

ROLE OF ARTIFICIAL INTELLIGENCE IN ANALYZING EMOTIONS

Pratik Puprediwar^{1*}, Dr Poornima Tapas²

^{1*}*Symbiosis International University Pune, India*

²*Symbiosis Institute of Business Management Pune, India*

pratikpuprediwar@yahoo.co.in¹
poornimatapas@sibmpune.edu.in²

Abstract— Automotive companies' endeavor is to make digital interfaces, products and advertisements more customer friendly and attractive. Traditional market research methods collect stated responses from customers but have limitations in decoding real emotions. Neuroscience used in performing market research is Neuromarketing. Artificial intelligence (AI) can integrate neuroscience and marketing to understand customer emotions by decoding brain activity and physical reaction to marketing stimuli. This study attempts to bridge the research gap where limited research has been conducted to understand how AI is applied in market research in automotive industry to analyze customer emotions. Study outcomes will help market research agencies to use AI effectively to understand customers. Qualitative research was conducted among Automotive companies and Market Research companies who provide Neuromarketing solutions. For testing product designs, digital interfaces like websites, marketing content Neuromarketing methods were used by a few automotive companies. This study unearthed potential of AI to overcome certain barriers of Neuromarketing like small sample size, longer time to complete the study and being expensive compared to traditional research methods. AI can help cover more sample size, take a shorter time of analysis /reporting and be more economical as compared to manual Neuromarketing. AI can decode emotions via analyzing data from Eye tracking, EEG and facial coding to conduct market research more efficiently.

Keywords—Artificial Intelligence, Emotions, Neuroscience, Automotive

I. INTRODUCTION

A. *Neuromarketing*

Neuromarketing was familiarized by Ale Smidts more than two decades back. Though at the nascent stage, it has been grabbing interest in industry and academia (Fischer et al., 2010). When market research is conducted using Neuroscience tools it is termed as Neuromarketing. These tools are Eye tracking (ET), electroencephalography (EEG), Functional magnetic resonance imaging (fMRI), Facial coding, Skin Conductance, etc. Use of Neuromarketing has been slowly increasing as it captures unbiased insights into the customer's emotions as compared to the traditional methods (Kumar & Singh, 2015). Emotions form the base of judgement and actions of customers whether it is an advertisement, product design, website or an app.

B. *Gap in academic research and industry application*

Majority of studies on Neuromarketing have taken place in academia as compared to its actual application in the industry. Multiple times it has been conveyed to improve this academia-industry partnership (Lin et al., 2018). Needs of the industry are diverse; hence, it is critical to study actual application Neuromarketing and scope of improvement from industry point of view (Baños, et al., 2020). It is claimed that Neuromarketing collects unbiased information about the customers' emotions as compared to the traditional methods (Kumar & Singh, 2015). This study attempts to bridge the research gap where limited research has been conducted to understand how AI is applied in the market research industry (Pluta & Szulga,2022).

C. *Role of emotions in Automotive Industry*

The automotive industry is one of the biggest industries globally. India is ranked 4th globally in the automotive sector (NITI Aayog, 2025). Indian automotive industry is advancing with the entrance of new brands and technologies like alternate fuels, safety features like ADAS, etc. (Puprediwar & Tapas, 2024). Automotive players conduct various market research to test products, advertisements

and user experience of their website, apps, etc. Emotions play an important role in the entire purchase journey of the customers. Hence authors have studied the role of AI in understanding emotions through market research in the Automotive sector.

D. AI (Artificial Intelligence)

AI is an emerging technology which is an intelligent system trained, based on large database, to learn, reason and communicate. AI can understand emotions and predict customer choices with notable accuracy. (Šola, et al.,2024). AI can lead NeuroAI to predict customer behavior and responses. AI can significantly aid market research to understand human emotions with the use of neuromarketing. It integrates neuroscience and marketing to know customer conduct by decoding brain activity and physical reaction to marketing stimuli.

