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Impact of Machine Learning On Targeted Advertisement

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Abstract—Ad targeting is a technique of advertisement where specific ads are placed in some specific areas of the screen to increase the chances of the ads to be clicked by the users. These ads are based on the user's past engagement with the website. Targeted ads target specific customer groups based on the demographics, psychographics, behavior and user experience that is learned usually through data produced by users themselves.In targeted advertisement, machine learning helps to essentially replicate the way the brain of the user or buyer works as software to make the same optimizations as a user or buyer would do in real life situation. Moreover, the system learns over time from different variables and then generates more accurate results as it works with new advertisements, making correlations that are tough for the human brain to detect.

Index Terms— machine learning, ad targeting, advertisements.

I. INTRODUCTION

Today, advertisement plays a crucial role in almost every business in the industry. Instead of investing a lot of money on the advertisements for all the users, advertisers have now adopted the technique of targeted advertisements. The technique of targeted advertisement focuses on displaying some specific advertisements to a specific group of customers. Though the effectiveness of targeting a small portion of customers for advertising has long been recognized by many businesses then also many websites today, are flooded with irrelevant and useless advertisements and offers, which most of the time results in vexation of the customer. If advertisements recommendation process to users, which they find suitable, could somehow be improved, it would open a pool of new opportunities for businesses, and increase customer retention.

Machine learning is used to perform advertisement optimization, mainly because of the synchronous availability of massive set of data on consumer behavior, data on the brand-specific actions of consumers and the ability to make advertising decisions and deliver advertisements in real time. The rapid growth of social networks has led to abundant availability in customers preferences. Almost all users shares everything online, be it their preferences in food, places, products, gadgets or in clothes over various social networks on a regular basis. These data sets can be used to serve the customers in a better way and display only those advertisements which they might be happy to see. This could also motivate a certain group of people to buy the product and could save a huge ton of money that advertising companies spend on their users.

The approach here is to combine thetechniques of ad analysis and user requirement analysis in order to create a system that would direct specific and meaningful advertisements to a particular group of people.Moreover, facial features that can extract user's age, sex and complexion etc. can be used to improvise the way ads are shown to the costumer.

II. PRESENT TECHNIQUES AND RELATED WORK

A. Analyzing the advertisement

The approach here is to analyze the advertisement instead of the user data and present it to the user group. The process of recognizing the context of the advertisement begins with extracting the audio and video from the advertisement. The first and foremost step is the extraction of the frames which is done by trimming the last few frames of the video. To make sure that the frames are not duplicate, hashes are maintained and then stored. Then speech recognition algorithm is fed with the extracted audio. Both processes will return the words recognized from the two inputs namely video input and audio input. Keywords extracted from frames might be words that are in the frames, or words that describe the objects in the frame, similarly from the audio input it would be the words that are recognized. Here only English language is concerned. These words would then be fed to another machine learning algorithm which is a text analyzer**.** Figure 1 shows the backend architecture

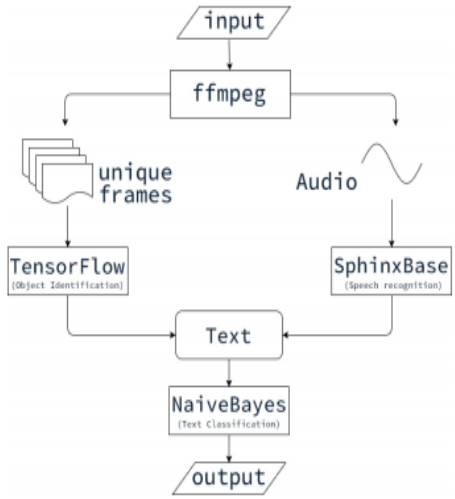

Figure 1. The Backend Architecture

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B. Analysing the user data

The approach here is to collect user data in various forms and then analyze to categorize the users into different groups accordingly. Advertisers collect customer's information via various methods. The purpose of collecting the user data is to create customer's profile. The advertisers group their customers into different groups according to their preferences. The advertisers then tailor the ads on the basis of the user specifications and display the ads which match the data

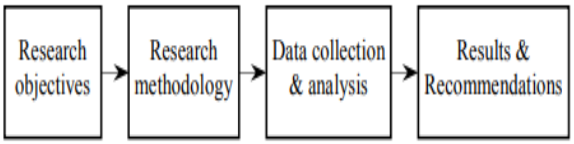

Figure 2. Consumer market research process

B.1.Targeted Advertisement agent

A seller can learn about its customers by monitoring how they use the website. The databases as well as the tools for data mining are used to classify customer segments. This helps the seller to understand the need of the user on the bases of their personalized choices. Figure 3 gives the model of targeted advertising agents where constructing the user profile and deciding the targeted users are two important tasks to do. Other agents are added to provide some help if the advertising agent needs that. In figure 3, p and c denotes profit and cost respectively

