

Researching the Topic of AI Data Analysis in Loyalty Programs

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Abstract: Loyalty programs have long served as valuable tools for customer engagement and retention. Today, with the increasing availability of customer data, new methods for analysis and program optimization are becoming a necessity. Artificial Intelligence (AI) has also been a topic of high relevance in recent years, and its connection with loyalty programs has not been researched and discussed enough to date. In this paper we aim to explore the emerging topic of AI data analysis in the context of loyalty programs. We examine various applications of AI data analysis in loyalty programs, including personalized rewards and incentives, customer segmentation and targeting and fraud detection and risk management. Covering these possible applications of AI data analysis provides a general understanding of AI data analysis functioning and its integration into loyalty programs. The provided information also serves as a good basis for understanding how AI data analysis functions and may be applied in various fields. In our paper we look at the outcomes of AI data analysis applications in loyalty programs from the point of view of a customer who is using those programs as well as from the point of view of the brand who manages them. By analyzing the identified points, we then highlight the benefits and challenges of using AI data analysis in loyalty programs. Key research gaps are also presented, emphasizing the need for further research on the topic, with particular attention given to problems such as ethical considerations, data privacy concerns, and the transparency of AI models. The main goal of our article is to provide readers with complex information on the topic of AI data analysis usage in loyalty programs and the ways this technology may benefit customers and the brand in the selected context. The article is theoretical-empirical and is based on external information from trustworthy sources, both digital and printed, completed with our own research outcomes.

Keywords: Loyalty programs, Artificial Intelligence, AI data analysis, Personalization, Segmentation

1. Introduction

Loyalty Programs have been an integral part of business strategies for a long time already. The primary goal of their usage is to cultivate customer engagement and increase their retention. Among the basic benefits or rewards provided in loyalty programs are exclusive discounts, gifts, benefits, or points collection with the goal of further exchange. In today's business world loyalty programs have become a common tool for building brand loyalty and are used rather commonly. This in turn led to the situation on the market, when the amount of information collected has become immense for traditional analytics tools in the way that those methods were not able to provide valuable insights and real-time data analysis results, limiting the possibilities for optimization of activities connected to loyalty programs. Since most programs are provided exclusively or non-exclusively in a digital form, online-specific metrics, like online interactions or user engagement with the content also became another point of interest.

Artificial Intelligence (AI) as a technology has become one of the solutions for analysing those giant datasets of information. Since AI models use machine learning technology, they can analyse vast amounts of data in a small amount of time and thus uncover the hidden patterns of customer behaviour. In our paper, we aim to describe the possibilities of AI data analysis and its implications in the field of loyalty programs. The information provided should explain to readers the way AI data analysis operates, what are its main advantages and limitations, and how it is used in the context of loyalty programs.

2. Theoretical Background

In order to explore the potential of AI data analysis in the context of loyalty programs we find it necessary to describe its core functionalities. As we've established in our previous papers, artificial intelligence as a technology can be defined as *"The machine performing in a way that imitates human behaviour"* (Kushnarevych & Kollárová, 2023). This is also valid in connection to AI data analysis, since the technology utilizes machine learning and various algorithms to be able to process those vast amounts of data, make conclusions, identify certain patterns and consequently make predictions based on the gathered data. There are a few technologies we have to define in this part in order to understand the functioning of artificial intelligence in the context of data analysis. Among them are:

- **Machine Learning:** Since AI data analysis mostly deals with giant sets of data, machine learning is one of the branches of AI that allows the technology to learn from those data sets and make better conclusions from them. For example, in the context of loyalty programs, by analysing customer behaviour, including the data about the app or web page usage, shopping history and purchasing

preferences, machine learning models can predict what specific customers would buy in the future, which rewards they would prefer and even potential churn and the ways how to avoid it (Caigny et al, 2024).

- **Data Mining:** This branch of AI makes it possible to identify specific findings from data based on patterns and trends and turn them into highly relevant insights for the brand (Witten et al, 2017). In the context of loyalty programs, this would allow to, for example, segment customers into highly relevant groups based on shared characteristics, which in turn brings brands a possibility to provide more targeted offerings and rewards.
- **Natural Language Processing (NLP):** In today's world, it has become very easy for anyone to leave their reviews or opinions about a brand, product or service anywhere and in any way possible. At the same time, feedback from reviews, surveys, social media comments and interactions are crucial for understanding the real customers' sentiment and preferences, and provide opportunities to prompt reacting to this information (Hemanth, 2024). Moreover, NLP, just like AI data analysis can be used in real-time, providing crucial data and insights for higher customer personalization and improvement of specific fields.

