Neuromarketing

Abstract

In any business scenario before launching any commercial entity the first step is to realize the conceptual model and simulate it to gauge its performance in the market. Consumers judge products not only on the basis of its ergonomics but also on its aesthetic appeal. They might not be aware of this but subconsciously the product's "Look & Feel" plays a dominant role in deciding user's inclination towards it.

Hence it becomes really essential to collect feedback about the effectiveness of the same from a group of subjects before introducing it into the competitive market. Traditionally, this has been done via a variety of ways like being oral feedback and questionnaires. These methods have two serious shortcomings. Firstly, There is no way to determine the credibility of the response, the person consciously or unconsciously might register a biased response.(Pepsi V/S Coca Cola). Secondly, only a limited amount of information can be extracted from the subject for responding in a certain fashion.

To address the above shortcomings we are proposing the study of user's ERP data while they analyze the pictures of popular commercial products and determine whether the products appeals to them. We will be segmenting their EEG waveform into 2 second windows and look for a spike (N31) when the decision is made. Using this data a model will be formulated that can cluster user preferences based on their EEG waveform automatically thereby reducing the amount of error in feedback, further generating more insights about the user's behavior to a specific product.

Introduction

A brand is the personality that identifies a product. Brands like Coca Cola, Ford, or Chanel are deeply embedded in our lives, and companies struggle hard to develop their brands and to provide a unique selling proposition. In most markets, there are competitors selling fake-name products which try to gain a share of the business. A central question in marketing research is therefore to what extent positive attitudes towards brands contribute to consumer decisions. If we ask people questions, they are not always accurate. Sometimes they lie. If we ask them about weight or income, they may feel embarrassed to be truthful. Or they lie to themselves, buying clothes for a skinnier version of who they are. To get around that, we use tools like EEGs and fMRIs to observe the brain activity of people as they react to films and

commercials, measuring what happen when they positively engage with content, or negatively. Interview statements and verbal self-reports may provide some information but they are notoriously insensitive with regard to the consumer's decision. Moreover, they are insensitive to implicit associations that are linked to unconscious automatic attitudes. Brands are thought to implicitly engage specific positive associations (e.g., quality, value, youth, strength, speed, etc.) which are not triggered by fake-name products. Such implicit associations may be critical for the consumer's decision to buy.

Neuroimaging studies have demonstrated activations of reward related structures such as the striatum and the dorsolateral prefrontal cortex in response to stimuli representing brand products. Thus, brands seem to have an implicitly rewarding property. Moreover brands, in particular luxury brands, may also be used to mark the social status of the owner and indeed logos of luxury brands were associated with brain activity in the anterior medial prefrontal cortex, a region known to be associated with self-centered cognitions.

EEG is a rather old technology in neurology but is still considered a good way to measure brain activity. The cells responsible for the biological basis of our cognitive responses are called neurons. We have over 100 billion neurons and trillions of synaptic connections which represent the basis of neural circuitry. In the presence of a particular stimulus like a piece of advertising, neurons fire and produce a tiny electrical current that can be amplified. These electrical currents have multiple patterns of frequencies called brainwaves which are associated with different states of arousal. When EEG is used for a marketing research experiment, electrodes are placed on the scalp of a test subject, typically by using a helmet or a band. Brainwaves can be recorded at very small time intervals. Some of the new EEG bands can record up to 10,000 times per second. This is valuable considering the speed at which we acquire information through our senses and the speed of our thoughts.

In our study we record EEG data data to process and get ERP. The aim of our study is bipartite:

- To cluster the subjects based on their ERP data while they analyze the pictures of popular commercial products and determine whether it appeals to them or not and analyze their brain activity during this decision making process.
- To analyse the inter cluster relationships between the ERPs for example different clusters like Fake Like-Fake Dislike or Real Like-Real Dislike will be

taken into consideration.

