

# Emarketing Techniques using Data Mining Approach

**Prof. Dr. Raj B. Kulkarni<sup>1</sup>, Ms. Shankari V. Gajul<sup>2</sup>**

Associate Professor, Dept of Computer Science & Engineering, Walchand Institute of Technology, Solapur, India<sup>1</sup>

PG student, Dept of Computer Science & Engineering, Walchand Institute of Technology, Solapur, India<sup>2</sup>

**Abstract:** For billions of people around the world, the Internet has become an essential component of their everyday social and business lives. As the new millennium begins, we are experiencing perhaps the most dynamic and revolutionary changes of any era in the history of advertising. These changes have been driven by advances in technology, and developments have led to the dramatic growth of communication through interactive media, particularly the internet. Advertisement on social media like facebook, twitter, teachstreet and my opera are becoming essential area of advertisement. Internet advertising is a form of marketing and advertising which uses the internet to deliver promotional marketing messages to consumers. Fast retrieval of the relevant information from databases has always been a significant issue. There are many techniques are developed for this purpose; in among data clustering is one of the major techniques. Data mining algorithm is good marketing strategies to analyses needs and lifestyles of people. A data mining technique- clustering technique is used for finding target users and their needs further more graphical representation is required to show different needs of people. This paper emphasizes on finding target users depending on their lifestyles, designing point to point plan, creation of marketing group and analysis of data.

**Keywords:** E-Marketing, Data mining, Preprocessing, Fuzzy C-Means Clustering.

## I. INTRODUCTION

With the explosive growth of information sources available on the internet, a social media presence is critical. One of the main purposes in employing Social Media in marketing is a strong communication tool that makes the companies accessible to those interested in their product and makes them visible to those who have no knowledge of their products. Having the knowledge of social media and its necessity, running a successful social media marketing campaign is totally a different idea. Factually, when it comes to establishing a social media presence that makes an impact, understanding the interest of all users & based on it publishing the required information as per their tastes is really an important factor.

The popularity of Social media has significantly increased in the last 5 years. The reach of Social media has increased enormously as more people are getting active on social networking sites. Social networking sites have spread across the globe by offering free text, video chatting and other interactive services. Facebook has already crossed 1.44+ billion users worldwide. Twitter has more than 300+ million users, LinkedIn has 380+ millions users and Google+ has 540+ millions active users. These figures have proved that social media can't be ignored if we want to reach a mass audience. Marketers use different offline advertising media like TV, Print, Radio, Outdoor, etc. They spend heavily on these advertising channels to reach their mass audience. However, they now acknowledge that the social and digital media have grown and spread across the globe and that these media are as important as traditional offline media. [24]

Social media is its power to reach not just one consumer at a time, but a huge network of friends through the open

graph. Social media are distinct from industrial or traditional media such as newspapers, television, and film as they are comparatively inexpensive and are easily accessible. [1]

Social media has special features like online discussion, posting messages, like tag to explore communication in the world. Facebook, Twitter, LinkedIn, Google+, Pinterest, Tumblr and Instagram are few examples of social media sites where millions of people are connected with each other. Such social media site has become a good platform for marketing and to reach maximum people for discussion. [4]

We can reach users through various social media channels:

- Video Distribution & Blogs (Own, Third Party, Guest Blogging Sites etc.)
- Press Releases (Free and Paid) as well as Articles (Third Party Sites) & Forums.
- Social Bookmarking, Review Sites, & Image Sharing & also Social Networking Sites (Facebook, Twitter, LinkedIn, Google+..etc)

For advertising campaigns and product development, discovering the appropriate target markets and audience is an important stage in the market research.

Social media is a means to find the users. The companies use social media to create business, and find out the target customers. With the help of Social Media advertising, companies can find out target users by analysing their interests, in particular brand or in a particular area. It relates to the media i.e. transmission tools that relay data but refers to that which allows users to be social and interact with one another. That said, social media in the online world relates to any online application that



empowers two or more people together. In the age of the social internet, we refer to the tools and content that is created by people using these interactive technologies as 'social media.'