The functionalities stated above allow us to transform those giant, raw sets of customer data into valuable insights that bring a brand an understanding of what their customers truly feel and think in connection to the brand. If the company decides to work with those technologies, it can provide them with possibilities to move beyond the traditional one-size-fits-all approaches and rather create highly personalized, dynamic, insightful experiences that may make them stand out in customers' minds.

3. AI Data Analysis as a Research Method

Whether an AI data analysis may be considered a research method itself is a subject for discussion. However, we can state for sure that AI data analysis may serve as a powerful support tool that complements existing research methodologies (Santorsola and Lescai, 2023). If we look at traditional research methods, among which are, for example, surveys, focus groups, questionnaires, individual interviews or group interviews, it is clear that they can provide many valuable conclusions on customer attitudes and preferences. However, these methods may struggle to handle the vast and complex datasets, which are becoming more and more common in today's world. In today's world, every click on the webpage, every depth of scroll, and every message typed can be collected as data, and since the amount and complexity of this information may be overwhelming, AI data analysis is a tool that may come in handy, or even inevitable for usage.

AI Data analysis can also be used as a good tool for evaluating research outcomes from traditional research methods. Let's look at the example of basic surveys in the form of questionnaires. If made in an online form, it is common to expect survey platforms to provide basic data visualization. However, oftentimes those platforms would just provide basic information and visuals which are efficient for time-saving but are not very helpful in deeper data understanding. Today, this task can be fulfilled by AI data analytics tools. Such tools may not only help with data analysis and data visualization, but also with a range of activities to uncover the hidden insights of the researched dataset. Among them are:

- **Finding correlations, research questions and hypotheses:** Since AI data analysis tools are using artificial intelligence, some of them are capable of generating text output in a scientific style, which may be appropriate for usage in academia (Rossi et al, 2024). Some solutions prefer to use their own AI models, while others use the connection to external Large Language Models (LLM) – whether it is GPT, LLAMA or Claude. This feature may be useful both, before and after research. In the preparatory phase, it may serve as a great help when coming up with questions, their order and depth. But even after the dataset has been collected, AI data analysis tools may come up with new correlations, new presuppositions and new insights which were not thought about previously.
- **Uncovering Hidden Patterns:** Just like with the previous point, it is something that might be missed by traditional analysis methods but can be grasped with the help of AI. It is not always easy to gain a deeper understanding of the results, to find connections between certain questions or to make certain conclusions. And when trying to do this, those activities tend to be very time and finance-consuming. At the same time, AI data analysis tools may help to get similar results for a much smaller investment (Tamasiga et al, 2023).
- **Improved Customer Segmentation:** AI data analysis tools may also help researchers and businesses to better identify customer segments and thus create better offers for them. We are used to defining customer segments based on demographical, geographical, psychological and behavioural

characteristics. With the help of AI, such segmentation can be pushed even further, due to the ability of AI tools to analyze insights and correlations of customer behaviour to details, thus making it possible to create extremely personalized messages for customers. Such an approach has a big chance of causing increased customer engagement and thus more conversions or leads.

- **Predictive Modeling:** AI data analysis tools are also capable of predictive modeling. Among the basic examples of the technology are the possibilities to predict churn risk, return purchase probability or preferred rewards (Mantri and Mishra, 2023).
- **Real-Time Insights:** One more advantage AI tools bring to data analysis is the ability to analyze data and process conclusions and insights in real time (Oklay, 2023). While in traditional research it is possible, it would require a large amount of human resources, which is not always possible. With the help of AI, this process can be automated, so the person responsible will get only the final results without the need to process it any further. In industries where the data is very time-sensitive, it can be incredibly important to manage a product, service, or loyalty program.

As we have established, by incorporating AI data analysis researchers and businesses can get a comprehensive and insightful understanding of customer behaviour and preferences without the need to invest in the process giant amounts of resources. By saving those resources on the analytics stage, they are able to use them in other parts of their working routine, thus creating better customer experiences. In this chapter, we also want to showcase a few of the AI data analytics tools available on the market today. It is important to note that at the moment of writing this article, in the first quarter of 2024, there are already a large number of tools available, many of which bring different functionalities and possibilities. However, the field is still rapidly developing and new models and tools are appearing on a monthly, or even weekly basis, so continuous research is required for the research to stay relevant and up to date.