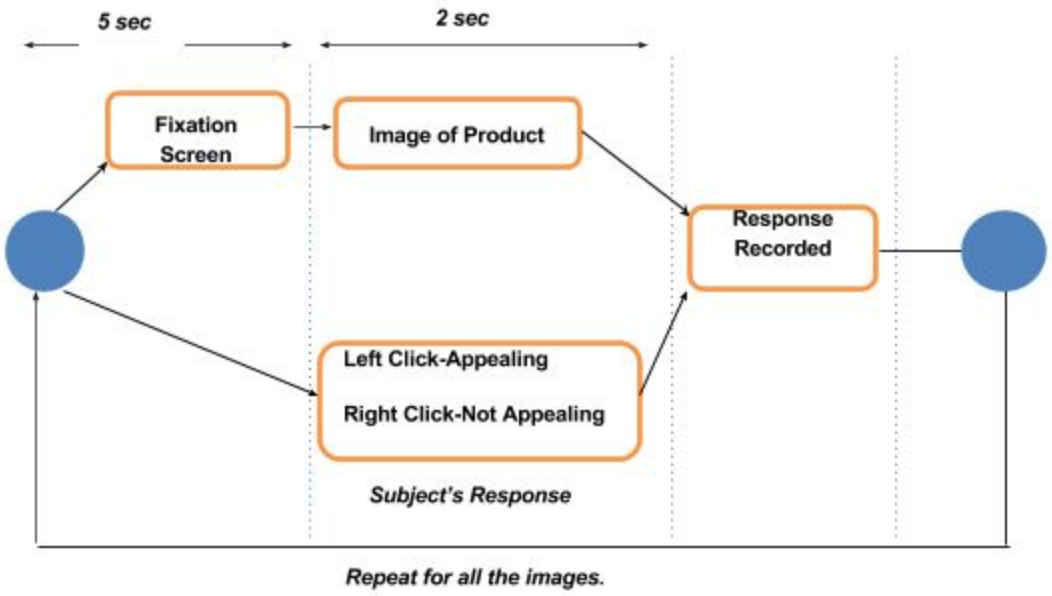
Related Work

We begin by recording the ERP data of various subjects and segmenting them into Real Like, Real Dislike, Fake Like and Fake Dislike.
The data that we get is essentially in the form on MxN matrix, where 1<=M<=32 (Electrodes) and N is basically the time slices that are under consideration. We receive the following MxN matrices for each cluster. Now we need to employ suitable statistical measures to combine these different matrices from each cluster to get something like a representative matrix.
So we need to basically preprocess the data in before we can analyse it. After the preprocessing and removal of noises we can select the suitable channels relevant to us and then we can analyse their respective plots to not only classify the newer ERPs coming but also to establish a relationship between different clusters as well.

Methodology

Experimental setup

The subject will be shown a set of predetermined images in a random fashion and their responses (Appeal/Does not appeal) will be logged. The image set has 1:3 mix of fake to real products. There are 2 pauses of 1 min each during the whole experiment at equal intervals.



Analytics

From the above experiment, we will obtain following 4 categories of data:

1. Real Like
2. Real Dislike
3. Fake Like
4. Fake Dislike

Now to begin clustering the response on these 4 areas we will follow the below procedure:

- Selecting the channels (out of 32) which are most appropriate for our study.
- Segmenting the ERP waveform into small segments to encapsulate the brain wave pattern around the response registration process.
- Extracting the features from the ERP signal to categorize responses into

the above 4 clusters.

- Formulating a model that will be predicting the user's response towards a product by analyzing their ERP waveform.

