



# Smart Customer Analysis for Personalized Promotion based on AI

Agostino G. Bruzzone<sup>1,2\*</sup>, Kirill Sinelshchikov<sup>3</sup>, Wolfhard Schmidt<sup>2</sup>

<sup>1</sup> University of Genova, via Opera Pia 15, Genova, 16145, Italy

<sup>2</sup>Simulation Team, Via Cadorna 2, Savona, 17100, Italy

<sup>3</sup>SIM4Future, via Trento 43, 16145 Genova, Italy

\*Corresponding author. Email address: agostino.bruzzone@unige.it

## Abstract

The retail framework becomes always more complex and increasingly competitive, which makes retailers search for different approaches and their combinations, one of which is utilization of information about clients to propose individual promotions. The article highlights importance and potential of Artificial Intelligence (AI) in differentiation of customers, their clustering and generation of individual promotion and action plans.

By analyzing vast amounts of client data, AI algorithms provide valuable insights, allowing retailers to produce targeted promotions, while covering as much as possible their customer base. Indeed, implementation of AI-driven customer segmentation, recommendation engines, and predictive algorithms allows retailers to deliver much more efficient personalized proposals, increasing the conversion and customer retention. Moreover, continuous fine-tuning of personalization, based on data fusion and prediction models, natural language processing, further improve customer experience, boosting brand loyalty. Indeed, by employing AI technologies, stores could create stronger connection with customers, consequently boosting revenue and remaining strongly competitive in the sector.

**Keywords:** Artificial Intelligence, Prediction Models

## 1. Introduction

One of very important challenges of traditional retail stores is to keep engagement with their customers, which becomes especially difficult due to growth of purely online stores. In order to address this issue, target marketing and target promotions could be used. Indeed, these approaches are essential for physical retail stores to effectively reach and engage their specific customer bases. In the past, the retailers were issuing promotions common for entire customer base, which had serious limitations. For example, a typical client would find in such promotion a lot of not suitable products, e.g. pet food for not pet owner, meat for vegetarian or simply products of completely different quality than certain client would buy. By tailoring their marketing efforts to specific groups of consumers, retailers could maximize the impact of their campaigns and increase customer loyalty, while acquisition of significant amounts of clients' data allows to improve efficiency of management of the stores (Fancello et al., 2017; Armenzoni et al., 2015; Braglia et al., 2014) as well to optimize overall planning, e.g. of delivery of goods (Cerrone et al., 2021).

One of famous cases related to identification of preferences and personalized suggestions is the Netflix Prize (Gomez-Uribe & Hunt, 2015). In particular, in this contest, conducted in 2006-2009, it was required to find most efficient algorithm to find recommendations for the users of the service for a prize. While this example is quite different from case study of retail, it provides an insight of how analysis of data is important for the forecasting and recommendations. Indeed, it illustrates the fact that nowadays such recommendation systems are essential parts of successful online services as well as importance and value of data acquisition.

One of the pillars of modern retail are the loyalty programs, which are essential to retain existing customers and are typically consists of exclusive promotions, discounts, and rewards. Indeed, loyalty programs encourage repeat purchases and create long-term relationships with customers. However, the most important aspect it possibility to gather valuable data on customer preferences and behavior through loyalty program memberships, as it is possible to associate receipts with specific customer ID. Moreover, satisfied loyalty program members may refer friends and family to the store, leading to new customers.



In overall, employing target marketing and target promotions in retail stores could lead to a more efficient use of resources, increased customer engagement, improved customer experiences, and ultimately, higher sales and customer loyalty. By understanding the customers better and delivering personalized experiences, retailers could remain competitive in constantly changing market and build lasting relationships with their clientele.

## 2. Data acquisition for personalized promotions

In order to be able to create a personalized promotion, it is necessary to acquire relevant data on clients. Indeed, as some say that "Data is the New Oil", the information about customers is essential at every step of the preparation of personalized promotions. First of all, it is required to assign persons to target groups, then it is necessary to prepare dedicated proposals and to update profiling of clients; finally, by keeping track of actions and consequences, the data is essential to determine efficiency of adopted measures. Hereafter are analyzed principal techniques commonly used to gather customer data for personalization purposes:

### 2.1. Point of Sale (POS) Data.

First of all, retailers could collect data at the point of sale by capturing information from customers' transactions, which includes purchase history, product preferences, and buying frequency. Analyzing this data helps in tailoring promotions to individual customers. In order to have access to this data, one of most common approaches is to implement a loyalty program. Indeed, implementing a loyalty program allows retailers to track customers' purchase history, preferences, and behaviors by associating each receipt with specific client identifier. At the same time, the clients are motivated to participate by offering exclusive benefits to members, such as personalized discounts.