The first tool we find to be helpful and relevant is called Polymer and was created by Polymer Search. It enables the user to combine data from different sources, visualize anything from the dataset in various forms and interact with their AI engine, Poly-AI which may be helpful during the whole process of data analysis. It is also important to note that no coding or design skills are required to work with this tool, since one of their selling points is easiness of usage. The tool is indeed very easy and intuitive to use, the only thing required is to upload a dataset or connect a source of data, among which are Google Analytics, Google Sheets, WooCommerce data and many more. Users can work with the data themselves or use one of more than 20 templates that already have prepared graphs and tables and can be customized. Among the visualization options are the creation of:

- Column and bar chart;
- pie chart;
- time series, which shows a data trend over the period of time on the horizontal axis;
- heatmap that can serve as a useful visualization tool of two variables;
- scatter plot that uses dots to represent values of two numeric variables;
- line plot that shows data trends along one other variable;
- bubble chart which is good for visualizing three data variables from the dataset (*AI-Powered Dashboard Creator - Polymer Dashboard Maker*, n.d.).

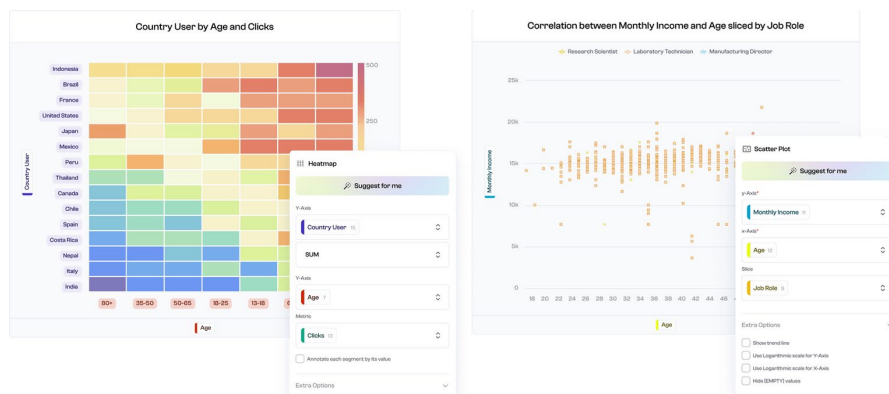


Figure 1: Heatmap and Scatter Plot in Polymer Source: “AI-Powered Dashboard Creator - Polymer Dashboard Maker.” (n.d.), [online], Polymer. <https://www.polymersearch.com/dashboard-creator>

As we have already mentioned, there is an option to use Poly-AI, the platform's artificial intelligence assistant. The system provides users with possible entry questions they may have, but one can ask the assistant anything and it will help with ideas, insights, and even create graphs for the user. On the bottom of the dashboard page, there are also some suggestions of interesting correlations that may be helpful for a user (*AI-Generated Dashboards & Data Visualization - Polymer AI*, n.d.). Another section in the tool connected to data visualization is data explaining, where the data is not only visualized in a table view but also certain metrics are being calculated and explained. Here the tool provides options to generate:

- Data table;
- scorecard;
- outliers, which compares three dimensions of data;
- return on Investment (ROI) calculator which may help businesses find their most profitable ads or products;
- pivot table that can be structured in any way suitable.