### **Social Networks-**

Social networks (SN) have a mediating effect between individuals and society in the virtual world [16]. In fact, social network represents a platform for marketing since they provide access to a large number of users, who group themselves into communities, based on a structured set of social relationships.

Social networking website is an important platform which allows individuals to interact with one another and build relationships. Ideally, they should create a two way communication on social media, as it is the best media to get real time consumer reviews within minutes. Every business has to upkeep their social profile with company updates, to keep their users abreast. Social media forms a two-way communication with users. Users get the opportunity to provide their feedback and suggestions directly to companies. Companies then get a chance to improve their product or services. It has helped many companies to make their product or services innovative. When companies join the social channels, consumers can interact with them. That interaction feels personal to users because of their previous experiences with social networking site interactions. [1]

The way of information is delivered to the customers through social networks that shifted one-to-many to one-to-one communication. Opinion mining and sentiment analysis explains how a certain product or a brand is identified. Classification of different types of content is the first step towards understanding the conversation on the social media platforms.

### **Social Media Marketing-**

Marketing has recently undergone significant changes in the way information is delivered to the customers [14]. Social networks, as a part of Web 2.0 technology, provide the technological platform for individuals to connect, produce and share content online [13]. They are becoming an additional marketing channel that could be integrated with the traditional ones as a part of the marketing mix. Social media marketing is also known as word-of-mouth marketing, viral marketing.

Social media marketing is a key factor of any successful business initiative. Social media in business allows anyone and everyone to express and share an opinion or an idea somewhere along the business's path to market. It gives marketers a voice and a way to communicate with peers, customers and potential consumers. It personalizes the "brand" and helps you to spread your message in a relaxed and conversational way. Social media marketing refers to the process of gaining website traffic or attention through social media sites. Companies are increasingly using social media for marketing purposes. Content marketing and social media marketing are effective and efficient practices for any type of business.

Social media marketing have evolved their approach to the customers, shifting from traditional one-to-many

communication to one-to-one approach, offering direct assistance to individuals at any time through the social media sites such as Facebook, Twitter, MySpace, etc. In turn, companies can learn about customers' needs through users' feedback or by observing conversations, resulting in involvement of members of the community in the co-creation of value through the generation of ideas. [15]

Social networking sites are more popular in the metro cities in India. But the popularity of social networking sites is also growing fast in rural areas. In India, 78% of people live in rural areas, whereas only 22% people reside in urban areas. As per the latest survey, 150+ millions users are active on Social Media from India. If the Internet and smart phones penetrate into rural India then this figure might change to 300+ millions. This is why facebook is trying to make the Internet free in rural areas of India by using solar-powered drones. They want the internet to reach all rural areas so that they can get a wider reach across rural areas for advertising. By using social media users are pointed out by various different categories such as their age group, designation, interest, qualification, geo location, topics, and remarketing, mobile devices. But, this is not possible to do via traditional advertising media. [16]

Social networking sites and blogs allow individual followers to repost comments made by the product being promoted. By repeating the message, all of the user's connections are able to see the message, therefore reaching more people. Social networking sites act as word of mouth. Because the information about the product is being put out there and is getting repeated, more traffic is brought to the product/company.

Social media analytics empower retailers with an early-warning system to identify influencers (good or bad) on the brand, its corporate reputation and organization. By analyzing online social media sources, marketers can understand how to reach consumers through improved behavioral targeting, media buying and planning. [1]

In online marketing environment, the concept of influence is more important than ever. It is becoming increasingly important for companies to raise their influence as a means of measuring audience engagement. Influence has become so important that some marketing firms use these scores to help them identify whom to hire, based upon their influence scores. [2]

The most common business framework is advertising, where social media has some opportunities i.e. people tell a lot about themselves and their interests, so information is available to precise targeting. Social media is in many areas changing the rules of any business that can be carried out online. There are 3 primary social media outlets that businesses use namely, Facebook, Twitter & Google+.

Here we have proposed a competent design & a clustering technique to boost up the advertising way towards identifying the key users using Facebook as a case study.

Our work is concentrating mainly on Facebook, let's move further to know what exactly Facebook is & why it has given more importance in e-marketing.

