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Audience Studies and Trend Tracking with AI

Azri Amel

University of 20 August, Skikda (Algeria), a.azri@univ-skikda.dz

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Abstract:

This study focuses on the use of AI in audience studies and synchronic tracking of audience rapid changing trends, mainly that the audience is the focal point of all communicative activities and economic actions in the digital world. In so doing, we analyzed the findings of different studies and reports of international organizations, and found out how AI is used in audience studies. In this regard, information on the digital behavior, demographic statistics, interactions, and social aspects are, first, collected and, then, analyzed. The analysis focuses on emotions, natural langue, images, and videos. Finally, the forecasts are modeled and reality is simulated to predict the sociopolitical patterns, trends, and the market orientations, and to set polls models, divide the audience, and personalize the content. In the end, findings show that AI allows for faster and exact results within fractions of seconds, and for an easy tracking and coping with all the changes.

Keywords: AI, AI applications, audience studies, digital behavior

1. Introduction

AI is the outcome of the rapid technological development. It provides a set of applications and techniques that allow for machine programming and learning, and is the substitute for the human intelligence, creativity, and learning. It simulates the human abilities in performing tasks and develops itself based on the collected information and experiences in industry, sociology, culture, economics, politics, etc. In this context, we shall focus on digital marketing and market, where commerce and audience are digital.

Corresponding Author: Azri Amel, a.azri@univ-skikda.dz

Such commerce and audience use social media to post, share, and exchange products and content, and at the same time, show needs, interests, and preferences. Such media continuously collect, analyze, and store data to retrieve them when needed, mainly when changes take place. Thus, the audience is monitored in exact authorized and unauthorized methods, for unethical spying and exploitation of needs and weaknesses, which they deliberately express with a good intention during the marketing processes.

The audience's rapid changes of taste, life styles, consumption, and preferences to keep up in pace with the digital environment oblige the economic companies to study, track, and, even, predict them to take the necessary decisions and measures. Currently, companies use AI for its huge potentials and sophisticated algorithms. Based on what was said, we decided to focus on the use of AI in audience studies, as all organizations today, including the economic, must understand and monitor their audience, customers, and the market in general. Thus, we raise the following problematic, "what are the techniques and methods of using AI in studying the audience and tracking changes and trends?".

2. AI and its applications:

2.1 AI applications:

AI is defined from different perspectives; therefore, it is not easy to set a common definition. Besides, it is still under development, making it difficult to cover all its aspects. However, John McCarthy defines it as the science and engineering of smart machines, mainly computer software. He adds that AI is about using computers to understand the human intelligence, and that it must not be limited to the biologically observed methods (McCarthy, 2007). AI is more about software than hardware, because machines are controlled by programs. In addition, in their "Artificial Intelligence: A Modern Approach", Russell & Norvig (2020) see AI as the study and design of smart factors, which are systems that perceive their environment and take measures to increase the potentials of success, without reliance

on man. Moreover, Encyclopedia Britannica states that AI is a branch of computer science that focuses on establishing systems that can perform tasks that usually need a human intelligence, such as speech recognition, decision taking, translation, etc (Encyclopedia Britannica, 2023). Thus, AI substitutes the human intelligence.

As for "applications", the term can be defined in different contexts, including computer sciences, engineering, math, exact sciences, sociology, etc. In this context, we focus on computer science and technology, and can say that "applications" refers to the computer's and electronic devices' programs that target given purposes and tasks, such as data procession, information management, text procession, internet browsing, etc (Roger & Bruce, 2014, p. 48). In other words, they are small programs designed for given tasks, and may be used online without download on computer, such as email, content management system, electronic trade, etc. According to Hartmann & Waller, they are online programs that use servers to provide diverse services (Hartmann & Waller, 2018, p. 78).

Phillips, Stewart, & Marsicano discussed the mobile applications when discussing Android applications, and described them as special programs on smart phones and devices that perform several tasks (Phillips, Stewart, & Marsicano, 2017, p. 102). In this context, the mobile applications are designed to work on mobile devices, such as smart phones and tablets, and can use their features, including GPS, camera, and notifications, to control and even spy on the users. As for AI applications, they are applications that use AI, such as Machine Learning and Natural Language Procession, to provide a performance that exceeds the traditional capacities of software, such as the automatic recommendations and Big Data Analysis (Russell & Norvig, Artificial Intelligence: A Modern Approach, 2020, p. 145).