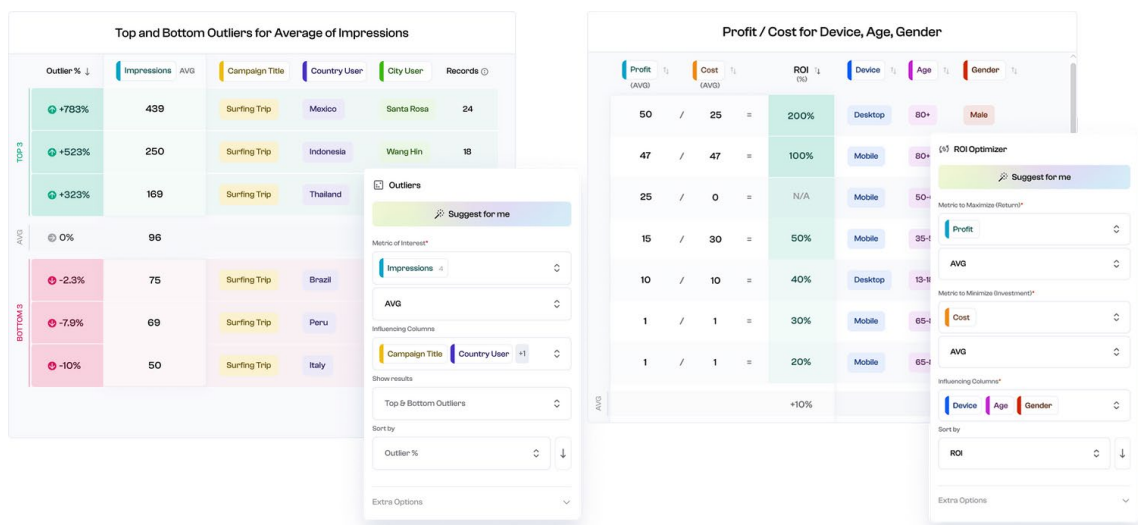


Figure 2: Outliers and ROI calculator created in Polymer Source: “AI-Powered Dashboard Creator - Polymer Dashboard Maker.” (n.d.), [online], Polymer. <https://www.polymersearch.com/dashboard-creator>

Another advantage of the platform is that it provides an option to work with real-time data downloaded from selected data sources. It is possible to set up scheduled updates of the data or update it at any time with a single click. To conclude, we may state that Polymer as a tool is capable of helping researchers and businesses with many stages of data analysis. Not only it is capable of creating beautiful visualizations in seconds, but the ability of it to create insights, correlations and even hypotheses based on the provided dataset sets it apart on the market. Even though the outcomes may not be as good as the real researcher would come to, it may serve as a great starting point, saving a lot of time and money for anyone using it.

The second tool we want to mention in this part of our paper is Microsoft Power BI. At its core, it is quite similar to the previous tool mentioned, however, it has its own set of pros and cons. Starting with the latter, Power BI is not as easy and intuitive to use as Polymer and new users can be confused at first. However, on the other hand, the system brings many more opportunities for data visualization, data analysis, and interconnectivity. Power BI is also using the Artificial Intelligence model as the helping tool that may help uncover insights, find patterns, and provide answers to questions.

Another big advantage of a tool from Microsoft is that it provides the opportunity to use it as an interconnected tool with other programs that are part of Microsoft 365. It means that the capabilities of the tool may be used in applications like Microsoft Outlook, Microsoft Teams, Microsoft Excel and others (*Power BI - Data Visualization | Microsoft Power Platform*, n.d.). This also means that sharing access to the tool is extremely easy and intuitive, which helps to create cooperations, work together on projects and keep data safe inside an organization. In conclusion, Microsoft Power BI is a very complex and comprehensive tool that may help users with any type or amount of data. However, it requires a deeper understanding of what exactly one wants to find in it and use the tool for.