E. Study Objectives

- To assess the usage of current market research practices in Neuromarketing by Automotive companies
- Understand the barriers to adoption of Neuromarketing
- Unearth the role of AI in understanding emotion through market research studies using Neuroscience

II. LITERATURE REVIEW

Literature review was performed using the Scopus database by the means of PRISMA framework (Nazir & Das, 2025). Search performed using keywords AI and Neuromarketing resulted into 63 documents. The interest in this topic has surged in 2024. Top countries where this research has happened are India, UK and US. Top 3 subject areas are Computer science, Business Management and Economics. With filter of Open access, English Article, conference paper and conference review, total 17 documents were retrieved. Most of the documents covered sectors like tourism, media & entertainment, education. They focused on how AI is used in digital marketing and combined with Neuromarketing. Very few papers have been written on how AI can overcome the barriers of Neuromarketing by analysing emotions. Also limited research has been done to understand the point of view of Automotive companies and market research companies on this topic. This exploratory paper tries to bridge the gap of limited research on how AI can analyse emotions and overcome the barriers of Neuromarketing.

III. RESEARCH METHODOLOGY

Qualitative method is followed to study the role of AI in Neuromarketing. Stratified sampling technique was used to approach participants. The strata were manufacturers of four wheelers, two wheelers, commercial vehicles and tractors. 12 in-depth discussions with Marketing and Market Research professionals from Automotive companies were held to understand the current adoption of Neuromarketing. Out of 12, 4 companies manufacture four wheelers, 4 two wheelers, 2 commercial vehicles and 2 tractors. 4 in-depth discussions were also conducted with Market research companies providing Neuromarketing solutions to understand the role of AI in analyzing emotions. All the interviews were recorded, transcribed and data was analyzed.

Table 1 – Participants from Automotive Companies

Manufacturer	Role in Automotive Company	Size of the company
Four wheelers	Market Research Department	Large
Four wheelers	Marketing Department	Medium

Manufacturer	Role in Automotive Company	Size of the company
Four wheelers	Marketing Department	Medium
Four wheelers	Product Design	Large
Two wheelers	Market Research Department	Small
Two wheelers	Marketing Department	Medium
Two wheelers	Product Design	Large
Two wheelers	Market Research Department	Medium
Commercial Vehicle	Market Research Department	Large
Commercial Vehicle	Marketing Department	Medium
Tractor	Market Research Department	Medium
Tractor	Marketing Department	Small

Source – Author Own Compilation

Table 2 – Market Research Company

Multinational / Indian	Role in Automotive Company	Size of the company
Multinational	Marketing of Neuroscience	Large
Multinational	Neuroscientist	Large
Indian	Marketing of Neuroscience	Medium
Indian	Neuroscientist	Small

IV. RESULTS

A. Usage of Neuromarketing by Automotive Companies

Discussion with Automotive players revealed that less than half of them have used Neuromarketing in market research. Those who have used Neuromarketing have done studies to test advertisements, vehicle designs and UX testing of website / apps. Top barriers identified through literature review and discussion with automotive companies are small sample size, longer time to complete the study and being expensive compared to traditional research methods. Details of barriers to adoption of Neuromarketing are given in table 1 below.

Table 3 - Barriers of adoption of Neuromarketing

Barriers	Explanation	Source
Ethics	Many researchers have raised concerns about ethical standards in Consumer Neuroscience	Lim, 2018
Not mobile	As most of the research happens in a lab setup, it is not mobile and can't go where consumers are based	Lim, 2018
Time consuming	In the era where fast turnaround is needed, neuroscience methods need more time to collect, process and present data	Panwar, 2020
Expensive	Equipment like EEG and FMRI are expensive and complex	De Oliveira, 2014, Alsharif et

Barriers	Explanation	Source
		al., 2023
Lower Sample	Consumer Neuroscience studies have smaller samples and hence, there are concerns about the size of samples and limited representativeness.	Meyerding & Mehlhose, 2020
Black Box	Research companies don't divulge the exact process of analysis of the neuromarketing data. Hence, brands conducting market research term it as black box	Brenninkmeijer et al., 2019
Preference towards traditional methods	Brands don't wish to take risks and are more comfortable with tried and tested traditional methods	Baños, et al, 2020
Correlational evidence but not causal evidence	Neuromarketing explains the understanding of consumers' brain, not consumer behavior	Cherubino et al., 2019
Lack of Expertise / Complex	As it is highly technical and complex, it needs neuro experts to explain	Alsharif et al., 2023