### 2.2. In-Store Tracking.

Using technologies like beacons, RFID tags, or Wi-Fi tracking, retailers can track customers' movements within the store; this data helps in understanding customer behavior and preferences, enabling personalized promotions while they shop (Cepolina & Aquaro, 2021). Based on specific legislation, this approach could have serious limitations.

### 2.3. Customer Surveys.

In some cases, conducting customer surveys, either online or in-store, is a direct way to gather valuable data. Surveys can include questions about customers' preferences, interests, and shopping habits. In order to motivate customers to participate, retailers could offer incentives, such as discounts or rewards. One of drawbacks of this approach is that sometime customers may feel uncomfortable to share negative review in person, making the acquired information less reliable.

### 2.4. Website and Mobile App Data.

In case of online presence, retailers could gather data from customers' interactions with their websites and mobile apps. This data includes browsing behavior, product views, and shopping cart activity; it is possible to use cookies and user accounts to track and

analyze this data.

### 2.5. Social Media and Third-Party Data.

Monitoring and analyzing customers' interactions on social media platforms can provide information about interests, preferences, and behavior. It may be possible to work with third-party data providers to access additional demographic, lifestyle, and behavioral data about the target audience, which can supplement existing customer data for better personalization. Obviously, this approach requires introduction of additional mechanisms of data acquisition, while this may cause negative perception from the customers, which may perceive themselves spied.

### 2.6. Email Marketing Data.

Analyzing email campaign performance, such as open rates and click-through rates, could provide important information about customers' engagement and interests. Retailers could use this data to segment their email lists and send personalized promotions based on customers' preferences.

Overall, it's important to highlight, that while collecting customer data for personalization could be highly beneficial, retailers must take care of customer privacy and data security. Indeed, obtaining consent, being transparent about data usage, and complying with data protection regulations are crucial aspects of implementing these techniques ethically and effectively.

## 3. Regulations and laws on data acquisition

Considering the fact that data acquisition is essential to produce personalized promotions and that, in general, more data means more efficiency, the legal limitations in this regard must be analyzed. Indeed, hereafter is provided a comparison of norms and regulations related to data acquisition in European Union (EU) and in USA. Obviously, the acquisition of personal data and shopping history of clients in both the EU and the USA has significant implications, but there are notable differences in the legal frameworks and approaches to data protection between the two areas.

### 3.1. European Union (EU).

In the EU the main law regulation data protection is the GDPR, which is a data protection law that came into effect in May 2018 and regulates the processing of personal data of individuals within the EU, regardless of the location of the company collecting the data. For instance, it implies that companies must obtain explicit and informed consent from individuals before collecting and processing their personal data, which must be freely given, specific, and easily revocable. At the same time, organizations are required to collect and process only the minimum necessary data for the intended purpose and retain it for a limited period, while individuals have the right to access their personal data held by a company and even to request its deletion (the "right to be forgotten"). Indeed, the EU places a strong emphasis on protecting individual privacy, and companies operating within the region must comply with stringent data protection standards to avoid fines and penalties, which could be very high.

### 3.2. United States (USA).

Differently from the EU, the USA lacks a federal data protection law similar to the GDPR. Instead, it has a series of state laws and sector-specific regulations, such as the California Consumer Privacy Act (CCPA) and the Health Insurance Portability and Accountability Act (HIPAA). At the same time, different industries and sectors are subjected to specific data protection regulations, leading to variations in data protection requirements. Indeed, in the absence of comprehensive federal regulation, some industries rely on self-regulatory frameworks and best practices for data protection.

Overall, while both the EU and the USA recognize the importance of data protection, their approaches differ significantly. Considering this, understanding and following of these data protection regulations is crucial for retail, which aims to benefit from customer data for personalized promotions, while ensuring legal compliance and protecting consumer privacy.

## 4. Utilization of Artificial Intelligence

Artificial Intelligence (AI) could play a significant role in personalizing promotions in retail based on acquired client data (Bruzzone et al., 2021; 2020). Indeed, AI technologies could analyze vast amounts of customer information, identify patterns, and make data-driven decisions to deliver highly targeted and relevant promotions and proposals. Hereafter are analyzed principal ways in which AI could be employed.

### 4.1. Customer Segmentation.

This process involves dividing the overall client base into distinct groups based on common characteristics, such as demographics (age, gender, income, etc.), psychographics (interests, lifestyle, values), and behavior (buying habits, loyalty). By identifying specific segments, retailers could create personalized marketing messages and offers that correspond to interests and necessities of each group. Hence, it allows to increased relevance, as marketing messages are tailored to address the unique needs and preferences of each customer category as well as to increase conversion rates by targeting specific segments, which could lead to more effective communication, resulting in better response rates and conversions. Finally, using this approach the resources are more efficiently used to focus on high-potential customer groups, instead of on customers who enter a sales point only for articles in promotion.