## Facebook-

Facebook is a social networking site (SNS), which provides users with a platform to create a personal profile page, add 'friends', and send messages. Facebook continues to add new features and developments on a consistent basis. Since it is free to create an account, Facebook has to generate its revenue elsewhere, through a venue such as advertising. Facebook provides features like posting videos, photos and description. Videos can be used to show features of product, how to use product. There can be description of product and testimonial of other users. Facebook provides link to actual product. [26] Advertisement can be posted on walls of friends of user. Reminders and festival offer can attract users of social networking sites. [5]

Facebook profiles are far more detailed than Twitter accounts. Facebook promotes a product in real-time and brings customers in. They allow a product to provide videos, photos, and longer descriptions. Videos can show when a product can be used as well as how to use it. These also can include testimonials as other followers can comment on the product pages for others to see. [1]

In Section II of this paper, we discuss the related work. Then, in Section III, we define problem statement and in section IV, we describe in detail the employed methodology with the description of sequential steps & data mining technique. Section V presents data extraction process. Lastly, Paper ended up with the Conclusion in Section VI.

## II. RELATED WORK

The author Harris and Rae [17], says about social networks may play an important role in the future of marketing; they may increase customers' engagement, as well as help to transform the traditional focus on control into a collaborative approach more suitable to the modern business environment. Traditional advertising techniques are not applicable to the social network platforms, resulting in companies experimenting with many different approaches, thus shaping a successful social media strategy based on their personal experiences [18] & focused on the users by trying to identify the most influential target group [19] or explain their relationship to social media [20][31]. Others have addressed the challenges of social marketing such as aggressive advertising, lack of e-commerce abilities, invasion of user privacy and legal pitfalls [22][21][32] over-commercialization and transparency [16]. Apart from the challenges, many opportunities have also been recognized, such as building brand awareness and raising public awareness about the company, finding new customers, community involvement and conducting brand intelligence and market research for gathering insights and knowledge for future steps [21][23] [33].

Based on exploratory findings and practical examples scholars try to generate guidelines for successful social marketing. Guidelines that apply for online word-of-mouth [27] also apply to Facebook marketing: (1) sharing the control of the brand with consumers and (2) engaging them in an open, honest, and authentic dialog. Kozinets

[14] states that is the first step towards understanding the conversation is the classification of various different types of product and services. Li [15] recommends that companies need to build a plan before diving into the social marketing in order to appropriately approach the frequent users who are most likely to virally spread their enthusiasm for a new product or service. He suggests (1) focusing on a conversation, (2) developing a close relationship with the brand through "friending" with the social marketing pages, and (3) building a plan for engagement and finding out what interactions, content, and features will keep users coming back.

The proposed system is focused on following important factors i.e. identifying the target users by analyzing their interest, designing of market plan, and building the categories of their interests. Categories have been found based on their influence by using clustering technique. Our study analyses the content of the posts shared on a facebook brand page. We focus on identification of the topics, referred to within the posts, categories of the posts, as an indication of intention for participation and emotions that people share through the posts. The paper focuses on the analysis of the user posts shared on a facebook brand page. The facebook brand page targets the younger customers with a social network marketing approach. In this paper, we examine classification of posts with their categories and sentiment shared on this brand page.

## III. PROBLEM DEFINITION

Social media plays vital role in communication. The problem statement can be stated as how to use social media for marketing, quality improvement and identifying target users.

A good design and clustering technique is designed to measuring audience engagement.

Data mining techniques can be used for effective advertisement. Association rules, classification hierarchies and clustering techniques can be used for the same.

## IV. METHODOLOGY

Figure.1. shows the steps involved in applying clustering algorithm to find the target users: [1] [27]

- 1. Preprocessing:** Includes a set of data is provided to the system.
- 2. Data Gathering:** Includes Data extraction from Facebook.
- 3. Tokenization:** Is carried out by selecting the query from Msg table and eliminate special and non-letter characters.
- 4. Cleaning:** Is done by removal of stop words.
- 5. Clustering:** Includes Classification of Post Message and Comment into different categories.
- 6. Discovering targeted users:** Includes finding of important users.
- 7. Design of Marketing plan:** Put out the new posts to key users based on their interests.