Source – Literature review and in-depth interviews

Neuroscience in market research also has many advantages over traditional research. The details of the drivers of using Neuromarketing are as follows:

Table 4 - Driver of adoption of Neuromarketing

Drivers	Explanation	Source
Real Time	Consumer Neuroscience techniques capture and understand the responses to a stimulus in real time by understanding the response of unconscious mind	Khushaba et al., 2012
Overcome limitations of traditional Methods	Traditional methods have limitations on providing more details about consumer mindset. The development in Consumer Neuroscience can help us understand the same	Singh & Jain, 2018
No Interviewer Bias	Many participants tend to give biased responses or don't open-up in front of the interviewer in traditional methods. In Consumer Neuroscience techniques there are no interviewers, response is passively collected	Cherubino et al., 2019
High Predictability	Consumer Neuroscience doesn't just stop at understanding the preference of the consumer, it also predicts their purchase	Çakir et al., 2018
Pure Response	Consumer Neuroscience can capture pure, unfiltered, and unbiased response from the unconscious mind	Page, G. 2012
Purchase Decision	Consumer Neuroscience can help to understand the purchase decision making process in a better way	Bhardwaj et al., 2023

Source – Literature review

Usage of AI analysing emotions in Neuromarketing

Our discussion with Research Companies revealed that they have slowly started using AI in Neuromarketing by decoding emotions. This has helped them to collect responses from large sample sizes, make the analysis faster and make it economical. It was unearthed from discussion with

research companies about how AI is being used with various Neuromarketing tools to help automotive companies understand customer emotional and rationale response. Details are explained below:

Facial Coding

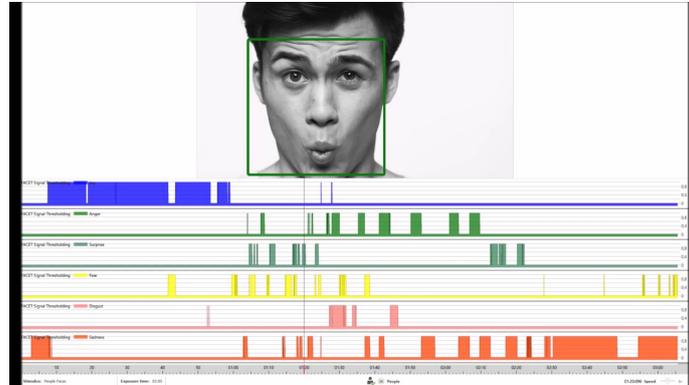
One of the research companies interviewed mentioned they have used AI in Facial coding. This was used to test the car company advertisement. The Facial Action Coding System (FACS) (Niinuma et al. 2021) is used to annotate almost all facial actions. FACS analyses shape and appearance modifications due to facial muscles and soft tissues. The AI model is trained to decode the facial expression for an advertisement. It is done through software that uses computer vision and deep learning. It is based on 5 billion facial frames, across 90 countries, and 11 million faces coding system (Kantar, 2025). It analyses facial expressions like expressiveness, brow furrow, smile, surprise, etc. It can infer subconscious response very quickly in hours as compared to traditional manual neuromarketing methods which take at least a week's time. The final output is to understand the efficiency of the advertisement and its areas of improvement. Computer vision model is used to label the response to create a dataset for a model to learn. A questionnaire online link is sent to the participants. They go through the advertisement to be tested. With prior permission, the camera of the laptop or mobile device is enabled on which survey is taken. It reads the facial expressions and compares them with databases to give results of the customer response. It can overcome the limitations of sample size of manual Neuromarketing as this survey can be sent to hundreds and thousands of customers at one time as compared to manual neuromarketing which has sample of 30-60. (thelightbulb.ai, 2025).

