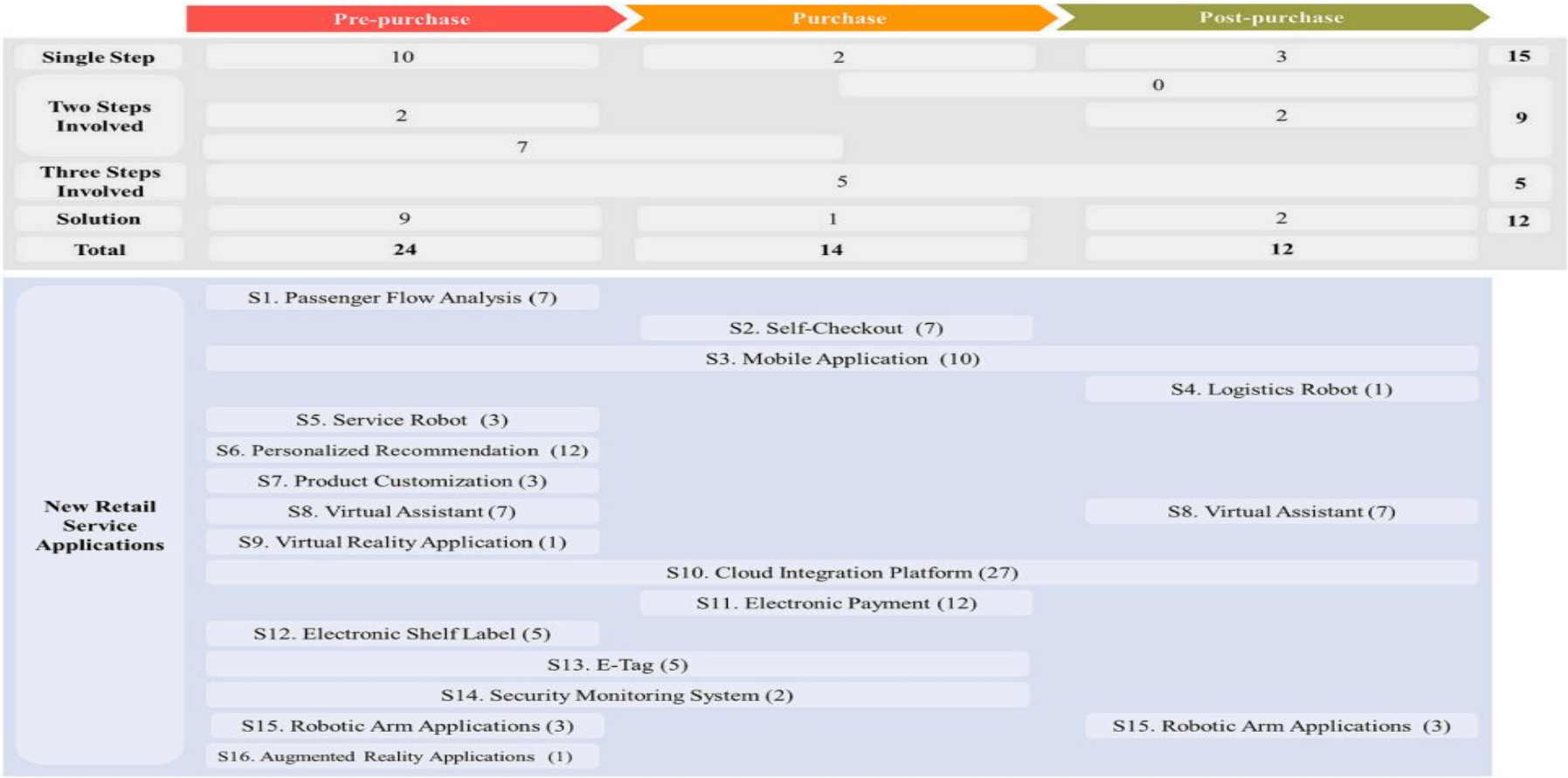
The **Second stage** focused on reviewing and analyzing key elements of the new retail sector. Four new retail experts encoded and categorized the research cases separately to prevent blind spots or personal subjectivity. As part of this step, experts examined how often the key elements - service applications , technology applications , application types, and AI development stages - appear in each case to see how AI applications are used in various shopping processes. A consensus is reached after repeated inventory and cross-checking. Finally, 16 service applications, 10 technology applications, 4 application types, and 4 AI development stages have been categorized.

