Non-invasive and Highly Explainable Recommendations: Bibliographic Review

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1 Current Status of Digital Marketing

Currently, digital marketing offers several advantages to the market, such as establishing a high level of interactivity with the consumer, facilitating the segmentation and targeting of customers (see Section 4), generating convenience for the consumer, and requiring less investment. However, there are still many barriers to be overcome. [13]

The online reputation of companies can be destroyed by negative feedback, as brands are visible and accessible to all users on the internet. There is a lack of consumer confidence due to the tracking and collection of user data for the technological development of personalized recommenders (check Sections 2 and 3), generating a conflict related to the privacy of the data. Digital marketing is highly dependent on [7, 8] techniques and technologies, and many companies do not make good use of the available tools and applications. [13] In this way, making digital marketing more transparent and comfortable for users is also necessary for companies.

2 Explainable Artificial Intelligence (XAI)

Artificial intelligence algorithms are applied in various marketing-oriented applications, such as personalizing recommendations, both for products and content, and such content ranges from news to knowledge sources and social media posts. Artificial intelligence also optimizes the financial returns gained from targeted marketing, using data mining of online consumer behavior (Customer Behavior) in conjunction with ad segmentation. However, many machine learning algorithms have very obscure decisions and behaviors, especially when we are talking about deep neural networks (Deep Learning) that are difficult to explore. Such behavior undermines customer confidence with possible algorithmic biases, leading to large-scale discrimination. [11]

Explainable Artificial Intelligence (XAI) is a class of systems that provide visibility into decision-making, making it fundamental for marketing research. Using personal information in personalized recommendations and mobile advertising raises privacy concerns for users. XAI is an important area of research that influences the calculation of individuals' privacy, being able to meet such demand in algorithms aimed at Marketing. [11]

3   Highly Explainable Recommender Systems

Modern recommender systems make use of explicit and implicit features for personalization. However, such recommendation models suffer from a lack of explainability, and many customers are dissatisfied with this lack of clarity. Models based on regressions and trees are more explainable, but there are alternatives with lesser explainability using models based on matrix factorization [6,9], collaborative neural filtering [4,5], generative adversarial networks [14,16], and graph-based models [3], which have grown a lot in the last decade. [15]

Adding contextualization features is seen as a solution for greater explainability of recommendation-focused machine learning models, and the most used features are locations, age, gender (metadata), images, titles, and descriptions of previously accessed items. Sentiment analysis based on comments about products is another resource currently widely used. Aiming to increase the recommendation's explainability, architectures with different levels of transparency are being studied: whitebox models with attention to features, greybox models with adversarial training, and blackbox models with counterfactual increases. [15]

4   Custumer Segmentation

Customer segmentation is used as an input to customize services based on current customer conditions, and is performed by processing customer data. [12] Market segmentation is defined as the division of a market according to the characteristics and needs of its customers, culminating in different marketing efforts [1]. On the other hand, customer segmentation takes the focus away from the market and puts the focus on the customer. The objective is to group the customer based on different schemes: value, behavior, lifestyle, life cycle, and activity. The client can be segmented by supervised and clustering methods, and by clustering, the clients are grouped more resistant to outliers, and [10] anomalies. Customer groupings can occur both descriptively and predictively. [2]

Market segmentation is one of the most important market concepts, but customer segmentation is an effective way of marketing personalization and assertiveness regarding customer needs. [2]

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