AI applications include any computer system that can execute tasks that usually need a human intelligence, such as logical thinking, planning, learning from previous experiences, and language comprehension (Poole & Mackworth, 2017, p. 12). In addition, they

are systems or programs that simulate the human abilities in given tasks, such as learning, comprehension, pattern recognition, and decision taking. They are used in healthcare, finance, marketing, and data management thanks to Machine Learning, Natural Language Procession, and Computer Vision (Russell & Norvig, Artificial Intelligence: A Modern Approach, 2020, p. 55). In addition, AI is defined as the software and hardware that can interpret external data, learn from them, and use them in performing given tasks without a human intervention.

3. The historical development of AI:

AI had gone through different phases, starting with simple works until the development of computer science and internet:

3.1 Phase 01: Genesis (Early foundation 1950-1970):

Thinking about AI had started early in the mid-20th century, when Turing tested the machine's ability to have a human-like intelligence (Turing, 1950). Then, many practices, such as logical programming and innovative models programming, were launched, making up the basis for AI (McCarthy, L. Minsky, Rochester, & E. Shannon, 2006). This phase witnessed a primary vision and perception of AI.

3.2 Phase 02: Relapse (slow development 1970-1990):

During this period, thought about AI shrank, as other priority technological issues dominated the scene due to the limited computing abilities and lack of sufficient data to operate AI. However, the idea did not completely faint, as research on AI went on, focusing on new techniques used in internet, such Artificial Neural Networks, which need research algorithms and optimization concepts that are used today (Minsky & Seymour, 1969).

3.3 Phase 03: Restart (rapid development 1990-2010):

This period witnessed big developments thanks to improvements in computing and software, and witnessed the use of

Artificial Neural Networks and Machine Learning to foster AI. Besides, internet rapidly developed and provided huge data to train the algorithms on different models (LeCun, Bengio, & Hinton, 2015).

3.4 Phase 03: Deep AI and its complicated applications (2010 until now):

The last decade had witnessed huge developments in Deep AI, which uses Deep Learning to process big data, which are collected from internet, mainly social media, websites, blogs, etc. The modern applications are characterized with improvement of the computing vision optimization, voice recognition, and machine human interaction. In this regard, AlphaGo, DeepMind, GPT-3, and OpenAI are good examples of modern AI developments.

4. Audience studies: development, problematic, and importance in AI era:

4.1 The concept of audience studies:

It is a classical concept that does not need much explanation for the experts. It is rediscussed from time to time due to its changes according to the new developments. In this context, we shall focus on some definitions. For instance, it is defined as a media research field that focuses on the behaviors, interests, and interactions of audience with media outlets to understand how the media content affects the audience, and how the audience interacts with the content (McQuail, 2010, p. 22). Audience studies aim at examining how the sociocultural factors affect the audience's reactions and preferences. Besides, they are defined as a branch of information and communication sciences, and aim at exploring how the audience interacts with media content and how these interactions affect the strategies of information and marketing (Horwitz, 2001, p. 92) because marketing, as a science, is based on understanding the audience to satisfy its demands. Furthermore, they are the process of collecting and analyzing data on how the audience consumes different media outlets, such as TV, radio, internet, and publications to study its behaviors and measure the media effects (Croteau & Hoynes, 2019, p. 43)

4.2 Media studies in the digital environment:

With the new millennium, which brought about a huge digital expansion and technological developments, audience studies witnessed big changes (Jenkins, 2006) and shifted focus into tracking the methods of audience interaction with the communicative tools to help companies take marketing and economic decisions. Besides, new methodological and interpretational approaches appeared, bringing about new tools for data collection and procession based on big databases and computer programs that can make exact analyses in brief time and allow for monitoring and studying the huge numbers of audience.

In this regard, the personal data of audience are presented for sale (commodifying audience) after being collected, classified, and stored, under "data industry". A report by Journal of Media Studies (2018) stated that the use of digital analysis tools helped widen the scope of such studies to cover audience behavior analysis through the different digital tools, such as social media, search engines, and mobile applications (Smith, 2018, p. 32). These tools are not limited to analyzing audience data; rather, they understand and analyze feelings, track trends, and predict the future orientations, allowing the companies to immediately and efficiently interact with the audience.