Predictive Modeling- the process of taking patterns discovered from the database and using them to predict the future. [1]

The detail of the system architecture is:

**1. Preprocessing:**

The preprocessing step includes the three components as facebook, Graph API and Internet. A supervised clustering algorithm is used for knowledge discovery. A set of training data is provided for clustering data. A various raw data is collected without violating the privacy of user. Depending on post called as buzz words data is collected. It is very important to find relevancy of the collected words and discarding irrelevant data. An efficient information retrieval can be used to retrieve data from wall posted by users. Depending on collected data different categories can be built such as entertainment, sports, technology and electronics etc.

**V. DATA ANALYSIS**

**Data Collection:**

The dataset used for this study which consists of posts from the facebook brand page. The data collection was performed from the official launch of the facebook page. To guarantee accuracy of the data post were fetched on a daily basis, using a script utilizing the Facebook Graph API4. The Graph API provides access to Facebook social graph via a uniform representation of the objects in the graph (e.g., people, pages, etc.) and the connections between them. For purpose of this study we have used the Feed connection of the Page object. Feed connection represents a list of all Post objects containing the post details, i.e. the message, likes, comments, time of creation, etc. The elementextracted from Facebook Graph API were stored in a relational database for further investigation. The following figure.2. Shows Extraction of data.

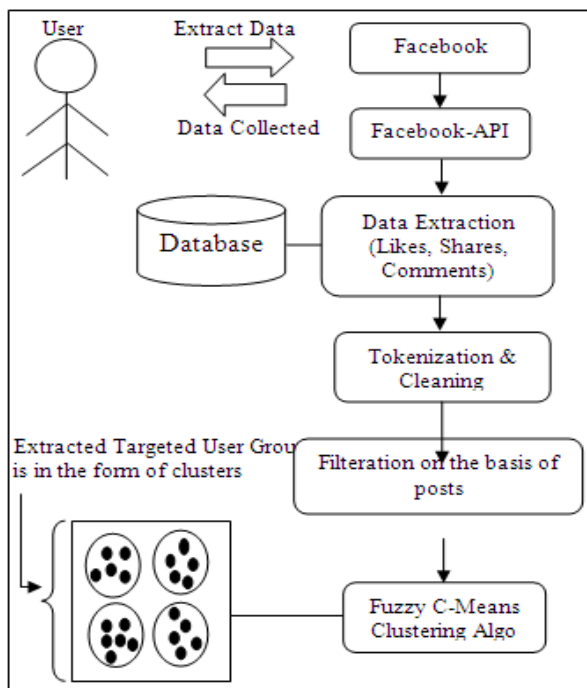


Fig.1. System Architecture

**2. Data Gathering:**

This step includes the components as facebook, Graph API and Internet connectivity. Data can be collected from

facebook. A basic authentication token is assigned to any facebook user & can be used to search any publicly available information. You allowed by facebook to search based on an ID. However, we can also search for wall posts for any known facebook ID. A basic input in the form of training set is provided to algorithm to extract useful data from web. [6] Data from posted wall, communication in the group and different hyperlinks can be used to collect data. Feedback and testimonials from existing users can be collected from online shopping sites for quality improvement and increase sell of product.

Using Facebook's Graph API Explorer to retrieve Page data:

A facebook has its own database. A facebook page is a public profile where pages are similar to name of brand for advertising purpose. Pages have their own photos of brands/product, videos of product, posts. These pages are public pages, visible pages i.e. everyone can see that pages. Therefore it is called as "Pages". Facebook have API (Application Programming Interface) which means it is an intermediate between Facebook & Programmer. [28] That interface is the "Graph API". The programmer wants to access data of facebook through Graph API with the help of INTERNET. [29]

Facebook's Graph API Explorer is to retrieve data from facebook pages. This is a low-level tool you can use to query, add, remove & fetch data. [27] It's a very handy resource to build your own app & that businesses use to exploit facebook's marketing possibilities is by creating a "page" for their business which facebook users can follow. [25] Businesses can use this resource for creating a page for their marketing purpose to market their products, offer deals, and build their brand as well as increase their engagement or marketing plans for website or application. [7]

