Creating Online Senses using Artificial Intelligence

Anugrah Narayan Shukla[a], Dr. Bibhas Chandra[a] & Nitya Kumari[a]

[a]Department of Management Studies and Industrial Engineering, IIT(ISM) Dhanbad, Jharkhand, India

Abstract—The shift of shopping trend from traditional brick and mortar stores to online stores has compelled marketers to provide similar atmosphere and senses in webmosphere(online store atmosphere). Developing the original senses for online product is a challenge for researchers and stores. As Artificial Intelligence (AI) can effectively explore and correlate data from both instrumental and human testing to generate solutions that benefit online retailers, it is becoming increasingly important for sensory and consumer behavior. AI is a field of science that takes inspiration from nature. in the present study, we show how applied AI is used to provide solutions in sensory marketing. First, this paper discusses the alignment of sensory experiences with human-AI perception. Second, this paper tells how AI can be used to create and classify online senses and how it can be measured with the latest studies in Human-AI sensory studies. Finally, this paper suggests future directions in the field of developing online senses using AI.

Index Terms—Human-AI, Artificial Intelligence, Sensory marketing, online senses

I. INTRODUCTION

Digital revolution in the last two decades has made everything available online. All the stores that were traditionally selling their products in brick-and-mortar stores are now selling their products online. But this has also created a tremendous competition among themselves. In order to attract maximum customers stores are trying to provide similar kinds of experiences and senses that they used to have in traditional stores. Providing right sensory stimuli and involving the customer senses helps customers to make decisions without confusion. The senses have a significant impact on how consumers perceive products and make judgments about what to buy and what not to buy (1). With the continuous increasing demand of research in the field, there has been a significant rise in the literature, but despite the availability of literature in the field of online sensory marketing very little research has been done on creation of online senses using artificial intelligence. There are some studies available that have shown marketers can simulate online sensory studies using AI (2). AI can enhance the visual appeal of products through dynamic pictures, high quality images and videos, it can also simulate the haptic properties of the products or even can help in recreating the scent.

Marketers incorporated AI models since the growth of AI for managing customer relations, personalisation and targeting (3–5) the customers but the advent of generative AI has marked a transformative moment for application of AI. Earlier models of AI were used only for data analytics (6) , while generative AI models can generate new content (e.g., texts, images and videos) based on the training of the data. Generative AI emerged as extremely powerful but that doesn't mean that it is infallible. Research in computer science has tested cognitive, emotional and linguistic abilities of large language models(LLMs). Large language Models often fails in the tasks that involve real world knowledge. Petit et. al (7) in their paper has discussed how sensory enabling technologies can help consumers to interact online. Previously, senses were restricted to sight and sound in the online realm. However, with the advancement of technologies like virtual reality, augmented reality, e-nose, touch pads and AI has helped businesses to

replicate the physical senses somewhat close to the original products. Further advancements in technology and AI will soon be able to collaborate with physical businesses and benefit from the potential presented by taste, smell, and touch in sensory marketing. With these questions arises: Can generative AI accurately replicate authentic sensory and emotional experiences in consumer interactions? Furthermore, can it craft marketing content that taps into sensory stimuli to evoke genuine emotions and influence consumer behavior effectively? The current paper summarizes the findings of studies that are using AI to replicate and measure online senses.

II. HUMAN-AI PERCEPTION AND PREDICTION

The physical body that is necessary for sensory experiences is absent from large language models (LLMs). Therefore, in order to learn from previous events, LLMs require on enormous amounts of training data. LLMs may be limited by this lack of embodiment as they may not be as precise or nuanced in their descriptions of sensory experiences as humans are, and their explanations may not have the same depth and genuineness.

The latest study on Human-AI perception alignment in sensory experiences investigates the alignment between Large Language Models (LLM) and human touch (8). For this, the authors designed and performed an experiment named" Guess What Textile?", during the experiment the participants were asked to describe the tactile difference between the textile samples to AI, which then attempted to identify the textiles. Results showed the similarity in the perceptions of Human and AI, but in some of the cases it varied like silk satin being a better identifier than others. This is the first study to explore AI's alignment with human touch perception revealing areas of improvement. All this can lead to more accurate and personalized marketing strategies.

Another similar kind of study has proposed a scalable and domain general method for predicting human similarity judgment between AI and Humans using large language models (LLM) (9) . The approach helps businesses in product recommendation and content generation in online sensory marketing by leveraging AI to analyze and predict human perception.

III. APPLICATION OF AI IN SENSORY MARKETING

Machine learning can be used to predict the sensory responses using non sensory data like chemical and physicochemical measurements, which reduces reliance on human tastes for sensory evaluation [6]. Like Ribeiro et (10) in his study used Random Forest to predict acceptance, ideal sweetness, acidity and succulence based on chemical and physicochemical measurements.

Computer vision and robotics AI can be used to assess food quality by processing images or videos to predict product quality parameters (11) . To predict the senses correctly technologies like e-nose are coupled with machine learning. AI also assists in developing new products, quality control and understanding consumer perception (12).