4.3 The importance of audience studies in AI era:

The importance of audience studies in AI era manifests in:

4.3.1. Improving the user experience:

The user experience refers to many points, such as the easy use, quality, nature, and presentation of a given product, and to the user's feelings, perceptions, and ideas. AI applications help analyze audience data in an exact way to better choose and personalize the content that suits interests and preferences, improve the user experience, and increase customer satisfaction with, and loyalty to, the brand (Houcine, 2023, p. 45).

4.3.2 Improving customer interaction and response:

AI can analyze big data to better understand the target audience, their interactions, and their reactions. In addition, it can

provide efficient recommendations to improve companies' response to the customer needs and inquiries and consolidate the relation and loyalty.

4.3.3 Prediction of the future trends:

AI helps predict the future trends of audience based on previous behavioral patterns thanks to Machine Learning (Al Abdellah, 2022, p. 102).

4.3.4 Improvement of marketing strategies and advertising campaigns:

It is possible to design efficient marketing strategies based on the exact information provided by AI on the audience.

4.3.5 Monitoring the public opinion:

AI can monitor social media and internet to provide immediate information on the public opinion and its trends to help understand and analyze the unexpressed feelings and views.

5. The use of AI applications in audience studies and researches:

The use of AI applications in audience studies is a reality that goes through the following phases:

5.1 Data collection:

The efficient and correct data collection is the first step towards success in audience study with AI. It needs choosing the suitable sources and tools to ensure data exactness and comprehensiveness (Gandomi & Haider, 2015, p. 138). Data collection requires diverse tools that aim at extracting exact indicators on the target audience, as follows:

5.1.1 The behavioral data:

They refer to all patterns of online behavior and activities made by the users when surfing online. They are collected from cookies, server logs, app analyses, etc (Gandomi & Haider, 2015, p. 139).

5.1.1.1 Search queries: This includes analysis of key words and statements written on the search engines. They allow for knowing the users' interests, needs, and intentions in given places and times, improving website suggestion in search results, and directing advertisement campaigns.

5.1.1.2 Browsing history: It covers the data on the visited websites and searches, and allows for identifying browsing and behavior patterns with time. Browsing data can be used to provide specific recommendations to each user to foster interaction with the digital and non-digital contents and products (Jansen& Spink, 2006, p. 250).

5.1.1.3 Websites visits, clicks, digital platforms, and applications: This includes data on the visited pages, links, surfing duration, and interactions. These are necessary data to understand and improve the user experience and satisfy his needs. In addition, they are used for user journey analysis to know the most visited pages and, even, spy on him to find out about his location, movements, weather, speech, etc.

5.1.1.4 Ad interactions: This covers all the interactions with, and views of, advertisements. Such data are used to analyze the efficiency of advertisement campaigns and identify the most attractive ones.

5.1.1.5 Purchase behavior: Data on purchase behavior show information on the purchased products, repurchase actions, and preferences, and help understand and predict the future trends, improve online shopping, and increase loyalty to the brand.

5.2 The demographic data:

The demographic data are vital for audience study and analysis. They cover the socioeconomic aspects of individuals and communities and are used in urbanist planning, general policies, and marketing because they help understand the audience. They are collected through questionnaires, user social media profiles, governmental or commercial data sources, etc. They include (Kotler & Keller, 2016, p. 202):

5.2.1 Age: It is one of the criteria that determine the preferences and needs, and is used to divide the audience into different categories to be targeted with specific advertisements, such as children, youths, etc.

5.2.2 Gender: It determines the preferences and is a key factor used to personalize marketing strategies and develop products that suit males or females.

5.2.3 Income: It shows the purchasing power of individuals and communities and classifies them into economic categories, such as the higher class, middle class, lower class, etc, to facilitate the advertisement campaigns.

5.2.4 Education: It highly influences the tastes, living standards, purchasing power, and lifestyle. Besides, understanding and using some products require a given educational level.

5.2.5 Marital status: Some preferences, needs, and selection methods single and married people differ.

5.3 Interaction data:

They cover all interactions with contents on social media, websites, videos, emails, etc. For example, comments and likes on social media show the audience interests. Interaction data are collected from cookies server logs, Google Analytics, surveys and polls, websites, phone applications, etc (Gentsch, 2018, pp. 68-70).