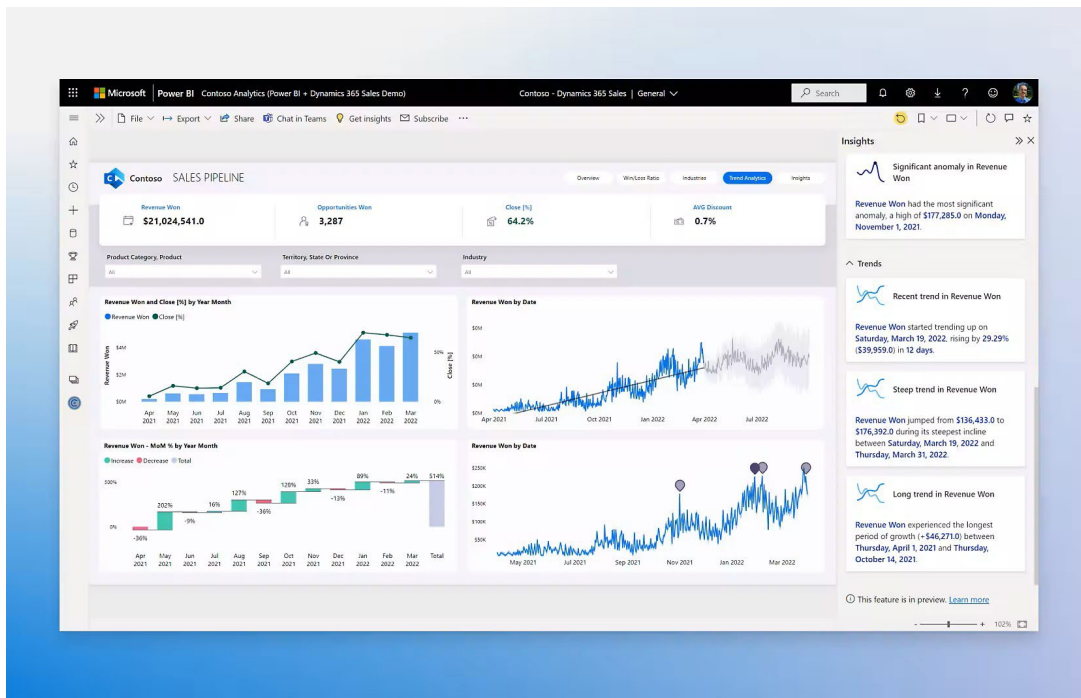


Figure 3: Data visualization in Microsoft Power BI Source: “Power BI - Data Visualization | Microsoft Power Platform.” (n.d.), [online], Microsoft. https://www.microsoft.com/en-us/power-platform/products/power-bi#tabs-pill-bar-ocb9d418_tab0

4. AI Data Analysis in Loyalty Programs

A skyrocket in customer data in the digital age presents a new opportunity to leverage AI data analysis for a more sophisticated and impactful approach. In this section, we want to discuss specific applications of AI data analysis within loyalty programs.

- **Personalization:** Probably the most powerful application of AI in the context of loyalty programs is personalization. It can be achieved by detailed analysis of several factors that loyalty programs are capable of collecting, especially customers' purchase history, searching and decision-making behaviour, past interactions, coupons and discounts used, time and days of purchase etc (Kumar et al, 2024). With the help of AI and AI data analytics solutions, brands have an opportunity to predict the individual preferences of many customers, tailor rewards accordingly and thus build a deeper connection with them.
- **Recommending relevant products or services:** Even before purchasing, AI data analysis tools can be of great help to the brands. Since today it is common for an e-shop to have a wide range of products and brands, the choice of which one to buy may become an issue and even disrupt potential customers from purchasing. By analysing data, a brand would be able to provide customers with much more relevant suggestions and thus reduce the time required to find the product or compare it to alternatives.
- **Offering dynamic tier structures:** Even the way loyalty programs are structured doesn't have to be the same for all the customers. For example, if some users prefer to use coupons for certain categories of products, AI may help provide them with such coupons. If other users are loyal customers of certain brands, a dynamic loyalty program may provide tailored-made benefits for everyone.
- **Providing targeted communication:** AI can help personalize emails and other communications with customers to highlight specific rewards or benefits relevant to each customer's profile. Even the way a brand communicates with its customers can be personalized in order to make customers feel more natural.

Another field AI data analysis may help with is dealing with potential fraudulent activities, misuse of loyalty programs and points manipulation from fake accounts. Since it is capable of analysing giant sets of data and making assumptions about the data collected, it may also identify suspicious patterns, like unusual spending

patterns or redemption activities and take actions to protect both, the business and the customers' side (Liu et al, 2023). Another advantage of using AI in this field is that it can make real-time risk assessments that don't require human intervention. Thus, if necessary, AI can prevent loyalty programs' misuse or even protect customers' data depending on the activities it notices in real time.

By implementing these AI-powered applications, loyalty programs can move beyond generic rewards and create a more personalized and engaging experience for each customer, which in turn may lead to increased customer satisfaction, loyalty, and ultimately, program effectiveness.

5. Outcomes of AI Data Analysis in Loyalty Programs for Customers

- In the following chapters of our paper, we want to look at the outcomes of AI data analysis in loyalty programs may bring for both, customers and businesses if implemented into one's brand strategy. From the information provided above we can summarize, that for the customers the main outcomes are:
- **Tailored Rewards and Incentives:** Based on the analysed dataset and the information on consumer behaviour, truly personalized, tailor-made rewards may be provided. We mentioned a few examples before, but even providing a discount coupon on a birthday based on his or her personal preferences can make a big difference in building loyalty and making customers feel like the brand cares.
- **Greater Program Engagement:** If the program does not feel generic but genuine, it is realistic to expect that the customers would want to engage with it more and proactively (Chakraborty et al, 2024). It can be achieved by increasing the number of activities happening there, creating real incentives for customers to use them and communicating in a way that feels natural for the target audience.
- **Targeted Communication:** Analysed information may be used in various ways and forms, and one of them is creating personalized communication incentives. For customers, such communication may mean building a closer connection to the brand and even loyalty, since there will no longer be a wall of generic messages, but only relevant and personalized information.
- **Data Safety Improvements:** While transparency is ideal, the extent to which customers are comfortable with AI analyzing their data for personalization is a crucial consideration (Sharma, 2024). As we've already established, real-time AI data analysis may help identify suspicious patterns and prevent incidents from occurring. This way, the safety of customers' information can be improved.