The **Third stage** aims to develop a technology roadmap for AI applications in new retail. Cases were analyzed from multiple perspectives: service application, technology application, type of application, and AI stage. The number of services and technology applications with particular key technologies that appeared in the same case was analyzed. Data from these sources determine whether a technology or service is widely used. A strategy for developing new retail based on AI applications is then proposed according to the technology roadmap results.


New discussion required if there is no consensus
Data collection and verification
Review and analysis of key elements in New Retail
Develop a correlation roadmap for the New Retail sector
Output a AI Service and Technology Roadmap for the New Retail Industry
Collection of related literature and New Retail study cases
Preliminary classification of New Retail service and technology applications
Analysis of Service application items
Analysis of technology application items
Analysis of AI development stages
Analysis of application types
Technical correlation of new retail service applications
Technical correlation of new retail technology applications
Proposals for the development of AI applications in the new retail industry
Proposals for the development of AI service and technology roadmap for the new retail industry

Analysis of application types

- After examining checkout behavior, this study divided the shopping process into three phases: pre-purchase, purchase, and post-purchase.
- Pre-purchase applications were found to be the most common. Specifically, enterprises optimized pre-checkout behavior increased chances of contacting product consumers and enabled consumers to locate products fast based on their needs. While there are few service applications in the purchase phase, self-checkout and electronic payments are found in many cases, suggesting their popularity has gradually increased.
- However, post-purchase services are less varied and frequently used. Hence, retailers should prioritize introducing logistics robots, virtual assistants, or robotic arms to minimize consumer wait time for product delivery.



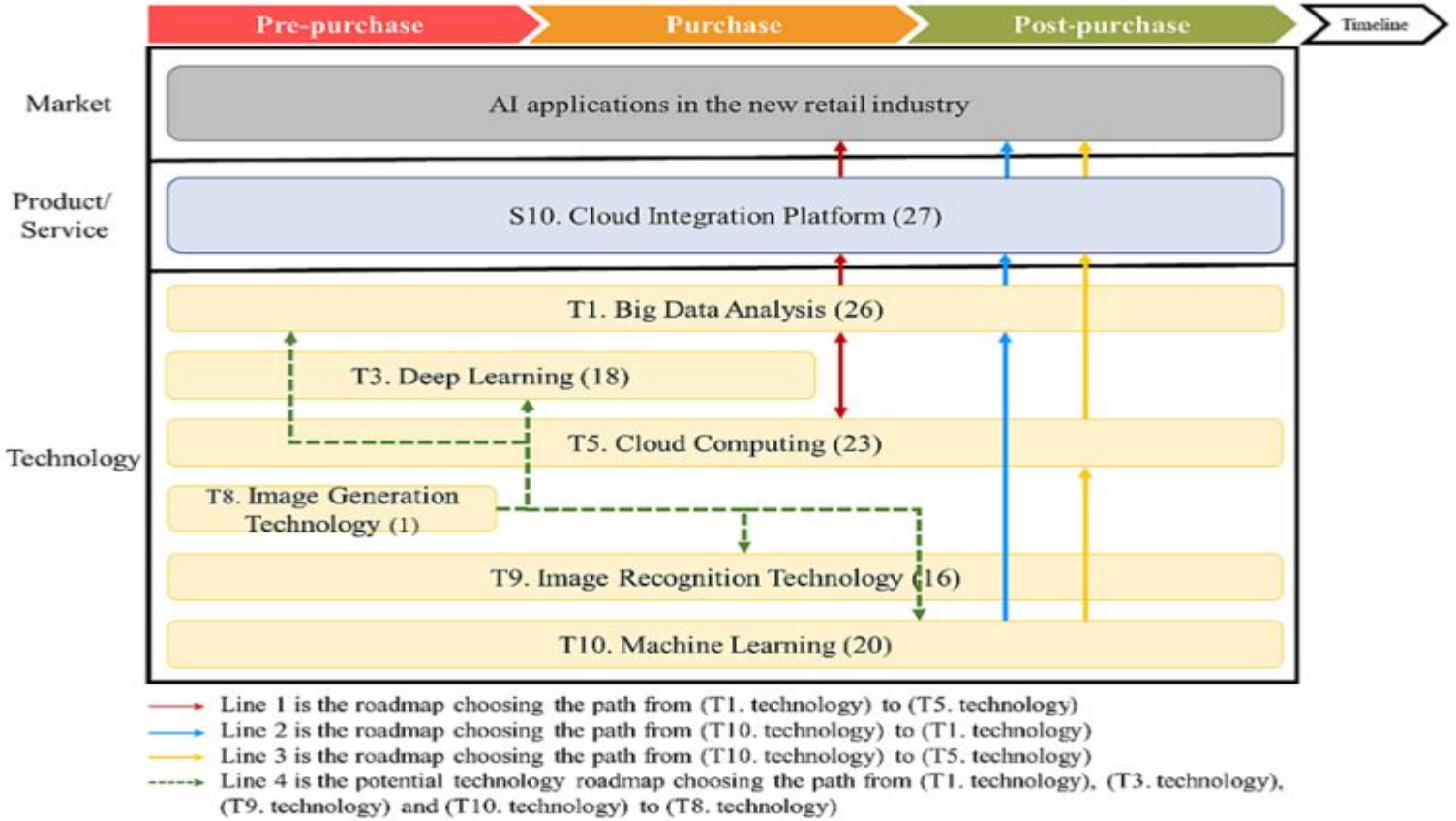
Application type review and service application type analysis diagram