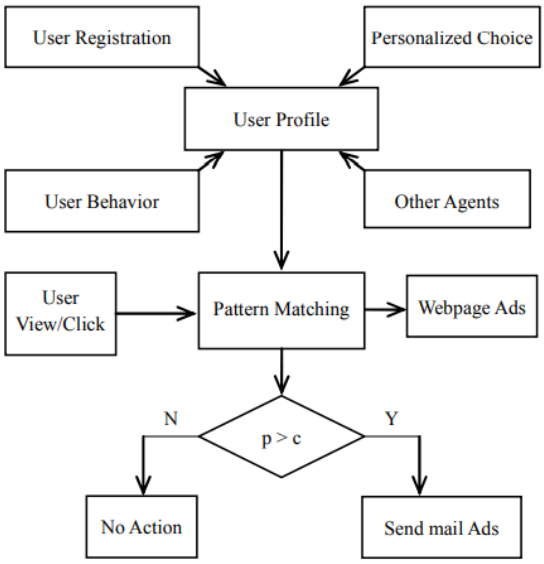

Figure 3. A model of targeted ad agent

B.2. Targeted advertising system based on audience face recognition

By identifying viewers, advertising content customized for the audience is displayed, and viewer interests can therefore increase for the particular product or service. In addition, the efficiency of the advertisements can be improved by limiting the frequency of the displayed ad to the same viewers. To provide customized content to audiences and measure its effect accurately, application of audience recognition technology suitable for a TV watching environment was suggested. In addition, the facial area and features are detected in a viewing environment where there were changes in the viewing distance and lighting, and based on such information, a method for extracting viewing behavior information such as watching TV and sleeping was studied. Applying the audience recognition information to a targeted advertising system, advertisements can be actively modified and provided for the target audience. The accuracy of the measurement results is expected to be improved, and the types of measurement indicators to be provided will be expanded. In addition, it was shown that the content and equipment can be controlled according to the viewing behavior

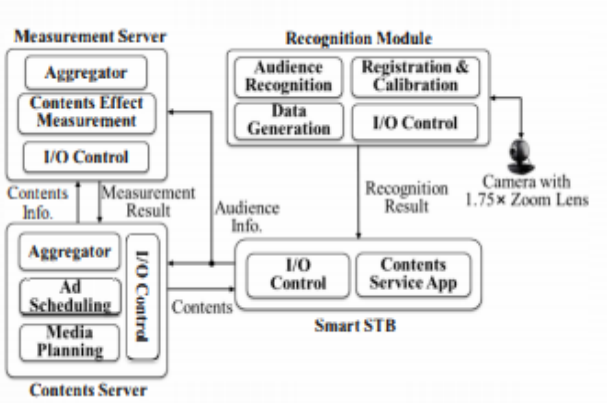

Figure 4. Audience recognition based targeted advertisement system architecture.

B.3. Targeted advertisement usingBLE device

Bluetooth Low Energy devices are installed in the malls in order to monitor the spatial movement of the users. Each of the advertisements is stored in the server and each one of them has tags associated with them. The BLE device asks users to access their social profile data that could tell the advertisers more about the user's choice. Collected data is received in JSON format and then sent for the keyword extraction. These keywords are matched with the tags of the advertisements and then top advertisements are recommended to the users.

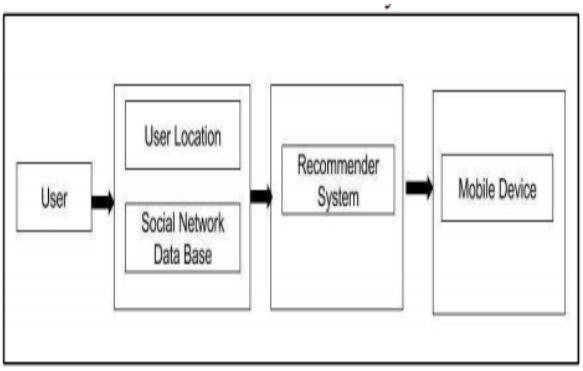

Figure 5. Model of the Targeted advertisement using BLE device.

