Advertisement Analysis System: Mining the connection between users' emotions and decisions

Teng Hu
Computer Science Department
Unviersity of San Francisco
San Francisco, CA 94117, USA
thu4@usfca.edu

Abstract

For people's common senses and most economists thoughts, standing by William James Adams's paper on *Economic Journal* (1977), advertisements create a considerable profit and competitiveness for a company or organization [1]. And, for data scientists or economists, the appealing topic is how to make advertising strategies more successful that customers will generate or increase their inclinations of purchasing of products. For this question, Hansen suggests that the clients' emotions while watching advertisements shall be significant and focused when data analysts evaluate an advertisement [4]. Then, under this consideration, Advertisement Analysis System is designed for collecting users' emotions by facial expressions and visualizing the received data with the most straightforward charts. Further, researchers would be more easily on exploring the connection between facial expressions and decisions of consumption from costumers. In general, the intention of this system is studying on the correlation between emotions and decision-making while customers are watching the advertisement.

Introduction

Since the popularization of household television, the form of advertising is evolving by this change into a more widespread and influential media for the public. Besides the powerful influence of advertisements to the customers, from the view

Some Terminologies

Demand Curve: On the economy, Demand curve stands for the relation between price and customers' demand. See details: http://www.investopedia.com/terms/d/demand-curve.asp

Monopolistic Competition: One of four basic market type, describing a hybrid market status consisting by both big companies and small business units. See details: http://www.investopedia.com/terms/m/monopolisticmarket.asp

EEG: abbrev. of Electroencephalogram. A device can detect the slight voice from muscle of brain to reflect the neural activities on the brain. See details: http://www.webmd.com/epilepsy/electroencephalogram-eeg-21508#1

Affectiva: A facial-expressions SDK built on MIT Lab. A highly accurate SDK on the field of facial-expressions http://www.affectiva.com/

of economy, ads product the considerable profit. When people talks about the ad on the economy, the most explicit way to support this idea is ads shift the demand curve facing a firm to augment the surplus in the monopolist's market [1]. And, in the monopolistic competition, ads always are utilized as a tool to enhance the influence of the entire market to dominate a greater proportion.

With the advertising comes to the bottleneck, customers lose their interesting and patience on watching advertisements. In one of the participants' words (a participant in the later study), "I feel weary while watching the ad because the content is dry and always unhelpful." Advertisements shall be more sensational and exciting to their audiences, instead of over-emphases on their products. As Sunil Erevelles, the Professor of Marketing in Belk College of Business, states, "Affective advertising should be more useful for 'feeling products' such as perfume" [3]. According to this theory, there is a high number of researchers diving on affecting advertising. In Soria and Alvarez's research reports in 2016, they implemented electroencephalography on studying brain neural oscillations and the change of participants' sentiment. By using Emotiv EPOC headset, an EEG device, they successfully built up the pattern of brain movement whether participants like or dislike for TV short video advertisements [6].

Base on the emergence of Affectiva, facial expressions detection is gradually developing and comes to an application stage for researchers and the industrial to implement on the researches and projects. And, Affectiva also is the primary external resource for this investigation and Advertisement Analysis System. In general, this study relates to Advertising and Affective Computing, which advertisements will influence people's intent and decision-making by evoking either positive or negative emotion. Social scientists, Burt and Strongman who have researched on advertising, passion, and donation, claimed "Advertisements that evoke negative emotions produce more and larger donations than those that evoke positive emotions, and the stronger the negative emotion is, the greater is the intention to donate" (2005) [2]. On the other hand, Empathy, emphasized by Kemp in the University of New Orleans, explains the mechanism of influence of advertising, which recapitulates the usage of emotions that shift human cognition with some unconscious ways [5]. Thus, the major problem of this study locates on whether emotions (empathy) affect people's intents, and which emotion is more effective in changing customers' attitudes.

Relative Works

Advertisements and System based on EGG

Soria Morillo, Alvarez-Garcia, and other researchers work on the affective computing on TV advertisements. They aim to recognize how brain activity responds during the visualization of short video ads using discrete classification techniques [6]. On the paper, there are abundant pictures to illustrate the connection between audiences' intentions and brain activities. And, according to the conclusion, there is 75% of accuracy on Ameva (the method they used in the study) to ANN method to predict customers' like of the advertisement.

Affectiva Youtube DEMO

Affectiva provides an developed demo to catch the emotion and the corresponding snapshot of the short film. The demo is great on exploring the funniest period of the entire video. It is neither a commercial product nor a scientific tool. But, it is a promising design for developers to refer and consider.