- By analyzing the shopping process, this study found that most technology applications cover three phases of the shopping process. More than half of the cases were analyzed using big data, cloud computing, and machine learning. Still, these items are based on existing technologies.
- Machine learning and deep learning are AI core technologies. Despite the success of machine learning in the post-purchase phase, deep learning has yet to be developed. As a result, this study suggests that AI-related technologies should be fully integrated into post-purchase phases when developing innovative applications.

Technology application type analysis diagram

- Technology providers should integrate image generation technology into the pre-purchase phase to provide consumers with innovative experiences. Cloud integration platforms are a top priority for retailers and service providers working with AI technology for the first time or with limited budgets.
- On the other hand, technology providers should prioritize developing more mature technologies such as big data analysis, cloud computing, and machine learning.
- The application of AI to traditional retail is enhanced with the ability to collect shopping process data and predict consumer behavior.

- COVID-19 has led to government restrictions on out-of-home purchases and social distancing, increasing consumer acceptance of online shopping and innovative technologies .
- This peculiar period presents an opportunity for retailers who desire to introduce image-generation technologies to their businesses to develop innovative technology applications. The reason is to collect data on consumer behavior and create a new shopping experience for consumers while optimizing their pre-purchase process when shopping.



Service and technology roadmap of AI applications in the new retail industry

CORREALATION MATRIX

A correlation matrix is a table or matrix that shows the correlation coefficients between many variables. It is a common tool in statistics and data analysis to understand the relationships between different variables in a dataset. Correlation coefficients quantify the strength and direction of the linear relationship between two variables.

- Positive Correlation ($r > 0$): When one variable increases, the other tends to increase as well.
- Negative Correlation ($r < 0$): When one variable increases, the other tends to decrease.
- No Correlation ($r = 0$): There is no linear relationship between the variables.

Service application correlation matrix

	T1. Big Data Analysis	T2. Natural Language Processing	T3. Deep Learning	T4. Barcode Scanning Technology	T5. Cloud Computing	T6. Sensor Technology	T7. Remote Application Technology	T8. Image Generation Technology	T9. Image Recognition Technology	T10. Machine Learning	Total count of key service correlation
S1. Passenger Flow Analysis	5	1	4	6	7	6	3	0	6	4	42
S2. Self-Checkout	6	2	4	5	6	7	6	0	8	4	48
S3. Mobile Application	7	2	3	5	8	6	5	0	5	4	45
S4. Logistics Robot	0	0	0	0	0	1	0	0	1	1	3
S5. Service Robot	3	2	0	2	2	2	3	0	2	2	18
S6. Personalized Recommendation	13	4	9	3	10	6	2	1	4	9	61
S7. Product Customization	2	1	0	1	0	2	2	0	1	0	9
S8. Virtual Assistant	7	7	5	2	5	7	3	0	2	5	43
S9. Virtual Reality Application	1	1	0	1	1	1	1	0	1	1	8
S10. Cloud Integration Platform	25	8	16	11	23	16	8	1	13	18	139
S11. Electronic Payment	10	5	7	7	10	10	7	0	7	6	69
S12. Electronic Shelf Label	4	1	2	5	5	4	3	0	4	4	32
S13. E-tag	4	2	1	3	2	4	4	0	4	2	26
S14. Security Monitoring System	2	0	2	1	1	1	1	0	2	1	11
S15. Robotic Arm Applications	2	2	1	2	1	2	2	0	2	2	16
S16. Augmented Reality Applications	1	1	0	0	0	0	0	1	1	1	5