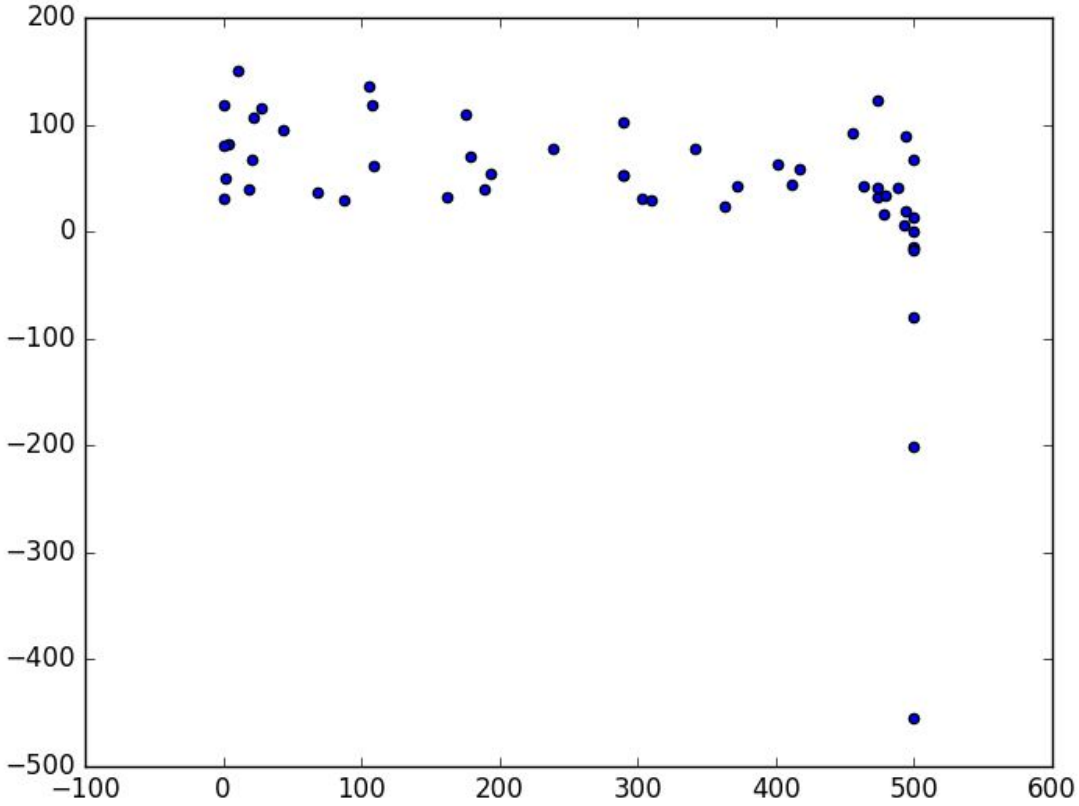
To cluster the user's response we right now have identified some key features based on the frequency domain analysis of the EEG signals. The EEG signal is composed primarily of these 4 brain waves:

- Delta
- Theta
- Alpha
- Beta

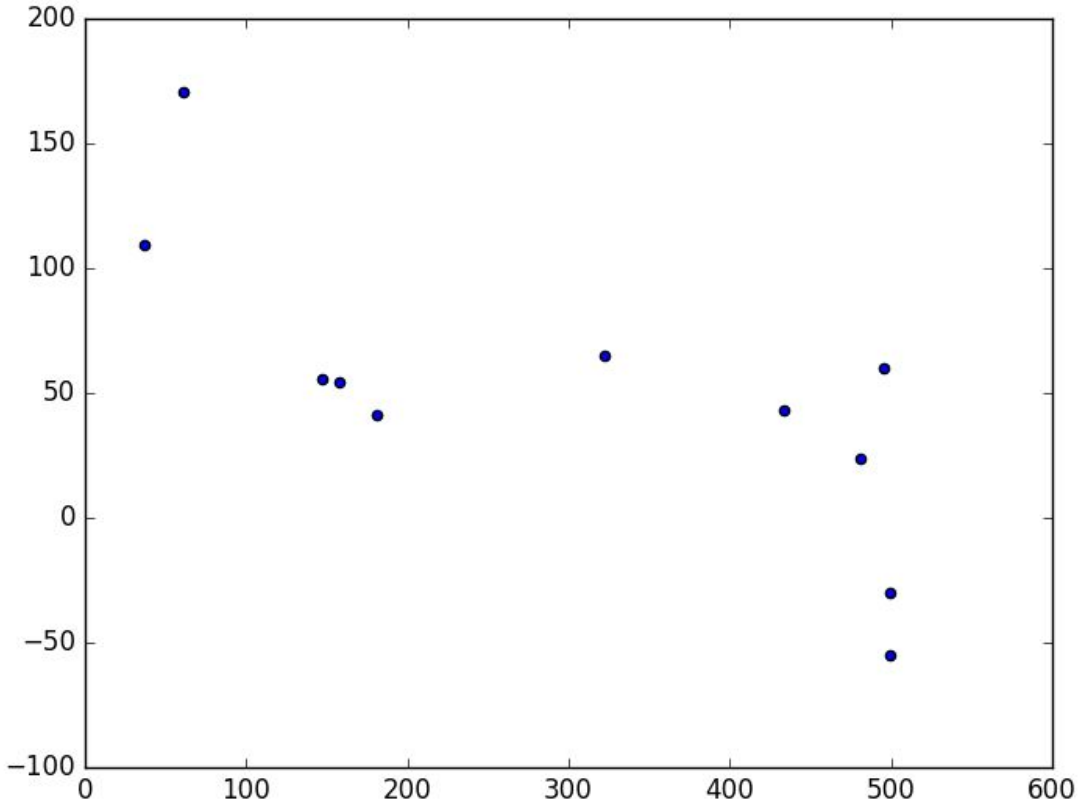
Each small segment that we will analyze will have certain percentage of these waves. So we will try to extract the characteristics of these features on each of the 4 clusters to predict the position of the new response in the suitable group.

Also to establish the correlation between different clusters we analysed the clusters using averaging techniques and visualising the plots obtained.So here we aim at finding the maxima for each individual cluster and theoretically it should occur more or less at the same time position.So below are the plots of maximas for each cluster:

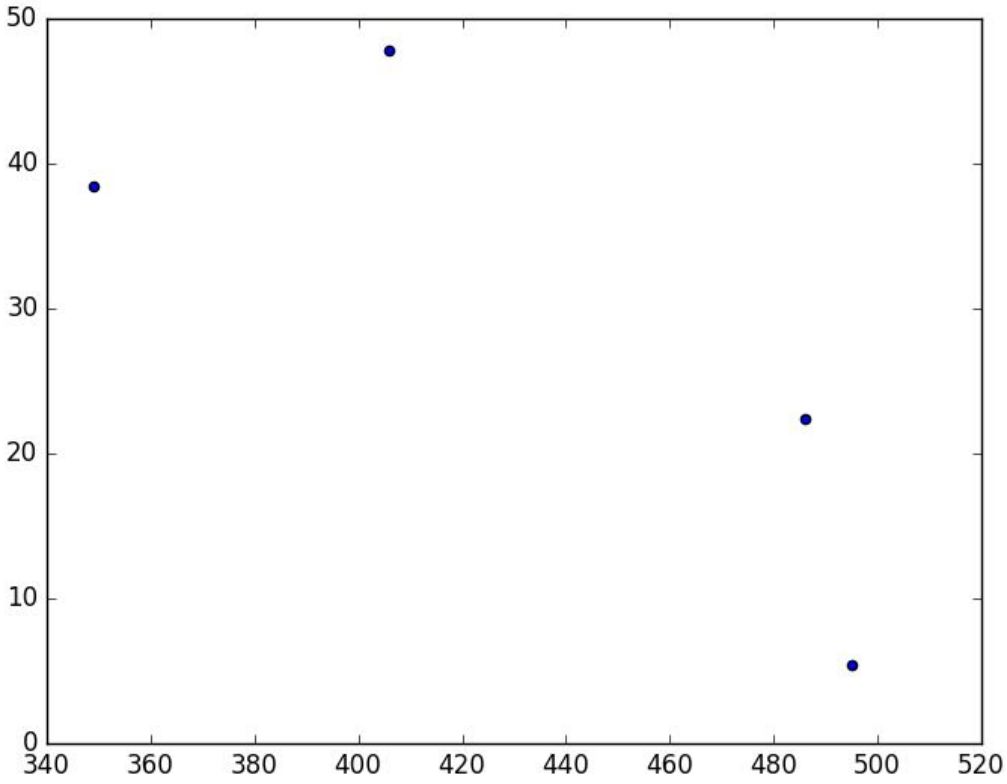
1. Real Like



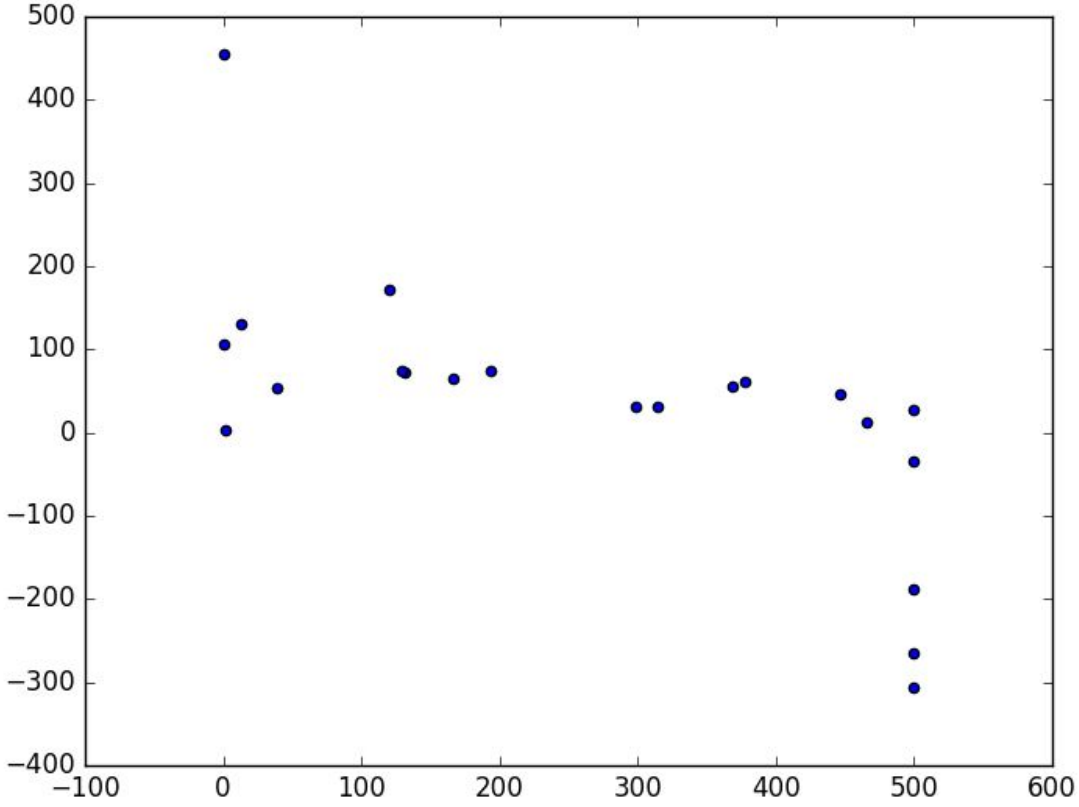
2. Real Dislike



3.Fake Like



4. Fake Dislike



But we see that the plots of the maxima that we obtained are not with the agreements with our hypothesis as the maximas are scattered throughout the timeline rather than being localised to a specific region as expected theoretically. Hence we need more preprocessing in order to spot the trend.

Future Work

We are using Matlab combined with the plugins EEGLAB and ERPLAB since these tools have the inbuilt data preprocessing capability. We will be calculating **Grand average ERP** from here and that will give us the relationships between different clusters directly.

References

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