System Design

The system bases on the platform of HTTP5 and CSS3 which are the standard of the current web browsers. It combines with Affectiva and D3, and implement in this study as a tool for analyzing the customers' behaviors by affective computing. While users are watching the advertisement, Affectiva will collect the facial expression data and pass them to D3 for data visualization. Later, researchers can explore the relationship between users facial expression and decisions of consumption.

Framework of the System

The whole system is simply combined with four components: Login, Dashboard, Watch, and Data. On "Login", users only need enter a username to sign in (Data privacy are not promised on this design. But, the while experiment is under the strict supervision to prevent sensitive data leakage); On "Dashboard", users choose topics and watch the video; On "Watch", users can watch the video and the realtime fluctuating graph of the current facial expressions; On "Data", users can check the donut chart, line chart, and Lovheim collage that estimate the floating of facial expressions during the watching process. See **figure 1** for the whole architecture of the system.

Methodology

There are five steps for participants to carry out. The early evaluation was conducted by Advertisement Analysis System, where 4 participants are asked to watch the video while the system is recording and categories the data.

- On the first step, the researcher will announce the introduction and ask the will of participants for recording their facial expressions. Then, participants need to fill the consent sheet and get informed with the general description of the whole experiment.

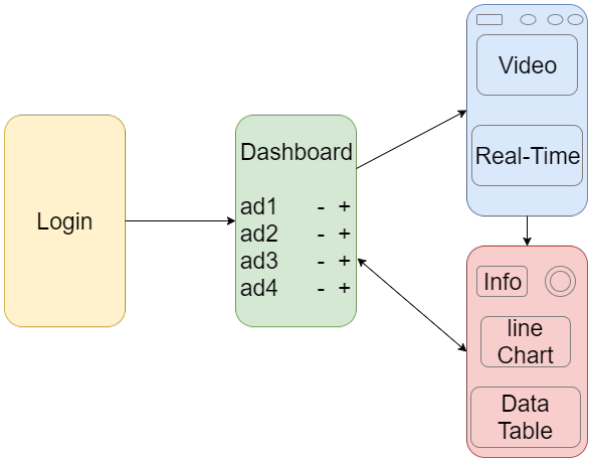

Figure 1: Four components of the system

- On the second step, researcher will relax participants and introduce the features of user interfaces.
- On the third step, researcher will leave for participants to watch the advertisement alone.
- On the fourth step, participants need to fill the video feedback survey for the advertisement they just watched, and researchers will discuss the result with participants by analyzing the data visualization. After the fourth phase, participants will repeat top two phase for the other advertisement.
- On the five step, participants will ask to fill the user experience survey and user identity survey for advance study.

See **figure 2** for the graph of methodology.

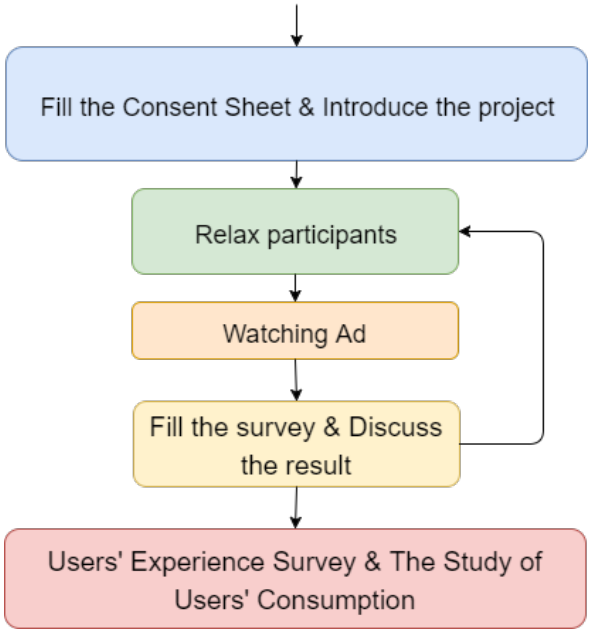

Figure 2: Five steps for the experiment

Figure 3: Participant is watching ad under the record

Figure 4: Researcher discusses the result with the participant

Data Analysis and evaluation

To study the outcome of the various data, two directions were made to organize the analysis. First, for a specific video, all participants' data were collected, and the researcher takes a vertical comparison between specific emotions and participants' subjective answer. Second, by passing all data to T-test, the researcher calculates T-stat and analyzes the outcome. For the efficiency of discussion, here are the necessary explanations for "q1", "q2", and "q3" on figure3 and figure 4

- q1: Do you like the video?
- q2: Will you buy or donate after watching ads?
- q3: Does this video affect your emotion?