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III. EFFECTIVENESS OF TARGETED ADVERTISEMENTS

When computing the effectiveness of a targeted ad, it's extraordinarily vital to not solely compare however the targeted and non-targeted populations answer advertising, however they respond within the absence of advertisements. This is often as a result of the targeted phase is additional seemingly to lead to the absence of the ad than the untargeted phase, and to really live the impact of advertising this choice bias should be accounted for. it had been found through studies[2] by Farahat et al that if a comparison was created between the searches of the targeted and untargeted cluster once seeing an advert, the ad upraised whole searches seventy two.1% on the average. Once we tend to management for class interest and clickiness, targeted users answer the ads just like the general population. Study parades many questions on the effectiveness of targeted advertising. Advertisers square measure seeking additional and additional to focus on their ads to the segments presumably to convert as a result of the advertising; but, this strategy might not value effectively as this phase is probably going to convert within the absence of any advertising. The study[2] byFarahat et al indicates that additional subtle targeting algorithms may not gain, and may even hurt, the advertiser as those seeing the ad would convert within the absence of advertising. To best perceive the advantages of targeted advertisements, it's easier to interrupt them into 2 sub-categories supported the parties involved; client and advertiser[9].

A. BENEFITS FOR THE USER

- More effective delivery of desired merchandise (product or service) on to your door step.
- More direct delivery of a message that relates to your interests.

B. BENEFITS FOR THE ADVERTISERS

- More economical campaign development.
- More effective use of advertising resources.
- Better use of the advertising budget.
- Increased return on investment of the advertisers

IV. FUTURE SCOPE AND ADVANCEMENTS

Right now the way advertisements are targeted depends upon the current needs of the user by analyzing his web history and clicks. The future advancements in the targeted advancements may lead to many innovative ways of advertisements that would be beneficial to both the user and the advertisers or company who is promoting. Some of the future enhancements are listed below.

1. **Usinguser's sentiment analysis for suggesting advertisements.**
   The approach of using the sentiment analysis of the user in order to check his/her current mood can help the advertisers to suggest their product or services. It can also suggest whether it is right time to show the advertisement or not.
2. **Combining the approach of advertisement analysis and analysis of user generated data.**
   Combining the already existing approaches of advertisement analysis [5] and the analysis of user data could result into a more efficient system and can reduce the overhead of advertisers to tag their advertisements and find suitable costumers.
3. **Minimizing the dependency of the model on user data.**
   Colleting user data again and again could create a huge problem with the storage of that data. Neural networks can be used to generate a self learning and correcting algorithms that can take minimum information about the user in order to create a mental model of the costumer and then can predict the products/services to the user without frequently collecting user data.
4. **Using scene prediction to suggest products/services.**
   CNN can be used to predict the scene around the user and can suggest suitable products to the user. The CNN could check the environment around the user in a snapshot and can predict what all the user might need e.g. if the model analyses that the user is sitting on a sofa then the model can predict sofa cover to the user in advertisements.
5. **Using face detection to show gender specific advertisements.**
   Often the most irritating thing any user faces in advertisements is that the product or service being advertise is for the opposite sex. Thus machine learning can analyze the gender using the facial features of the user and can predict the products and services that might be suitable for the advertisements to the advertiser.

V. PRIVACY ISSUES AND SOLUTIONS

The main concerned in targeted advertisements is about the privacy of the user. If the advertiser is collecting the data that is sensitive to the user than it could lead to the breach of the user's privacy. Many approaches are hence made in this direction in order to make policies of targeted advertisements open to the user.First and foremost is to ask for the permission of the user in order to collect his/her data for the purpose of suggesting products/services. According to Google AdSense policy [10] it is the user who decides what to share and what not to share with the thirds parties. Google uses something called advertisement cookies which stores the data useful to provide the advertisements to the users.The user is given full control of its data and has the choice of opting out from the personalized advertising whenever required.

Another methos of preserving the privacy of the user is discussed by Hamed Haddadi et al which describesMobiAd[11] as a system for personalised, localised and targeted advertising on smart phones. Analysing the set of information available on the user's phone,MobiAdprovides the user with local advertisements preserving the privacy. Advertisements are filtered by the user's device from the pool of advertisements which are broadcasted on the mobile base station nearby or maybe are received from the Wi-Fi hotspots nearby locally. In this way, the users only download those advertisements which are relevant to their interests, and are for products and services in his locality. Information about advertisement views and clicks are then encrypted and sent to the advertisement channel via other mobile phones. In this approach, other

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nodes and network operators cannot monitor which advertisements are being viewed. Similarly, the advertiser cannot determine which user group viewed which advertisements rather it only receives aggregate information. MobiAd allows businesses, both local and global, to target users narrowly and directly, without compromising user's privacy and causing no harm to the businesses.

VI. CONCLUSION

In this paper the main ideology behind the impact of machine learning on targeted advertisements is brought forward. Many approaches and machine learning models are currently being used to make the process of advertisement more efficient and such approaches can be observed in this paper. This paper also puts forward the privacy issues in the process of targeting of the advertisement to a specific group of users and ways to protect the user's privacy. Moreover it provides more ways that could use machine learning in order to bring out new ways by which advertisers could improvise the way of showing advertisements to their users.

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