Technology application correlation matrix

	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
T1. Big Data Analysis		8	16	9	21	13	8	1	12	17
T2. Natural Language Processing	8		5	2	6	7	3	0	2	6
T3. Deep Learning	16	5		4	14	9	4	1	9	14
T4. Barcode Scanning Technology	9	2	4		10	8	6	0	6	5
T5. Cloud Computing	21	6	14	10		12	6	0	10	17
T6. Sensor Technology	13	7	9	8	12		7	0	9	10
T7. Remote Application Technology	8	3	4	6	6	7		0	7	4
T8. Image Generation Technology	1	0	1	0	0	0	0		1	1
T9. Image Recognition Technology	12	2	9	6	10	9	7	1		9
T10. Machine Learning	17	6	14	5	17	10	4	1	9	
Total count of key technology correlation	105	39	76	50	96	75	45	4	65	83

- An overview of 30 AI application case studies in the global market is presented in this paper, which focuses on the latest developments in AI application cases.
- Nevertheless, its application should not be pushed too hard too quickly. Customers will prevent them from easing into it or may even trigger a rejection response, causing the business to lose its chances.
- Technology providers should use image and voice processing technologies to launch interactive applications and image processing services in the future, which will gradually lead retailers and service providers towards the fourth stage of AI development.

- This paper identified 16 service applications, 10 technology applications, 4 application types and 4 AI stages, eventually leading to a technology roadmap. Aside from suggesting 3 possible sequences for a crucial development order, it also proposes a development order for potential key technologies.
- Furthermore, the study provides recommendations regarding AI integration in New Retail, which can serve as a reference for retailers and service/technology providers.

Conclusion

- Artificial Intelligence (AI) is reshaping the retail industry :-

1. enabling data-driven decision-making
2. enhancing customer experiences,
3. optimizing various aspects of retail operations.

- Customer analytics is a cornerstone of retail success. AI-driven customer analytics allows retailers to understand their customers at a granular level, predict their behaviors, and personalize interactions.

REFERENCE

[1] Liu, L., Liu, L., Wang, Z., Li, J., & Guo, H. (2021). *"Market prediction and boosting algorithm based on machine learning."* In Proceedings of the 6th International Conference on Industrial Engineering and Applications (pp. 92-96). Springer.

[2] Yu, W., & Li, Y. (2020). *"Application of machine learning algorithms in the prediction of e-commerce market trends".* Journal of Intelligent & Fuzzy Systems, 38(1), 1217-1225.

[3] Namasudra, S., & Prakash, S. (2018). *"Intelligent recommender system for market basket analysis using apriori algorithm".* In 2018 IEEE Calcutta Conference (CALCON) (pp. 16-19). IEEE.

[4] Shende, R., & Rokade, M. (2019). *"An automated inventory management system using RFID and IoT for small-scale supermarkets".* International Journal of Engineering and Advanced Technology, 8(6), 3110-3114.

Cont.

[5] Tang, J., Wang, D., Wang, Q., Liu, T., & Yang, J. (2018)." *Market basket analysis using a fuzzy decision tree with tree structure-based membership functions"*. International Journal of Fuzzy Systems, 20(1), 240-255.

[6] Luo, X., Duan, Y., & Edwards, J. S. (2009)." *New insights into retail category management based on data mining"*. International Journal of Information Management, 29(5), 362-371.

[7] Shen, D., Shen, H., Wang, J., & Zheng, Y. (2017)." *Research on sales prediction of retail enterprises based on RFM model"*. IEEE International Conference on Industrial Engineering and Engineering Management, 1-5.

Cont.

[8]Ogunjimi, A., Rahman, M., Islam, N., Hasan, R., 2021. Smart mirror fashion technology for the retail chain transformation. Technol. Forecast. Soc. Chang. 173, 121118 https://doi.org/10.1016/j.techfore.2021.121118.

[9]Shankar, V., Kalyanam, K., Setia, P., Golmohammadi, A., Tirunillai, S., Douglass, T., Hennessey, J., Bull, J., Waddoups, R., 2021. How technology is changing retail. J. Retail. 97 (1), 13–27. https://doi.org/10.1016/j.jretai.2020.10.006.

[10]Yeh, C.H., Lin, H.H., Gau, Y.L., Wang, Y.S., 2020. What drives customers' purchase behavior in a click-and-mortar retailing context: a value transfer perspective. J. Enterp. Inf. Manag. https://doi.org/10.1108/jeim-10-2019-0344.

THANKYOU

QUESTIONS??