As we can see, AI data analysis may bring plenty of potential outcomes for customers if a business decides to implement it into its strategy. In our opinion, the main benefits the customer gets from it are personalized offers, rewards and communication. However, there are different layers of personalization, and that is exactly where AI data analysis and AI as a tool may be of big help. Since the amount of information analyzed can be gigantic, the outcomes can be very specific and thus the personalization can be brought on another lever, creating a one-of-a-kind experience for a user.

6. Outcomes of AI Data Analysis in Loyalty Programs for Businesses

In this part of our paper, we want to look at the outcomes AI data analysis in loyalty programs provide for the other part of B2C business relations – the businesses themselves. Among positive outcomes, businesses can expect:

- **Increased Customer Engagement and Retention:** Just the way higher personalization and enhanced UI of loyalty programs motivates customers to engage with programs more, the same way it is beneficial to businesses. Higher engagement has a higher probability of turning into conversion for a brand, whether it is a lead, amount of time spent in the application, or purchase.
- **Improved Program Design:** By analysing details like button shape, colour, reaction to hover effects, pop-ups and other elements brands get the possibility to improve the loyalty program itself, which in turn may lead to higher customer satisfaction and engagement (Khamaj and Ali, 2024).
- **Improved Customer Lifetime Value:** Since one of the primary goals of loyalty programs is to build loyalty, better loyalty programs with highly personalized rewards and tailored design have a higher chance of building loyalty.
- **Reduced Customer Churn:** AI can predict customer churn by identifying customers at risk of disengaging with the program. With this knowledge, businesses can proactively implement retention

strategies such as exclusive offers or personalized communication to keep valuable customers engaged with the brand.

In essence, AI data analysis equips businesses with the tools to transform loyalty programs from generic reward schemes into powerful tools for customer engagement, retention, and brand advocacy. By leveraging the power of data and personalization, businesses can create a win-win situation for both themselves and their customers.

7. Research Gaps and Future Directions

In this part of our paper, we want to look into some research gaps and possible future directions of AI data analysis research. The first category we can mention here is ethical considerations. One big worry with AI data analysis is the possible harm to customer privacy. There is a valid question of how much data is appropriate to analyze and where is the line of ethically appropriate data usage. Another concern is algorithmic bias. AI algorithms can replicate biases existing in the data they learn from. In this context, research should focus on studying algorithmic bias within loyalty programs to guarantee that AI-driven personalization does not disadvantage certain customer groups. The final ethical consideration we want to mention is the explainability and transparency of AI data analysis solutions. When AI models are like a "black box," it can be hard to know how they come up with certain suggestions or choices. Studies on explainable AI might assist in establishing faith with consumers by offering clarity about the way their information is utilized within the loyalty program.

The second category, which is mostly applicable in terms of AI data analysis in the context of loyalty programs is the long-term impact on customer behavior. For example, businesses should be aware of the "Spoiled Customer" effect that may occur. There is a worry that excessive personalization with AI might create an attitude of entitlement in consumers, where they anticipate continuous benefits and price reductions.

We can't forget that AI became widely accessible to the public less than two years ago, and many tools are still in the early stages of their life cycle. If these research holes are looked into, it will make sure that AI data analysis becomes a strong method for improving customer loyalty programs in an accountable and lasting way.

8. In Conclusion

For a very long time, loyalty programs have been crucial for maintaining customer involvement and keeping them with the company. But in this digital period where we are today, there is an abundance of customer data that brings up new difficulties and opportunities. This study looked into how AI data analysis can be used in research and the potential for its functioning in loyalty programs.

Firstly, we analyzed AI data analysis as a research method, where we included information on how it may help businesses and scientists with research, its potential usage and capabilities, among which were finding correlations, research questions and hypotheses, uncovering hidden patterns in data, improved customer segmentation, predictive modeling and real-time insights. We also included two practical examples of AI data analysis solutions – Polymer and Microsoft Power BI, along with a description of what the tools are capable of.