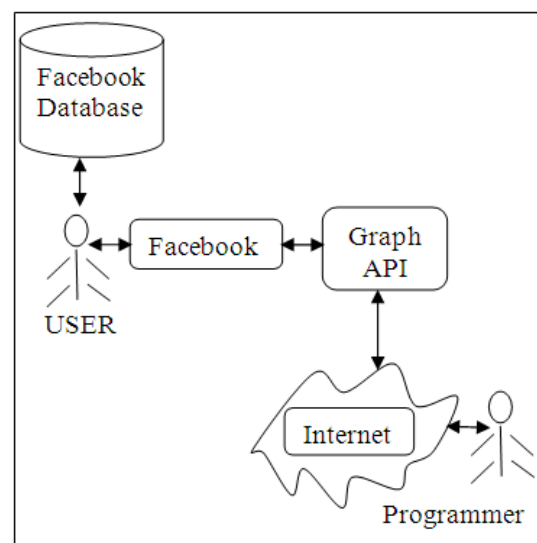


Fig.2. Extraction of Data

**3. Tokenization:**

Extracted data is stored in separate database and can be referred as source of knowledge for further task. Tokenization and Cleaning functions are considered as a filtration phase. Filtering is done based on the list of Stop



words and Stemming words, these words are provide assistance in the process of filtering the contents of messages i.e. post messages (Likes, Comments) due to this filtration process we can get the relevant data. By filtration process we can remove Stop words & convert Stemming word into stem word (i.e. Root word) by using Stemming technique.

Tokenization phase is carried out by selecting the query from msg table and eliminate special and non-letter characters.

Tokenization of Post Message extracted is carried out in this phase as shown below:

- a. Execute select query to select Msg from the Msg table.
- b. Store Msg in a string
- c. Elimination of special characters
- d. Eliminating all non-letter characters
- e. Split the Msg with white space and store that in an array

#### 4. Cleaning:

Cleaning function is done by removal of stop words. Filtering is done based on the list of stop words and stemming words. Many of the most frequently used words in English are useless in Information Retrieval (IR) and text mining. These words are called 'Stop words'.

Stop-words, which are language-specific functional words, are frequent words that carry no information. [8] Stemming techniques are used to find out the root/stem of a word. Stemming converts words to their stem word.

Cleaning of Post Message extracted is carried out in this phase as shown below:

- a. Removal of stop words
- b. Applying stemming technique.
- c. Array generated is acting as an input for the function in the next section.

#### 5. Clustering:

The previous filtration process gives the relevant data. On the basis of the relevant data we can perform the clustering process. This process includes functions of classification of post message into different categories.

A. Clustering includes classification of different categories:

1. Post Message
2. Comment into different categories
3. Historical Actions
4. Personal Information

B. Classification of Post Message into different categories:

In order to make effective analysis of posts to find the quality of them, we have collected a dataset of thousands of posts. Before start working on them, clustering process will categorize them into different categories using Keyword based classifier. The different categories chosen by us for facebook Posting are Festival & functions, My Pictures, Relationship (which includes Friends, Family and Others), Education etc.

C. Fuzzy C-Means Clustering:

By using Fuzzy C-Means clustering process we can identify the people who are interested in information related to a particular category. This process involves

extraction of users who have liked or commented the post in that category.

Clustering can be used to partition data sets into clusters and equivalent classed. Similarity among the members of a class should be more than similarity among members across classes. [10]

The algorithm Fuzzy c-means (FCM) is a method of clustering which allows one piece of data to belong to two or more clusters. [9][30] This algorithm organizes items into groups based on similarity criteria. The Fuzzy c-Means algorithm is a clustering algorithm where each item may belong to more than one group (hence the word fuzzy), where the degree of membership for each item is given by a probability distribution over the clusters. [11]