Discoveries on the specific video

At this part, the researcher studies two videos:

- VID: DVdZ9KjQvIA, a comedy advertisement. More destails see:https://www.youtube.com/watch?v=DVdZ9KjQvIA
- VID: K9vFWA1rnWc, a moving advertisement. More destails see:https://www.youtube.com/watch?v=K9vFWA1rnWc

For the comedy advertisement, seeing figure 3, participants' joy and engagement are positive correlated. Also, participants who have a high value of joy and engagement have a more positive answer on the first question (total score is 6). So, there is a correspondence between joy, engagement, and like when people are watching advertisements. However, by comparing with participants' answers for question 1 and question 2, there is no sign to allude the connection between like and the intention of purchasing that is out of the prediction. Thus, I hold a further discussion with the participant, Junes, who graded six on question

	A	B	C	D	E	F	G	H
	email	video	joy	engagement	total	q1	q2	q3
	jraymond	DVdZ9KjQvIA	40	609	946	2	1	1
	Junes	DVdZ9KjQvIA	323	1224	3120	6	0	0
	wuyou	DVdZ9KjQvIA	0	115	3662	3	1	1
	jenny	DVdZ9KjQvIA	967	1319	1572	5	2	3

Figure 5: Data Collected based on the comedy ad

email	video	sad	disgust	contempt	total	q1	q2	q3
jraymond	K9vFWA1rnWc	0	81	1	725	5	3	4
Junes	K9vFWA1rnWc	2	0	35	1959	4	1	3
jenny	K9vFWA1rnWc	10	13	64	1871	5	3	3

Figure 6: Data Collected based on the moving ad

1 and 0 on question 2. He indicated that he likes the advertisement but does not think this product is his will list, which is a possible answer to explain this common situation for all participants. And. This point also was proved by the users' identity survey that all four participants confirmed that they are more rational while purchasing the products.

For the moving advertisement, seeing figure 4, participants have more negative facial expressions such as sadness and disgust and relatively high score on question 1, 2, and 3 than another advertisement. This outcome proves Burt and Strongman's argument on the influence of negative emotions that are more effective than positive emotions on changing customers' decisions [2]. According to the user's identity study, Jenny, the female participant, said that donating is an absolute idea when she watches this touching story. This point is proved by the modern theory of psychology that people will pay more attentions on getting rid of negative emotions than enjoying the pleasure. If a donation or buy some products which can help them feel better, they have a great motivation to process that.

Discoveries on the general performance

For analyzing the connection between participants' emotions and will to purchase or donate, I implement t-test to figure out the similarity between two means. By converting two groups of data into the form of percentage and assuming two groups are equal variances, then Excel calculated T-Stat with 1.905 which is greater than one-tail and smaller than two-tail (See figure 5). It indicates that there is not a convincing evidence to prove a significant different between two variables. Plus, the difference of two variances of two variable is not too much high. In the conclusion of this t-test, participants' emotions and wills to purchase or donate are to some extent connected. And, this outcome can be a credible evidence to support the prediction that participants' emotions are corresponding with their decisions to buy.

Further Work

This is the early stage of this system. The number of participants is too small to provide a small error interval for statistic study. Also, some data is inaccurate basing on the early version of the system that some threshold are regarded as too large for the experiment.

Further, we may provide more related data by other device like Empatica. Also, increasing the size of participants to narrow the error interval. And, basing on more users' study, more rational threshold can be implemented to increase the accuracy of this system.

Conclusion

The most impressive discovery is that human's facial expressions are far more than they thought. Most participants state that they have few facial expressions while watching TVs or ads. But on the users' study, I collect a considerable data by Affectiva. The interesting part is that most people are rational when they consider purchasing products, and

t-Test: Two-Sample Assuming Equal Variances

	Variable 1	*Variable 2*
Mean	5.6649	4
Variance	6.845058	8.421052632
Observations	20	20
Pooled Variance	7.633055	
Hypothesized Mea	0	
df	38	
t Stat	1.905632	
P(T<=t) one-tail	0.032142	
t Critical one-tail	1.685954	
P(T<=t) two-tail	0.064284	
t Critical two-tail	2.024394	

Figure 7: T-test for Question 1 and Question 2

advertisements can do few things on arousing their interests that they do not need in the recent days. However, when they face choosing one product from several similar products, they have more inclinations to determine what they saw on the video. That means advertisements change their selection while they are facing the selection of two or more similar products. Impressions enhanced by emotions while watching ad always is a conscious reason or an unconscious inclination to assist their selection. In the future, I will discover whether gender makes the influence of advertisement different.

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