5.4 Social data:

AI applications analyze the users' interactions on social media. The study of net patterns allows for the identification of influencers and sub-communities. Besides, social data need analysis of posts, comments, shares, and tags to understand the feelings and trends. Such data allow understanding the nature and quality of relations between users and their influence on each other. They are collected using Hootsuie, Brandwatch, Multi-level Network Analysis, etc (Mclevely, Scott, & Carrington, 2017, pp. 150-160).

6. Big Data Analytics:

Analyzing big data using AI is the main strategy for studying and tracking the audience trends online, and for finding out the repetitive trends and patterns to make decisions, improve user

experience, target customers, and determine the future market trends. Analysis and decision making are automatic thanks to preprogrammed algorithms. For instance, social media collect huge data by interacting with users, and use them to improve services and direct advertisements and content. The main analysis techniques include:

6.1 Sentiment Analysis:

It helps analyze the written or oral linguistic texts on social media, blogs, websites, email, YouTube, and others by understating language and extracting the implicit or explicit feelings (Liu, 2012, p. 10). Besides, it allows for analyzing face expressions, visual content, and reactions to content. In this regard, the feelings, views, trends, and impressions are analyzed and classified into positive and negative. The techniques use different algorithms that can analyze texts and understand feelings, such as Machine Learning and Deep Learning. Sentiment Analysis is a dynamic process that helps companies understand customers' views regarding products and services and, thus, improve the marketing strategy. Besides, it helps control and analyze the development of feelings, such as the development of the feelings of the Western audience towards the events in the Middle East from October 2023 to October 2024, to understand them and predict the future feelings. In addition, the combination of temporal and spatial analyses (country, region, city, etc) allows for a better understanding of the relations between feelings and other factors in a given place with time.

This analysis is used in policy, health, prevention of suicide, education, cyber-bullying fighting, customer services, etc. In this regard, a modern study on the temporal patterns and feeling changes during Covid-19 measured the change of citizens' feelings during different periods of the day for 04 successive months by dividing the day into 06 groups (early morning, morning, noon, afternoon, night, and late night) and classifying the general feelings based on them. Then, the authors counted the frequency of each period using thermal maps to show the distribution of each feeling according to place and time, and the changes in them (Rodríguez-Ibánez, Casánez-Ventura,

Castejón-Mateos, & Cuenca-Jiménez , 2023). Despite the importance of feelings analysis and comprehension, some challenges arise in understanding the natural language, mainly when the text is complicated, includes slang expressions or indirect styles, or has different meanings based on culture.

6.2 Natural Language Analysis:

It is an important technique that allows for analyzing language patterns and discovering the main trends and information. It is used to understand interactions, feelings, and views through an analysis of texts, articles, comments on posts, internet discussions, views towards products or topics, and twits, and to better understand the needs and build a good targeting technique. The main applications for Natural Language Analysis include translation bots and chatbots.

6.3 Image and video analysis:

Image and video analysis with AI focuses on analyzing the visual content, such as places, behaviors, movements, face expressions, decors, etc, to deeply understand the audience preferences and detect falsification and manipulation, such as illegally modified images to be used as proofs. For instance, the Zionist media outlets fabricated images of animals to show they are children who were burned by Hamas in 07 October attacks; however, some activists discovered the trick using AI. Besides, the techniques protect the intellectual property by recognizing the stolen images and videos, reveal faces and creatures, check identity, and enhance quality. In addition, they help generate images for delightful and educational purposes.

7. Prediction modeling:

Prediction modeling with AI highly relies on algorithms and is about transforming the crude data into models ready for use, such as solutions to problems, ready decisions, methods to manage crises and situations, etc. In addition, it is about creating visions that help predict the future events and take efficient decisions, mainly in economy and

marketing. Reality modeling with AI in audience studies relies on content personalization and making data-based decisions.

7.1 Machine Learning:

It is the ability to use previous experiences and data to improve the tasks and adapt with the new variables. In this regard, algorithms are used to train systems on recognizing data and take decisions without an exact programming. Machine Learning is vital for data analysis, behavior comprehension, inclination analysis, trend prediction, and marketing strategies' direction. A report by Harvard Business Review pointed that Machine Learning improves the predictions to 40% in audience studies (Anderson, 2021, p. 92), and can be used for understanding the audience behavior, reactions to content and ads, needs, and preferences; for improving their experience thanks to special recommendations, personalized content, and digital services; and for identifying the new trends and emerging opportunities in a given market.