To improve the consumer's online experience, there is a need of assessing or evaluating online sensory experiences. Traditionally, assessment of the sensory experiences online was a tedious and time taking job as it was done manually and often subjective. (13) in his study tries to bridge this gap by introducing Online Sensory Marketing Index (OSMI). It integrates various AI techniques including Natural Language Processing and Machine Learning to automate the evaluation process (14) . A field study was conducted by the authors analyzing sixteen different websites such as technology, automotive, fashion and food using online sensory marketing index to measure the sensory elements. It was found in the study that automated assessments closely

matched with manual evaluations.

IV. FUTURE RESEARCH IN AI AND SENSORY STUDIES

Delivering immersive experiences online to the consumers of e-commerce is a topmost priority of business. As the level of involvement helps in the decision-making process, it becomes necessary for businesses to provide enhanced online stimuli. Past studies have shown that the integration of AI into online sensory experiences has a significant potential for enhancing consumer interactions which pave a path for future researchers in the direction of developing multi-modal AI systems that combine visual, auditory and tactile input to create cross modal and immersive experiences. These technologies can mimic sensory experiences such as virtual food tasting, by utilizing computer vision with natural language processing and machine learning. This allows businesses to create immersive experiences for customers to engage them. For example, AI can be used to create comprehensive visual and descriptive feedback that mimics the experience of trying various cuisines online, offering a more fulfilling and deeper user experiences [6].

Personalization is another important aspect that can be used to engage customers. With advancements of AI and use of it in personalization of products for e-commerce has been increasing. Future researchers should focus on utilizing AI in tailoring these experiences based on individual consumer preferences and behaviors. Analyzing past purchase history and sensory feedback, machine learning and large language models can predict consumer preferences for specific textures, flavors and other sensory attributes, ensuring that the experience is highly relevant and engaging for each customer. Tailored sensory experiences may promote better engagement and loyalty delivering a competitive edge in the digital marketplace. This tailored approach not only boosts user happiness but also establishes a closer connection between customer and the brand (9) .

It is also possible to greatly improve the realism and interactivity of online sensory experiences by combining AI with VR and AR technology. With AI, these experiences may be enhanced by dynamically and engagingly constructing virtual worlds that adapt in real time based on human interactions.

With a level of realism that surpasses typical online interactions, this combination may imitate many sensory experiences and give users a sense of presence and immersion. AI is also capable of analyzing biometric data to determine the emotional reactions of customers, enabling real-time adjustments that improve customer happiness. These developments will, all things considered, make it possible to create online sensory experiences that are more emotionally compelling, individualized, and interactive, raising the bar for customer interactions in the digital age.

REFERENCES

1. Krishna A. An integrative review of sensory marketing: Engaging the senses to affect perception, judgment and behavior. Journal of Consumer Psychology. 2012 Jul 1;22(3):332–51.

2. Gonzalez Viejo C, Torrico DD, Dunshea FR, Fuentes S. Emerging technologies based on artificial intelligence to assess the quality and consumer preference of beverages. Beverages. 2019;5(4):62.

3. Huang MH, Rust RT. Artificial intelligence in service. Journal of service research. 2018;21(2):155–72.

4. Libai B, Bart Y, Gensler S, Hofacker CF, Kaplan A, Kötterheinrich K, et al. Brave new world? On AI and the management of customer relationships. Journal of Interactive Marketing. 2020;51(1):44–56.

5. Ma L, Sun B. Machine learning and AI in marketing–Connecting computing power to human insights. International Journal of Research in Marketing. 2020;37(3):481–504.

6. Davenport T, Guha A, Grewal D, Bressgott T. How artificial intelligence will change the future of marketing. Journal of the Academy of Marketing Science. 2020;48:24–42.

7. Petit O, Velasco C, Spence C. Digital Sensory Marketing: Integrating New Technologies Into Multisensory Online Experience. Journal of Interactive Marketing. 2019 Feb;45:42–61.

8. Zhong S, Gatti E, Cho Y, Obrist M. Exploring Human-AI Perception Alignment in Sensory Experiences: Do LLMs Understand Textile Hand? arXiv preprint arXiv:240606587. 2024;

9. Marjieh R, Van Rijn P, Sucholutsky I, Sumers TR, Lee H, Griffiths TL, et al. Words are all you need? Language as an approximation for human similarity judgments. arXiv preprint arXiv:220604105. 2022;

10. Ribeiro MN, Carvalho IA, Ferreira DD, Pinheiro ACM. A comparison of machine learning algorithms for predicting consumer responses based on physical, chemical, and physical–chemical data of fruits. Journal of Sensory Studies. 2022;37(3):e12738.

11. Dewi CK, Mohaidin Z, Murshid MA. Determinants of online purchase intention: a PLS-SEM approach: evidence from Indonesia. Journal of asia business studies. 2020;14(3):281–306.

12. Viejo CG, Fuentes S, Godbole A, Widdicombe B, Unnithan RR. Development of a low-cost e-nose to assess aroma profiles: An artificial intelligence application to assess beer quality. Sensors and Actuators B: Chemical. 2020;308:127688.

13. Hamacher K, Buchkremer R. The Application of Artificial Intelligence to Automate Sensory Assessments Combining Pretrained Transformers with Word Embedding Based on the Online Sensory Marketing Index. Computers. 2022;11(9):129.

14. Hamacher K, Buchkremer R. Measuring online sensory consumer experience: introducing the Online Sensory Marketing Index (OSMI) as a structural modeling approach. Journal of Theoretical and Applied Electronic Commerce Research. 2022;17(2):751–72.