Indeed, customer segmentation is the main pillar of recommendation engines, as those could be used to suggest products or services based on customers' past purchases and preferences. Hence, it could be possible even to suggest some type of product, which would be new to a customer, yet to have relatively high probability of success. The market segmentation is essential process for various companies, such as Amazon (Nguyen, 2023).

### 4.2. Personalization

Personalized marketing uses customer data and analyzes it in order to provide individualized product recommendations, offers and experiences (Longo et al., 2021). For instance, this could be done through email marketing, website customization and dedicated promotions.

Personalized communications make customers feel valued, enhancing their overall shopping experience, while personalized promotions are more likely to capture the attention of customers and drive action. Finally, customers are more likely to remain loyal

to a retailer that understands and meets their individual needs or “remembers” personal details, e.g. provides discount for specific client’s birthday.

### 4.3. Geotargeting

This technique involves adjustment of marketing messages based on the geographic location of customers and is widely used for online sales. For example, retailers could use GPS data and IP addresses to deliver location-specific promotions. This approach allows retailers to promote products and services that are popular or relevant in specific locations. At the same time, retailers can drive customers to their physical stores by sending location-based offers, build a stronger local presence and connect with customers.

### 4.4. Behavioral Targeting

This approach utilizes data regarding customers' past actions, such as purchase history and behavior, to deliver relevant promotions. By offering products related to a customer's previous purchases, the chances of conversion are increased. At the same time, advertisements are shown to customers who are more likely to be interested, minimizing wasted ad spend, which is particularly high for traditional generic paper promotions, e.g. distributed in mailboxes of entire town. Finally, behavioral data allows retailers to adjust promotions in real-time based on customer actions.

### 4.5. Predictive Analytics.

AI could be used for predictive analytics, hence, to forecast customer behavior, such as identifying customers at risk of switching to another seller or those likely to make a specific purchase soon. In these cases, AI could create targeted promotions to retain at-risk customers or to retain occasional buyers and to transform them in loyal regular customers (Bottani et al., 2021; Bruzzone et al., 2013).

### 4.6. Dynamic Pricing.

AI-based algorithms could be used to dynamically suggest adjustments of product prices based on factors like customer demand, competitor prices, and inventory levels. This allows retailers to offer personalized discounts to price-sensitive customers while optimizing the overall revenue (Bruzzone et al., 2022).

### 4.7. Natural Language Processing (NLP).

NLP allows processing and analyzing unstructured textual data, such as customer reviews, feedback, and social media interactions, which could be used to detect changes of clientele perception as well as to provide rapid assistance. Nowadays, such solutions are used by various organizations for customer support, for instance by Airbnb (Li, 2022).

AI-powered chatbots and virtual assistants could interact with customers in real-time, answering their questions, and making personalized product recommendations. While in the past these solutions were common only in online stores, nowadays there is a grown interest in robotic assistants operating directly in physical stores. These conversational interfaces enhance the customer experience and increase the chances of conversions (Bruzzone et al., 2019).

Overall, by utilizing AI technologies for personalized promotions, stores could create more engaging and relevant experiences for their customers, leading to increased customer satisfaction, loyalty, and ultimately to higher sales.

#### 4.8. A/B Testing and Optimization.

AI could be used to help in conducting A/B tests on different promotional strategies and learn from the results to optimize future campaigns. In this case, the marketing team formulates a hypothesis to test specific elements of the promotion that they believe could affect customer response. The marketing team segments the client list into two equal groups randomly: Group A and Group B and creates two versions of promotions. Group A (Control Group) receives the standard promotion with a generic subject line and general product recommendations.

Group B (Variable Group): This group receives a personalized promotion with a customized subject line addressing the recipient by their name and featuring product recommendations generated based on their past purchases and preferences. After a predetermined period, the marketing team analyzes the results and compares the performance of the two groups. This iterative process helps retailers fine-tune their promotions for better performance.

### 5. Proposed Solution

In this paper, the authors focus attention on specific problem of clientele clustering applied to a specific case study and on generation of experimental personalized set of promotions. In particular, the problem was split in several independent yet connected ones:

#### 5.1. Identification of general constraints

First task of the work is related to identification of the goal, which need to be achieved, and of general constraints. While the overall goal is obviously maximization of profit, it is necessary to identify most effective ways to achieve it.

In general, as with most of promotion campaigns, the principal constraints are absence of consecutive promotions of the same product and avoiding of contemporary promotion of complimentary ones. For instance, putting in promotion at the same time sauce for pasta and pasta, charcoal for grill and meat or toothpaste and toothbrush; indeed, acquisition of one of products of such complementary combination would most certainly lead to acquisition of another one, hence, application of discount to second product would just reduce overall profit.

Of course, there could be exception for both consecutive promotions of the same product and for complimentary ones, but as general rule those should be avoided.