Big companies, such as Netflix, use Machine Learning to improve content recommendations based on viewers' preferences and behaviors' analysis (type of content, time of watching, watching with whom, etc), and to increase users' interaction.

7.2 Deep Learning:

It is an advanced Machine Learning technique for treating texts, images, and videos. For example, Google used Deep learning to improve search engines, image recognition, and search quality.

7.3 Prediction of sociopolitical trends and patterns:

AI techniques analyze the trends and patterns expressed on social media, allowing for the establishment of models that predict the users' sociopolitical trends. Deep Learning is used to understand the complicated interrelations, identify the social leaders and influencers on social media, and build exact models on the audience trends, such as predicting the electoral behavior. These models can identify the critical regions to focus efforts on them during electoral campaigns.

For instance, in 2012, Obama campaign used AI to predict votes in given areas and efficiently direct resources.

7.4 Content personalization and recommendation:

Data Analytics allows for recommendations to personalize content to given individuals. AI recommendation systems are used to personalize the content, such as in Netflix and YouTube, based on the users' behaviors and watching history, and to predict what the user wants to watch or buy to improve his experience.

7.5 Analyzing market trends:

AI can analyze social and commercial data to predict the market trends based on big data analysis, including previous purchases, interactions with brands, and personal preferences. For instance, Amazon uses Collaborative Filtering to compare the users' behaviors, provide recommendations on the interesting products, and improve transfers and sales.

7.6 AI models in polls and public opinion:

AI is used for a fast and exact analysis of polls and public opinion researches based on Text Mining to extract the keywords and identify the prevailing common views. For instance, research institutions use Natural Language Processing to analyze the citizens' reactions towards sociopolitical issues.

7.7 Audience segmentation:

It is about dividing audience into homogenous groups based on defined criteria, such as product usage, demographics, and history. It is one of the main practices in media and marketing. In the past, segmentation relied on demographic criteria, such as age and gender. However, with AI, tools of advanced data analysis generate more exact and efficient divisions based on complex behavior patterns, such as purchase habits and personal preferences, and personalize content with Decision Trees and K-means Clustering.

7. 8. Social reality simulation:

AI simulates the audience interactions with the sociopolitical events. The models are Agent-Based, simulate the individuals' behaviors, and predict their responses to given conditions and their future reactions.

8. The challenges facing AI in audience studies and researches:

Despite the big potentials provided by AI in audience studies, it faces different challenges regarding exactness, privacy, ethics, bias, and miscomprehension of cultural contexts. In this regard, AI applications collect huge amounts of personal data, including name, age, country, interactions on social media, digital behavior, etc, what may violate privacy and increase "control capitalism", which privileges the use of personal data for profitable aims instead of privacy protection. Thus, the main question is about using data without violating privacy under stringent laws, such as GDPR laws in the EU, which provide for carefully dealing with the personal information to maintain privacy. Besides, the laws do not show who takes responsibility and results of misusing information (Zuboff, 2019).

In audience studies, AI faces challenges of transparency in using personal data because most of the methods used in collecting and analyzing data are not transparent or authorized. Therefore, they create worries and maximize social inequality and algorithm bias, leading to unfair and intransparent targeting of some categories. For instance, algorithms are used in digital advertisements to exclude given categories based on the collected data; thus, they foster the social differences. In addition, reliance on biased or distorted data to train AI models generates inexact and incorrect results and inaccurate economic predictions, divides the audience unequally, and fosters social and racial segregations (O'Neil, 2016). In addition, AI may misunderstand the sociocultural context and fail to interpret the results of audience studies (Miller T. , 2020, p. 74). Finally, the obtained data may be subject to different interpretations, and most of complex

algorithms that analyze audience are unclear and their method of taking decisions is vague; therefore, researchers may mistrust it.

9. Conclusion:

The use of AI in audience and communication studies is necessary, mainly that it provides advanced analytical potentials to understand the audience behaviors and trends through Big Data Analytics, Sentiment Analysis, Machine Learning, Deep Learning, and social nets analysis. In addition, AI helps understand how people interact with content and facilitates dealing with big data to understand the general trends, hidden patterns, and exact preferences of the audience. Moreover, it allows for tracking changes, understanding feelings towards given issues or products, and identifying the effect of advertisement campaigns on these feelings to understand and predict the audience behavior, better target them , direct the marketing strategies, and establish good communication with them.

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