We looked at AI usage in loyalty programs and its outcomes such as personalization, segmentation and fraud detection. The possible advantages for customers and businesses were mentioned, like more involvement, better value and program optimization through data analysis. However, there is a need to consider ethical aspects related to the privacy of data, bias in algorithms as well as customer authority over their information.

To sum up, AI data analysis seems to be a very hopeful and powerful tool for loyalty programs in the future. By using its ability to make things more personal, improve programs with help from data understanding and take into account ethical factors, businesses can form better relationships with customers and push program success forward over coming years.

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References

"AI-Generated Dashboards & Data Visualization - Polymer AI." (n.d.), [online], Polymer.
<https://www.polymersearch.com/ai-dashboard-generator>.

"AI-Powered Dashboard Creator - Polymer Dashboard Maker." (n.d.), [online], Polymer.
<https://www.polymersearch.com/dashboard-creator>.

- "Power BI - Data Visualization | Microsoft Power Platform." (n.d.), [online], Microsoft. https://www.microsoft.com/en-us/power-platform/products/power-bi#tabs-pill-bar-ocb9d418_tab0.
- Chakraborty, D., Polisetty, A., Sowmya, G., Rana, N. P., and Khorana, S. (2024) "Unlocking the potential of AI: Enhancing consumer engagement in the beauty and cosmetic product purchases.", *Journal of Retailing and Consumer Services*, Vol 79, pp 1-15.
- De Caigny, A., De Bock, K. W., and Verboven, S. (2024), "Hybrid black-box classification for customer churn prediction with segmented interpretability analysis.", *Decision Support Systems*, Vol 181, pp 1-13.
- Hemanth, D.J. (2024) *Computational Intelligence Methods for Sentiment Analysis in Natural Language Processing Applications*, Morgan Kaufmann, Cambridge.
- Khamaj, A., and Ali, A. M. (2024) "Adapting user experience with reinforcement learning: Personalizing interfaces based on user behavior analysis in real-time.", *Alexandria Engineering Journal*, Vol 95, pp 164–173.
- Kumar, V., Ashraf, A. R., and Nadeem, W. (2024) "AI-powered marketing: What, where, and how?", *International Journal of Information Management*, 102783.
- Kushnarevych, A. and Kollárová, D. (2023) "Development of Artificial Intelligence as a Breakthrough for Personalization in Marketing", *3rd International Conference on Electrical, Computer, Communications and Mechatronics Engineering (ICECCME)*, Canary Islands, Spain.
- Liu, Y., Ramin, P., Flores-Alsina, X., and Gernaey, K. (2023) "Transforming data into actionable knowledge for fault detection, diagnosis and prognosis in urban wastewater systems with AI techniques: A mini-review.", *Process Safety and Environmental Protection/Chemical Engineering Research and Design/Chemical Engineering Research & Design*, Vol 172, pp 501–512.
- Mantri, A., and Mishra, R. (2023) "Empowering small businesses with the force of big data analytics and AI: A technological integration for enhanced business management.", *Journal of High Technology Management Research*, Vol 34, Issue 2, pp 1-12.
- Oklay, Y. (2023) "Real-time artificial intelligence and event processing.", [online], IBM Blog. <https://www.ibm.com/blog/real-time-artificial-intelligence-and-event-processing/>.
- Rossi, S., Rossi, M., Mukkamala, R. R., Thatcher, J. B., and Dwivedi, Y. K. (2024) "Augmenting research methods with foundation models and generative AI.", *International Journal of Information Management*, 102749.
- Santorsola, M. and Lescai, F. (2023) "The promise of explainable deep learning for omics data analysis: Adding new discovery tools to AI.", *New Biotechnology*, Vol 77, pp 1–11.
- Sharma, S. (2024) "Benefits or Concerns of AI: a multistakeholder responsibility.", *Futures*, Vol 157, pp 1-10.
- Tamasiga, P., Ouassou, E. H., Onyeaka, H., Bakwena, M., Happonen, A., and Molala, M. (2023) "Forecasting disruptions in global food value chains to tackle food insecurity: The role of AI and big data analytics – A bibliometric and scientometric analysis.", *Journal of Agriculture and Food Research*, Vol 14, pp 1-18.
- Witten et al (2017) *Data Mining. Practical Machine Learning Tools and Techniques*, Morgan Kaufmann, Cambridge.