#### 5.2. Preparation of products' data

Second task is the labeling of products in the experimental category, according to their properties. Indeed, in retail stores, which not yet adopted advanced analytics and prediction solutions, there is little need in extensive categorization of products. Considering this, at the beginning, available data of each single article was following: name of the product, weight (where applicable), price, EAN (European Article Number) code, group, subgroup and category. Obviously, only these data filed give very

little information about product properties, as there is no information about actual properties of the article. Considering this, first task is to perform association of every product with different "tags", describing properties of a product. Indeed, in some cases, it could be possible to assign automatically some of the tags, as name may include hints in doing so. Principally, some of names contain following indications:

- Brand. Some brands may be known for products with specific properties, e.g. all biological, high-tier, local/regional traditional, lowest price etc. In other cases, the brand itself may be a tag, as some clients buy highly advertised products because of the name rather than product properties.
- Nature of the product, e.g. name may contain words "bio", "sugar-free", etc.

Considering this, first task is to assign this kind of tags to each product. For instance, a jar of pickled vegetables may have following combination of tags: "average quality", "local production", otherwise "high quality", "small package". As anticipated, some of tags were assigned to products automatically, while human personnel assigned others manually. In overall, even a small retail store could have thousands of different articles, while a retail chain could have tens of thousands of them. However, for this specific case study it is decided to focus on relatively small sub-category of canned food products.

As anticipated, in order to have possibility maximize impact of promotions, it is necessary to identify complementary products. Hence, as much articles as possible need to be checked in this regard. Indeed, one of techniques would be to make client buy complimentary product at full price, e.g. to convince to replace toothbrush by offering new toothpaste or to buy milk by offering cereals etc.

#### 5.3. Preparation of clients' data

Another critical task is analysis of shopping history of clients in order to suggest them most efficient personalized promotions, based on their shopping history. Indeed, at the first step, for each client it is obtained a list of general preferences, based on his/her shopping frequency (e.g. multiple small buy, periodic big ones, occasional etc.), macro categories of typically bought products (e.g. meat, wine, fresh fruits) and avoided products (e.g. pet food). Consequently, the list of acquired products is analyzed in order to create extended profile of the client, based on more detailed characteristics of bought products, obtained from their tags.

In this particular case study, it was provided anonymized receipts data relative to clients belonging to the loyalty program. Based on this information, it was decided to create a hybrid recommendation system, capable to address the problem of personalized promotions using combination of various instruments.

#### 5.4. Preparation of individual promotion proposal

An important consideration in regard of promotion is related to the nature of the products. Indeed, as products in this case study are essential goods, the buying behavior of the client differs from that one of, for instance, online cinema or luxury store. In particular, the client most certainly will buy proposed products regardless their price, at least in reasonable range. Considering

this, the targets of promotion become to keep customer loyal, to make him/her to try another product and to give a stimulus for impulsive acquisitions.

Based on these considerations, it is evident that it is not sufficient to simply forecast future acquisitions and to give a discount, as this may be counter-productive, but it is necessary to simulate effect of various combinations of proposed promotions on overall turnover and profit produced by a target client. Considering this, the authors developed an algorithm, which combines Machine Learning (ML), Genetic Algorithms (GA) and Modeling & Simulation in order to provide most efficient promotional proposals. Indeed, this approach allows to combine forecasting capability of ML, optimization efficiency of GA and to estimate overall target values by using modeling. In this regard, combined utilization of these three techniques allows to identify patterns and correlations in acquisitions, hence, to make predictions regarding interests of the customer as well as to evaluate outcomes of different combinations of possible proposals. Last but not least, once the experimentation solution is completed and it is deployed on larger scale, more data will be acquired, hence, higher will be the precision of the system.

In order to optimize implementation of this solution, the authors used as base the previously created system, which employs Tensorflow library (Bruzzone et al., 2021). The project is still in active development phase at the moment of the writing.

## 6. Conclusions

Artificial Intelligence (AI) has emerged as a powerful tool and is currently used in variety of fields. In particular, for retail stores it allows to personalize promotions and enhance customer engagement. Indeed, by adopting AI-based technologies, retailers can analyze vast amounts of customer data to gain information about preferences, behaviors, and purchase patterns, hence, to segment customers effectively, deliver personalized product recommendations, as well as to forecast future buying behavior.

The integration of AI-powered recommendation engines, personalization of communication and location-based promotions allows retailers to deliver much more relevant offers and discounts to customers at the right moment, increasing the chances of conversion, which previously was not possible to achieve efficiently for such vast client bases.

However, it is essential for retailers to take care of customer data privacy and adhere to data protection norms and regulations, such as the GDPR in the European Union. By implementing correct data practices, retailers could build and maintain customer trust, which is fundamental for long-term brand loyalty.

Overall, AI has changed the way of how retail stores approach promotions, allowing them to create efficient connections with customers, boost sales, and improve competitiveness.

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