Fig 1 - Facial coding system



Source – EIA Group 2024

Fig 2 - Facial coding analysis illustration



Source - pazarlamasyon.com

Eye Tracking

Another research company mentioned they are making use of Generative Adversarial Networks (GANs) and SP-EyeGAN, that matches actual human eye patterns. The training of AI models is done on a large dataset of past studies on eye tracking. The research company has used this technique to test car design. The new car design is tested against the large dataset for eye fixation and gaze resulting in the hot spots as shown in illustrative example below. This output was used by the car company to complement it with traditional market research techniques like qualitative in-depth discussions to get further feedback on specific elements of the design. (InstantEyeTracking.com). This saves time and money against manual way of conducting eye tracking study where the participants are asked to wear goggles and then the output is generated.

Figure 3 – Eye Tracking



Source - <https://instanteyetracking.com/>

Figure 4 – Eye Tracking Setup

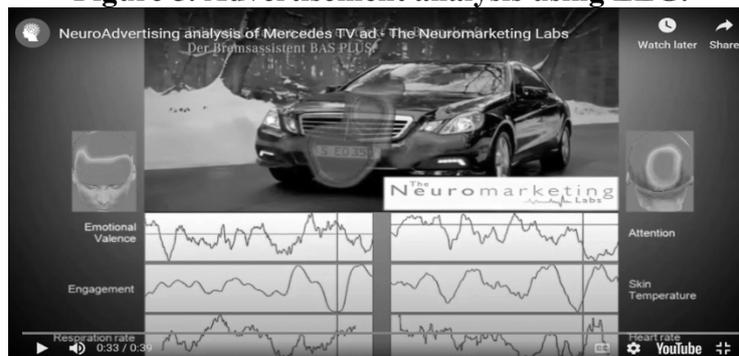


Source - https://www.researchgate.net/figure/Eyes-Tracking-Equipment_fig12_233810394

EEG

Artificial Intelligence was used by a research company to analyze the results of EEG to test the advertisement commercial for a car company. EEG captures various emotions of the customers like happiness, fear, excitement, boredom, etc. They made the use of The Brain Imaging Data Structure (BIDS). BIDS is a process for organizing neuroimaging data. The BIDS process enables application of AI models. (Whelan & Lemaître 2025). This eliminates the dependence on neuroscientists to analyze the data and report it. Hence, it helps in reducing the time for analysis and reporting the emotional response. The illustrative example is given below

Figure 5. Advertisement analysis using EEG.



Source - Pinterest (2014)

V. Implications

Through this qualitative study, various barriers of neuroscience in market research were unearthed from discussion with the automotive companies and literature review. It was also understood that emotions play a very important role in reacting to any marketing stimuli. Discussions with market research revealed that AI can be used to analyze these emotions to get response for advisement or testing a product design. Research companies can use AI in conducting various market research studies to capture and analyze emotions using neuroscience tools. This will help to make the process faster, cover larger sample size and make it economical. This can further increase the adoption of neuromarketing and help automotive companies understand the customer response in a better way.

Learning from this study can be useful to market research companies to understand the barriers of adoption of Neuromarketing and use of AI. Use of AI will also make the research study conducted by automotive companies more economical, reach larger sample and complete the study much faster. Automotive companies can go beyond traditional research methods and use AI in Neuromarketing to understand emotions of the customer better. This can result in making better product designs, advertisements and digital interfaces like websites and apps.

V. CONCLUSION

This study attempts to overcome the research gap where limited research has been conducted to understand how AI is applied in analyzing emotions in market research. Also, most of the research in the past has been done in academic domain. This research takes the viewpoints of automotive companies and market research companies. Hence this will lead to strengthening the industry-academia partnership. Qualitative research was conducted among Automotive companies and Market Research companies, providing Neuromarketing solutions. For testing product designs, digital interfaces like websites and marketing content, Neuromarketing methods were used by automotive companies. This study unearthed potential of AI to overcome the barriers of Neuromarketing. This research also unveils that AI is playing a significant role in output of EEG, facial coding and eye tracking. This should be used by Automotive companies to test product designs, their digital interfaces and advertisement commercials. It can make the study economical, give faster results and cover more sample size. Market research companies and associations like ESOMAR and NMSBA should promote the same through webinars and conferences. In future, comparative study using the output of manual research and AI led research should be done and its accuracy validated.

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