This method is frequently used in pattern recognition. It is based on minimization of the following objective function:

$$J_m = \sum_{i=1}^N \sum_{j=1}^C u_{ij}^m \|x_i - c_j\|^2, \quad 1 \leq m < \infty$$

where m is any real number greater than 1,  $u_{ij}$  is the degree of membership of  $x_i$  in the cluster j,  $x_i$  is the  $i$ th of d-dimensional measured data,  $c_j$  is the d-dimension center of the cluster, and  $\|*\|$  is any norm expressing the similarity between any measured data and the center.

where m is any real number greater than 1,  $u_{ij}$  is the degree of membership of  $x_i$  in the cluster j,  $x_i$  is the  $i$ th of d-dimensional measured data,  $c_j$  is the d-dimension center of the cluster, and  $\|*\|$  is any norm expressing the similarity between any measured data and the center.

Fuzzy partitioning is carried out through an iterative optimization of the objective function shown above, with the update of membership  $u_{ij}$  and the cluster centers  $c_j$  by:

$$u_{ij} = \frac{1}{\sum_{k=1}^C \left( \frac{\|x_i - c_j\|}{\|x_i - c_k\|} \right)^{\frac{2}{m-1}}} \quad c_j = \frac{\sum_{i=1}^N u_{ij}^m \cdot x_i}{\sum_{i=1}^N u_{ij}^m}$$

This iteration will stop when  $\max_{ij} \left\{ \left| u_{ij}^{(k+1)} - u_{ij}^{(k)} \right| \right\} < \epsilon$ , where  $\epsilon$  is a termination criterion between 0 and 1, whereas k are the iteration steps. This procedure converges to a local minimum or a saddle point of  $J_m$ .

#### Fuzzy c-means Algorithm

The algorithm is the following steps:

- Initialize  $U=[u_{ij}]$  matrix,  $U(0)$
- At k-step: calculate the centers vectors  $C(k)=[c_j]$  with  $U(k)$

$$c_j = \frac{\sum_{i=1}^N u_{ij}^m \cdot x_i}{\sum_{i=1}^N u_{ij}^m}$$

- Update  $U(k)$ ,  $U(k+1)$

$$u_{ij} = \frac{1}{\sum_{k=1}^C \left( \frac{\|x_i - c_j\|}{\|x_i - c_k\|} \right)^{\frac{2}{m-1}}}$$

- If  $\|U(k+1) - U(k)\| < \epsilon$  then STOP; otherwise return to step 2. [12]

## 6. Discovering targeted users:

Identify the people who are interested in information related to particular categories like Advertisement, technology, Sports, electronics etc. The process uses selection of category to identify the interested users from the posts. The process involves extraction of users who have liked or shared or commented the posts in that category. Prepare the database of users interested each category.

## 7. Design of marketing plan:

To promote set of users, first find the category of the post. Then select the targeted users of that post. Put out the new posts to key users based on their interests.

## VI. CONCLUSION

Social media marketing has become more popular worldwide and small businesses are also taking social media seriously as a marketing tool from the perspective of e-marketing, e-advertisement and product development. Social media is free or partially paid and SMEs can invest some amount in social media to market their products or services online. Social media has widespread reach whereas traditional media has a limited reach. Marketers can market their products or services globally by effective use of social and online media. Social media delivers market intelligence. So that marketers can use social media to attract users and to learn about what the current market trends and demands.

It will allow the advertiser to select only those users who meet certain profitability criteria based on their individual needs and design marketing tactics for them using internet advertisement. Marketers can understand how to reach consumers through improved behavioural targeting, media buying and planning. The proposed system is to find out the target users by analyzing their interests, needs and taste in particular brand or area. And produce the categories of their interests by tracking their activities in social networking site. The scope of the proposed system is to analyse and predict user's behaviour over a period of time based on his historical actions and their personal information and to target advertisements based on this analysis.

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## BIOGRAPHIES



**Dr. Raj B. Kulkarni** is Ph.D. in Computer Science and Engineering and presently working as Associate Professor in Computer Science and Engineering Department at Walchand Institute of Technology, Solapur, Maharashtra, India.



**Ms. Shankari V. Gajul** completed B.E. (CSE) from Solapur University and pursuing Master's Degree in Computer Science and Engineering at Walchand Institute of Technology, Solapur, Maharashtra, India.